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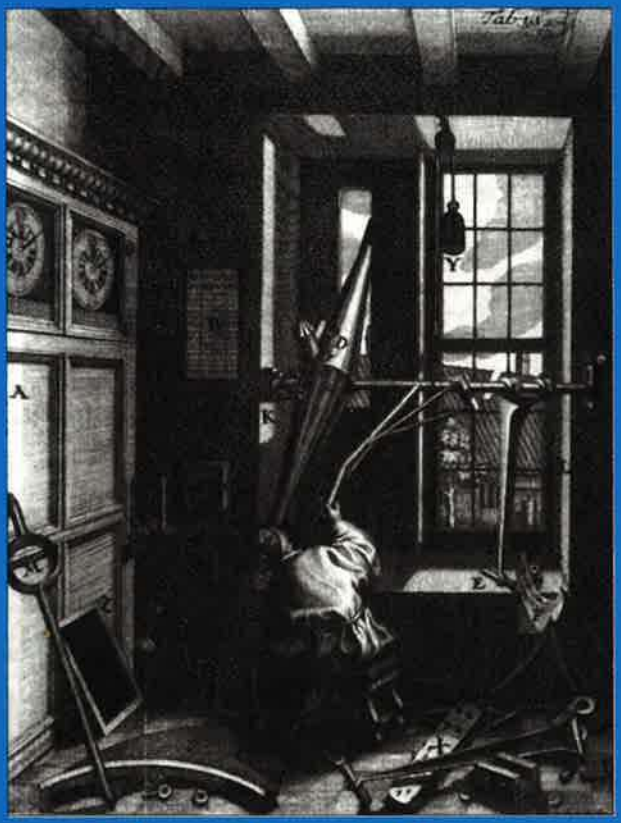

Cultures of Natural Philosophy in Seventeenth-Century Scandinavia

J.F.C. Danneskiold-Samsøe

Muses and Patrons

To Andreas, Elisabeth and Thora.

Muses and Patrons

Cultures of Natural Philosophy in Seventeenth-Century Scandinavia

J.F.C. Danneskiold-Samsøe

Lunds Universitet
Ugglan
Minervaserien 10

Cover: An astronomer observing the night sky from his house in Copenhagen. Apparently an isolated figure trying to uncover the secrets of nature, while everyone else is asleep, but as we can see, the roof of the building across the street has been cut to facilitate his observations. There is a connection between the apparently private research of the natural philosopher and the society that surrounds him. He depends on its support, just as the depends on the skills of the craftsmen who have constructed his various instruments. If we interpret the picture allegorically, his telescope is perhaps not only directed at the stars above. He may as well be looking for God or patrons somewhere among the dark rolling clouds. This natural philosopher is essentially the subject of this book. Table from Horrebow's *Basis Astronomiæ* 1735, taken from an unpublished manuscript left by his teacher Ole Rømer.

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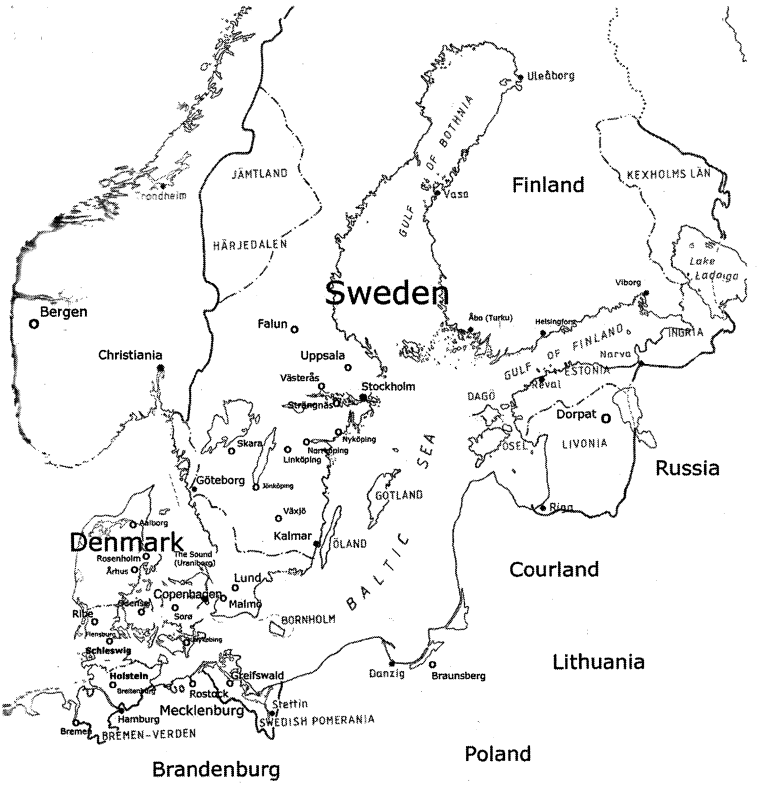
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Introduction

1. Background

This book is a cultural history of natural philosophy in Scandinavia in the 17th century. The idea of writing it began back in 1995, while I wrote a dissertation on natural philosophy in early modern Denmark. While Danish intellectual life in the late medieval period had found itself on the northern fringe of European developments, this changed remarkably in the sphere of natural philosophy in the early modern period. While everyone is well familiar with Tycho Brahe, few outside Denmark are aware of developments in the 17th century, when this relatively poor agrarian country on the northern fringe of Europe produced a number of natural philosophers of international fame and importance. In anatomy and astronomy Danes and Norwegians made important contributions to the development of natural philosophy, they influenced discussions on the nature of light and were important in bringing Paracelsian medicine and metaphysics outside the medical and esoteric circles.

Gradually developing during the 17th century, a flourishing culture of natural philosophies arose in Copenhagen, reaching its climax around 1670. And then it all seemed to end. The culture of natural philosophy dried out in Copenhagen. Surely, there would still be professors in anatomy, mathematics, and whatever we may call natural philosophy, but they no longer took any formative part in the general European development of natural philosophy. No one took the pains to dissect the human body to map its ingenious construction. The scientific journal established in the 1670s was given up. Experiments, so far as they were conducted, were more often than not used for entertainment at Court. In other words, in the general discussion of 'The Scientific Revolution' in early modern Europe, the example of Denmark seemed to be one of an arrested development. Puzzled by this observation, I was lead to further investigations as to 'the rise and fall of The Scientific Revolution in Denmark'.

First of all, it was perfectly clear that the innovative natural philosophers were all connected to one of two major circles. Instead of seeing the rise of natural philosophy in Denmark as the

emergence of particularly talented individuals, it therefore seemed appropriate to analyse it as the rise of particular intellectual circles and cultures that stimulated new approaches to the study of nature in talented individuals. The first was the circle around Tycho Brahe at Hven that flourished from the 1570s and until the fall or death of most of its members in the years around 1600. Shortly afterwards, another circle of natural philosophers arose in Copenhagen, centred around a dynasty of intermarried academic families, which for the sake of convenience shall be called the 'Bartholin family' in this study. This circle dominated the development of natural philosophy in Denmark until the end of the 17th century.

Secondly, it was striking how the emergence and decline of these cultures coincided with changes in the political system. Just as the fall of Tycho Brahe in the 1590s was closely connected to political changes, the decline of natural philosophy in 17th-century Copenhagen began with the establishment of absolutism in 1660, or rather in the 1670s when the new political culture decisively changed society. It was therefore evident that the culture of natural philosophy was not immune to general political developments. Natural philosophers depended on support from the leading men of the country, and changing political agendas – including changing religious agendas – defined the status and context of natural philosophy. It was therefore no coincidence that the culture of natural philosophy at Hven, which unfolded at a time when the theology and humanism of Philipp Melanchthon dominated Danish church life and political thinking, was different from the culture of the Bartholin family, who lived in an age of political centralisation and Lutheran orthodoxy.

The indication that natural philosophy was influenced by general developments in society raised the question of the social fabric of these cultures and their place in an early modern society, which (*de jure* at least) placed its members into estates defined by function. Apart from Tycho Brahe, who as a natural philosopher of noble birth was unique in early modern Denmark, almost every natural philosopher in 16th and 17th-century Denmark was professor at the University of Copenhagen. However, the stimulus for scientific innovation seemed to come not from the framework of institutions as such, but from values operating on the semi-private fringe of academic life. It is not in the syllabus of the University that we find innovation in natural philosophy, but in the pursuits

practised by university professors at home. This again raised the question of the relationship between institutions and more informal organisational frameworks of natural philosophy.

Finally, this identification of elements in the development of natural philosophy in 17th century Denmark led to reflections on how representative such mechanisms were: How far was the dynamics a matter of 'national context', and how far was it part of a more general European development? If, for example, I was right in attributing the decline of natural philosophy in late 17th-century Denmark to the introduction of absolutism, I had to recognise that absolutism in itself was not antithetical to the emergence of the new natural philosophy. Elsewhere in Europe, such as France, Tuscany and Brandenburg, absolutism was vital to the establishment of scientific institutions and the patronage of science, and it was in Restoration England that the Royal Society began to flourish.

What I wanted was therefore to compare developments in Denmark with developments elsewhere, preferably a country as similar as possible in terms of social, religious and political structures. My choice fell on Sweden, which, despite structural differences, the extent of which I had clearly underestimated, was one of the countries most similar to Denmark. Both countries were Lutheran and both witnessed the establishment of absolutism in the late 17th century. They were both located on the northern fringe of Europe, somewhat removed from the main intellectual centres of the Continent, but increasingly drawn closer to general intellectual European currents. But while natural philosophy rose and declined in Denmark in this period, the development in Sweden was different. Farther removed from the European mainland and economically less developed until the end of the 16th century, general European developments, political as well as intellectual, initially reached Sweden later than Denmark. Likewise, it was not until the 1650s that native Swedes made lasting contributions to science, although in the occult sciences this integration began somewhat earlier. But while the new natural philosophy was late in producing results on Swedish soil, Sweden did not experience a decline in natural philosophy at the end of the 17th century; rather, the study of nature was highly stimulated, and in the early 18th century Swedes made valuable contributions to the general European history of science, while natural philosophy in Denmark had come to a standstill.

Thus, from what I already knew, or thought I knew, when I set out to write this book, it seemed that despite the many similarities between the two Scandinavian kingdoms and the fact that they received – or at least had access to – the same intellectual and technological influences from the European mainland and Britain, the peculiarities of the 'national context' played an important role in the development of natural philosophy.

2. The Field of Study

As a study of scientific cultures, this book is concerned with values, identities, ideas and mentalities on the one hand, and with the social, political and material framework of these cultures on the other. As such it tries to throw light on two fundamental questions: *Why* natural philosophy was carried on in 17th century Scandinavia and *how* it was carried on. Neither of these two questions is as straightforward as it may seem at a first glance. In our modern society, science has become professionalized, and men and women all over the world conduct science, if for no other reason, because they, prosaically speaking, are paid to do so. They are professionals.

This was certainly not the case in early modern Europe. Most early modern Europeans who contributed to the history of science were not professionally obliged to do, and even those employed as university teachers were generally committed to carry on existing traditions and knowledge, rather than produce new knowledge themselves. Furthermore, the way of acquiring knowledge of natural phenomena at European universities around 1600 was still dominated by scholasticism and traditionalism. Despite a growing outcry for experience and experiment (the word *experimentum* could mean both), academic teaching in natural philosophy was still based on Aristotelian physics. It was a practice of the mind, with no connection to quantitative method, systematic experiment or technology.

In other words, in terms of methods and practices, there was not a well-established institutionalised culture of natural philosophy in Europe around 1600, which in any way resembled that of modern science. Modern students of science enter a culture with established professional practices, duties, and obligations both in terms of producing new scientific knowledge and in terms of presenting it, and although people may pursue scientific studies out of all sorts of motives and backgrounds, they can assimilate this

culture without any deep reflection, and as professionals they can separate it from their private pursuits and convictions. This was not the case for the early moderns. Those who remapped the human body or the Universe had not one firm and established scientific tradition or methodological and theoretical framework to lean on, but rather a rattle-bag of traditions and practices, and their pursuits necessarily carried with them a number of reflections and notions, ideas gathered from all areas of human experience - religion, politics, personal experiences and social life.

Accordingly, like their contemporaries in other parts of 17th-century Europe, Scandinavians chose to study nature out of all sorts of reasons. Often religious (though not necessarily heterodox or even essentially Christian) motives and ideas were the most important driving force in the study of nature,[1] also in the sense of trying to find truths that could reconcile the warring Christian sects. Therefore, this study is bound to follow paths, which is generally left untouched by historians of science.

Having established, as far as possible, various motives for studying nature and create new scientific knowledge in 17th century Scandinavia, we are still faced with the problem of *how* these intentions were carried into practice. This means not only to look at the development of new theories and methods of natural philosophy. Since the culture (or cultures) of natural philosophy outside the university framework was something essentially new, its practitioners must somehow win support for their pursuits. Therefore, the question of *how* science was pursued must deal with how natural philosophers mobilised support for their studies, how they presented their natural philosophy and manoeuvred in changing political and religious climates, and why those in power found it worthwhile to support or at least sanction such pursuits.

Thus, the two questions carry with them a complex of themes and problems, which obviously cannot be exhausted within the limits of this work, or indeed any work, even if we limit ourselves to Scandinavia. What I hope to do is to show the intellectual and social dynamics in the development of new cultures of natural

[1] The fact that 17th century science was not a matter of *science versus religion* is almost too commonplace among historians of science to be even mentioned. But alas, it still seems to play a pivotal role in many popular accounts of Western Science.

philosophy, but it is necessary to specify what is studied in this book, and what has been left out.

The focus of this book is *natural philosophy*, a term I deliberately use instead of *science*. In the 17th century, *scientia* simply meant 'knowledge' (equal to the Greek ἐπιστήμη), sometimes theoretical, but a diffuse term, although the term *scientia naturalis* was used interchangeably with *philosophia naturalis*.[2] I might thus have chosen to use the somewhat cumbersome 'natural science', but have preferred the more neutral term 'natural philosophy' in order to avoid the heavy connotations the modern age has put on the term 'science'. Only in the last chapters of the book, 'science' will be used to indicate the essential change in outlook. Philosophy is essentially concerned with understanding the world, while those men who are treated at the end of this book were mainly concerned with controlling it. Therefore it would seem misleading to call them natural philosophers.

As far as the middle ages went, the content of natural philosophy was largely provided by Aristotle's *libri naturales*, i.e. the *Physica, De Caelo, De generatione et corruptione, Meteorologia, De anima, Parva naturalia*, and so on. Sensible matter, that is, material things as they appear to the senses, provided the generic subject of consideration. This served to distinguish natural philosophy from mathematics, which was concerned with quantitative being, and from metaphysics, which was concerned with being in general. We also notice that since Aristotle did not write specifically on medicine, this subject was not covered by the *libri naturales*. Nonetheless, medicine was generally regarded as being part of natural philosophy and is pivotal to this study.

Most of the natural philosophers in this book were physicians, and medicine contained several of the developments in 17th century natural philosophy. From its rather theoretical starting point, it came to include anatomy, chemistry, and botany. Since Paracelsus, minerals were used as remedies, and physicians also took interest in geology. But while the focus of this book is natural philosophy, we shall see that developments within this area of

[2] The word *scientist* in its modern meaning did not come into general usage in English, until William Whewell introduced it in the 19th century, see F.H. Brookman, *The Making of Science Policy*. Amsterdam 1979.

learning were often connected to other areas of learning such as theology, poetry, history, metaphysics, and theosophy. To rigidly separate natural philosophy from these topics would be anachronistic.

The Renaissance diffused the concept of natural philosophy through its broadening outlook. A new discipline, chemistry, unknown to the Greeks, began to gain importance, and although it would only hesitantly enter the universities (the first ordinary chair was established in Marburg in 1609), and only attain a theoretical breakthrough in the next century, chemists were among the most prominent propagators of experiment. Furthermore, the truth-value of mathematical description and the position of mathematics vis-à-vis other disciplines, particularly physics, was debated and gradually changing, while Neoplatonists would sometimes include the invisible world and spiritual entities in their natural philosophy.

Thus, in the 17th century there was no strict definition of what constituted natural philosophy, and I shall therefore use the term rather liberally. As for the concept of Nature (*natura, φύσις*), it had been given more than one definition by Aristotle,[3] but in the early modern period it essentially meant the world as created by God and containing its own generic powers, as distinct from *ars*, the creations of Man. The latter might imitate Nature, and during the 17th control and manipulation of Nature became a great attraction at European courts. Natural philosophy was concerned with how nature normally worked (*naturaliter*), in its natural state, so to speak, as ordained by God. Instances when God or the Devil directly interfered through extraordinary occurrences like miracles and omens were matters for theologians. Surely, the definition of the natural vis-à-vis the unnatural or extraordinary was always a matter of debate, and as the 17th century went on, the extent of the latter would generally diminish.

This book focuses on the connection between natural philosophers and political power, and concentrates on the study of nature by educated men in Copenhagen, Uppsala and Stockholm. Nearly every natural philosopher treated in this study was connected to a university or had at least an academic background. We are thus

[3] *Metaphysics*, v.4

concerned with the Latin-speaking and –reading intellectual elite at the Scandinavian centres of learning. The background and position of these men imposed certain limits on them, particularly in terms of what was included in their thinking and what was not. These limits changed somewhat during the 17th century and shall be analysed throughout the study.

It must be emphasised, however, that while many of the notions and ideas of these innovative natural philosophers were to have importance to future scientists and indeed influenced contemporary society in certain ways, they were the ideas of a very small intellectual elite. Most notions on nature and its workings from past ages were still accepted by the vast majority of Scandinavians in this period. Rather than the scientific treatises of Tycho Brahe or Thomas Bartholin, it was, what a later aged has termed 'popular books' (*Volksbücher*), that framed the thoughts on the world. One of the most popular of these was *Lucidarius*, a dialogue in the Danish vernacular of religion and nature. After its first publication in 1510 it was edited to fit Evangelical theology, but as far as nature went, the new edition differed only slightly from the 12th-century German text from which the Danish *Lucidarius* derived. The book appeared in new editions as late as 1892, and in the 17th century it was read by high and low in Danish society. It was only in the Age of the Enlightenment that such books were purged from the book shelves of men and women who considered themselves sophisticated, but in the period we are dealing with here, most Scandinavians imagined the world in ways similar to their ancestors.[4] In *Lucidarius* and similar works and in the mentality and daily practices of 17th-century Scandinavians of all kinds, much lived on, which can generally be described as a 'magical' explanation of nature (or 'superstition' to use a pejorative term). Several recent studies of early modern Scandinavia have emphasised the extent to which magic mentalities survived well into the 18th century, even among educated people. Magic and occult notions can also be found in the natural philosophers stud-

[4] The original Lucidarius was a 12th-century German text. The Danish version, which probably dates from the late 14th century, was more than a translation, and substantial parts were original. Also Dutch and Bohemian editions existed; see J. Knudsens's introduction to the modern edition, 25ff. (Lucidarius 1909).

ied in this book, but I have found it more interesting to study how these men differed from their contemporaries, than to show the great number of notions and ideas they shared with them.

The study is thus concerned with innovation in natural philosophy, and particularly with the stimulus for innovation. Therefore change will be emphasised above stability. Historians of mentality have amply demonstrated the large extent to which values and notions were shared by most early modern Europeans. Such studies are useful indeed, but they are in themselves concerned with similarities and cannot explain changes in outlook and values. The perspective of this study is therefore differences rather than similarities.

The example of *Lucidarius* shows how mentalities and notions transcended the great divide, which traditionally is supposed to exist between the age of the Reformation and the medieval period. While this book is about the 17th century, I once and again go further back in history in order to trace developments. This is particularly so in the first part of the book. Generally, I have chosen the Reformation and its aftermath as the chronological starting point, since the institutional, intellectual and political context of natural philosophy was profoundly affected by the change of religion and the centralisation of learning and religious life that it produced in Scandinavia. However, the break of continuity brought about by the Reformation can easily be overestimated, especially if we uncritically adhere to the opinions of its champions. In intellectual, institutional and political life, many medieval structures and attitudes survived well into the 17th century, and in many areas the Reformation was a catalyst of existing developments rather than their origin. If we concern ourselves with *la longue durée*, if we gaze into the 'Well of Time' (to use Thomas Mann's expression) for beginnings of the various intellectual developments we are studying, we shall find ourselves lost in the Middle Ages or antiquity. There can be good reasons for going further back than the Reformation age in order to understand the 'national context' of early modern science,[5] but such endeavours have been beyond

[5] As was done twenty years ago in the interesting comparative study of science in Sweden and Denmark, Andrew Jamison, *National Components of Scientific Knowledge. A Contribution to the Social Theory of Science.* Lund 1982, esp. 198ff. in the

the limit of this work, and I shall therefore begin with the Reformation, perhaps not the most important beginning, or even a true one, but at least one with an essential impact on the development of Scandinavian natural philosophy.

3. The National Perspective

Although this book is a study of both Denmark and Sweden,[6] I must fairly admit – since this will soon enough become evident to the keen reader – that focus has been put much more on developments in Denmark than in Sweden. There are two reasons for this, one deliberate and one forced by necessity. As for the latter, the time limit of my work has been three years which necessarily has put a restriction on the amount of source material, both primary and secondary, that I have been able to cover. Since my knowledge of natural philosophy in Denmark, Danish history in general and the scholarship about it, is far greater than my knowledge of developments in Sweden, I have been able to follow natural philosophy in Denmark more closely and detailed than in Sweden.

My focus on the realms of the Danish king is, however, not only circumstantial. This book is far from *the* complete history of natural philosophy in 17th century Scandinavia. It is a general study of the development of natural philosophy from a political and cultural perspective, to my knowledge the first of its kind in Scandinavia. I have attempted to throw light on the mechanisms that shaped its development, by focusing on areas or connections that have generally been neglected by historians. Therefore, a figure like Tycho Brahe, who has been studied in numerous books and articles, has not been covered in detail, whereas I have taken greater interest in some natural philosophers, which may not amount to the same stature in the history of science.

discussion of the different 'metaphysical bias' of the two countries. See Chapter Six below.

[6] In the 17th century the borders of the two Scandinavian states differed considerably from the current. The Realms of the Danish King included modern day Denmark, Norway, Iceland, and part of the Duchies of Schleswig and Holstein in modern day Germany, as well as (until the middle of the century) also the provinces of Scania, Halland, Blekinge, and Bohuslän in modern day Sweden. The Kingdom of Sweden also included Estonia and the grand duchy of Finland, and at times also parts of northern Germany, Poland, and Livonia. For convenience I shall generally refer to Denmark and Sweden.

In the end I hope this study will provide a synthesis of the development of natural philosophy in 17th century Scandinavia and the mechanisms behind it. As a consequence of this, I have felt that the need to cover developments in Denmark was greater than to cover developments in Sweden, since it has turned out that natural philosophy from a cultural perspective has generally been better covered by Swedish scholars than by their Danish colleagues.

The reason for this is largely due to differences in the modern university structures in the two countries. Since the 1930s Sweden has benefited from departments of the history of learning (*lärdomshistoria*) in Uppsala, Stockholm, Lund, and elsewhere,[7] whose research have had a forum in the journal *Lychnos*. To a certain degree this research is also accessible to a non-Scandinavian audience, since many articles in Lychnos contain a summary in English, German or French.

The Swedish tradition of the history of learning is humanistic in its origin. The departments are organised under the Faculty of the Humanities, and its first professor, Johan Nordström was originally a student of the history of literature. While history of science in the Western World is generally placed under the Faculty of Science or Sociology, Swedish scholarship on the subject generally has a humanist point of origin. One of the advantages of this is that their area of study allows for a transgression of modern definitions of science and involvement of areas such as history (cultural, social, and political), literature, and philosophy. This is evident in Nordström's successor Sten Lindroth's four-volume history of learning in Sweden, a one-man tour de force that draws on Swedish scholarship and deals with all branches of learning (science, law, and the humanities) and connects them to the general cultural development of Swedish society.[8]

[7] The first independent Swedish Department of the History of Learning was established in Uppsala in 1932-33. For a critical analysis of the Swedish tradition, see Bo Lindberg and Ingemar Nilsson, 'Sunt förnuft och inlevelse: Den nordströmska traditionen', *Humaniora på undantag ? Humanistiska forskningstraditioner i Sverige*, ed Tomas Forser. Storkcholm 1978. See also Tore Frängsmyr (ed.), *History of Science in Sweden. The Growth of a Discipline 1932-1982.* Stockholm 1984.

[8] Sten Lindroth, *Svensk Lärdomshistoria*, I-IV. Stockholm 1975-1981. The most recent history of learning in Sweden, Tore Frängsmyr's excellent *Svensk idéhistoria*, 2. vols. Stockholm 2004 stands in the same tradition.

In Denmark, the study of the history of natural philosophy has not had the advantages of such institutional foundations. While departments of the history of medicine have long existed at some universities, these seldom connect their subject to general historical and cultural developments. To a certain degree the same applies to the Department of the History of Science, which was established at the University of Århus by the late Olaf Pedersen. Since students of this department are required to have a background in natural science, the focus has therefore been on internal scientific developments rather than their social framework. Things are changing and the upcoming history of science in Denmark explicitly includes social history.[9]

If we look for a cultural perspective on natural philosophy in 17th-century Denmark, we shall generally look in vain. The exception is Tycho Brahe and the Danish Paracelsians, who primarily have been studied by American scholars. They have done an admirable job, and have also put these natural philosophers into a broader social, political and cultural context, but the scope of their studies has still been limited to individuals or specific traditions. With a few exceptions, the studies of Danish scholars have reflected the general specialisation of modern academic life. Scholars from a background in individual disciplines - philosophy, medicine, astronomy, literature, philology, history, and so on - have all made valuable contributions that throw light on natural philosophy in 16th and 17th-century Denmark, but have generally turned back from moving beyond their own discipline. Thus physicians have written the history of medicine with only erratic use of the historical or theological, not to speak of the social, aspects of the subject they have studied.

But this was not always so. Like in Sweden the history of science was initially in the hands of historians of literature, and in general works on the history of Danish literature from the 19th and early 20th century, cultural developments and natural philosophers are included. Furthermore, as part of a great national rally in the second half of the 19th century a Society of Danish Church History (*Selskabet for Danmarks Kirkehistorie*) was established, which later published a journal called *Kirkehistoriske Samlinger* (Collections of Church History). Despite its name, the journal published

[9] *Dansk Videnskabshistorie I-IV*, ed. Helge Kragh et al , forthcoming.

a wealth of articles and primary sources on the history of learning in Denmark. Though the members of this society were mostly theologians, they covered a broad range of topics on the learning of early modern Denmark under the leadership of H.F. Rørdam, one of the most indefatigable visitors to archives ever, who was also strongly involved in the journal *Danske Magazin*, which likewise published much source material. The work of Rørdam and his companions contains a storehouse of information, and their reading on primary sources (published as well as unpublished) was vast. This is evident in Rørdam's incomparable history of the University of Copenhagen from the Reformation to 1621, which remains one of the most informative studies of Danish intellectual and cultural history, and whose last volume is a collection of primary sources.[10]

These works are generally highly valuable in terms of details, but inevitably have certain flaws. As for the older works, the authors did not yet adhere to the principles of modern source criticism, which often makes them believe things modern historians generally dismiss as propaganda, *topoi* or overstatements. Furthermore, these authors were naturally influenced by the discipline they originated in. As for the theologians, their focus is on developments in religion, while the physicians focused on scientific discoveries in particular. As for both groups, they generally had a limited knowledge of general history, which, even if they tried to, made them incapable of connecting intellectual history with social or political history. They were happily unaware of the emergence of materialist history and the sociology of science in the 20th century and were therefore inclined to see theological and philosophical developments, rather than power structures or socio-economic formations, as the explanation for the developments.

The historian of medicine Axel Garboe wrote in 1949 in the preface to his eminent biography on Thomas Bartholin: *"There is yet much about Thomas Bartholin that can be studied in order to understand a significant man and his time".*[11] This, alas, has not happened. The Danish tradition of the history of 17th century science and history of learning dried out in the first half of the 20th

[10] Holger Fr. Rørdam, *Kjøbenhavns Universitets Historie fra 1537 til 1621*, I-IV. Cph. 1868-74.

[11] Axel Garboe, *Thomas Bartholin. Et Bidrag til dansk Natur- og Lægevidenskabs Historie i det 17. Aarhundrede*, vol. I. Cph. 1949, 13.

century, as did the general tradition of national history it was tied to. Garboe's biography was, as a matter of fact, one of the last contributions to it. The national motivation of Rørdam and his circle became obsolete as intellectuals began to take a more critical view on national historiography and its political implications, and academic specialisation also made sweeping cultural studies out of fashion. With no central institutional framework such as the Swedish departments of the history of learning, the study of natural philosophy in Denmark therefore became fragmented. Astronomers, chemists, and physicians have published articles on aspects of the science of the period, but no one has until recently tried to study the natural philosophy of Thomas Bartholin and his contemporaries against a broader background.[12] An illustration of this is the fourteen-volume work that was published in connection with the 500-anniversary of the University of Copenhagen in 1979. Here, every faculty of the modern university has written its own history. As for the Faculties of Science and Medicine, most articles have been written by professionals - physicians, astronomers, and mathematicians. It contains a wealth of information, but no general syntheses of the development of learning or science at the university has been attempted, and the cultural, political, social, and religious background has only been lightly covered, if it has been included at all.[13]

On the other hand, Danish philologists must have formed a sacred pact with Minerva, for during the last decades they have certainly done her great favours. The correspondence of nearly all major Danish natural philosophers in the 17th century has been published, and still more is forthcoming. To this may be added the publication and translation of a number of books, manuscripts and other source material.[14] In other words, a large source material

[12] The exception to this is Nicolaus Steno who was evoked an extensive literature from Catholic scholars. However, little has been done to combine the scientific and religious aspirations of Steno.

[13] Svend Ellehøj et al (eds.), *Københavns Universitet 1479-1979*, I-XIV. Cph. 1979-91.

[14] The most important of these are the letters of Nicolaus Steno (op. cit.) and Ole Worm; H.D. Schepelern (ed), *Breve til og fra Ole Worm*, I-III. Cph. 1965-68, as well as H.D. Schepelern, *Museum Wormianum*. Odense 1971; Niels W. Bruun and Hans-Otto Loldrup (eds), *Thomas Bartholin. Cista Medica Hafniensis*. Cph. 1982; August Ziggelaar (ed), *Chaos. Niels Stensen's Chaos-manuscript*. Cph. 1997; *Ole Rømer. Korrespondance og afhandlinger samt et udvalg af dokumenter*, ed. by

has been made available to students of 17th century Danish history of science, which few scholars have used so far. But things are definitely changing. At the present moment several Danish and Norwegian scholars are engaged in studies of early modern natural philosophy and learning, which aim at placing it in a wider context, and hopefully the chapters on Denmark found in this book, would be much different, if they were written ten years from now.

For this reason, it has seemed more urgent, and indeed possible, to throw new light on developments in Denmark than in Sweden The general development within the history and sociology of science, the discussions on the occult philosophy in the Renaissance, general discussions on 17th-century history, as well as recent studies on the importance of patronage systems in Early Modern Europe, all make it due time to re-evaluate and synthesise the development of cultures of natural philosophy in 17th century Scandinavia in connection to developments elsewhere in Europe. This study can only be a preliminary, but I hope it shall inspire others to carry on the work and try to set their knowledge of individual scientists and branches of science into a wider historical context. If this happens, my work, for all its inevitable errors and shortcomings, will have succeeded.

4. A Word on Method

This book is essentially a study of culture, and such studies necessarily transgress traditional disciplinary boundaries. The author is neither a historian of science nor a student of the sociology of scientific knowledge (also known as SSK). My background and approach is that of a historian, which for all the diversity in modern historiography still represents a different discipline in terms of methods and emphasis. Unlike most historians of science, I have no background in the sciences, and only a limited insight in the massive development of the sociology of science that has occurred in the last generation. This necessarily puts some limits on this study, and distinguishes it from most contemporary studies. I have neither the desire nor skill to contribute to discussions on the internal technical development in the various scientific disciplines. The sociological approach is in many ways the opposite due to its

Per Friedrichsen and Chr. Gorm Tortzen. Cph. 2001. Furthermore, an English edition of the letters of Thomas Bartholin is under preparation.

concern with structures of acquiring, organising and presenting knowledge and the attempt to relate such structures to socio-economic contexts.

Both approaches are inevitable, and should be complementary, but should also be connected to studies of general historical developments. Unfortunately this happens only too rarely. In my view one of the reasons for this is the closed character of many contemporary sociological studies. One of the main objections to the Scholastics among humanists and progressive natural philosophers in the early modern period was their preoccupation with the commentaries and definitions of other scholastics, rather than with the subject matter itself, e.g. the individual natural phenomena. Unfortunately the same holds true for a great deal of the SSK, which one may be tempted to coin as 'Neo-Scholasticism'. The historian, whose main concern is the empirical study of the past, and who ventures into such studies to expand his scope and find useful analytical models, is often bombarded with a seemingly endless reference to the studies and definitions of other sociologists and with equally endless discussions on terminology. It appears as a closed and self-reproductive system with precious little reference to a systematic use of primary source material or indeed other disciplines, and despite the undeniably valuable insights and analytic tools provided by such studies, the historian often finds that the efforts required to get hold of sociological discussions is simply not worth while. Thus, the historian who wishes to study the development of natural philosophy finds himself caught between two traditions, which he cannot easily fit into: On the one hand what one we may call the 'internal' history of science, occupied with ideas and techniques, on the other the 'external' sociological approach.[15]

This raises the question whether the historian with no or little scientific, philosophical or sociological training has anything to offer to our understanding of the development of science. The historian, i.e. the tradition within historiography that is the starting point of this author, is concerned with the study of change and

[15] The distinction between internal and external history of science is simplistic and is here used only provisionary, for reflections on the distinctions, see Steven Shapin, "Discipline and Bounding: The History and Sociology of Science as Seen Through the Externalism-Internalism Debate", *History of Science* XXX (1992), 333-369.

stability of past societies based on his reading (in the broad sense) of primary sources. Whether the focus of study is political, socio-economic, mental or intellectual change, and whether he engages in micro- or macro history, he is ultimately concerned with processes. Unlike the historian of ideas who can cover several centuries in order to trace the progress of certain ideas or complexes of ideas, the historian is bound to chronology and must take into account all possible factors in the process he is studying. Philosophers and ideas that may seem trivial and unimportant to historians of philosophy may be included by the historian in so far as they were important in their own time. Thus, the historian is essentially bound to regard every historical process as unique in its own right. He can therefore not allow himself to speak of 'science' or 'natural philosophy' as a general phenomenon, but must always connect it to a specific historical context. This is the strength and limit of the historical approach. From this perspective, historians and sociologists of science often take a too simplistic or downright anachronistic view of the study of nature in the past, perhaps necessarily so since their training lies elsewhere.

Here the historian can make his contribution. I think few will deny the necessity of understanding natural philosophers in their historical context. Tycho Brahe and his circle cannot be separated from the society and culture in which they lived.[16] Neither can the discussions on experiment between Robert Boyle and Thomas Hobbes be isolated from the political and social situation in Restoration England,[17] or the success and fall of Galileo be disconnected from social, religious and cultural structures of 17th-century Italy.[18] The organisation of science into academies in many European countries from the late 17th century cannot be disconnected from the emergence of absolutism and mercantilism and so on. This historical approach also leads to an interest in the time and location of developments, 'the national context' which helps to explain

[16] V.E. Thoren, The Lord of Uraniborg. Cambridge 1990; A. Wittendorff, *Tyge Brahe.* Cph 1994; .J.R. Christianson, On Tycho's Island. Tycho Brahe and his Assistants, 1570-1601. Cambridge 2000.

[17] S. Shapin and S. Schaffer, *Leviathan and the Air-Pump. Hobbes, Boyle, and the Experimental Life.* Princeton 1989.

[18] M. Biagioli, *Galileo, Courtier. The Practice of Science in the Culture of Absolutism.* Chicago 1993; R. Feldhay, *Galileo and the Church. Political Inquisition or Critical Dialogue?* Cambridge 1995.

why scientific outlook and practices developed differently in various countries and cultures.[19]

This study combines the history of culture and ideas with the history of power and politics. As for the former it is concerned with the identity, values and mental and cultural horizon of natural philosophers, and therefore includes discussions, methods and concepts from social history and anthropology. It should also throw light on motives for the study of nature and innovation in natural philosophy, and the acceptance, rejection and transformation of various ideas in different cultures. In the history of ideas, we usually find that we may trace the progress, but not the process. While we can identify the spread of an idea (or complex of ideas) through time and space, it is generally impossible to say for sure why a man (the natural philosophers treated in this book were all male) accepted certain ideas and rejected others. Some ideas and notions were implicit in the thinking of natural philosophers; a prerequisite for their entire thinking and so fundamental that they did not have to be spelled out. Furthermore, people change their views during their life, their thinking is not necessarily consistent, and finally the ideas they express in the extant source material must always be related to the context and genre of the source material. As we shall see, the context differed depending on whether a natural philosopher discussed the study of nature in letters to colleagues, in lectures at the university, in letters of dedication to princes and noblemen or in treatises in the vernacular.

I have tried to analyse the cultures to which the various natural philosophers and their patrons belonged. By culture is meant social entities whose members were dependent on each other, and shared certain values and ideas, also in terms of self-presentation. By showing how cultures of natural philosophy changed in this period, usually only gradually, I hope to be able to provide a background for comprehending changing views of natural philosophy. Changes in the setting of natural philosophy were, after all, prior to changes in natural philosophy itself.

To complicate things, we shall see that natural philosophy was conducted within a certain context and that natural philosophers

[19] See R. Porter, R. and M. Teich (eds.), *The Scientific Revolution in National Context.* Cambridge 1992.

sometimes stood with a leg in two different cultures. Nearly all natural philosophers treated in this study were university professors. The culture of the academics and the syllabus of the universities were generally highly conservative. Academics of all faculties belonged to a culture that derived from the medieval period and which again was rooted in the clergy. While teaching, they were obligated to wear uniform. Both literally, in terms of the black dress worn by professors, but also intellectually, as far as their teaching was supposed to be subordinated to the framework of Scholasticism and Lutheran theology.

But outside the lecture room, in the *museum* of their private residence or that of their noble patron, the very same men who had dictated traditional natural philosophy in the morning, would represent a very different kind a natural philosophy - Paracelsianism, neo-Platonism and other currents of ideas. It was here new developments in natural philosophy won terrain, and only gradually (if at all) seeped into the lecture room. This is an important aspect of the problem, and during this study we shall treat it in some detail.

In order to answer the question of *how* natural philosophy was promoted in 17th century Scandinavia, this book has been written from a historian's point of view. Since historiography today shows a rich variety of methods and approaches this needs to be elaborated. Immediately from the start, it became clear to me, that the success or failure of natural philosophers in 17th century Scandinavia (or indeed elsewhere in Europe) to promote their science to a large degree was dependent on things that had very little to do with natural philosophy per se. Today we have established certain criteria for evaluating the talent of scientists, which should (ideally) give governments, funds, and academic institutions objective reasons for supporting one scientist or research program rather than the other. In the 17th century no such criteria existed or were at best very rudimentary. Nonetheless, certain natural philosophers won support, some of them extensive support, and the question arises, which criteria determined why some were preferred at the cost of others. The example of Nicolaus Steno, probably the most talented and innovative natural philosopher in 17th century Scandinavia, who was passed over for a chair in Copenhagen, which was given a far less talented man, should prove the fact that factors other than sheer scientific talent were at play.

The success of an early modern natural philosopher in promoting science cannot be separated from his success in promoting himself, which again was closely connected to his success in winning the support of those in power, which in the early modern period meant that they had to operate within the system of patronage.[20] Thereby other elements came into play - political, religious and cultural, and therefore the method of this book has been one of political history, which takes interest in *change*, and inevitably relates all developments to a matter of *power*. This, of course, does not necessarily mean raw violence. Power is a many-headed hydra, and sometimes cultural and religious mechanisms dominated the agenda. But as we shall see, and as some natural philosophers in this book found out to their dismay, even the loftiest philosophical or religious ideals were ultimately dependent on support from those who controlled government in Denmark and Sweden. The problem is further accentuated by the fact that the men dealt with in this book often promoted new discoveries (some of them ground-breaking and highly controversial) or even entire disciplines such as astronomy, chemistry, and anatomy.

Following the method of political history, I have tried to uncover the mechanisms behind developments and present my findings as a narrative. I have done this intentionally and with an edge against those currents of contemporary historiography that gives up any attempt of establishing consistent narratives or even rejects such attempts in principle. Influenced by post-modern philosophy and literary theory, there has, particularly in North America, been a general outcry for dismantling the great narratives that has structured Western historiography – the process of secularization, the scientific revolution, the idea of progress etc.[21] Scepticism has re-merged in academic life, and scientific objectivity has been questioned and sometimes dismissed as an utopia.

This new revisionism has not been totally off the mark. Most of the great historical narratives are simplistic and originate from a particular, generally liberal and positivist, historiography connected to a specific political and cultural outlook focused on progress, rationality and the western world. As for the history of early

[20] The phenomenon of patronage will be analysed in Chapter One.

[21] For these currents see Lynn Hunt (ed.), *The New Cultural History.* Berkeley-Los Angeles 1989; Georg G. Iggers, *Historiography in the Twentieth Century. From Scientific Objectivity to the Postmodern Challenge.* Hanover, NH. 1997

modern science, for instance, this has led to a massive interest in those men regarded as the forerunners of modern science (Kepler, Galileo, Newton), while most scholars have turned a blind eye to those currents of the past, which could not easily be fitted into the picture of scientific progress, even if such currents played a decisive role in the thinking and cultural background of celebrated scientists. The emergence of the new cultural history, feminist and non-western historiography, the vast interest in astrology, alchemy, cabala and the Hermetic tradition, as well as the introduction of sociological and anthropological methods and problems has remedied much of this. The picture that has emerged is much more complex, not so say muddled, the division line between the 'great forerunners of modern science' and their contemporaries has been blurred.

Essentially there have been two approaches in these studies. The one, the anthropological, is to understand the past in its own terms, i.e. to understand the rationality behind phenomena like the occult sciences of the Renaissance by analysing their universe of symbols and ideas. The other, the sociological, has essentially been concerned with power structures, and both approaches have often included linguistic analyses, for example in order to show how power structures played a decisive role in drawing a demarcation line between 'science' and 'superstition'.

For all the inarguable merits of such approaches, they have also given rise to a certain historiography that frustrates the present author. Deconstruction is valuable, but historiography is essentially construction. If the great historical narratives have been simplistic or downright false, we still need to construct new ones, undoubtedly more complex. Too many contemporary scholars engage themselves in breaking down traditional historiography without endeavouring to replace it. An essential part of writing history is to produce analyses and explanations of change. This need not lead to Whig history, but history is essentially about change and development. Even if much implied in the concept of the Scientific Revolution can be dismissed, it is beyond doubt that great changes took place in educated people's view on nature between 1500 and 1700. And if the new science did not win the ground because it was the 'right one', we still need to explain why and how it won the day.

When issuing such problems scholars must be courageous, for here they must venture beyond the texts and leave themselves open

to the same criticism as that directed against traditional historiography. Causality is always the most difficult and precarious part of the work of a historian, and when dealing with subjects that cannot be quantified, causality, of course, can only be based on probability. Nonetheless, if historians abandon causality and the attempt to relate the past to the modern world, history becomes apolitical and irrelevant. If we abandon the attempt to explain why things turned out as they did and relate them to historical processes eventually leading to the present, and limit ourselves to 'describing the past', history dissolves itself to fragments of little interest to others than academics. This, however, will not stop the appearance of chains of causality (or narratives), namely by people with various non-scientific motives, whether these are based on political agendas, opportunism or sheer ignorance.

Nonetheless, I find attempts to deconstruct the great narratives of traditional historiography useful. In this book, the reader will thus find little reference to the concept of '*The Scientific Revolution*',[22] which would only blur matters. First of all, while this concept deals mainly with the introduction of the mechanical world picture as promoted by Galileo, Descartes and Newton, and thus with mathematics and physics, this book is primarily concerned with medicine and related disciplines as far as Denmark goes. Secondly, while there can be little doubt that natural philosophy changed radically from around mid-17th century, also in Scandinavia as we shall see, the focus of this book is not the replacement of one complex of scientific ideas (or one paradigm) with another, but rather the cultural framework of natural philosophy. Natural philosophy in Scandinavia was generally eclectic, and when contentions arose between various ideas, it was often closely connected to institutional, political and cultural structures.

A notion often connected to the concept of a Scientific Revolution, is the idea of an essential tension between religion and science. It is obvious to anyone familiar with early modern natural philosophy that this dualism has no hold in reality, but since it incessantly re-emerges in popular descriptions of The Scientific Revolution it is worth mentioning. However hard it may be, historians have to admit the fact that 17th century Europeans were religious. They might not agree with each and every religious doctrine

[22] See Osler (2000).

propagated from the pulpit. They might adhere to a world-view inspired by the some of the numerous currents included in Renaissance Neoplatonism, that can hardly be called Christian, or they might adhere to a diffuse world view, a rattle-bag of various notions and ideas. But religious they were, brought up with the idea of a divine providence that pervaded History and the world that surrounded them.[23] They were also brought up with the idea that the whole world, even though it may contain several layers of reality or divisions between the world of God and the world of the Devil, could be contained in one system.

The confidence in a divine order of things was also reflected in natural philosophy. Around 1500 Europeans had access to systems of thought that could explain the world around them. To most Europeans they were surrounded by a multitude of benevolent and malevolent spirits and powers governed by a divine providence, with saints covering different areas of life and protecting certain groups of people. To those few Europeans with an academic training the world could be explained within the framework of Christian Aristotelianism and attached theories like the cosmology of Ptolemy and the medical system of Galen. Some inquisitive minds knew that these systems were not perfect, but they presented a coherent system connected to religion that explained everyday phenomena. In the Renaissance other systems like Neoplatonism emerged that likewise presented a coherent system for the educated, based on hierarchies of reality.

Therefore, Europeans at the beginning of the 16th century were not in lack of explanations for the natural phenomena that surrounded them, explanations whose foundations were religious views whether these were Scholastic, Neoplatonic or belonged to popular culture. New theories that opposed established authorities were therefore likewise founded on religion (or religious philosophy). It is well known that Copernicus' heliocentric theory was

[23] Lucien Febvre has expressed this eloquently: "Wanting to make the sixteenth century a skeptical century, a free-thinking and rationalist one, and glorify it as such is the worst of errors and delusions. On the authority of its best representatives it was, quite to the contrary, an inspired century, one that sought in all things first of all a reflection of the divine", *The Problem of Unbelief in the Sixteenth Century. The Religion of Rabelais.* Trans. by Beatrice Gottlieb. Cambridge, Mass. 1982.

inspired by Neo-Platonic ideals he had encountered in Italy,[24] as were William Harvey's theory on the circulation of the blood,[25] whose first champions were disciples of Renaissance occultism such as Robert Fludd.

In other words, the philosopher's general religious attitude was often integral to his approach to the study of nature. This does not mean, however, that the schism within Western Christianity that emerged in the wake of the Reformation and the Counter-Reformation, allows us to speak of a Lutheran, a Calvinist, and a Catholic science. This has been convincingly rejected by William B. Ashworth,[26] who sees no common features among Catholic scientists in early modern Europe. He points out, that while they were all motivated by religious considerations; each was led in a different direction.[27]

On the other hand, when he claims that Nicolaus Steno did not experience a conflict between Faith and Reason, this is hardly true. While it applies for the young Steno who made his brilliant scientific discoveries within several sciences, it must not be forgotten that Steno ended his life as an ascetic Catholic bishop in a hostile Protestant environment, no longer taking any interest in science and rejecting the value of Reason.[28] And Steno was not the only great scientist of the 17th century, who ended his life in religious anxiety. The same did the brilliant Dutch zoologist Jan Swammerdam who at the end of his life rejected his pursuits in science so bitterly that he tried to burn his manuscripts.[29] Steno and Swammerdam are 17th century examples of a religiously motivated science that ended in a personal crisis that rejects their science.

[24] E.J. Dikjsterhuis, *The Mechanization of the World Picture.* Trans. by C. Dikshoorn. Oxford 1961, 63f.

[25] Hugh Trevor-Roper, *Renaissance Essays.* London 1985, 168-173, 200-210, 216-221.

[26] William B. Ashworth, Jr: »Catholicism and Early Modern Science«, Lindberg & Numbers (1986), 136-166.

[27] Ashworth (1986), 147.

[28] This is evident from the modern edition of Steno's letters. The first volume is a caleidoscope of scientific discoveries and reflections, while the second volume hardly mentions science at all; Harriet Merete Hansen (ed), *Niels Stensen's korrespondance i dansk oversættelse,* 2 vols., Cph. 1987.

[29] A. Schierbeek, *Jan Swammerdam (12 February 1637 – 17 February 1680). His Life and Works.* Amsterdam 1967.

So, religious motivation is central in understanding a 17th century philosopher. In Scandinavia this not only found expression within circles of Neo-Platonism and Occult philosophy. As has recently been shown by Sachiko Kusukawa, the study of natural philosophy was an integral part of Melanchthon's system of learning that was directed towards religion,[30] which was to have a great impact on intellectual life in Scandinavia. As we shall see in this book, this natural philosophy was carried on at the time when Lutheran Orthodoxy from the 1570's began to replace Philippism in Lutheran Europe.

Another aspect of religious motivation for the discovery of Nature may be termed as Irenic. In a Europe of increased dogmatic controversy, men all other Europe studied God's Creation, in an attempt to find a Truth that would transgress confessional divisions and unite Europe (or at least learned Europe) in peace and harmony. In short, religious concerns were probably the most important driving force for natural philosophers in early modern Scandinavia. A great part of this book will therefore be dedicated to religious issues and developments.

Finally, a word has to be said of the source material of this study. This consists mainly of letters and treatises by natural philosophers and their patrons. As mentioned, I have whenever possible tried to establish causal relations, not least in terms of the power relationships that enabled or prevented the propagation of natural philosophy. Most of this is analysed within the framework of the system of patronage. This poses two fundamental problems. First, while there was nothing obnoxious about having a patron, the dealings between natural philosophers and their current or hoped-for patrons were generally oral, conducted either directly or through a broker. So while natural philosophers are quite explicit in terms of mentioning their patrons, the exact content of the relationship cannot be disclosed. Secondly, when in this study I use relationships to patrons or attempts to win a patron to explain the behaviour of natural philosophers this is sometimes, but not always, based on explicit statements in the source material. The missing links in the source material in case of patronage could lead

[30] Sachiko Kusukawa, *The Transformation of Natural Philosophy. The Case of Philip Melanchthon.* Cambridge 1995.

(and has led) some historians to disregard this important phenomenon all together. I have chosen to deal with it, but my analysis will generally be based on probability (sometimes conjectures). Hopefully, the reader will find the endeavour worthwhile.

5. Synopsis

The first part of this study deals with the intellectual, cultural and social framework that the 17th century inherited from its predecessor. Chapter One discusses Scandinavian society at the wake of the Reformation and the system of patronage. Chapter Two deals with the religiously orientated natural philosophy of Philipp Melanchthon and other reformers, and its introduction in Scandinavia. Chapter Three analyses a setting for natural philosophy outside the universities, namely the noble and humanist cultures of learning. Chapter Four analyses the process of political centralisation in Scandinavia and its dramatic effect on the framework of patronage and learning.

In the second part we move into the 17th century and identify the establishment and development of various cultures of natural philosophy in Denmark and Sweden. Chapter Five is concerned with natural philosophy in Denmark in the first half of the century, and illustrates the diversity in natural philosophy within a very small community. Various philosophical traditions are discussed, and particularly the relationship between religion, power, and natural philosophy. Chapter Six deals with similar developments in Sweden and discusses the essential differences in 'national style' between the two Scandinavian countries. It is argued that the apparent incongruent traditions of a utilitarian Ramism and speculative Hermeticism were allowed to co-exist and develop due to the usefulness of both to the ambitions and politics of the Swedish elite.

Chapter Seven analyses the introduction of public dissections and the establishment of anatomical theatres in Scandinavia. The various arguments in defence of dissections are examined, and so is the self-presentation and self-image of anatomists Thomas Bartholin and Olof Rudbeck. Chapter Eight analyses the culmination and diversity of the culture of natural philosophy in Copenhagen in the decades from 1650, as well as its decline after the introduction of absolutism and its revaluation of society and learning. Finally, Chapter Nine discusses the development of natural philosophy in Sweden well into the 18th century. Chapter Ten closes the

study by summing up the findings of the previous chapters and relating them to general discussions on the emergence and spread of the new science in order to place Scandinavian developments in a broader European context.

Abbreviations of frequently cited works

AC	*Acta Consistorii* (see bibliography)
Chaos	*Chaos. Niels Stensen's Chaos-manuscript Copenhagen 1659. Complete edition with Introduction, Notes and Commentary*, ed. Aug. Ziggelaar. Acta Historica Scientiarum Naturalium et Medicinalium 44. Cph: 1997.
CR	*Corpus reformatorum Philippi Melanthonis opera quae supersunt omnia*, ed. C.B. Bretschneider and H.E. Bindseil, 28 vols. Halle-Brunswick 1834-52.
DLH	*Dansk litteraturhistorie*, II-III, reprint. Cph. 1990.
DM	Danske Magazin
HT (da.)	Historisk Tidsskrift (Danish)
HT (sw.)	Historisk Tidskrift (Swedish)
KB	*Kongelige Bibliotek* (Royal Library in Copenhagen).
KBB	*Kancelliets Brevbøger.* Cph. 1908ff.
KCF	*Kong Christian den Fjerdes Egenhændige Breve*, ed. C.F. Bricka and J.A. Fridericia. Cph. 1887-89, reprinted 1969.
KS	*Kirkehistoriske Samlinger.*
KUH	H. Fr. Rørdam: *Kjøbenhavns Universitets Historie 1537-1621,* 4 vols. Cph. 1868-77.
KVAÅ	Kungl. Vetenskapsakademiens Årsbok
LW	*Luther's Works* (English translation), ed. J. Pelikan and H.T. Lehman, 55 vols. St. Louis 1955-76.
MBW	*Melanchthon's Briefwechsel: kritische und kommentierte Gesamtausgabe, im Auftrag derHeidelberger Akademie der Wissenschaften*, ed. H. Scheible. Stuttgart 1977ff.
OWB	*Breve til og fra Ole Worm.* 3 vols. Ed. H.D. Schepelern. Cph. 1965-68.
TB	*Tycho Brahe Dani,* ed. I.L.E. Dreyer. Reprint, Copenhagen 1972.
UUÅ	Uppsala Universitets Årsskrift
VHAAH	Vitterhets Historie och Antikvitetsakademiens Handlingar
WA	*Dr Martin Luthers Werke, kritische Gesamtausgabe*, 63 vols. Weimar 1883-1987.

The Order of Life

1. The Emergence of a New Order

In the first decades of the 16th century Scandinavia was ablaze. The Union of Kalmar, which had united the kingdoms of Denmark, Norway, and Sweden for more than a century broke down in 1523. Christian II, who had ruled Scandinavia not only lost control over Sweden, but was also deposed as King of Denmark by the high nobility. A decade later followed a bitter and bloody civil war, the so-called 'Count's Feud' 1534-36. The powerful Hanseatic League of Northern Germany intervened politically and militarily, peasants and town burghers rose in revolt, the estates of the high and mighty were sacked, and representatives of the Church and secular power beaten up or murdered. Also Sweden witnessed severe rebellions, and in certain parts of the country unrest was endemic for decades. The whole foundation of Scandinavian society was shaken, and it took severe measures to restore order.[31]

When royal power eventually emerged victorious in both Denmark and Sweden, the new order that was established was unlike that of any previous age, as many new concepts and ideals were introduced. The triumphant kings, Christian III of Denmark and Gustav I Vasa of Sweden, established the Reformation, in Denmark almost overnight,[32] in Sweden gradually.[33] Thereby, the

[31] For an introduction to general Scandinavian history in this period see volumes four to seven of S. Grenholm (ed.), *Den svenska historien.* Stockholm 1978 for Sweden. For Denmark see A. Wittendorff, *På Guds og Herskabs nåde, 1500-1600* and B. Scocozza, *Ved afgrundens rand, 1600-1700,* which are volumes seven and eight in Gyldendals and Politikens Danmarks Danmarkshistorie. Cph. 2003 (1989); Ø. Rian, *Den aristokratiske fyrstestaten 1536-1648,* Danmark-Norge 1380-1814, vol. 11. Oslo 1997 includes Norwegian history as well. For an introduction in English see D. Kirby, *Northern Europe in the Early Modern Period. The Baltic World 1492-1772.* London 1993 (1990), which includes a bibliography on studies in English.

[32] On the Reformation in Denmark, see Leif Grane and Kai Hørby (eds.), *Die dänische Reformation vor ihrem Internationalen Hintergrund - The Danish*

crown not only took over the widespread estates of the Catholic Church and the monastic orders, but also the administrative, social and educational obligations of the late medieval church.

The years of turmoil that had threatened to dissolve the kingdoms of Sweden and Denmark thus ended in victory for central power. Peasant and burgher movements had been crushed, the Church and religious life brought under government control, the Crown had become far the greatest landowner in the country, the interference by the Hanseatic League had been thwarted, and Norway which had been an independent kingdom in the Middle Ages, became little more than a Danish territory.

Stiffened by the wealth gained from ceased church land, Gustav I Vasa and Christian III were stronger than any of their predecessors, but they had not won single-handed. The suppression of social rebellion was attained in an alliance with the major part of the high nobility, and the century following the upheavals in the early 16th century marked the golden age of this class in Scandinavia. As we shall see in later chapters, the power structures of post-Reformation Scandinavian society and the cultural outlook of its social elite was to have decisive influence on the development of natural philosophy in the northern part of Europe. We must therefore take a closer look at Scandinavian society as it emerged from the bonfires of civil war and rebellion.

2. The Reinvention of Nobility

Like the society that preceded it, post-Reformation Scandinavian society was based on collectivism, and a person was defined, supported and controlled by the various groups he or she belonged to.

Reformation against its International Background. Göttingen 1990. See also C-G. Andrén (ed.), *Reformationen i Norden. Kontinuitet och förnyelse.* Lund 1973 and I. Brohed (ed.), *Reformationens konsolidering i de nordiska länderna 1540-1610.* Oslo 1990.

[33] The Swedish translation of the New Testament was published in 1526, the following year the Crown seized church property, the first Evangelical bishop was appointed in 1531, the Swedish liturgy was enforced in 1536, and in 1544 at the Diet of Västerås Catholic liturgy and the worship of saints was forbidden and Evangelism proclaimed the national creed to which all estates had to swear loyalty; H. Holmquist, 'Reformationstidevarvet', *Svenska Kyrkans Historie* I-II, ed. H. Holmquist and H. Pleijel. Stockholm 1933; M. Roberts, *The Early Vasas. A History of Sweden 1523-1611.* Cambridge 1968; Å. Andrén, *Sveriges kyrkohistorie. Reformationstid.* Stockholm 1999.

These ranged from the patriarchal (sometimes matriarchal) extended family, over the various professional organisations such as the guilds of craftsmen and artisans to the Church and the academic community. Generally, of course, these groups would coincide. Family ties and professional ties would overlap, since men very often took over their father's profession and found a wife from the same background.

In theory, in the world of legislation and political thinking that is, these groups operated within clearly separated estates each with specific privileges, duties and role in society. Professions were connected to the functional division of the various estates - nobility, clergy, burghers and peasantry - presented in legislation and at the meetings of the estates.

In reality of course, society was much more complex and dynamic than that. People could break with their local network and move, and individuals as well as entire families could climb or degrade socially. The social upheavals and the growth of central power in Scandinavia in the early 16th century reflected developments that can be found in most parts of Europe. A number of factors were at play, most importantly within the realm of economic history - the development of the monetary economy and capitalism, widespread inflation and demographic changes. Those who could benefit from these strengthened their power, while others, notably many noble families faced ruin and social degradation.[34]

The princes, who received their taxes in money, strengthened their economic basis, as did those who were attached to the Court and paid by it and the noblemen who produced grain and livestock to the growing population of Western Europe. But also a number of burghers, craftsmen and even a few peasants had managed to acquire substantial fortunes and thereby threaten the economic supremacy of the established social elite,[35] and during the Count's Feud in Denmark and the social rebellions throughout

[34] In Denmark, 165 of the 416 noble families known from the late middle ages had already disappeared from the estate by 1536 due to social degradation or extinction.

[35] For Denmark and Norway see E. Ladewig Petersen (1980) and O. Feldbæk, *Danmarks økonomiske historie 1500-1840.* Cph. 1993 supplemented with S. Dyrvik wt al, *Norsk økonomisk historie 1500-1850.* Oslo 1979; for Sweden see E. Heckscher, *An Economic History of Sweden.* Cambridge, MA. 1954.

Scandinavia, burgher leaders - sometimes even peasants - made a bid for political power.

Furthermore, the so-called "military revolution" challenged the traditional military monopoly of the elite. Developments in military technology and warfare had made the traditional warrior knight obsolete. Due to the development of guns and firearms, the fortified mansion no longer ruled the countryside unchallenged, and the development of a new kind of professional warfare demanded increasingly high technical and administrative skills of would-be commanders.[36]

These challenges to the status and power of the elite led to a political and cultural reaction, and if anything, the developments in the second half of the 16th century strengthened the collective and traditionalistic ideals and the separation between the estates. Martin Luther and Evangelical theology emphasised the patriarchal character of family life,[37] and insisted that men contributed to the Christian society by following the calling of the estate to which they belonged.[38]

This religious thinking went hand in hand with a rally and closing of ranks from the nobility.[39] On the cultural level, a new class awareness was developed - in order to emphasise its social superiority and legitimate its privileges, emblems of nobility were elaborated - noble family names were adopted, in Scandinavia often referring to the coat-of-arms such as a beam (Bielke), a chevron (Sparre), a bush (Podebusk), or an ox (Oxe), genealogies and family histories were produced,[40] and *conspicuous consumption* was

[36] See G. Parker, *The Military Revolution.* Cambridge 1988. To illustrate the decline of the nobility's military importance in Denmark one can compare the campaigns against Ditmarsken (Dithmarschen) in 1500 and 1559 respectively. In the first the nobility formed the major element in the royal army, while the army of 1559 consisted almost entirely of mercenaries. See also G. Artéus, *Till militärstatens förhistoria. Krig, profesionalisering och social förändring under Vasasönernas regering.* Stockholm 1986 and G. Lind, *Hæren og magten i Danmatk 1614-1662.* Odense 1994.

[37] For an analysis of Northern European family life in this period see S. Ozment, *When Fathers Ruled. Family Life in Protestant Europe.* Cambridge, MA. 1983 and idem, *Ancestors. The Loving Family in Old Europe.* Cambridge, MA. 2001.

[38] Luther, *Werke. Weimarer Ausgabe*, vol. 11. Weimar 1900, 229-281; ibid. vol. 52. Weimar 1915, 136ff.

[39] It was only in 1523 that the word 'nobility' appears in an official Danish document as a general term, namely in the coronation charter of Frederik I.

[40] In 1526 it was actually made mandatory for noblemen to carry a family name.

displayed in dressing and jewellery,[41] and probably also in other ways which shall be discussed below.

The Reformation and the growth of central power offered new opportunities for attaining prosperity and status. The Crown's seizure of most of the land that had belonged to the Church and the monastic orders meant that noble families could no longer place their younger sons in lucrative positions within the Church and the monasteries (not to speak of unmarried daughters), but the swelling lands and increased administrative burdens of the Crown, together with the general European development of international communication and diplomacy, offered careers at court, in the central administration, or as lord lieutenants of royal fiefs (Da. *lensmand,* Sw. *länsman*).[42]

In return for their support in crushing social rebellion, the nobility gained royal support in monopolising such offices, and the division of society into estates was elaborated in political thinking and enforced in legislation. As documented by Peter Englund, the rigid division of society into estates was relatively new in this period, albeit it had roots in medieval concepts,[43] and although this development seems to have taken place in Denmark already before the Reformation, the outcome was the same.[44] Supported by the Crown, the nobility enhanced its privileges and powers over the lower estates and virtually monopolised political power. Although it was unable to prevent a few individuals of a more humble origin from attaining high offices at court, these either remained isolated figures or they were ennobled (which was

[41] The phenomena of conspicuous consumption has only been scarcely treated by Scandinavian historians, but see Erling Ladewig Petersen, 'Conspicuous consumption: The Danish Nobility of the Seventeenth Century', *Kwartalnik Historii Kultury Materialnej* 1/1982, 57-65; Karen Arup Seip, 'Jordegods og gyldne kjeder', *Fortid & Nutid* 1998/2, 106-138.

[42] On this development for Western Europe in general see N. Elias, 'State Formation and Civilization', idem, *The Civilizing Process.* Oxford 1994. The classical study of the crisis of the nobility, though largely from the social historical perspective is Lawrence Stone, *The Crisis of the Aristocracy 1558-1641.* Oxford 1965. For the transformation of the nobility in France see Schalk (1986).

[43] See P. Englund, *Det hotade huset. Adliga föreställingar om samhället under stormaktstiden.* Stockholm 1989; K. Arup Seip, *Mogens Gyldenstjerne. En monografisk studie i adelens forestillinger om status og karrieremobilitet på 1500-tallet.* Unpubl. dissertation, Oslo 1996.

[44] Already in 1513 the Danish king had to gain acceptance from the Council of the Realm before he could make new ennoblements.

almost unheard of in Denmark, but widespread in Sweden from the late 16th century and particularly from 1640) whereby the social equilibrium was maintained.

In the wake of the Reformation the nobility thus managed to monopolize the must lucrative offices of the expanding central administration and the entrance to the Council of the Realm (Da. *rigsråd*, Sw. *riksråd*), which was the most, if not the only, important political organ and the connecting link between the king and the assembly of the estates.[45]

At a glance, Scandinavian society in the late 16th and early 17th century thus appears as stable and consisting of well-defined and separated social and professional groups. Below the surface of normative legal terms, however, the picture that emerges is much more complicated. Throughout the period the relationship between various groups changed, and at the same time relations between people would often transgress legal and collective groups. As an estate, noblemen shared privileges and political power, but the high nobleman with close connections to the Court, who received generous donations of lands in return for his services to the Crown was a world apart from the poor unconnected nobleman in a remote province, hardly distinguishable from his peasants.[46]

Within each estate there were hierarchies, a differentiation of power and status. The period witnessed a greater concentration of political and economic power into the hands of a few noble families, primarily due to economic developments.[47] By expanding their lands and providing their sons with expensive education abroad, these families could cement their position. Thereby political power was virtually monopolised by a handful of noble families (including of course the various branches of the ruling dynasty), while the majority of the estate declined economically and politically with several families sinking into oblivion. Much the same development took place within the estate of burghers, with a few patriarchal families (many of whom were emigrants from Ger-

[45] For an overview of the constitutional organisation of Sweden and Denmark in the early modern period see L. Jespersen, 'The Constitutional Situation', *A Revolution from Above? The Power State of 16th and 17th Century Scandinavia,* ed. idem. Odense 2000, *44*-58.

[46] See S.A. Nilsson, *Krona och frälse i Sverige 1523-1594.* Lund 1947; K.J.V. Jespersen (ed.), *Rigsråd, adel og administration 1570-1648.* Odense 1980.

[47] See E. Ladewig Petersen (1980).

many or the Netherlands) attaining wealth, while others had a hard time. The successful burgher families were *de jure* barred from the leading offices of the administration and the council of the realm, and thus from real political power, but as their fortunes exceeded that of many noblemen, and they lend substantial sums to noblemen, they had power indeed.[48]

3. Patronage

This makes it clear that we shall have to dig deeper in order to understand structures of dependency in early modern Scandinavia. In an age where was not yet any clear separation between professional and private life, family ties and personal relations were decisive for a man's career prospects, and a closer look at these mechanisms is essential if we are to understand the position of the natural philosopher in early modern society.

Generally speaking, personal relations came in two kinds, which we may call horizontal and vertical respectively: 1) Kinship between members of the same estate or, 2) A relationship of protection between a protector and a protégé from a lower estate (or lower strata within the same estate). Though relations between two men are referred to as *friendship* (*amicitia* in Latin texts), we shall often find, that it actually was dependency with one 'friend' being in need of the other for establishing or advancing his career. This, of course, did not exclude mutual feelings of affection,[49] but unless kinship was involved, both parts were aware that it was essentially a relationship of mutual benefit, which might end if the prospect of benefit ended. It was therefore consistent with the logic of the system that men should change protector if the old one died or fell from power or the prospect of an even more powerful protector arose.

In early modern Europe structures of protection and dependency between two people generally worked within the framework of the system of patronage. Sometimes historians make a distinction between 'clientage' as referring to political and social dependency, while 'patronage' refers to support of art and learning. For our purposes we are mainly concerned with the latter, and al-

[48] For the loans of the commoners to noblemen in Denmark see Hansen (1964).

[49] For a discussion of the phenomenon of 'the mourning client', see Magnus von Platen, *Klient och Patron. Befordringsvägar och ståndscirkulation i det gamla Sverige.* Stockholm 1988.

though the distinction is not always crystal clear and the two types might overlap (as in the case of Tycho Brahe which we shall discuss below), it makes sense in so far that most of the persons with whom we are concerned in this book were not only men of learning, but also non-nobles and *eo ipso* politically impotent.

While the mechanics of patronage (or clientage), i.e. a relationship between a patron and one or more clients, has long been recognised and studied by historians of ancient Rome,[50] as it has among historians of art and literature, it has only recently aroused widespread interest among historians of early modern Europe. It seems that historians have been too influenced by general theories of class struggles and social formations, and too attached to legal definitions of estates (that represented these as homogenous and distinct groups) to recognise relationships that transgressed the supposed interest of particular social groups.

During the last twenty years, however, the existence and importance of patronage systems in early modern societies has been recognised. In 1984 an international conference on patronage was held in Munich, followed by a number of studies on patronage in various parts of Europe.[51] This interest has also been extended to the relationship between patronage and learning. While historians of learning always have known (or at least ought to have known, since this is evident from the dedication found in almost every book from the early modern period) that writers, scholars, philosophers, and scientists had patrons, it is only recently that this has been studied as more than a personal relationship between a

[50] According to Lewis and Short, *A Latin Dictionary*, 'patronus' literally meant a defender or protector of cities and individuals, as well as the former master of a freedman. Later it also came to mean an advocate who pleaded the case of another.

[51] See Antoni Mączak (ed.), *Klientelsysteme im Europa der frühen Neuzeit.* Munich 1988; Y. Durand (ed.), *Hommage à Roland Mousnier. Clientèles et fidélités en Europe à l'époque moderne.* Paris 1981; Sharon Kettering, *Patrons, Brokers, and Clients in Seventeenth-Century France.* Oxford 1986; idem, "The Historical Development of Political Clientelism", *Journal of Interdisciplinary History* 3 (1988), 419-447; Ronald G. Asch and Adolf M. Birke (eds.), *Princes, Patronage, and the Nobility. The Court at the Beginning of the Modern Age c. 1450-1650.* Oxford 1991; Guy Lytle and Stephen Orgel (eds.), *Patronage in the Renaissance.* Princeton 1981.

patron and his client, and the picture of whole structures and rituals of patronage of learning has emerged.[52]

Generally speaking, patronage can be defined as *a routine way of exercising power and authority at a time when the public and the private were not yet clearly separated.*[53] Despite local differences, varieties of patronage seem to have existed in most parts of early modern Europe, and although it has been claimed otherwise,[54] patronage also flourished in early modern Scandinavia. Before the introduction of absolutism in Denmark and Sweden in the later half of the 17th century, it may not have been as explicit and formalised as in other parts of Europe, but it certainly existed as a fact of social life though studies are still scarce.[55]

We have to clarify the concept, however, since patronage has become *en vogue* among historians and students. At the present moment the term appears in all likely, and indeed unlikely, connections, sometimes just signifying ties of dependency. That a man depended on someone economically or socially did not necessarily make that person his patron. In dealing with the phenomenon of patronage, we have to make clear what it was and what it was not.

First of all, patronage did not imply a legal obligation and contained no written contract. You could not be brought to court for failing to fulfil your duties as patron or client, though patron-

[52] For an anthology of various examples see Bruce Moran (ed.), *Patronage and Institutions.* Rochester, N.Y. 1991; for a study that includes anthropologic and sociologic analysis, Mario Biagioli, *Galileo Courtier. The Practice of Science in the Culture of Absolutism.* Chicago 1993; for the mutual benefits of patronage under changing political and social conditions see Lisa T. Sarasohn, 'Thomas Hobbes and the Duke of Newcastle. A Study in the Mutuality of Patronage befor ethe Establishment of the Royal Society', *Isis* 90:4 (1999), 715-737.

[53] Definition by Antoni Maczak, "From Aristocratic Household to Princely Court. Restructuring Patronage in the Sixteenth and Seventeenth Centuries", in *Princes, Patronage, and the Nobility. The Court at the Beginning of the Modern Age c. 1450-1650,* ed. Ronald G. Asch and Adolf M. Birke. Oxford 1991, 315f.

[54] By Maczak (1991), 326.

[55] Magnus von Platen (ed.), *Befordringsvägar och ståndscirkulation i det gamla Sverige.* Stockholm 1988, in which the first essay by Stig Strömholm describes the development of patronage from Antiquity to the early modern period. For literary patronage in Denmark, see *Dansk Litteraturhistorie,* Cph. 1990, 375ff. One of the only studies of patronage relationships in a specific region in early modern Scandinavia is still Ø. Ryan, 'State, Elite and Peasant Power in a Norwegian Region, Bratsberg County, in the 17th Century', L. Jespersen (2000), part. 196-203.

age certainly implied duties, particularly on behalf of the client. Nonetheless, patronage had the character of a contractual relationship. It was not charity, but was based on reciprocal services. A patron would expect services in return for his support, tokens of gratitude that would enhance his own status. The client offered a patron his services and a token gift, and in case the offer was accepted, it was understood that both parts must cultivate the relationship. Patronage was in other words based on an 'honour economy'. While a client who failed to satisfy his patron, must face the withdrawal of support and protection, the patron had his or her honour tainted if the obligations were not lived up to. It was as a matter of fact an expression of power. Power, as it has been pointed out, is not a static phenomenon, but a process. It must constantly be exercised and maintained,[56] especially in societies like early modern Scandinavia, in which a man's status was connected to the personal relations of him and his family.

This brings us to a second observation concerning patronage namely that in Scandinavia at least, it was a phenomenon of the social elite, particularly the nobility. The scarcity of studies on patronage in early modern Scandinavia, makes it difficult to trace its historical roots, but at a glance it seems that the emergence of patronage as a ritualistic expression of dependency was connected to the emergence of the noble identity in the 16th century and the influence of Renaissance humanism, which we shall discuss in Chapter Three. In his analysis of the ideology of the Swedish nobility, Peter Englund has pointed to generosity and extravagance as some of the main characteristics of the ideal nobleman.[57] Patronage was in other words of way of showing off one's power and benevolence in a patriarchal society, and one might say, also an aspect of *conspicious consumption.* By bestowing patronage, a nobleman or -women, demonstrated that he and his family belonged to the ruling order of society and lived up to its ideals of patriarchal protection and generosity, and the honour gained by the client in learning or literature would likewise help to glorify the patron.

[56] Michael Foucault, "Truth and Power" in *Power Knowledge*, ed. Colin Gordon. New York 1980, 109-133.
[57] Englund (1989).

Thirdly, as shall be clear in the next chapters, finding a patron was not an option, but a necessity for ambitious sons of the lower estates. If you did not have a patron to further your career, you could be sure that your rivals had. Nobody could attain an office in the administration, at grammar schools or at University without support of a patron, and despite the scarcity of studies on patronage in Scandinavia, it is not difficult to find out, who protected a man's career.

Patronage was not a secret,[58] and humanists making a virtue of imitating Antiquity would gladly refer to their '*patronus*' or '*maecenas*'. We can read to whom a man directed his pleas for patronage or his gratitude, and we can often see or conclude who was responsible for his appointment to a certain office[59] or the bestowment of a certain grant, but if we try to uncover in details the negotiations behind the patronage system, we almost always run into a dead end. Until the introduction of absolutism in Scandinavia in the later half of the 17th century, social conventions were not as ritualised or codified as in Italy or France. It was relatively easy for a man to get into contact with a potential patron. Furthermore, particularly in Denmark clients and patrons were generally not separated geographically; negotiations were therefore oral and not recorded in the extant source material.

Furthermore, while patronage itself was not secret, the negotiations between a client and his patron would often be regarded as too secret to be recorded. First of all, the patron might have to work against the patron of other applicants for a certain office or grant, or perhaps these other applicants even shared the same patron. This problem would accentuate the more power was centralised, and in the beginning of the 17th century the majority of the professors at the University of Copenhagen would be clients of the royal chancellor. Thus, an intriguing situation would often arise where clients who shared patron competed. An analysis of this phenomenon is beyond the limits of this study, although we shall see some examples of it later on.

[58] A man could be praised as a great patron, as when the funeral oration on the Danish Chancellor Thomesen Sehested says: *'He was the father and patron of so many men'*, Barsker (1658), fol. A3, 86.

[59] The extent acts of the governing body of the University of Copenhagen (the *Consistorium*), for example, often reveal who recommended (sometimes ordered) the appointment of a professor.

While clients generally were restricted in terms of which patrons they could acquire, and who could further their careers, powerful patrons on the other hand were at greater liberty to choose among clients. There was in other words a market of talented - and less talented - applicants for vicarages and positions at schools, University and the administration. Therefore, clients competed, but there was also a competition between patrons. It was attractive to have a famous or talented man as your client, and since patronage was an assertion of power, extensive patronage was a demonstration of who was in power. From the 16th century, when power was centralised and a handful of noble families in both Denmark and Sweden grew richer and more powerful, while others declined, patronage was likewise centralised, and still fewer men had any real power, when it came to further men's careers at University and at Court.

The system of patronage, however, was not limited to a bilateral relationship between a patron and his client. A hierarchy of patronage existed. Patrons had their own patrons, with the king as the supreme patron followed by the great men of the Court, local magnates, and eventually commoners like bishops, town patricians, and schoolmasters. Patronage played an important part early in a man's career. If his family was without funds, it might be necessary to obtain support from the local magnate or bishop in order to enter a grammar school. After a few years here he might also be employed as a teacher in the school or in the noble household. The next important step in a talented young man's career would be university studies, at home and abroad. Since sons of the nobility were often very young when they were sent abroad, they needed a *praeceptor* to accompany them. The choice of a praeceptor would often fall upon a man already connected to the noble family. He would follow them around Europe, but often he would be able to study himself, perhaps even taking degrees. In this way, men of non-noble origin were able to visit parts of Europe that their economical and cultural background would not normally allow for.

Patronage would generally extend beyond the employment as praeceptor. After his return to Scandinavia, the patron would often find employment for the praeceptor. This employment, of course, depended on how powerful and well connected the patron was. Sometimes he provided a vicarage, sometimes a job as a teacher in the local grammar school, but if he was a member of the

high nobility or connected to it, he might provide royal grants, a university chair or employment in the central administration. Such a service would again demand a token of gratitude from the client. And even after a client had entered a career, the link of patronage would remain. Often it would last for life, and often it would be carried on to the next generation.

The usefulness of a patron depended of what services were required. If a man aimed at a vicarage, it was useful to be a client of a local nobleman who had the right to appoint clergymen (*ius patronatus*) to one or several churches. If, however, the ambition was a professorship, a contact to the court circles in Copenhagen or Stockholm was inevitable. In 17th-century Denmark, the most important patron in that respect was the royal chancellor, who was also the chancellor of the university. While the *Consistorium* in principle appointed the professors, there is no doubt, that from the time of Christian IV, it followed the recommendations of the chancellor. In Sweden, the situation was a bit more ambiguous. The archbishop of Uppsala was also the chancellor of the University well into the 17th century, but in terms of appointments various civil servants held power, often competing with each other for influence, but increasingly the centralisation of power also led to a concentration of patronage, though the structure remained more pluralistic than in Denmark.

The hierarchical and patriarchal structure of early modern societies was also reflected in the structure of the patronage system. It was unfitting that men from an obscure background, i.e. from families with no links of patronage to the social elite, should apply directly to the supreme members of the hierarchy. Intermediaries must be found. Modern scholarship on patronage has coined the term 'patronage broker' for those intermediaries who acted between an applicant and a potential patron. Mario Biagioli has suggested to define them as preserving *"social structures and boundaries that might have been otherwise violated by improper contacts resulting from attempts to establish patronage relationships".*[60] I might add that generally a broker was not a person to whom you would normally dedicate books.

In Scandinavia the function of brokers often seems to be connected to local power structures. The first step for a young man

[60] Biagioli (1993), 20.

would often be to secure support from the local magnate, bishop or rector of the local grammar school. Having secured his support (or at least recommendations), one might be able to aim at a person higher up in the hierarchy, perhaps ending with great men or women at Court or even the King himself.

While the broker between a client and a potential patron would often himself be a client of the patron and thus part of the system of patronage, this was not always the case. Sometimes, a local patron would establish contact between a client and a powerful man who was not his own patron, but who was better suited to meet the requirements of the client. Heinrich Rantzau in the Duchies, for example, was not less powerful than the royal chancellor in Copenhagen and was certainly not a client of his, but the latter was definitely more influential in terms of securing university chairs. Rantzau therefore frequently established contacts between some of his own clients, generally young men from the Duchies or Northern Germany, and the royal chancellor.

Other brokers who were vital to the patronage of learning in early modern Scandinavia did not even live in Scandinavia. Perhaps the most important broker of all in the mid-16th century was Philipp Melanchthon While he received grants from the Scandinavian governments (as did other German professors like David Chytraeus in Rostock and Johannes Sturm in Strasbourg), he was certainly not dependent on it. He lectured most of the Scandinavian students who went to Wittenberg in the decades after the Reformation, and several of them lived in his house. When they returned home, many of them received a letter of recommendation from Melanchthon, often in connection with a poem or book of theirs, and his support to a student was highly influential.[61] Other important brokers were otherwise connected to Court, such as the court physician, the teacher of the crown prince, the court chaplain, foreign diplomats and perhaps also some artists and architects.[62]

[61] e.g. Melanchthon's letter to Chancellor Johan Friis on behalf of a young student, *Dansk Litteraturhistorie*, II, 376.

[62] e.g. the Danish court physician Petrus Severinus acted as broker on behalf of several scholars among whom were the astronomer and theologian Cort Aslakssøn and the physician Thomas Fincke, both of whom we shall later deal with. Another was Mikkel Vibe, who would later become one of the most succesful merchants in Copenhagen. For a court artist, who most probably acted as a bro-

A student and a man of learning had several ways of pleading for patronage or for showing gratitude to a patron. While Scandinavian noblemen and kings generally took little interest in academic degrees or scholastic subtleties, the humanist education of the social elite that we shall discuss in Chapter Three meant that there was a genre that most of them could appreciate, namely Latin poetry. To compose a well-written Latin poem was taken as a mark of learning, a proof that a young man mastered the Latin language as well as dialectics and rhetoric and therefore could think clearly and express himself fluently.[63] Latin poems dedicated to a powerful man or woman were one of the most celebrated means for a young man, often a student on his academic peregrination to secure himself a patron, and it has been counted that men below thirty years of age composed approximately one out of two Latin poems that was published in Denmark in the period between the Reformation and the year 1600.[64] As we shall see below, also astrological horoscopes could be important means of attracting the attention of potential patrons.

Book dedications were another way for a man of learning to approach a patron. In an age when royalties were the exception and no effective copyright system existed, authors generally earned very low salaries (if any) from their publications from printers, and sometimes they even had books printed at their own expense. The material benefit from books was gained from the patron of the author via the dedication at the beginning of the book. So, until the end of the 17th century, when the right to dedicate a book was often taken over by the book printer or publisher,[65] book dedications were the greatest asset of the author in terms of earning himself a living and advancing his career. To mention an illustrious patron in the beginning of a book would give prestige to the au-

ker, we can point to the Dutch painter Karel van Mander, who was well acquainted with the Copenhagen natural philosophers and men of letters; P. Eller, *Kongelige portrætmalere i Danmark 1630-82.* Cph. 1971, 132ff. deals with Mander's house as a meeting place for men of learning in the 1640s, but does not discuss his role in the patronage system.

[63] See *Dansk Litteraturhistorie.* Cph. 1990, II, 375ff; Peter Zeeberg, *Den praktiske muse.* Cph. 1993; Bo Bennich-Björkman, *Författaren i ämbetet. Studier i funktion och organisation av författerämbeten vid svenska hovet och kansliet* 1550-1850. Uppsala 1970.

[64] Zeeberg, 'Neo-Latin Poetry' in Merisalo (1994), 9-21.

[65] Stina Hansson (1988), 68.

thor as well as his patron. Generally, scholars agree that the dedication to a patron is evidence of support that had already been received, but as we shall see in the next chapter, a dedication could also be an attempt to win support from a patron not already won.[66]

The fact that poems and book dedications represented the two most important means of a man of learning for winning or upholding patronage rises an interesting question that unfortunately is impossible to answer with any certainty: How far was the phenomenon of patronage responsible for publications in early modern Europe? Or to put it hypothetically: How much poetry and natural philosophy would have been published in this period, if the poet or philosopher would not have had to win and keep the attention of those in power? As we shall see in the following chapters, it is significant that generally natural philosophers published much more frequently at times when they were trying to secure patronage.

In an age with no formal criteria for appointments, patronage was in many ways a workable and stable system, since it originated in personal relations, which was generally continued throughout generations. It gave ambitious men certain channels through which they could carry their ambitions. On the other hand, it could be a dangerous game. First of all, the client must frequently provide his patron with gifts of gratitude. Secondly, the career of the client was linked to the power of his patron. If the patron died or fell from power, talent was required to obtain a new patron, not talent in one's profession, but talent for attracting new patrons and for adapting oneself. Particularly in times of changing power structures, as those that occurred in both Denmark and Sweden in the closing years of the 16th century, political talent was a requirement for success.

Patronage was the extension, or rather assertion, of power, and when power changed, the hierarchy of patronage was shaken, and a man must find a new patron or, at best, find his career in a

[66] H. Schück, *Från vor bokhandels barndom.* Stockholm: Studentföreningen Verdanis småskrifter 92 (1900), 16; W. Krieg, *Materalien zu einer Entwicklungsgeschichte der Bücher-Preise und des Autoren.Honorars.* Vienna 1953, 62; however, if the title page contains remarks like *"sumptibus propriis"*, it implies that the patron had not yet paid for the expenses of publication.

blind alley. This happened when a patron died or fell into disgrace. The most obvious example is that of kings, the supreme heads of the patronage hierarchy. Below the king would be a number of men (sometimes also women), typically members of the government, who would be clients of the king, but who in turn would have their own clients, an so on. Often the crown prince would represent a different (often competing) system of patronage as a means of asserting himself. This was the reason why entire governments in early modern Europe often changed, when a new ruler ascended the throne, and as we shall see in the following chapters, this had importance all the way down the hierarchy of patronage.

The Greatness of God in His Creation

Who does not realise that such observers [of Nature] are more inspired with wonder and love towards God than men who have achieved no greater awareness of these phenomena than cattle, and who look upon these remarkable manifestations of Creation with bovine eyes. Jens Sinning (1591)

1. The Challenge from the Enthusiasts

The idea that the world testifies to the greatness of the Creator is almost as old as Christianity.[67] Hence it was employed in the struggle against Gnostic dualism, but always with the caveat that creations were inferior to the Creator. The study of Nature for its own sake was therefore stamped as sterile curiosity (*vana curiositas*),[68] the sciences must always serve theology, and Augustine ultimately came to regard knowledge of Greek physics (*rerum natura*) as unnecessary to the Christian.[69]

This ambiguous relationship between Christianity and the study of nature lived on through the Middle Ages. According to Thomas Aquinas, all human cognition is based on sense impressions through which we can perceive God by way of analogies and negation. Thus, it was the intellect that connected cognition of the fickle physical world with that of the eternal spiritual one.[70] The

[67] D.S. Wallace-Hadrill, *The Greek Patristic View of Nature.* Manchester 1968; R.A. Marcus, 'Augustin. God and Nature', *Cambridge History of the later Greek and early Medieval Philosophy.* Cambridge 1967, 395-405; Aksel Haaning, *Middelalderens naturfilosofi.* Cph. 1993.

[68] Augustine, *Confessiones,* V, 3. The changing views on *curiositas* are discussed in Chapter Five below.

[69] Augustine, *Enchiridion,* Migne, PL 40, col. 235-236.

[70] F.C. Copleston, *Aquinas.* Harmondsworth 1975, Chapter Three; idem, *A History of Medieval Philosophy.* Notre Dame 1990; David C. Lindberg, *The Begin-*

study of the created world, primarily based on transformed Aristotelian natural philosophy thus became the starting point of Thomistic Scholasticism, but it was regarded as a first step to deeper insights into the nature of the divine, and by William of Occam and the scholastics of the *via moderna*, theology was disconnected from natural philosophy.

A more predominant place was given to natural philosophy by some currents within medieval mysticism and Platonist inspired philosophy. The idea of the two books, the Biblical revelation and the Book of Nature (*Liber naturae*) was already contained in Augustine's thinking,[71] but gained momentum in the 12th century.[72] It was connected to the urge for a living experience of God's omnipotence and benevolence, and was employed by religious authorities like Bernard of Clairvaux, who contrasted the contemplation of trees and stones with bookish learning.[73] First of all it flourished within the medieval tradition of mysticism, which continued in the 16th and 17th century and was often defined as heretical by the established churches. The *Liber creaturarum seu naturae* by Raimund de Sabunde (ob. 1436), rector of the University of Paris, contrasted the uncorrupted Book of Nature, the Bible of laymen, with the Bible which was subject to error and corruption, and repeated this conviction in his *Theologia naturalis* (c. 1430): *"Someone can easily twist Scripture through some impious interpretation, but no one is so great a heretic in terms of dogmas that he can falsify the Book of Nature".*[74]

At the dawn of the Reformation, Western Christianity thus contained a number of traditions, which put different emphasis on the status of natural philosophy, most agreeing however that it must be studied from a religious perspective. The recovery of the

nings of Western Science. The European Scientific Tradition in Philosophical, Religious, and Institutional Context, 600 B.C. to A.D. 1450. Chicago 1992; for various Scholastic views on natural philosophy see William A. Wallace, 'Traditional natural philosophy', *The Cambridge History of Renaissance Philosophy.* Cambridge 1996, 201-325.

[71] Augustine, *De Genesi ad litteram,* Migne PL 34, 219-222.

[72] For the origins of this idea see Erich Rothacker, *Das "Buch der Natur". Materialien und Grundsätzliches zur Metaphern-geschichte.* Bonn 1979. See also, Aksel Haaning, *Naturens lys. Vestens naturfilosofi i højmiddelalder og renæssance 1250-1650.* Cph. 1998.

[73] Bernard of Clairvaux, Ep. 106.

[74] Quoted by Haaning (1998), 315.

vast and diverse corpus of ancient natural philosophy in the Renaissance, and the attempts to create a synthesis of the seemingly incongruent views, did not change this. If anything, the conglomerate of thought currents generally labelled as Renaissance Platonism or Neoplatonism,[75] which also included Hermetic, alchemical and Cabalist thinking, strengthened the connection between natural philosophy and religion, though of course it sometimes propagated views, which were not in concordance with those of church authorities. Surely, in their everyday work mathematicians or physicians might practise their profession with more affinity to their Greek and Muslim predecessors than to Christian thinking, but any theoretical reflection on the study of nature would ultimately place it within a religious framework.

The Reformation placed the study of nature in a specific religious context that was to form an important background for natural philosophy in early modern Scandinavia. When Martin Luther began his criticism of established theology, the University of Wittenberg was dominated by Thomist scholasticism.

This kind of theology with its confidence in human intellect and will was the starting point of Luther's protest in the second decade of the 16th century.[76] According to Luther the wall that such a theology had constructed between the individual Christian and the Gospel must be broken down, and one of the most efficient means of doing so was to weed out in the Scholastic system of learning. The study of the Bible and the languages needed to understand it in its uncorrupted form should be emphasised at the expense of the philosophical writings of Aristotle and the commentaries that had grown up around them. Not all of Aristotle should be discarded, however. Disciplines like logic, rhetoric, and poetry should be maintained for the sake of theological thinking and preaching, as should practical disciplines like medicine, law

[75] Brian P. Copenhaver and Charles B. Schmitt, *Renaissance Philosophy.* Oxford 1992, 14: *"The Renaissance, however, recognized no deep divide between Plato's teachings and those of the Neoplatonists. This blurring of categories was particularly momentous for the fifteenth century when an immense Neoplatonic literature - several times the size of the Platonic Corpus - also became known."*

[76] Leif Grane, "Die Anfänge von Luthers Auseinandersetzung mit dem Thomismus", *Theologische Literaturzeitung* 95: 241-249.

and mathematics, since they were useful to secular life, but no religiously edifying role was attached to them.[77]

The impact of the Reformation on the view on learning and its organisation in Lutheran Europe, was first of all the result of the work of Luther's companion Philipp Melanchthon (1497-1560).[78] It was he who redefined learning and its content, and he was immensely influential on education in Scandinavia, Germany and Central Europe in the century after the Reformation. In the first edition of the Lutheran bestseller *Loci communes* from 1521, he adhered to Luther's view on learning and emphasised the all-important significance of Faith for salvation. As far as Nature goes, Faith implied a full confidence in the absolute power of God, also in his Creation and ruling of the World,[79] but for the time being these themes were not central to the polemics of the Wittenberg reformers,[80] since the issue was the Catholic doctrine of justification by good deeds and the authority of the Papacy vis-à-vis the Bible.

Soon, however, the Wittenberg reformers were confronted with other opponents than established Catholicism, and this changed their view on learning as well. The new menace came from the more radical forms of Protestantism propagated by reformers and mystics like Thomas Müntzer, Caspar Schwenckfeld, Sebastian Franck, Ulrich Zwingli, and from within their own ranks by Andreas Karlstadt. The views of these men differed considerably, and we must not make the mistake of judging their ideas only through the polemics of their opponents.[81] Nonetheless, our concern here is Melanchthon's view, according to which these reformers shared common ground in regards to two basic concepts

[77] *Address to the Christian Nobility* (1520), translated by C.M. Jacobs and revised by J. Atkinson in *LW,* XLIV, 200f.

[78] *Loci communes (1521),* trans. L.J. Satre and revised by W. Pauck in *Melanchthon and Bucer.* London 1969, 97. Studies on Melanchthon and learning are numerous. The standard work is still K. Hartfelder, *Philipp Melanchthon als Preceptor Germaniae.* Berlin 1899; see also the essays and references in H. Scheible (ed.), *Melanchthon in seinen Schülern.* Wiesbaden 1997.

[79] *Loci communes,* 98.

[80] In this chapter I use the term 'the Wittenberg reformers' as a collective name for Luther and Melancthon, and henchmen like Johann Buhenhagen. It does, of course, not include heterodox reformers in Wittenberg like Andreas Karlstadt.

[81] In my opinion the best introduction to a range of these mystics is still Alexandre Koyré, *Mystiques, spirituels, alchimestes du XVI siècle allemand.* Paris 1971.

– the belief in predestination and a sharp dichotomy between the world of the flesh and the world of the spirit, between body and soul.

From these basic concepts other ideas might follow, such as contempt for secular as well as religious authorities, and the vindication of the right of rebellion against such authorities. To Zwingli, for instance, God is an invisible, omnipotent and all-knowing godhead. His providence is the basis for predestination (or *Selection* in Zwingli's terminology), and no human act can change God's decision. Thus, Faith becomes a sign of being selected, the sacraments have only didactic significance, and ultimately even apparently 'evil' deeds committed by the selected are righteous. To Zwingli, Man is a divided creature – a spirit that yearns for the love of God, but is constantly imprisoned in this search by the flesh.

When the ideas of such radical reformers were connected with social revolt, as happened in Wittenberg during Luther's stay in Wartburg, during the violent rebellions of the German peasant war which Melanchthon witnessed in Thuringia in 1525, and in the 'New Jerusalem' established by Anabaptists in Münster in 1535, they had explosive consequences, that truly upset Luther and Melanchthon and made them change their means. From the 1520's and culminating with the colloquy of Marburg in 1529, they began to distance themselves from the Zwinglians, a move that was all the more urgent, since Luther's old opponent, Johannes Eck, during the diet of Augsburg 1530 lumped Luther together with Zwingli and other reformers who claimed the right of civil disobedience.[82]

Thus, to Luther and Melanchthon the problem was theological as well as political. In terms of the Gospel they needed to enforce the Lutheran view of the Eucharist against the Zwinglians, while at the same time they needed to emphasise obedience to secular authorities in order to avoid social unrest that imperilled their religious program of reform, and made it suspect in the eyes of many wavering Catholics. The result of this was the emphasis on obedience towards secular authorities that we find in the Augs-

[82] Johannes Eck, *Articulos 404 partim ad disputationes...partim vero ex scriptis pacem ecclesiae perturbantium extractos, Coram divo Caesare Carolo V etc.* Ingolstadt 1530, fol. Diiiir.

burg Confession, and from the late 1520's they changed their strategy towards having their reforms carried out by means of the princes.

In the view of Melanchthon, however, a third solution to both problems could be found in the development of a philosophy that in connection to Lutheran theology would clarify fundamental concepts, emphasise obedience to civil authorities, and show the existence of God's providence *in the world.*[83] From the late 1520's he focused on philosophy and left the work with theology itself (the Gospel) to Luther. In 1527 he began his long series of philosophical textbooks that were to have such an immense influence on learning in Northern Europe.[84] These textbooks were aimed at students at Lutheran universities, and were therefore not intended for professionals, but they constituted a comprehensive, though eclectic, system of philosophy.

To turn on the radical reformers, Melanchthon had to change focus. In the battle against the belief in human reason and the doctrine of justification through deeds, he and Luther had emphasised the spiritual aspects of religion. In the battle against those who radicalised spirituality, he returned to some of the philosophical writings that he and Luther had dismissed earlier. Apparently, Melanchthon thus returned to the view of the *via antiqua* that the study of nature improved Man's understanding of God, but it was in close connection to Lutheran theology.

In his attempt to emphasise civil obedience, Melanchthon turned to natural law (*lex naturae*). Based on St. Paul (Romans 2:14f.) he claimed that God has given all men the power to judge in matters natural and morale, and that it is written in the hearts of all men that secular authority must be obeyed.[85] Thus, Melanchthon to a certain extent still adhered to the view rooted in Antiquity that right reason is essential to good conduct.[86] In a

[83] The following is essentially based on Sachiko Kusukawa, *The Transformation of Natural Philosophy. The Case of Philipp Melanchthon.* Cambridge 1995, supplemented by discussions with Dr. Kusukawa herself.

[84] The standard work on Melanchthon's educational programme is still Karl Hartfelder, *Philipp Melanchthon als Praeceptor Germaniae.* Berlin 1889.

[85] CR, XII; Kusukawa (1995), 67.

[86] C.S. Lewis, *The Discarded Image. An Introduction to Medieval and Renaissance Literature.* Reprint, Cambridge 1994, 160. To medieval and renaissance philoso-

manuscript entitled *Epitome ethices* dating from 1532, Melanchthon explained the nature of moral philosophy:

> *Philosophy is neither gospel nor any part of it, but it is a part of divine law. For it is the law of nature itself divine written in men's minds, which is truly the law of God concerning those virtues which reason understands and which are necessary to civil life. For philosophy, properly speaking is nothing other than the explanation of the law of nature. But I call philosophy not all of men's opinions but the sure perceptions and those, which can be demonstrated.*[87]

Aristotle's *Ethica* was taken up again, not for its treatment of good deeds (which in the view of the Wittenberg reformers contained a false doctrine of justification), but as a textbook in civil obedience.[88]

In connection with this, and to contain the dichotomy between spirit and body propagated by the radical reformers, Melanchthon combined moral philosophy with the study of Nature. In a poem about *Ethica*, he praised God that has created everything with a design,[89] and in the following years he elaborated the connection between moral- and natural philosophy within a polemical religious context.[90] We shall discuss this further, but first it is useful to take a view on Melanchthon's view on particular natural philosophical disciplines.

2. The Machine of the World

If we turn to Melanchthon's textbooks in natural philosophy, we shall find that his theologically orientated system of learning was not only concerned with the connection of various disciplines, but also extended to his philosophy of nature itself. This is evident if we take a look at *Initia doctrinae physicae dictata* (1549), which became a standard textbook of physics at Lutheran universities,

phers 'the heart' was not merely associated with emotions. A man who was *cordatus* was not a man of feeling but a man of sense.

[87] *Eptome Ethices* (1532), translated by R.A. Keen in Melanchthon (1988), 204.

[88] CR. II, 579f; Kusukawa (1995), 69ff. With but one exception (1545) Melanchthon's lectures on Aristotle's Ethics were all based on the fifth book.

[89] CR, X, 537f.

[90] For its gradual development see Kusukawa (1995).

such as that in Copenhagen, and can be seen as the culmination of his natural philosophical thinking.

To a large extent Melanchthon's physics was a continuation of late medieval scholasticism. He maintained Aristotelian dialectics as the foundation for scientific thinking, and like the Peripatetic he regarded movement as the central phenomenon of nature.[91] But although Melanchthon called his physics 'Aristotelian',[92] it was essentially eclectic. Not only was Melanchthon, like any Christian philosopher, bound to regard the World as having a beginning (Creation) and an end (the Apocalypse).[93] More significantly, he abandoned the Aristotelian concept of act and potentiality.[94] To Aristotle a movement ends when it reaches its "natural place". To Melanchthon a movement once started continues until it is stopped by another force.[95] This means, that while movement according to Aristotle reflects an inherent striving in things themselves, Melanchthon sees it as a relation between things. This implies, logically, that Nature, which Melanchthon calls a "machine of the world" (*machina mundi*),[96] consists of a chain of causality that can only be broken by God or man, and thereby he disconnected movement from ontology and emphasised the importance of God as 'first cause' (*causa prima*).[97] Accordingly, Melanchthon criticises the Aristotelian concept of form as dependent on matter, and adopts Plato's concept of ideas, propagated in *Timaeus* and also

[91] *CR*, XIII, 355: "*ignorato motu ignorari naturam*".
[92] *CR*, VII, 475; XIII, 183f.
[93] Augustijn (1998).
[94] See Günther Frank,, 'Gott und Natur. Zur Transformation der Naturphilosophie in Melanchthons humanistischer Philosophie', Frank and Rhein (1998), 43-58.
[95] Frank (1998), 46. This was an idea developed by Averroes, but had not been fully embraced by medieval scholastics.
[96] *CR*, XIII, 206: "*Magna est dissimilitudo rerum et motuum in hac tota mundi machina.*" and ibid. 294, where he calls it "*universa machina*".
[97] Frank (1998), 47ff., 53. While Melanchthon in his reflections on movement seems to be on his way to the mechanics of the late 17th century, his religiously inspired reflections on substantial forms takes him in the opposite direction. To Aristotle being occurs when matter comes together with a substantial form. To fit this theory into a Christian framework already Aquinas had extended the theory, so that substantial forms could exist without matter, as pure spiritual beings, such as angels. This line of thought was continued through the late medieval and the renaissance period and was adopted by Melanchthon see CR, XIII, 314 and Frank (1998), 51 that also discusses Melanchthon's view on accidental forms.

employed by Augustine.[98] The first article of *Initia doctrinae* is called "De Deo". The ambiguous meaning of this title epitomises Melanchthon's view on natural philosophy. It is knowledge *from* God and knowledge *about* God.[99]

Thus to Melanchthon, both the arrangement of nature and its place in time can only be seen from a religious perspective. He embraced the idea of the Book of Nature as a mirror of God's greatness and benevolence towards Man,[100] but rejected the study of nature for its own sake, as evident in his abandoning of Aristotelian ontology, and was vehemently opposed to wild speculation in natural philosophy, which he regarded as being motivated by vane curiosity.[101] Although he acknowledged progress in natural philosophy, in the preface to *Initia doctrinae physicae* he pictured Adam as having essentially the same knowledge of nature as his contemporaries, whom he believed stood in a long tradition.[102] Through reason Man could recognise the reason of God's arrangement of the machine of the world, but natural philosophers should be aware how far their opinions were warranted. They should be based on a firm philosophical concept, which was the reason why he regarded Aristotelianism as superior to all other philosophical traditions,[103] they were inferior to the Bible, which gave greater certainty,[104] and philosophical insight had no direct connection to Man's salvation.

3. Melanchthon and the Heavens

Perhaps Melanchthon's most important contribution to the development of natural philosophy in Northern Europe was to be

[98] CR, XIII, 195: *"Notum est, Aristotelem initio dicere de materia elementorum. Sed nos ordiemur a prima causa efficiente, et a corporibus coelestibus, ut Plato in Timaeo..."*.

[99] CR, XIII, 198; Keen (1998), 76.

[100] CR, XIII, 198: *"Hanc doctrinam de Deo mens humana circumferens, tanquam liber est et speculum monstrans Deum."*. For Melanchthon's antropocentric view of nature see ibid., 204f. and esp. 214: *"...omnia in natura rerum propter homines nasci, homines autem natos esse propter Deum, videlicet, ut innotescat et celebretur Deus."*

[101] CR XIII, 216-222; Heiko Oberman, *Contra vanam curiositatem. Ein Kapitel der Theologie zwischen Seelenwinkel und Weltall.* Zürich 1974.

[102] Augustijn (1998), 20f.

[103] Methuen (1998), 89.

[104] Augustijn (1998), 23; Frank (1998), 54f.

found in astronomy, astrology, and mathematics. In the Thomist tradition the term Nature (*natura*, *physis*) was, strictly speaking, referring only to the part of the world that was situated below the moon. This was the world of change, decay and renewal treated by Aristotelian physics. As for the more remote, perfect and therefore supposedly unchangeable upper regions of the universe, other laws applied, and, according to this view, man can have no certain knowledge of such matters. Astronomers might be able to measure the orbits of the celestial bodies, and by way of mathematics work out cosmologies to "save the phenomena", but these would always remain hypothetical constructions, which did not contain the kind of certainty found in physics. If they went against physics or Biblical authority, they must yield.[105] Though astronomy and mathematics were well established disciplines at many German universities,[106] they were predominantly regarded as a matter for technicians and specialists and given an inferior role in the scholastic system of learning, as they were also excluded from the educational programmes of many leading humanists.[107]

Throughout the Antiquity and the Middle Ages, however, there were traditions that gave mathematics (generally meaning geometry) a superior role in discovering the secrets of nature. Plato had endorsed mathematics as a preparatory study for the contemplation of things divine, and described the universe as having a geometrical structure that reflected the ideas in the mind of God the geometer.[108] In the various Neoplatonic and Pythagorean traditions mathematics also played a dominant role in attaining knowledge,[109] and the tradition represented by Ptolemy certainly regarded astronomy as being capable of attaining facts.

Already from the beginning of his career, Melanchthon polemically took a positive view on mathematics, due to its usefulness

[105] For the status of mathematics see Robert S. Westman, 'The Astronomer's Role in the Sixteenth Century: A Preliminary Study', *History of Science* 18 (1980), 105-147.

[106] Charles B. Schmitt, 'Philosophy and science in sixteenth century universities: some preliminary comments', *The Cultural Context of Medieval Learning*, ed. J.E. Murdoch and E.D. Sylla. Dordrecht 1975, 485-530.

[107] Such as Erasmus, *De ratione studii.* Erasmi Opera Omnia, vol. I.2. Amsterdam 1971, 122-123. The same view was expressed by Juan Luis Vives, see Debus (1996), 3.

[108] *Republic VII,* 530d; *Timaeus,* 47a.

[109] See Lovejoy, *The Great Chain of Being.* Cambridge, Mass. 1998.

in practical life and as a tool for sharpening the student's sense of logical thinking.[110] Gradually, however, he also incorporated the mathematical sciences in his religious philosophy of nature. In 1531 a comet could be seen on the night sky, and in a letter to a friend, skilled in astrology, Melanchthon tried to understand this portent.[111] In the same year, he wrote a preface to an edition of the medieval astronomer Sacrobosco,[112] emphasising the necessity, yes indeed obligation, of studying astronomy and astrology:

> *Plato should be judged to have said not only eruditely but also in conformity with religion (religiose) that eyes were given to us for the sake of astronomy [Timaeus 47a, The Republic VII, 530d]. For eyes were certainly given especially for this reason: that they may be guides to seeking some knowledge of God. Therefore, of the philosophers, those alone who despised astronomy were deliberate atheists: by having removed Providence they have also undermined the immortality of our souls. If these men had dealt with this doctrine they would have discovered the manifest footprints of God in nature; by heading [those footprints] they would have been forced to admit that this totality of things was both made and is governed by a certain Mind. But if anybody asks for the authority from Scriptures, which commends this study, he had the weightiest testimony in Genesis [1.14] where it is written 'let them [the lights] be signs and for seasons, and for days and years.*[113]

The celestial bodies shall therefore be studied, not only because Scripture guarantees it, but also because the observation of these are just as fundamental for Man as that of using his eyes. God's gifts should not be rejected. Those who deny the value of such studies are 'atheists', which at Melanchthon's time meant people who deny the obvious.[114] In the preface Melanchthon praises recent German astronomers like Peurbach (1423-1461)

[110] On Melanchthon's view on mathematics see Charlotte Methuen, 'Zur Bedeutung der mathematik für die Theologie Philipp Melanchthons', Frank and Rhein (1998), 85-103.
[111] Letter to Johann Carion, 17/8-1531.
[112] Sacrobosco, *De sphaera.* Wittenberg 1531. See also Lynn Thorndike, *The Sphere of Sacrobosco and its Commentators.* Chicago 1949.
[113] MBW no. 1176; CR, II, 531f.
[114] Kusukawa (1995), 127 for a discussion of the term.

and Regiomontanus (1436-1476), and also defends astrology, that, according to his view, is not against Christian religion.[115] To Melanchthon astronomy and astrology both proved God's providential governing of the heavens, and he paralleled astrological forecasts with medical ones.[116]

As an aid for the study of the heavens, Melanchthon tried to stimulate mathematical studies together with men like Joachim Camerarius and Jacob Milich.[117] In 1531 Camerarius published a treatise on the significance of comets to which Melanchthon wrote a preface. The following year, Camerarius wrote a defence of astrology based on classical sources, and shortly afterwards he published Ptolemy's astrological treatise, Tetrabiblos, which Melanchthon used in his Wittenberg lectures 1535-45. [118] Inspired by Platonism, Melanchthon acknowledged that the structure of the world could be discovered through mathematics and speaks of God the divine architect as a Geometrician,[119] and he took on himself to write introductions to an edition of Euclid's *Elementa* and to Peurbach's *Theoricae Novae Planetarum.*

4. Melanchthon's View on Medicine

Although Melanchthon did not write textbooks on medicine as such, he was to have great influence on the view on medicine in Northern Europe.[120] While Luther took little interest in medicine as a science, Melanchthon from around 1530 concerned himself with medicine at several occasions, and held orations on the lives of Hippocrates, Galen and Avicenna.[121] Here Melanchthon joined a general humanist tradition. While Erasmus had dismissed mathematics from his educational programme, he had emphasised the importance of medicine, i.e. humanist medicine rather than

[115] Kusukawa (1995), 129f.; see also Müller-Jahncke (1998).
[116] Kusukawa (1995), 130.
[117] Kusukawa (1995), 134. Melanchthon's Platonist inspired enthusiasm for geometry is beyond the limits of this study, but is treated in Kusukawa (1995), 135.
[118] Kusukawa (1995), 135.
[119] Frank (1998), 52.
[120] On Melanchthon's view on medicine see Wolfgang U. Eckart, 'Melanchthon und die Medizin', Frank and Rhein (1998), 183-202 and Hans-Theodor Koch, 'Melanchthon und die Vesal-Rezeption in Wittenberg, ibid. 203-218.
[121] Eckhart (1998), 183-185 lists Melanchthon's nineteen declamations solely concerned with medicine from 1529 to 1560. These can also be found in CR, vols. XI and XII.

the academic medicine of his age.[122] While Erasmus regarded the neglect of medicine as amounting to stupidity (*stultus*), Melanchthon from the beginning saw it as impiety.[123] To both men medicine belonged to the humanist arts, but to Melanchthon the concern with medicine was not only an intellectual duty, but first of all a matter of piety, since medicine was concerned with the living work of nature in its incredible glory.[124]

While Melanchthon in his praise of the study of living nature had an edge against traditional academic medicine, he also had to take a stand against enthusiasts, Empirics, who were ignorant of philosophy and created religious and social turmoil.[125] True medicine must combine philosophy and experience, and he encourages civil governments to regulate the medical profession.[126]

Medicine, however, also implied some of the theological problems, which confronted the Wittenberg reformers. Contrary to Erasmus, Zwingli and most of the radical reformers, the Wittenberg reformers did not believe in a dichotomy between soul and body.[127] Already in his controversy with Eck back in 1519, Luther had emphasised that Man consists of soul as well as body. Man's body as well as his soul are perverted by sin, and there is no divine spark left in us. Thus, both body and soul are the objects of Grace, and Luther's view on the Eucharist stressed that it contained both the Word and the acceptance of the wine and bread by the believer.

These theological concerns, the dualism between spirit and body as well as the problem of establishing order in society, led Melanchthon to redefine the place of medicine in the system of

[122] Erasmus, *Declamatio Erasmi Roterodami in laudem artis medicae* (1518). He work has been published in a facsimile-edition with German translation as *Vortrag des Erasmus von Rotterdam zum Lobe der ärzlichen Kunst*, ed. Eduard Bornemann (1960).

[123] *Encom med.*, CR, XI, 199: *"At Medicinam aspernari, non stultitia, sed impietas est"*.

[124] *Laus artis medicae*, CR, XI, 191-197.

[125] Particularly in *Contra empiricos Medicos* (1531), CR, XI, 202-209.

[126] ibid., 206-207. Melanchthon's view was later to lead to regulations of the medical profession see Eckart, 191. Unlike what is sometimes claimed, Paracelsus was not among the Empiricists attacked by Melanchthon, probably because the fame and writings of the Swiss medical reformer was not yet widespread; see Stefan Rhein, 'Melanchthon und Paracelsus', *Parerga Paracelsus. Paracelsus in Vergangenheit und Gegenwart*, ed. Joachim Telle. Stuttgart 1991, 57-73.

[127] *WA*, II, 415. See also *Lectures on the Galatians* (1519), *LW*, XXVII, 364.

learning. To the ancient Greeks and Romans, astronomy and medicine held little in common, although astrological forecasts were sometimes employed by physicians. The various scientific fields were independent of each other. To medieval philosophers, however, all wisdom derives from God. The methods of the various sciences differ, but their object is the same. Melanchthon, whose interest in natural philosophy focused on astronomy, astrology and medicine, shared this opinion. Unlike, say physics and chemistry, these sciences were not (at his time) concerned with the nature of matter, but with the arrangement of Creation.

In *Initia doctrinae physicae*, which is probably based on his lectures on Ptolemy, the study of medicine is connected to the study of the heavens. Melanchthon gives two sources for change in inferior (i.e. sublunar) bodies – a heavenly and a sublunar. Accordingly, Melanchthon identified two traditions within ancient natural philosophy - one, which he calls 'astrology', dealing with the movements and influences of the stars, and one, which he calls *physice*, that studies changes in the sublunar bodies themselves in terms of qualities and temperaments, i.e. the Hippocratic-Galenic tradition.[128]

Melanchthon emphasises that Aristotle believed in a continuation between the upper spheres and the sublunar world. Thereafter, he explains planetary movements and effects, probably according to *Tetrabiblos*, but he includes new discoveries such as Copernicus' correction of the apogees for the sun and the upper planets.[129] According to Melanchthon, natural philosophy consists of both the traditional study of sublunar bodies and of astrology. It is a worthy occupation in itself, but has also significance for medicine. He rejects scepticism, and claims that certainty in these matters *can* be found, if we follow certain didactic rules. These are: innate knowledge, experience and syllogistic reasoning. It is these rules that give certainty, not a specific philosopher, since they have all made mistakes:[130]

> *The whole nature of things is like a theatre [for] the human mind, which God wished to be watched, and for this reason He placed in the minds of men the desire of considering*

[128] *CR*, XIII, 182.
[129] *CR*, XIII, 225, 241, 262.
[130] *CR*, XIII, 189.

things and the pleasure, which accompanies this knowledge. These reasons invite healthy minds to the consideration of nature, even if no use followed. Just as vision delights, even if no use followed, so the mind also, by its own nature, is led to beholding things. Therefore these are the reasons of this study, especially because consideration per se leads to the most pleasant joy, even if other uses did not follow.[131]

Thus, from Melanchton's point of view, Creation exists for the sake of Man, and Man is its centre. He defines Providence as the knowledge through which God foresees everything and employs his whole creation.[132] In a later edition of *Loci communes* Melanchthon speaks of God's wish to be acknowledged in Nature, and the goal of creation as the revelation of God.[133] Natural philosophy is also important to the individual Christian. Sometimes, a man in his heart may perceive God as fickle, but when he observes the night sky, he can acknowledge that God is firm and immovable.[134] The apprehension of God through His creation is knowledge of the goodness of God. It is a pious knowledge, not a rational one, and implies Faith. Understanding of Nature enhances the pious knowledge of God, but it is not a condition for it and do not cause it. If that were the case, the pagan philosophers would have acquired such knowledge, and the Gospel would not be necessary. In other words, natural philosophy serves theology.[135]

Also Pliny was eventually included in Melanchthon's philosophy of nature. In 1525 he had dismissed Pliny's *Historia naturalis* as difficult to teach, but in 1534 Milich published a commentary to Pliny in an attempt to trace, how "*God's providence could be seen in Creation*".[136] This led Melanchthon to reconsider his opinion of the natural history. In 1538 he expressed that Pliny's natural history taught the nature of things (*de rerum natura*) and led the mind to an appreciation of God's creation and providence. From 1545 he introduced the natural history into the curriculum of the arts faculty in Wittenberg.[137]

[131] *CR*, XIII, 189.
[132] *CR*, XIII, 186f.
[133] *CR*, XXII, 66-68.
[134] *CR*, XII, 128.
[135] *CR*, XXI, 607; Keen (1998), 78.
[136] Kusukawa (1995), 137.
[137] Kusukawa (1995), 137.

In every part of natural philosophy, Melanchthon thus propagated the order and greatness created by the all-mighty and providential God. The study of nature was religious edification, and as such connected to moral philosophy. Nowhere is this more evident than in the commentary to Aristotle's book on the soul (*De anima*), which he published in 1540, and which became one of the most widely read commentaries to that treatise in the 16th century.[138] In the preface, Melanchthon emphasises that learning is necessary for re-establishing order in society as well as in church life, moral philosophy once again. The commentary itself, however, deals with Man's physical as well as his spiritual nature.[139]

Melanchthon discusses the ingenuity of the human body, and adopts Galenic medicine, not only for its clear way of exposition and emphasis on experience, but for its locating Man's three souls in specific parts of the body – the rational soul in the head, the sensitive soul in the heart, and the nutritive soul in the liver:[140]

> *For Galen, the soul, that is, especially the sensitive and vegetative soul, is either a temperament, or a vital spirit and natural spirit in animated beings; that is, a temperament or the vital spirit is the principle of life and motion in animated beings, or it is the thing moving the body. Thus Galen tried to point at something so that we should surmise what kind of a thing the soul might be.*

In the study of anatomy, one should therefore not concentrate on the specific parts of the body, but enjoy its construction and interaction:

> *You should imagine that you are led into a temple or some sacred place, wherefore you should watch with all respect not only look at the material but much more so at the skill and consider the design and diligence of the Maker. For the plan of the work itself testifies that man did not come into existence by chance, but that he originated from an infinite Mind, which arranged all the parts with wondrous planning and assigned them to certain ends and impressed in*

[138] *Commentarius de anima.* Wittenberg 1540.
[139] Kusukawa (1995), 85-87; Eckart (1998), 192-198.
[140] *Commentarius de anima*, p. 6v; Kusukawa (1995), 88ff.

him knowledge and mind, which is the clearest footprint of divinity.[141]

These are words that we shall later find almost identically echoed in the works of Scandinavian anatomists.[142] Melanchthon felt that progress within the sciences was a possibility,[143] and his interest in anatomy did not end with Galen, but intensified through his reading of the ground-breaking *De humani corporis fabrica libri septem* (usually known as *Fabrica*) written by the Flemish anatomist Andreas Vesalius in 1543. In Vesalius he found, even more than in Galen (who after all was a pagan and had furthermore only dissected dogs and pigs) an empirically based human anatomy used for the acknowledgement of God's greatness, as expressed in the following lines:

Singing songs of praise to God, the Universal Creator, we shall render thanks to Him that he has bestowed on us a Rational soul, which we have in common with angels (and so, not to forget even ill-used philosophers, Plato himself intimated). If only to this good gift of God we add Faith, we shall enjoy that eternal felicity, when the seat of the Soul and its substance need be sought neither by dissection of the body nor by our reason oppressed and feathered by the body. For He who is True wisdom will teach us, not as beings formed of this substance which comes into being and passes away, but [as beings formed] of a spiritual substance which resembles His own. But since up to now we are that which frail Reason declares us to be, we shall explore the ingenuity of the Artificer of the Universe, as shown in the remaining parts of the brain, according to our powers as men.[144]

When Melanchthon in 1552 published a new and revised edition of the commentary to *De anima*,[145] the anatomy of Vesalius

[141] *Commentarius de anima*, p. 44v-45r; the translation comes from Kusukawa (1995), 92.
[142] Chapter Five below.
[143] *CR*, VII, 746.
[144] As translated in Singer (1952), 40. I would like to thank Sir Geoffrey Lloyd, master of Darwin College, Cambridge, for permitting me to use the college's copy of *Fabrica*.
[145] *Liber de anima recognitus.* Nürnberg 1552.

had replaced that of Galen, and a new passage on the study of anatomy was also included:

> *Seeing this wonderful variety of work and these arrangements of God, looking from without and through a thick darkness, we are dumbfounded, and grieve that we cannot examine nature deeply and see the causes. But then, at least, when we see the Idea of nature in the divine mind, we shall look at this whole machine from within, and understand the plans of the Creator and the causes of all the divine works. Now by this incomplete consideration, we acknowledge that God is the Architect and we should be inflamed with the desire for that perfect wisdom.*[146]

Melanchthon and Vesalius shared the view on anatomy as a means to acknowledgement of God's ingenuity,[147] and thus as a means to piety, but Melanchthon's view on anatomy was closely connected to moral philosophy and Lutheran theology. In this theology Law is the "schoolmaster" for Christ, meaning that, when we understand our sinfulness and incapability of obeying the Law, we turn to the Gospel. This, in the end, is where Melanchthon connects moral- and natural philosophy. In the commentary to *De anima* the reader experiences God's greatness as shown in the ingenuity of the human body. Then Melanchthon deals with the soul, emphasising that without the Holy Spirit we are unable to turn to God. In other words, Melanchthon's natural philosophy was meant to confront Man's own incapability with the greatness of God.

5. Natural Philosophy in Copenhagen

Through students of Melanchthon, the reformer's view on natural philosophy was adopted by the two Scandinavian universities, that of Uppsala in Sweden and that of Copenhagen in Denmark.[148] In

[146] CR, XIII, 57; translation by Kusukawa (1995), 118f.

[147] Melanchthon's high esteem of Vesalius was reflected in a poem in praise of the anatomist, which Melanchthon included in the dedication in the 1552-edition of *De anima*; Eckart (1998), 195f.

[148] During the 17th century three more Swedish universities were established, namely Dorpat (modern day Tartu) in Estonia in 1632, Åbo (Finnish Turku) in Finland in 1640, and in 1666 Lund in the province of Skåne that had recently been conquered from Denmark. Furthermore, Sweden controlled the university

the beginning, Danish reformers had shared Luther's initial hostility to philosophy and taken a negative attitude towards university education,[149] but Melanchthon's re-evaluation of philosophy made them change their mind, and they petitioned the king to reopen the University of Copenhagen as a Protestant seat of learning.[150]

When the University of Copenhagen was re-established by Christian III in 1537, the year after the establishment of the Reformation in Denmark, it took place under impression of the radical reformers. Ten years before, Christian, then Duke of Gottorp, and the Wittenberg reformer Johannes Bugenhagen had held a colloquy with Melchior Hoffmann, which led to his expulsion from the duchy.[151] Hoffmann expressed many ideas common to radical Protestantism – a strong emphasis on eschatology, a heterodox view on the Eucharist, and a strong hostility against established learning. Hoffmann was also accused of promoting civil disobedience, a suspicion that does not seem unfounded as he later inspired the debacle of the Anabaptists in Münster (1535).

With these incidences and the turmoil and social as well as religious uproar of the Count's Feud fresh in mind,[152] it is not surprising that Bugenhagen, who was called upon to re-establish the University of Copenhagen, managed to transplant Melanchthon's ideas of philosophy as a stabilising element to the Danish university.

This is evident in the university's charter of foundation (1539), signed by Christian III, but written by Bugenhagen. Here, "the king" in strong terms calls on his successors to honour the university and not neglect it economically: "*This would be to serve*

of Greifswald in Northern Germany for great parts of the 17th century. These universities shall be discussed later on.

[149] See Peder Laurentsen, *Malmøbogen*. Malmø 1530, reprinted and edited by H.F. Rørdam, Cph. 1864.

[150] For this petition, see Norvin, II (1940), 1-3. Norvin has mistakenly given the date 1537; it should be 1536, M. Schwarz Lausten, *Christian den 3. og Kirken 1537-1559*. Cph. 1987, 110, note 1.

[151] See Martin Schwartz Lausten, "Melchior Hoffman og de lutherske prædikanter i Slesvig-Holsten 1527-29", *KS* VII:5 (1963-65), 237-285.

[152] From at least 1545 enthusiasts appeared in Denmark such as Simon Corb and Adrian Holländer, see Rørdam, *KUH* I, 171-173. In February 1552 a process was begun against two "enthusiastic" Danish clergymen Christoffer Michelsen and Lavrits Heliesen led by the professor of medicine Peter Capeteyn, cf. *Ny Kirkehist. Saml.* I, 323. *Danske Magazin* V, 200.

Mammon and destroy true religion, since Paul calls avarice idolatry".[153] Following Melancthon's demand that Man shall use the abilities given by God, it says: "*Our successors shall know that arts and sciences are gifts from God, who has given Man high abilities which He wants us to use*".[154] In the more specific part of the charter, the *Ordinatio*, the difference between the Gospel (the subject of the theologians) and the Law (which is the area of the jurist, the physicians, and the philosophers) is emphasised, with the latter being ultimately subordinate to theology.[155]

Natural philosophy was mainly covered by the faculty of Medicine. Already in 1537, the Vice-Chancellor Christian Torkelsen Morsing, a former student of Melanchthon and a champion of the Reformation, had drawn up a lecture-list for the medical faculty. According to Morsing, its two professors should lecture on theoretical medicine based on original Greek texts by Galen and Hippocrates, while the other should lecture on practical medicine and more recent authors. Lectures would also be provided on some of the more difficult authors of physics, mathematics and cosmography. Finally it was emphasised that anatomy should not be neglected.[156] To Morsing medicine had religious implications and was, or should be, an act of piety, as is evident from an introduction (or rather approbation) he wrote to Henrik Smith's popular herbal in 1556:[157]

> *And as Paul states, that among those chosen for the holy office of preacher, only few are powerful and noble, similarly not many wealthy and mighty, but only poor and simple people, are chosen to become physicians, thereby serving*

[153] *Norvin*, II, 11: *Admonemus uero et obsecramus per Christum saluatorem omnium nostros successores Danie Reges, ut donec regnum tenuerint, hanc huius Schole ordinationem et confirmationem illesam seruent, eamque per manus ad posteros suos transmittant, ac nullo modo permittant, ut ista salaria alio transferantur. Hoc enim esset seruire Mammone, et uerum Dei cultum abolere, quemadmodum Paulus uocat auaritiam idolorum culturam.*

[154] Rørdam, *KUH* I, 78.

[155] Rørdam, *KUH* I, 81; Norvin, II, 25.

[156] The lecture-list is reprinted in Norvin, *Københavns Universitet*, II, 4-8.

[157] Reprinted A.E. Brade (ed), *Henrik Smiths Lægebog*, I-IV. Cph. 1976. For Morsing's introduction, see fol. Aij in the 1556 edition. On medicine as practical piety in Denmark, see Ole Peter Grell, 'Caspar Bartholin and the education of the pious physician', *Medicine and the Reformation*, eds. Ole Peter Grell and Andrew Cunningham. London 1993, 78-100.

Man's bodily needs, as his soul is served through the preaching of the Gospel.

Both ministers and physicians were considered part of the apostolic tradition and recruited from the common people. Morsing went on to stress the physician's obligation:

To know herbs and other healing plants which God allows us to grow on Earth for the use and benefit of Man, and to see several human bodies dissected, part by part, in order better to understand how the inner parts of Man is created, in order to know what remedies are needed for that part of Man's body which is found to suffer from want and damage.

Though the Ordinatio generally follows Morsing's suggestions, it, interestingly enough, deviates on some points and generally opts for a more traditional approach to medical education. Bugenhagen used the Melanchthonian Statues from Wittenberg as a model, which specifically included medical authorities like Avicenna and Rhazes, who had been left out by Morsing, and it was pointed out that "*the most learned medical doctors are of the opinion that Avicenna should not be thrown out of the universities*". Likewise, books by Galen or Hippocrates should be used, while modern books might also be included.[158] As for anatomy, all students of the University ought to attend introductory lectures on the subject. The medical faculty should still have two professors, but it was emphasised that these should not only teach at university but practice at Court, in the city and throughout the realms as well, "*since no great assembly can be without a physician*".[159]

Lectures on physics and mathematics were also among the duties of the two professors of medicine. In Physics they should not only use "*some book by Aristotle, who has written several books on physics, not only those who are called physical*".[160] Aristotle's Physica was recommended, but also other of books should be used, particularly some introduction (*Isagogas*) to medicine and anatomy.[161] Physics was one of the courses that all students had to at-

[158] Norvin II, 26: "*Doctissimi enim medici non sustinent, au Auicenna è Scholis explodatur*".
[159] Norvin II, 26: "*Nullus enim magnus cetus carere potest medico*".
[160] Norvin, II, 26f: *In Physica unum et alterum libellum Aristotelis, qui multos libros Physicos scripsit, non illos solum, qui Physicorum appellantur.*
[161] Ibid., 26f.

tend, and it was emphasised that medical and anatomical teaching should also be directed towards all students, not only those of medicine. The provisions for the teaching of medicine at the university thus reflected Melanchthon's view on the edifying role of studying God's creation. Mathematics should cover planetary theory based on Euclid and Ptolemy. Sometimes the medical professors should lecture on astrology based on the highest authorities (i.e. Melanchthon) and avoid superstition. Finally they should in turn write the almanac.[162] That the study of the stars above was given high priority by the authors of the Ordinatio is also evident in the provisions for the arts faculty. The teacher in rhetoric was specifically ordered to explain the rise and setting of the stars according to Ovid's *Fasti*, and the teacher in Greek was assigned to include a proper explanation of Hesiod's description of the rise and setting of the celestial bodies in order to "*invite students to this part of Philosophy*".[163]

The teacher of mathematics in the arts faculty should likewise lecture on astronomy, but since it its mentioned that he shall lecture on practically oriented authors like the German astronomer and cartographer Petrus Apian (1495-1552), it seems fair to assume that the mathematician should cover the more technical aspects of astronomy, while the physicians were to cover the arrangement of the universe and the influence of the celestial bodies. The connection between moral- and natural philosophy is also contained in the statutes for the mathematician, however, since he was supposed to lecture on Melanchthon's compendium of moral philosophy as well as Aristotle's *Ethica*.[164]

Finally, the Ordinatio claims *"We maintain all sciences at this academy, without caring whether many things are taught, for which common people do not see the use, to train the minds (ingenia), to learn the works of God and to serve others through His wonderful and strange gifts. Therefore, for the sake of our own realms and others, we promote all sciences to bring up men that can serve the secular community (politia) and the parish, and make other people enjoy and thank God."*[165]

[162] Norvin, II, 27.
[163] Norvin, II, 30, 31: *...ut Scholasticos ad illam partem Philosohie inuitet..*
[164] Norvin, II, 32f.
[165] Norvin, II, 37: *Nos autem in hac Schola ad hoc fouemus omnes artes, nihil morati, quod multa discuntur, quorum usum uulgus nosse non potest, ad exercendum*

Melanchthon's view on the study of Nature was thus reflected in the organisation of natural philosophy in Copenhagen. Natural philosophy that was covered by the faculties of arts and medicine was part of a system of learning that should lead the way to piety, through the observation of God in His creation, and lead the student (who would in far the most cases be a future clergyman) to embrace Faith and Evangelical religion. He should understand that the world was ruled by divine providence and created for the benefit of Man. This is also evident from the seal of the medical faculty. It shows a crown, symbolising the Danish Monarchy, out of which grow flowers and herbs. These useful plants have all been created thanks to God's Providence, which is implied by the hand stretching down from heaven. Thus the seal served to underline the significance of Reformation theology for the study of medicine in Copenhagen.[166]

The influence from Melanchthon did not end with Bugenhagen and the instrument of foundation. Several of the first professors of the re-established university, had been lectured by Melanchthon in Wittenberg and shared his view on learning. One of the leading Danish bishops after the Reformation, Peder Palladius, who theologically was closer to Luther than to Melanchthon, wrote in 1555 an instruction for the clergy. Here he described the various academic disciplines, generally according to the statutes of the University, but also mentioning natural philosophical books not covered by it, but recommended by Melanchthon. These included Theophrast's *Historia plantarum*, the natural histories of Pliny and Aristotle, as well as Melanchthon's commentary to the latter's *De Anima*, which as already shown played a central role in Melanchthon's symbiosis between ethics, natural philosophy and

ingenia, ad cognoscenda Dei opera et ad seruiendum aliis per preclara et singularia Dei dona. Fouemus inquam artes omnes, ut educemus uiros pro nostris Regnis et aliis, qui consultant politiis et Ecclesiis, de quibus gaudeant alii et Deo gratias agant.

[166] Grell (1993), 83. As Grell points out, it is a misinterpretation when modern historians of medicine have interpreted the hand as coming from above to pick the flowers, cf. V. Møller-Christensen and A. Gjedde, "Det lægevidenskabelige Fakultet", in S. Ellehøj (ed), *Københavns Universitet 1479-1979*, VII. Cph. 1979, 1-49.

theology, and in the 17th century it was used in medicine as well as in physics.[167]

Another student from Wittenberg, the theologian Jens Sinning, gave in 1545 a speech about the role of philosophy for the study of theology.[168] It was published in 1591 and clearly reflects the importance of philosophy for the study of theology. Sinning not only emphasises the importance of eloquence, logic and ethics,[169] but turns to natural philosophy as well. He gives two arguments for the value of natural philosophy. First of all, knowledge of natural philosophy is necessary for the ability to clarify and expound innumerable passages in the Scriptures.[170] Furthermore, "even simple consideration of the universe substantiates faith in God.... and magnifies the awe of Him":[171]

> *There are those who know from the work in mathematics the sizes, effects and movements of the celestial bodies, as widely different from one another as they are spectacular, and who are aware that the sun we enjoy daily is larger than the entire earth. Similarly there are those who perceive that to the smallest herbs and other plants and to individual substances heaven has attached specific qualities and endowments for the use and maintenance of mankind. Who does not realise that such observers are more inspired with wonder and love towards God than men who have achieved no greater awareness of these phenomena than cattle, and who look upon these remarkable manifestations of Creation with bovine eyes.*[172]

[167] Peder Palladius, *Formula visitationes.* Cph. 1555; *Designatio* 1612, 1623; KUH IV, 536. In a draft for the new constitutions of the university, it was also included in the prescribed titles in physics, *AC* VI, 39.

[168] Jens Andersen Sinning, *Oratio de studiis philosophicis theologiæ studioso necessariis.* The speech was delivered in 1545, and published in Ribe 1591 by Anders Sørensen Vedel. Facsimile of the Latin editions with translations into Danish and English. Copenhagen 1991; Jens Glebe-Møller, 'Om Jens Sinning og hans "Oratio", *Kirkehistoriske Samlinger* 2001, 25f. points out that the oration is modelled on Melanchthon's *De Philosophia*; Fink-Jensen (2002), 81n. that arguments are also taken from the *De doctrina physica.*

[169] Sinning (1591), Bv-B2, B2v, and Cv-C2.

[170] Sinning (1591), B3iiii.

[171] Sinning (1591), C.

[172] Sinning (1591), C-Cv.

Sinning writes as a true pupil of Melanchthon, and the use of natural philosophy by the Wittenberg reformer was a living part of learning of the University of Copenhagen. As we have seen, Melanchthon did not take Aristotle, Ptolemy, and Galen as definite authorities on natural philosophy, but incorporated the discoveries of Vesalius into his natural philosophy. Furthermore, contrary to a view still held by some historians, Luther and Melanchthon did not vehemently oppose Copernican astronomy,[173] and Melanchthon adopted Copernicus' mathematical improvements. Until Galilei's discovery of the phases of Venus in 1610 there was no imperative argument for accepting the heliocentric theory of the universe, and even Galilei's discoveries could be compatible with the Tychonic system. In the scholastic hierarchy of sciences, mathematics was only a tool for the higher sciences, and the Copernican world picture collided with Aristotelian physics, Biblical evidence, and what was regarded as experience as far as a stellar parallax could not be observed.

Despite Melanchthon's influence, it is, however, hard to discover any systematic study of nature growing forth within the framework of the University in the 16th century. To most students, university studies were a means to secure a vicarage, while the few students of medicine were more concerned with practical medicine. They may have gathered useful knowledge of disease and remedies, but no systematic study of Nature was conducted. Neither was the positive attitude to anatomy and observation, shared by Melanchthon and some of his students like Morsing, reflected in university teaching, which was based on lectures and disputations. Scientific truth was achieved through the dialectical process of arguments, counter-arguments and syntheses, and the university had neither laboratories nor facilities for dissections nor astronomical observation.

Thus, in Copenhagen Melanchthon's view on natural philosophy does not appear to have brought any innovation within the academic framework as such. This should not mislead us. The reformer's religiously and humanist inspired attitude to the study of nature was to have vital importance for the development of natural philosophy in the 16th and well into the 17th century, but it

[173] This opinion is mainly based on the *Tischreden*, WA, IV, 412f., a rather problematic source material.; see Pozzo (1998).

is within circles outside the University that we shall see it unfolding. These circles shall be analysed in the following chapters, but first we shall turn to Sweden, the other kingdom of early modern Scandinavia. Despite the seemingly similarities between Denmark and Sweden, we shall see that already in the 16th century, developments in politics created a different background for the study of nature, differences that were to determine the different development of natural philosophy in the two Scandinavian kingdoms in the following century.

6. Natural Philosophy in Stockholm and Uppsala

In Sweden the Reformation was introduced piecemeal. King Gustav Vasa began by seizing church property, little by little an Evangelical liturgy and church order was introduced, but the government did not find resources to re-establish the University of Uppsala that had ceased during the turbulence of the 1520's. Unlike the Reformation in Germany and Denmark, its establishment in Sweden was therefore not connected to the existence or reestablishment of local universities. Instead the King used secular power to purge the country of religious enthusiasts, most of them belonging to the substantial German population of Stockholm, who threatened social stability,[174] and instead of allocating resources to re-establish the University, he found it less expensive to support the studies of Swedish students at Evangelical universities like Wittenberg, Rostock, and Greifswald.

While social and political turmoil in Denmark ended with the Count's Feud, and the country was free of violent internal conflicts throughout the early modern period, Swedish history in most of the 16th century was ridden by civil war and numerous rebellions, the latter often including a protest against religious change. As far as religion went, the shifting governments held different views. Gustav Vasa tried to reduce the political role of the church, Erik XIV held Calvinist sympathies, while his brother Johan III who deposed him to a certain extent tried to introduce

[174] One of these being Melchior Hofmann, who went to Holstein, from where he was expelled by Duke Christian and Johann Bugenhagen as mentioned above; see Piet Visser, '"A Lasco wedder uns". A Lasco und die Täufer und Nonkonformisten', *Johannes a Lasco (1499-1560). Polnischer Baronm Humanist und europäischer Reformator.* Beiträge zum internationalen Symposion von 14.-17. Oktober 1999 in der Johannes-a-Lasco-Bibliothek in Emden. Tübingen 2000, 300.

reformed Catholicism. The son of Johan III, Sigismund, who was also elected king of Poland, was deposed by his uncle Karl IX, who used the opposition to Catholicism to usurp the throne, and for years war raged between Karl IX and Sigismund.[175]

This instability in political life was reflected in educational life, and therefore Sweden did not get an academy based on Melanchthon's system of learning to the same degree as it happened in Copenhagen. From 1566 the University of Uppsala was re-established little by little, but it had barely been firmly established, when the controversies surrounding Johan III's attempt to reintroduce a Catholic liturgy broke out in the 1570's, and by 1580 its activities had ceased.

The professors at Uppsala were all stout Philippists; students of Melanchthon like the men who re-established the University of Copenhagen. To counter them, Johan III in 1576 established a college in Stockholm, the *Collegium regium Stockholmense.*[176] It was a crypto-Catholic institution led by a Norwegian Jesuit, Laurentius Nicolai,[177] and its curriculum was formed after that of Jesuit schools. When its Catholic character was disclosed, Nicolai had to leave the country, and Johan III was bound to abandon his scheme of reintroducing Catholicism openly. The college was not closed down, however, but was instead turned into a humanist school in 1583. It seems that it was still based on Jesuit education, purged of obvious Catholic leanings. The emphasis on natural philosophy was great. It hosted the first Swedish chair in physics, and mathematics was taught as well. In the 1590's its activities came to an end, and its professors were transferred to Uppsala, where the university had once more begun its activities in 1593.[178] Despite its brief existence, the college became important as an alternative to the theological scholasticism of the university, and many whom

[175] Roberts (1968).

[176] See Gunnar Bolin, "Johan III:s högskola å Gråmunkeholmen", *S:t Eriks årsbok* 1912 and 1918; Oskar Garstein, *Rome and the counter-reformation in Scandinavia*, I. Oslo-Bergen 1963; Vello Helk, *Laurentius Nicolai Norvegus S.J.* Kirkehistoriske Studier 11: 22. Cph. 1966.

[177] On Laurentius Nicolai who later tried to propagate Catholicism in Denmark, Vello Helk *Laurentius Nicolai Norvegus S.J. En biografi med bidrag til belysning af romerkirkens forsøg på at genvinde Danmark-Norge i tiden fra reformationen til 1622.* Cph. 1966.

[178] For the University of Uppsala, see Claes Annerstedt, *Uppsala Universitets Historia. Första delen 1477-1654.* Uppsala 1877.

we shall meet later on, such as Johannes Bureus, Laurentius Paulinus Gothus, and Johan Skytte, had their ideas on natural philosophy formed through the teaching of the Stockholm college.

The University of Uppsala had more resemblance to a cathedral school than to a university. Its head was the archbishop of Uppsala, and the cathedral chapter functioned as the Academic Council. No faculty of law was established, and the chair in medicine was not filled until 1617. This meant that Melanchthon's full structure of learning adopted in Copenhagen did not exist in Uppsala. Attempts were made to remedy this. In 1604 Karl IX made an attempt to establish a chair in law, and the chair of medicine was supposed to include anatomy,[179] but it came to naught.

The same year Johannes Rudbeckius, the new professor of mathematics in Uppsala and a student from Wittenberg held an inaugural speech on the use of studies.[180] Rudbeckius claims that reason and language are the two gifts that raise man to his natural position above the beasts. The study of things divine and human raises us towards the heaven and increases our knowledge of God: "*What is philosophy, but a ray of the divine being revealed in Man's soul, of which all, who God and Nature made to great deeds, make use.*"[181] Then Rudbeckius turns on the government, who has neglected learning in general and the university in particular. Initially, however, Rudbeckius' outcry was to no avail. Suspecting it loyalties, Karl IX revoked the University's privileges in 1607, and it lasted more than a decade until Uppsala became a fully equipped university.

7. Intellectual Horizons

Textbooks written or recommended by Melanchthon dominated the syllabus of Scandinavian grammar schools and universities well into the 17th century. However, alternative books and thought currents also entered Sweden and Denmark. In the following chapters we look shall more closely at those specifically important to natural philosophy, but here we shall concentrate on those concerned with the relationship between religion and the study of nature.

[179] Annerstedt (1877), 111-114.

[180] *Oratio de literarum et scholarum utilitate simul ac necessitate habita in illustri academia Upsaliensi a M. Joh. Rudbeckio Nericio an. 1604 d, 12 Sept...typis Consistorii Arosiensis 1624;* Annerstedt (1877), I, 116-118.

[181] ibid.

Most new ideas were imported to Scandinavia by way of students, who had been abroad, and the travels of students were the most important link between intellectual life in Scandinavia and general European developments. In general, Europeans in the late 16th century travelled more than ever before.[182] Many students continued the tradition of the *peregrinatio academica* of the previous centuries,[183] and printed travel guides became common in the beginning of the 1600's.[184] The Reformation had opened career possibilities within the church to the lower estates and insisted that clergymen should be educated, and this drew increasing numbers of students to the Latin schools and universities on their way to the pulpit. A few would become students of law or medicine, but far the majority would study theology, many never moving beyond the baccalaureate.

In the realms of the Danish king, several townspeople, well-off peasants and clergymen began to invest in the education of their sons. Since many of these came from Jutland and the Duchies, parts of the country where the nobility in the 16th century managed to stop the economic expansion of the middle class and monopolise much of the trade, it is perhaps worth considering, whether these investments can be seen as a desperate measure to find other means of existence for the next generation, especially within the Church. The fact that non-nobles were not allowed to buy land until 1660 probably encouraged this development as did the prestige bestowed on learning by the Court and the high nobility, which we shall analyse in the next chapter.

Until the end of the 16th century Sweden was economically backwards compared to Denmark. Towns were small, trade insignificant, and industry only in its coming. In order to cover its need for educated men for the growing administration, the crown therefore largely imported foreigners. When it took to sponsor the

[182] On travel in early modern Europe, Antoni Maczak, *Travel in Early Modern Europe.* Engl. Trans, Ursula Phillips. Cambridge 1995 (1980).

[183] On academic peregrinations as a general European phenomenon, Hilde de Ridder-Symoens (1997). For an overview of Scandinavian peregrinations until 1660, see Sverre Bagge, 'Nordic Students at Foreign Universities until 1660', *Scandinavian Journal of History* 9 (1984), 1-29.

[184] These also included Danish contributions such as the *Itinerarium Galliæ et Angliæ. Reisebüchlein, Darinn Die Reise in Frankreich undt Engelland...beschrieben ist.* Leipzig 1614 by Peter Eisenberg who had travelled as præceptor for the sons of the nobleman Caspar Markdanner.

studies of Swedes from a non-noble origin, they were sent to German universities. From the 1580's the rise of the mining industry and Sweden's growing role in European politics and warfare created the economical basis for a class of administrators, soldiers and entrepreneurs who could afford to send their sons abroad, and the numbers of Swedish peregrinations reached the same level as the Danish.[185]

The usual route for young Scandinavians in the late 16th and early 17th century was first to go one of the universities on the Baltic seaboard. To students from Denmark, Norway, and Iceland the most common starting point of the peregrination was the university of Rostock. Swedes and Finns went to Rostock as well, but many also started at Greifswald that was closer to Sweden. After initial studies in Rostock or Greifswald, and perhaps a stay in the great city of Hamburg, far the majority of the students would travel up the River Elbe to Wittenberg, the cradle of Lutheranism and for most of the 16th and early 17th century the great authority in matters of theology and philosophy. During this period few non-noble students would go further than that, unless they were travelling as employees of noblemen, and even if they did, they would rarely go further than Strasbourg in the west and Heidelberg in the south. In this way a new Scandinavian cultural horizon for non-noble students was established in the century after the Reformation pivoted around Wittenberg and Melanchthon's system of learning, for it must be kept in mind that Melanchthon not only influenced the structure and content of learning at Wittenberg and Copenhagen, but at most Northern German universities as well.[186] This included his religious transformation of natural

[185] See V. Helk, *Dansk-norske studierejser fra reformationen til enevælden 1536-1660.* Odense 1987; L. Niléhn, *Peregrinatio academica. Det svenska samhället och de utrikes studieresorna under 1600-tallet.* Lund 1983; for an introduction in English idem, *'Swedish Society and the Swedish Students abroad in the 17th Century',* Rystad (1983), 97-117; C. Callmer, *Svenska studenter i Rostock 1419-1828.* Stockholm 1988, all with extensive bibliographies.

[186] Melanchthon not only wrote statues for the University of Wittenberg, but also directly or indirectly took a strong hand in the university reforms at Tübingen, Frankfurt an der Oder, Leipzig, Heidelberg, Greifswald and Rostock, and to a certain degree Helmstedt. For this influence within medicine see Eckart (1998), 198-202. Richard Toellner, 'Die medizinischen Fakultäten unter dem Einfluß der Reformation', *Renaissance Reformation. Gegensätze und Gemeinsamkeiten,* ed. August Buck. Wolfenbüttel 1984 is rather disappointing, since it is more concer-

philosophy, and at academies like Rostock and Helmstedt his commentary to *De anima* (in the 1552-edition) was required reading.[187]

In the second half of the 16th century, Wittenberg was one of the most vigorous centres of natural philosophy in northern Europe, particularly within anatomy and astronomy. Practical medicine was emphasised, and anatomy flourished under Caspar Peucer (1525-1602), Melanchthon's son-in-law, who also took a strong interest in mathematics, and in astronomy, Wittenberg became one of the first centres of Copernican cosmology. This was not due to Melanchthon, who admired Copernican mathematics, but rejected his cosmology and adhered to the Ptolemaic world picture.[188] At Melanchthon's time, however, one of Copernicus' pupils, the astronomer Georg Joachim Rheticus (1514-1574) was professor of mathematics. Copernicus had given him his work for publication, but for personal reasons Rheticus declined and handed it over to Andreas Ossiander, who in an anonymous preface presented it as a mere hypothesis.[189] Afterwards, however, Rheticus was one of the first astronomers to seriously discuss Copernican cosmology, which he defended by making a distinction between Biblical and scientific knowledge of nature,[190] and it was probably through him that Tycho Brahe became truly familiar with heliocentric cosmology.[191]

From the 1570s, however, the importance of Wittenberg declined, when after the death of Melanchthon serious turmoil broke out at the university between followers of Melanchthon and theologians who presented themselves as representing Orthodox Lutheranism.[192] Later, travels to Saxony would also be imperilled by warfare, so despite fluctuations, the prestige and influence of

ned with Luther than with Melanchthon, whose influence on medical teaching was undeniably much greater.

[187] Eckart (1998), 199.

[188] Augustijn (1998), 16; Barker (2000); Blumenberg (1960).

[189] See O. Gingerich (ed.), *The Nature of Scientific Discovery.* Washington, D.C. 1975; R.S. Westman (ed.), *The Copernican Achievement.* Berkeley-Los Angeles 1975; *Science and Society. Past, Present and Future.* Ann Arbor, Mich. 1975.

[190] On Rheticus see K.H. Burmeister, *Georg Joachim Rheticus 1514-1574. Eine Bio-Bibliographie,* 3 vols. Wiesbaden 1967-1968; Reijer Hoykaas, *G.J. Rheticus' Treatise on Holy Scripture and the Motion of the Earth.* Amsterdam 1984.

[191] Thoren (1990), 86, 237.

[192] W. Friedensburg, *Geschichte der Universität Wittenberg.* Halle 1917.

the University of Wittenberg declined from the beginning of the 17th century as far as Scandinavians went. Though the Saxon university remained a prime destination for theological students, the academic peregrinations of physicians and noblemen increasingly went elsewhere.

For Scandinavian students, nobles as well as non-nobles, Rostock had been the gateway to European learning already in the 15th century, and it resumed this role after the Reformation. In terms of matriculations, it was the most popular university among Danish, Norwegian, Icelandic, Swedish and Finnish students abroad. Even after order had been restored in Wittenberg around 1600 and the new university in Leiden had became more popular than any other university, Rostock still attracted a substantial number of students en route to the Netherlands and elsewhere.[193]

There were several reasons for this - the closeness of Rostock to Scandinavian harbours, and the close political and cultural ties between Mecklenburg and Scandinavia among the foremost. As we shall see later on, a number of Rostock professors found employment in Copenhagen and Uppsala, but the Baltic seaport also offered a haven for Scandinavians when plague or warfare raged at home. To Swedes, Rostock became an important refuge for exiles during the turbulent years of civil war in the later half of the 16th century. Numerous Swedes lived here, or stayed in Rostock en route to Sigismund's court in Poland, and the publisher Petrus Johannes Gothus constituted for years the centre of this Swedish colony.

In Rostock the ideas of Melanchthon had been adopted, including his view on natural philosophy,[194] and it had eminent pro-

[193] In the years 1551-1600, 819 Danes (incl. students from Norway and Iceland) and 251 Swedes and Finns were matriculated at Rostock, while the numbers for the period 1600-1650 were 415 Danes and 305 Swedes; Helk (1987), 42-43; Nilehn (1983), 162. On Scandinavian students at Rostock, see also C.A. von Willebrand, 'Finnlands Verbindungen zu den Universitäten Rostock und Greifswald', *Mare Balticum* 1967:4, 13-16; Christian Callmer, 'Svenska studenter i Rostock 1419-1828', *Personhistorisk tidskrift* 84 (1988):1-2.; Jan Liedgren, 'Svenska studenter i Rostock 1418-1828. Supplement', *Personhistorisk tidskrift* 88 (1992). Various figures have been suggested as to the percentage of Scandinavians among students in Rostock, Czaika (2002), 85ff., 427f. suggests at least 14% for the period 1550-1600 and 6.8% for 1600-1650.

[194] On Rostock see the somewhat outdated Otto Krabbe, *Die Universität Rostock im 15. und 16. Jahrhundert.* Rostock 1854 (1970).

fessors in natural philosophy. Heinrich Brucaeus (1531-1593), a close friend of Tycho Brahe, lectured on mathematics and medicine and included dissections in his teaching, and during the years 1587-1590 the Scotsman Duncan Liddel (1561-1613) lectured on the world systems of Ptolemy, Copernicus and Tycho Brahe.[195]

To most Scandinavians, however, the central figure in late 16th-century Rostock was the theologian and historian David Chytraeus (1531-1600), today a somewhat neglected figure outside Germany, but highly influential in his own day.[196] Chytraeus was a student of Joachim Camerarius and Melanchthon, and became a close friend of the latter. He had reformed Rostock's curriculum after that of Melanchthon's reform of Wittenberg, was active in the organisation of Evangelical education in Mecklenburg and the Protestant parts of Austria and stood in contact with scholars, princes, and noblemen all over Europe. After Melanchthon's death, Chytraeus was the greatest mediator between Scandinavia and intellectual developments in Germany. He took care of the great numbers of Scandinavian students in the Baltic port, received donations from the governments in Stockholm and Copenhagen, stood in contact with leading Scandinavian noblemen, professors and bishops,[197] and twice it was attempted to call him to Copenhagen.[198]

[195] On Liddel cf. *Album Academiæ Helmstadtiensis*, I, ed. P. Zimmermann, I. Leipzig 1926.

[196] On Chytraeus, Otto Krabbe, *David Chryträus.* Rostock 1870; K.H. Glaser et al, *David und Nathan Chytraeus.* Ubstadt-Weiher 1993; Rudolf Kellner, 'David Chytraeus', *Biographisches Lexikon für Mecklenburg*, III. Rostock 2001, 36-42. On Chrytræus' great influence on Swedish church life, Otfried Czaika, *David Chytræus und die Universität Rostock in ihren Beziehungen zum schwedischen Reich.* Helsinki 2002. On Chytraeus as a historian see Skovgaard-Petersen (2002). Also his brother, Nathan Chytraeus (1543-1598), a celebrated poet, professor, and author of itineraries had close connections to leading circles in Scandinavia, see Elsmann et al (1991).

[197] Chytraeus' contact with Scandinavia had been established during his time at Melanchthon's side in Wittenberg. His contacts in Denmark included noblemen like Heinrich Rantzau, Niels Kaas, Tycho Brahe, Christian Barnekow, and Arild Huitfeld, as well as the leading theologian Niels Hemmingsen, and several bishops. In Sweden his contacts included princes, noblemen and statesmen like Erik XIV, Johan III, Sigismund III, Duke Karl, Erik Sparre and Johan Skytte, as well as professors like Laurentius Paulinus Gothus and Magnus Magni; see KUH II, 285-286; Callmer, (1988), Czaika (2002), esp. 178-187.

[198] KUH I, 191, 270-273.

Chytraeus was a champion of Lutheran orthodoxy, but although he endorsed the *Formula concordia*, he was still a representative of the Philippist spirit of friendly persuasion that increasingly gave way to a more aggressive polemics in the closing decades of the 16th century. Although he was keen on defending Evangelism against what he viewed as erroneous doctrines and practices, he saw no conflict between Luther and Melanchthon and perceived himself as continuing their work in collaboration with princes and high noblemen.[199] In a polemic against the Jesuit Antonio Possevino, with whom he fought over the fate of the Swedish church during the reign of Johan III, he developed an irenic position. He worked for concord with both the Greek Orthodox Church and the old Bohemian church, and he was also positive towards the aspirations of Erasmus and other humanists for a reformed Catholicism, in his own time embodied by the efforts of reconciliation by Georg Cassander, who had the backing of a branch of the Austrian Habsburgs.[200]

As such, Chytraeus was a champion of moderation, and was probable responsible for the fact that Scandinavian theologians essentially regarded Luther and Melanchthon as being part of the same tradition, unlike the polarisation that took place in Wittenberg in the closing decades of the 16th century. Furthermore, Chytraeus adhered to Melanchthon's view on the importance of natural philosophy. He was himself trained in astronomy and astrology,[201] and to a certain degree he was also open-minded towards new intellectual currents.

Among these currents was Ramism, the ideas of the Paris-professor Petrus Ramus (Pierre de la Rameé 1515-1572). Ramism is a diffuse phenomenon, which is probably the reason so why many historians of ideas refer to it, but so few has covered it tho-

[199] As is evident from his *Historia der Augspurgischen Confession.* Rostock 1576. A good analysis of Chytraeus' theology is given in Czaika (2002).

[200] Chytraeus wrote to Patriarch Jeremiah II in 1576, and to demonstrate the essential common points between Western and Eastern Christianity, he published a collection of sources on the Greek church that was appeared in several new editions, *Oratio de Statu Ecclesiarum hoc tempore in Græcia, Asia, Boëmia &c.* Rostock 1576 and later. All editions from 1580 till 1582-83 were dedicated to Chancellor Niels Kaas in Denmark, though Chytraeus was more involved in the development of the Swedish church. For Chytraeus' Irenical attempts, see Czaika (2002), 242-259 and Glaser et al (1993).

[201] See Krabbe (1870), esp. 27f.

roughly and often with many misconceptions.[202] Its role in Danish and Swedish natural philosophy shall be covered in the appropriate chapters, but here a few general remarks must be made, since it often appears in histories of science.

First of all, Ramism was not a complete or independent philosophical system. It was developed in a specific context, and must be viewed within an intellectual and social context. Secondly, the ideas of Petrus Ramus were rooted in a broader humanist tradition, concerned with the relationship between speech and thinking, between rhetoric and philosophy.

Strictly speaking, Ramism did not represent a philosophical or even logical system. The ideas of Ramus were based on his experiences as a teacher of Aristotelian dialectics in Paris. They originated in an attempt to facilitate the apprehension of logic by undergraduate students and were pedagogic and rhetorical inventions.[203] But Ramus went further than that. From the 1540's, he began to turn his dialectic on mathematics. He published a translation of Euclid's *Elements*, followed by textbooks on arithmetic, geometry, and algebra. He was not a talented mathematician himself, but he spurred interest in the subject. According to Ramus, university training was to contain a demonstration of the practical use of philosophy. Arithmetic should be learned from the problems of the marketplace, geometry through mechanics, and rhetoric through courtroom practice. Hypotheses must come from observation, not the other way around. The basis for thinking is language; men must be able to relate to the terms they are using. The way to acquire knowledge went through clarification of language through discussion true. This kind of dialectics was, according to Ramus, evident in the dialogues of Plato, and he regarded mathematics the ultimate tool of dialectics, since mathematical rules were a tightened form of linguistic clarity.

[202] Many of these have been dealt with in the outstanding, Walter J. Ong, S.J., *Ramus. Method, and the Decay of Dialogue.* Cambridge, Mass. 1958; see also Neal W. Gilbert, *Renaissance Concepts of Method.* Columbia U.P. 1960.

[203] See Ong (1958), Chapter III. Ramus' pedagogical programme can be summarised in three rules, namely: 1) That the elements of philosophy must be necessary (*necessaria*), i.e. based on a general assertion, which can be proved within the strict limits of the subject; 2) That irrelevant subjects must not be mixed with the specific parts of the presentation; 3) That the various parts of the presentation must be on a right level (*propria*), what is general must be treated as general, what is specific must be treated as specific.

Part of the problem of distinguishing Ramism arises from the fact that Ramus drew heavily on currents of Renaissance humanism, particularly the dialectics of Rudolf Agricola. The influence of such currents was, of course, not restricted to Paris. When the ideas of Ramus were diffused and mixed with such currents, they gave Ramism another character than its Parisian origin. This began when Ramus visited Switzerland and Germany in the years 1568-70. In the Rhine Valley, from Basel, Zürich, and Berne, to Strasbourg and Heidelberg, and eastwards as far as Nuremberg and Augsburg, he lectured and fraternised with circles of humanists. It was probably during this journey that he adopted Calvinism, and in the following decades the centres of European Ramism were located at Calvinist parts of Switzerland and Western Germany.

But although Ramism was most firmly established within Reformed circles, it also entered Lutheran Europe, especially the University of Rostock. Although Ramus himself, together with several of his biographers, treated Chytraeus as a convinced Ramist, this was not the case.[204] Chytraeus, however, was not hostile to certain aspects of Ramism. The pedagogical gifts, the emphasis on Rhetoric, and the hostility to empty speculation all made Ramus congenial to men brought up in the spirit of Philippist humanism.[205] While rigid lines were drawn elsewhere in Europe between Aristotelians and Ramists, Chytraeus tried to combine Ramism with Melanchthon's system of learning in what has been called Philippo-Ramism, which tried to fit Ramism, particularly Ramist dialectics, into a Philippist framework. Around Germany, other men such as Rudolph Goclenius (1547-1628) in Marburg, likewise tried to adopt certain parts of Ramism into the system of learning, and as we shall see he was also influential on some Scandinavian natural philosophers.

Thus, Ramism was not a complete system of philosophy, not even within the various disciplines of philosophy. It arrived in Scandinavia at various times and took various guises, and since it cannot be separated from more general frameworks of learning; it

[204] cf. P. Ramus, *Defensio pro Aristotle.* Paris 1571, 119; Charles Waddington's highly influential biography, *De Petri Rami vita.* Paris 1848, 393 uncritically recorded this as a fact, and it was taken over by many later authors. Chytraeus' Ramism is generally not treated in the literature on the Rostock professor, but cf. Tor Berg, *Johan Skytte* (1920), 31.

[205] *Chytræi Epistolæ*, 547f.

shall be treated as part of an analysis of these frameworks.[206] Finally, it must also be noted that although Ramus has sometimes been regarded as a herald of modern science,[207] and undoubtedly influenced men like Francis Bacon, his onslaughts on Aristotelianism was first of all carried out through a vehement Christian rejection of *"pagan philosophy"*.[208] It was in other words not a secular learning that Ramus was championing.

Before we close this chapter on the religious context of natural philosophy, it is important to emphasise that while Melanchthon's symbiosis of natural philosophy and religion placed the study of nature within a particular Evangelic framework, the connection between natural philosophy and religion could be found in all parts of Europe. Those Scandinavian students who went beyond the intellectual world of Lutheranism, either through travel or reading, would meet a similar religious attitude to natural philosophy. While those traditions, which were closely linked to Catholic theology, would be of little interest to Scandinavians, there were traditions, which albeit religious were less intimately connected to specific religious institutions.

One of these was the concept of the Book of Nature, which, as we have seen, found one of its most vehement spokesmen in Raimund de Sabunde in the 15th century. Raimund's books were placed on the Index of the Inquisition in 1596 - which probably only increased the interest in them - and they were influential in the early modern period. The idea of natural philosophy as a knowledge *from* God and *of* God was carried into the 16th and 17th century, not only by German mystics like Sebastian Franck and Jakob Böhme and controversial Catholics like Paracelsus, Giordano Bruno and Tomasso Campanella, but also by less speculative characters. Michel de Montaigne had translated Raimund de Sabunde in 1568, and the longest of his essays bears the title "Defence of Raimund de Sabunde".[209] The idea of the Book of Nature

[206] Ramism in Denmark will be treated in the next chapter, while Swedish Ramism is treated in Chapter Six.
[207] This is particularly evident in Waddington (1848) and those who uncritically have echoed his views.
[208] See e.g. Petrus Ramus, *Scholae in liberales artes.* Basel 1569, col. 930.
[209] 'Apologie de Raimond de Sebonde', *Montaigne. Les essais*, ed. Denis Bjaï et al. Paris 2001, II, 689-932.

was also adopted by the great anatomist Andreas Vesalius as evident from the quotation above, by Johann Kepler, by Galileo Galilei and most other natural philosophers of the period.

Furthermore, from mid-sixteenth century a whole genre grew up in both Catholic and Protestant Europe that took a particular interest in the 'freaks of nature', monstrosities and prodigies, propagated by prominent writers, but also including crude popular broadsheets. These accounts showed nature manifesting the wrath and omnipotence of a hidden and transcendent God and enjoined readers to repent and humbly worship the awesome Lawgiver. As Pierre Boaistuau, one of the most successful French authors of this genre wrote in his *History of Prodigies* from 1560:

> *Of all the things that can be contemplated under the hollow heavens, there is nothing that better wakes the human spirit, seizes the senses, horrifies, or generates more admiration or terror in creatures than the monsters, prodigies, and abominations in which we see the works of Nature not only reversed, overturned, mutilated, and truncated: but (what is more) we discover there most often a secret judgment and scourge of the wrath of God in the things presented to us, which makes us feel the violence of his justice that is so harsh.*[210]

Among the prominent authors who wrote books in this genre were men like Jean Bodin and Joachim Camerarius, both well known to Scandinavians. When we recall that the latter was a close friend of Melanchthon, it is evident that although the Wittenberg reformer developed his view on natural philosophy in a specific polemic context, it merged with a more general European tradition.[211]

To sum up, wherever Scandinavian natural philosophers went, they could find a view that regarded the study of nature as a

[210] Pierre Boaistuau, *Histoires prodigieuses.* Paris: Charles Macé 1575; see also Jean Céard, *La nature et les prodiges. L'insolite au XVIe siècle en France.* Geneva: Droz 1977; Anne Blair, *The Theatre of Nature. Jean Bodin and Renaissance Science.* Princeton U.P. 1997, chapter 1.

[211] The sources of Melanchthon's view on the connection of natural philosophy and religion has to my knowledge not been studied. It is certain that it did not emerge *ex nihilo*, and was undoubtedly inspired by the idea of the Book of Nature. One source of inspiration may have been his relative and warden, the cabbalist Johannes Reuchlin.

pious endeavour. This means of course that it is absurd to regard 16th- and 17th-century natural philosophy as antithetical to religion, but it also means that despite Melanchthon's incorporation of natural philosophy in his system of learning, the symbiosis of natural philosophy and religion was not necessarily closely connected to Lutheran theology. Despite confessional differences, Scandinavians could agree with Catholics on the idea of the Book of Nature. In this way the study of nature was seen from a religious, but not confessional perspective, and this combined with social and cultural developments, which shall be analysed below, gave natural philosophy an international character in an age of mounting hostility between the various Christian camps.

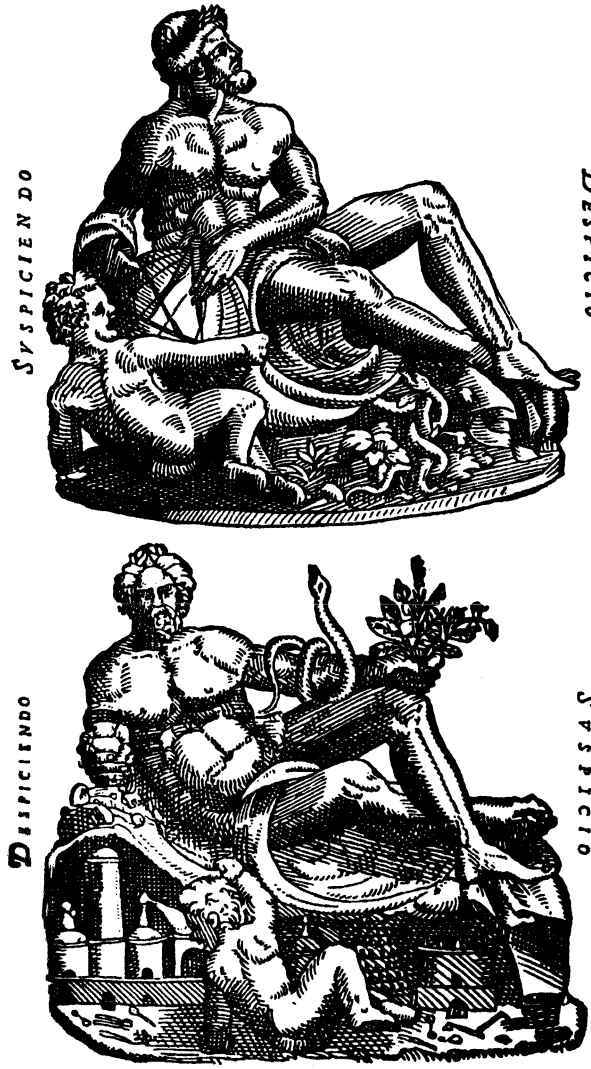

Fig. 2. The emblematic statues of Astronomy and Chemistry at Uraniborg.

The Abode of the Muses

> *Let others paint lions, eagles, and other creatures on their coat of arms. More true nobility is possessed by those who can inscribe on their shields all that they have achieved through the cultivation of the arts and sciences.* Erasmus of Rotterdam (1530)

To religious reformers like Philipp Melanchthon and David Chytraeus natural philosophy was part of a system of learning centred upon schools and universities and intimately connected to Protestant theology. Despite changes in the curriculum and the emphasis on observation in natural philosophy, academic culture in the 16th and early 17th century was essentially like of medieval Europe. At meetings of the estates, the professors still belonged to the ecclesiastical estate, teaching was still highly formalised and focused on lectures and disputations, and the Reformation had not changed much in terms of garb, rituals and ceremonies.

The university, however, was not the only important framework of natural philosophy in 16th and 17th-century Scandinavia. While the importance of religion was regarded essential to political stability, academic culture was not the culture of the elites. At Court and at the residences of the high nobility, two other types of learning flourished. The one was the learning of the nobility; the other may be described as humanist culture.[212] These elite cultures

[212] Humanism (*Humanismus*) is of course a 19th-century coinage, invented to describe the programme of studies, and its conditioning of thought and expression, covered by the *studia humanitatis*. In this study, I shall generally use it in connection with a particular cultural and social setting, rather than as a name of a group of disciplines. For an introduction to historical definitions of Renaissance humanism, see Wallace Ferguson, *The Renaissance in Historical Thought. Five Centuries of Interpretation.* Cambridge, Mass. 1948; Vito R. Giustiniani, 'Homo, Humanus, and the Meanings of "Humanism", *Jour. of the Hist. of Ideas* XLVI:2 (1985), 167-195.

were neither separated from each other by watertight shudders, nor from the culture of traditional academic learning. Many academics and churchmen were also part of the humanist culture and connected to noblemen and the Court, and the culture of humanism was particularly closely related to the culture of the elite. However, in terms of content and first of all in the social framework of learning, the learning of the humanists, so far as it was a bourgeois phenomenon, differed from that of the nobility, and both represented a framework of learning different from that of the university. In this chapter we shall therefore discuss these two frameworks in their Scandinavian context.

1. The Learning of the Nobility

The transformation of the functions and identity of the nobility discussed in Chapter One also resulted in a changing view on the education of noblemen. There are several examples of learned noblemen in medieval Scandinavia, but such men were almost always leading members of the Church or the monastic orders, learning itself was not connected to the general knightly ideal of the social elite. However, when members of the great noble families in Scandinavia during the 16th century began to adopt a new identity and self-presentation, the learning of noblemen became secularised. Like social elites in most of Europe they no longer defined themselves solely as a class of warriors and landlords, but expanded their interests to include administration and diplomacy, thereby redefining their education, self-perception, and role in society.[213]

[213] For an introduction the nobilities in most various countries, H.M. Scott (ed.), *The European Nobilities in the Seventeenth and Eighteenth Centuries*, I-II. London 1995; for the transformation of the aristocracy, see L. Stone, *The Crisis of the Aristocracy* (1965); O. Brunner, *Adeliges Leben und europäischer Geist.* Salzburg 1949. For an analysis of the self-identity of the Swedish nobility in the 17th century see Peter Englund, *Det hotade huset. adliga förestillingar om samhället.* Stockholm 1989; se also the various studies by Gustafsson in the bibliography. While numerous studies are concerned with the Danish nobility from a political and economic perspective or individual noblemen and -women, a general study of the culture of the Danish nobility is yet to come though Gjellerup (1873-74) and Andersen (1971) are useful, while studies like J.A. Fridericia, *Adelsvældens sidste Dage.* Cph. 1894 (repr. 1969) contains useful details but mostly produces examples to support the the author's degeneration-theory.

A European literature on the desirable qualities of a nobleman grew forth. On a more superficial level, treatises on the refinement of manners appeared, such as Erasmus' widely-read *De civilitate morum puerilium*, and gradually the social elites withdrew from the popular culture that had been part of every European's cultural heritage at the beginning of the 16th century – the minstrels, the fools, the jugglers, the tales, and the cult of saints, and eventually also from the views of the universe held by the vulgar crowd.[214]

The interest in manners was connected to an ideal of self-restraint, suitable for the nobleman's new role in society as courtier, diplomat and administrator. Furthermore, Renaissance humanists took up the classical ideal of *sapientia et fortitudo*. They emphasised the importance and edifying function of learning to statesmen and military commanders and drew on examples from Antiquity to prove their point.[215] In Baldesar Castiglione's highly influential dialogue on the perfect courtier, *Il cortegiano* (1528), the role of learning is discussed vis-à-vis the traditional feats of arms associated with nobility. It is generally agreed that learning is an important and desirable quality, and it is emphasised that the perfect courtier does not have to be a professional soldier, and in times of peace, he must rather be able to show qualities other than those connected to a warrior.[216] Later, humanist educators like Erasmus, Juan Luis Vives and Justus Lipsius connected learning to ethics. The idea was that a man through learning could cultivate his character, that education was self-cultivation. Through self-cultivation, a man would gain temperance and be able to tame his passions, an important requirement for the transformation from

[214] Peter Burke, *Popular Culture in Early Modern Europe*. London 1988, 270ff.; Robert Muchembled, *Culture populaire et cultures des élites dans la France moderne (XVe-XVIIIe siècle)*. Paris 1978; for Denmark, R. Paulli in J.P. Jacobsen *et al* (eds), *Danske Folkebøger* XIII. Cph. 1915-36, 171f. For the history of manners see Elias (1994), 1-256.

[215] Gustafsson (1959), 2ff.

[216] Castiglione (1976), 57f., 92-94; on the reception of *Il cortegiano*, see Burke (1995), which also includes an inventory of known owners of the book. In Scandinavia these are the Swedish nobleman Per Brahe, the Danish noblemen Niels Friis, Joachim Gersdorff, and Sigvard Grubbe, Cornelius Lerche, Erik and Janus Rosenkrantz, and Jakob Ulfeldt, as well Prince Christian of Denmark, son of Christian IV, professor Peder Scavenius, and the Dutch painter Karel van Mander, who lived many years in Copenhagen.

soldier to courtier.[217] Erasmian humanism, which was mainly based at the courts and among Western European town elites, also introduced a new ideal of nobility, a *vera nobilitas* based on personal qualities rather than pedigree or martial prowess. In his treatise, Erasmus writes in the dedication to a prince: "*Let others paint lions, eagles, and other creatures on their coat of arms. More true nobility is possessed by those who can inscribe on their shields all that they have achieved through the cultivation of the arts and sciences*".[218]

These humanist ideals of nobility also reached Scandinavia in the 16th century, and members of the high nobility adopted learning as a prestige mark. This is evident if we take a look at one of the most important type of sources to the Scandinavian nobility in the 16th and 17th century – the funeral orations.[219] These orations were held in front of the gathered family of the deceased. The context of these orations naturally led to a flattering of the deceased and an emphasis on his piety and learning rather than martial deeds. The funeral oration of a great man or woman was intended to be edifying, to serve as an example (*exemplum*) to be followed. Textbooks on these orations, such as the *De rhetorica ecclesiastica libri tres* by the humanist bishop of Verona, Augustinus Valerius, gave certain topics to be treated in the oration, one of these being learning (*doctrina*). The preacher, who in this period would almost always be a student of Melanchthon, would use the supposed learning of the deceased as an example for other noblemen to follow. Thus, in his funeral oration for the Danish admiral Herluf Trolle Professor Machabæus praised the enthusiasm of the deceased for learning and expressed the wish that other noblemen would follow his example.[220]

The mentioning of learning in a funeral oration does therefore not necessarily imply that the deceased was particularly learned. On the other hand it gives an indication of the prestige connected with learning in a certain cultural context, and it is

[217] The idea of refinement as a mark of nobility precedes the 16th century, but changed character in that period, see Elias (1994), esp. 56-67.

[218] *De civilitate morum puerilium.*

[219] On 16th century funeral orations in Denmark, cf. Marianne Pade, 'Danske Ligtaler i det 16. århundrede', *Litteratur og lærdom. Renæssancestudier* 1 (1987), 95-106.

[220] F.J. Billeskov Jansen, *Humanitas Christiana. Mindetaler over Herluf Trolle af Niels Hemmingsen og Christian Machabæus.* Cph. 1990, 37.

striking how studies and learning are praised whenever possible.[221] Likewise, studies are always emphasised in the autobiographies of many noblemen from this period,[222] and in 1602 the noble Danish youngster Godske Lindenov held a speech on the purpose of a nobleman's studies. He claimed that noble privileges were connected to service in the administration rather than to martial skills, and reminded his audience that "*divinus Plato*" had taught us to use our eyes to observe Nature and learn from it.[223]

Perhaps the most telling evidence of the connection between nobility and learning comes from clients or potential clients of Scandinavian noblemen. Holger Rosenkrantz' *praeceptor* in Rostock, Daniel Cramer, was apparently impressed during a visit to Denmark in 1592: "*What arts and sciences exist that are not cultivated in that class*".[224] In his drama *De Aretino and Eugenia* (1602), dedicated to a Danish prince, the learned hero Aretinus is according to Cramer: "*A reflection of the idea of the Danish nobility*", while Eugenia like Danish noblewomen is "*a virgin skilled in the medical art*".[225] In 1601 a Saxon, Salomon Sparnagel, published a *Dialogue on the educated Nobility* where he claimed that learning is not only an ornament for the nobility, but a necessity. It does not taint nobility, which according to Sparnagel was the general opinion in Germany, but increases it. To encourage the German nobility to engage in learning, Sparnagel refers to Danish noblemen like the Rantzaus, Henrik Ramel, and the Rosenkrantz (father and son) as examples to be followed.[226] In the Dutch historian Johan-

[221] See Casper Peter Rothe (ed.), *Brave Danske Mænds og Qvinders berømmelige Eftermæle,* I-II. Cph. 1753; C.F. Bricka and S.M. Gjellerup (eds.), *Den danske Adel i det 16de og 17de Aarhundrede.* I. Samling, Cph. 1874-75, II. Samling, Cph. 1913, esp. Christian Barnekow (II,9f.). See also the funeral oration on chancellor Christian Friis to Kragerup, *Oratio fun. de Chr. Friis Dn. de Kragerup.* Hafniæ 1640, D 3b.

[222] See for example S. Gissel: 'To samtidige Jørgen Rosenkrantz-biografier', *Personalhistorisk Tidsskrift* XII. R.4.H (1949), 141-145.

[223] Gjellerup (1873-74), 37ff; *Magtstaten* (1984), 34.

[224] D. Cramer, *Isagoge in Metaphysicam Aristotelis.* Hanoviæ 1594 dedicated to Tycho Brahe.

[225] *Areteugenia: de Aretino et Eugenia, quod nobiles artes et virtutes permantur, non opprimantur; Fabula ficta et comice descripta a M.D. Cramero* (ded. November 1592).

[226] *De nobilitate literata Dialogus...*autore SALOMONE SPARNAGELIO Mysnico. Magdeburg 1601, fol. C.6v. The book was dedicated to members of the noble family of Gans, barons of Pulitz, who were related to Holger Rosenkrantz.

nes Meursius' preface to his historical description of Leiden, dedicated to Holger Rosenkrantz, learned Danish noblemen are praised together with non-noble men of learning like the Bartholins.[227]

Undoubtedly, men like Cramer, Sparnagel, and Meursius all had good reasons to praise members of the Danish nobility in an effort to obtain patronage. We can therefore not use their statements as evidence that Danish noblemen were more learned than their fellows in other parts of Europe. What we can say, however, is that in the view of these authors, Danish noblemen could be flattered by referring to their learning. In other words, learning was an important part of the self-perception and self-image of a number of aristocrats in this period. Thus, the Danish seneschal Kristoffer Valkendorf in 1595 established the first residence hall for students at the University of Copenhagen, and the Swedish King Erik XIV (whose education had been that of a high nobleman) had himself portrayed as a learned philosopher, as did the Danish Chancellor Christian Friis to Kragerup.[228] Others, like Herluf Trolle combined reverence for learning with the traditional idea of the nobleman as a defender of his country. Together with his wife he established Herlufsholm, a school for the education of the nobility in 1565, but at the same time he legitimised the privileges of the nobility with their duty to defend the kingdom.[229]

In Sweden there was an even greater interest in the ideal qualities of true nobility, stimulated by the great number of ennoblements during the 17th century.[230] The central theme was the relationship between learning and the traditional martial values of the nobility. As late as in 1658, the Swedish poet known under the pseudonym Skogekär Bergbo, and who is generally thought to have been a nobleman, criticised the nobility for neglecting letters on behalf of martial skills.[231]

[227] Johannes Meursii Opera, ed. Lamius XI, p. 387. For another example, see Salomon Gesner, *Genesis sive primus liber Moysis.* Wittenberg 1604, dedicated to Christian IV.

[228] Andersson (1963), 143; Degn (1988), 164.

[229] Scott (1995), II, 41.

[230] See Lars Gustafsson, 'Dienstadel, Tugendadel und Politesse mondaine. Aristokratische Bildungsideale in der schwedischen Großmachtzeit', Lohmeier (1978), 109-127 and idem (1959).

[231] Gustafsson (1959), 1f; on Skogekär Bergbo, Schück and Warburg (1985), 316ff.

However, what was important to most Scandinavian noblemen in the 16th and 17th century was not high humanist ideals of true nobility, but everyday reality, the problem of securing a career for their sons. In that sense the demands of the government was dominant, and while governments had use of military commanders, they had even more use of good administrators, particularly in Sweden in the wake of the great conquests in the 17th century. This was evident in the iconography of the meeting hall of the Swedish nobility in Stockholm (*Riddarhuset*), that combined the virtues of Mars and Minerva, and at which we shall look more closely in Chapter Nine. Learning was a requirement for an office in the administration and the diplomatic service, or as the Swedish chancellor Axel Oxenstierna, himself a member of the high nobility, put it on an occasion when he was critisised for appointing learned commoners as envoys rather than noblemen: "*He who cannot or will nor take the pen in his hand and undertake training in order to earn his living, is not suitable for such offices.*"[232]

The learning of the nobility, however, was not identical to academic learning, and it was generally agreed that the nobleman should not turn into an academic. The distinction mark of Castiglione's perfect courtier is versatility and easiness: "*to practice in all things a certain nonchalance which conceals all artistry and makes whatever one says or does seem uncontrived and effortless*"; he must avoid being pedantic and the ideas conveyed by his words must be "*beautiful, witty, shrewd, elegant or solemn, according to the need*".[233] Needless to say, this ideal of the perfect courtier was incompatible with traditional academic culture.

The nobility's general attitude towards academic learning seems to have been ambiguous. On the one hand, learning was admired and connected to prestige, but on the other hand, aristocrats clearly distinguished themselves from the culture of the universities with their medieval rituals and traditions. It was regarded improper for a nobleman to receive an academic degree,[234] and the

[232] "*Den som icke kunde eller villa taga pennan i handen och skaffa sig övningen, dermäd att fortjäna sitt bröd, han vore till sådane ämbeten icke bekväm*", *Handlingar rörande Sveriges historia*, ed. 1940-41, 4:2, 133; Platen 141ff.

[233] Castiglione (1976), 67, 77-83, 88.

[234] Thus it was said that the young Frederik Rosenkrantz declined to have himself promoted to master in Wittenberg, because his social standing and country would not have allowed this; KUH II, 349; ibid, III, 571.

academic quibbler, the black-clad pedant, was a target of ridicule. Behind the ideal of versatility we find the notion that a nobleman was a free man contrary to non-nobles who in legal terms were counted "not free" (Da. *ufri,* Sw. *ofrälse*). A nobleman could venture into a range of arts and sciences, but he must not be trapped. In that case he might turn into a pedant, blur the distinction marks between the nobility and the other estates and forfeit his talents as a courtier. Conveniently this also dispensed the nobles from any obligation to compete with non-nobles within the formalistic rules of academic learning.[235]

As noblemen also required particular martial and courteous skills, they needed special schools. In Denmark this was reflected in the establishment of schools directed towards sons of the nobility based on Protestant German models,[236] in Sweden in the Stockholm college mentioned in the previous chapter. Many of the requested skills could only be learned abroad, and in the post-Reformation century it therefore became imperative for noble families to send their sons abroad, and huge sums were invested into it. A significant number of the dozens of Scandinavian students that every year travelled down to the European mainland belonged to the nobility.[237]

It has often been claimed that to the culture of the upper classes, the Reformation was less important than the Renaissance.[238] While this is true for Europe in general, in Scandinavia the two currents almost collided in time and were intermingled within the process of political centralisation. The first influences from renaissance humanism and courtly ideals had hardly gained ground in Scandinavia, when the Reformation changed the political agenda, and the predominant influence of Lutheranism on political and religious thinking in 16th and early 17th century Scandinavia meant that the travels of Scandinavian noblemen for a while followed pretty much the same pattern as those of their

[235] Cf. Castiglione (1976), 117 where wrestling with peasants is discussed.
[236] Those of Herlufsholm 1565, Frederiksborg Castle 1568 and Sorø 1585. All of these schools were located on the island of Seeland within a day's journey from the capital. They were based on the Saxon schools of Pforta, Meissen and Grimma.
[237] In the period 1536-1660 about 20% of the 3586 Danish, Norwegian, and Icelandic students that made a study tour were noblemen, Helk (1987), 44.
[238] e.g. Burke (1988), 271.

countrymen of more humble origins. They went to Wittenberg, Rostock, and Leipzig in order to be lectured on Lutheran theology and philosophy, a requirement for men who were to administer a Monarchy whose most important self-imposed duty was the defend the Evangelical faith.[239]

Although it was the study of law and theology that attracted these noble students to the universities of Protestant Germany, their studies there also made them acquainted with natural philosophy. Castiglione had followed Cicero in identifying learning with classical literature, history and mastery of Latin and Greek. The study of nature was only suitable in so far as it enabled a courtier to imitate Nature in painting,[240] and neither did the study of Nature (medicine excepted) play a significant role in the educational ideals of Erasmus. Scandinavian noblemen, however, who went to Melanchthon's Wittenberg or Chytraeus' Rostock, could become familiar with natural philosophy, which played a far greater role at the arts faculty of these academies than at the smaller and more predominantly theological universities in Copenhagen and Uppsala. The most striking example is that of Tycho Brahe, who was sent to Wittenberg to pursue law studies but returned as a natural philosopher. Brahe was unique in many ways, but the occupation with natural philosophy was a central part of several Scandinavian noblemen's stay in Germany.

Another illuminating example is that of Holger Rosenkrantz, whose high noble family intended him for a career in the central administration and, hopefully, in the council of the realm.[241] His father, Jørgen Rosenkrantz, had heard Luther and Melanchthon in Wittenberg, and was a fervent Lutheran with an almost paranoid fear of heterodoxy. Since Wittenberg was submerged in troubles at the time of Holger's departure, Jørgen sent him to Rostock, the most orthodox university available. From the extant source material we get an impression of how far young Holger emerged in natural philosophy during his studies in Rostock in the early

[239] All Danish and Swedish chancellors in this period had studied at Wittenberg, almost all at Rostock.

[240] Castiglione (1976), 90, 97.

[241] The standard biography on Holger Rosenkrantz is still that of the church historian J. Oskar Andersen, *Holger Rosenkrantz den Lærde.* Kbh. 1896. H.R.'s studies in Rostock are documented through letters, which exit in transcript in KB NKS 4° 2091, vol. 1-3.

1590's. Not only did he study Euclidian geometry and the theory of spheres, probably according to Theodosios, and Georg Liebler's *Physics.*[242] At the end of 1591 he attended "*physical disputations*" once a week, as well as Heinrich Brucaeus' anatomical seminars that included practical exercises.[243] He asked his father for writings of Galen and Zabarella that his teacher Flacius had recommended,[244] and simultaneously with these studies in natural philosophy he was lectured on Aristotelian Ethics. It was only after three years of university studies that Rosenkrantz was ready to commence the studies in the law faculty.

Although Holger Rosenkrantz was, like Tycho Brahe, undoubtedly a more gifted student than most of his fellows, the point is that the structure and content of learning at the leading Lutheran universities made students acquainted with natural philosophy long before they reached the higher faculties, which many of them never entered. Since noblemen were not pursuing an academic or ecclesiastical career, most of them had little use of logical distinctions or theological subtleties. Their studies at the arts faculty therefore concentrated on Ethics, natural philosophy and poetry.

Furthermore, the education of noblemen differed from that of most students when it came to the extent of their travels. A future courtier was in need of other skills than those taught by the universities. In an age of expanding European diplomacy, modern languages such as High German and French were required. The first was best learned in Leipzig, the latter in Orléans, while both could be learned in Strasbourg. Many noblemen also learned Italian, to which a visit to Italy (preferably Siena) was required. To this came courtly skills such as dancing, fencing, and horsemanship that could be learned many places, not least at the noble academies in Tübingen and Kassel.[245]

Thus, while Scandinavian noblemen in the late 16th century initially went to Lutheran centres of learning, their further travels often brought them to all corners of Western and Southern Europe and covered Catholic and Calvinist countries and cities as well.

[242] Letter from D. Cramer 1/7-1591, transcript in KB, NKS 4° 2091.
[243] Letter from D. Cramer 2/12-1590, transcript in KB, NKS 4° 2091.
[244] Andersen (1896), 24.
[245] For Danes in Tübingen see Henny Glarbo, *En Adelsskole i det 16. og 17. Aarhundrede. Collegium Illustre i Tübingen.* Cph. 1923.

Furthermore, noblemen seem to have taken another attitude to travel than most of their non-noble countrymen. In the 16th century a new literature of travel guides grew up,[246] which also reflected a new attitude to travel. Travellers no longer took the road only to go somewhere – the journey itself became valuable, and men were encouraged to travel with their eyes open in order to study the culture, learning, monuments, sights and languages of foreign places. As a Danish nobleman put it in an unpublished guide for the peregrination of young noblemen: *"To study books and maps and converse with wise men at home is useful; but there are things you do not understand until you see them, and everyone who goes abroad sees something new that others did not notice".*[247] As we shall see below, the broader horizon, both in terms of geography and in terms of environments, was important not only to noblemen, but to those commoners who acted as their praeceptors and were connected to noble households.

2. Noble Circles of Learning

One of the most prominent examples of the transformation of the noble identity and the influence of educational ideals of Renaissance humanism was Heinrich Rantzau (1526-1598), who from 1556 and until his death served three Danish kings as viceroy in the duchies of Schleswig and Holstein.[248] His father, Johann Rantzau, had travelled the world as a knight errant; he made a pilgrimage to Santiago de Compostela, fought against the Turks and was knighted at the Holy Sepulchre. He made his fortune as a *condottieri*, was employed by the future king Frederik I of Denmark, fought on the side of his son and successor in the Count's Feud (1533-1536) and suppressed the peasant rebellion in Jutland in 1534.[249] He was a fighting man, with no academic education and ignorant of Latin, but he participated in the increased diplomatic

[246] Hilde de Ridder-Symoens (1997), 417. See also M czak (1980).

[247] Gabriel Akeleye, *Peregrinatoriæ prudentiæ recepta* (1643), KB MS..

[248] For Rantzau the best introduction is the short biography D. Lohmeier, *Heinrich Rantzau. Humanismus und Renaissance in Schleswig-Holstein.* Heide 2000; also idem, 'Heinrich Rantzau und die Adelskultur der frühen Neuzeit', *Arte & Marte,* ed. idem. Neumünster 1978, 67-84 is useful in this context. For an introduction to Rantzau in English, see R.J.W. Evans, 'Rantzau and Welser: aspects of later German humanism', *History of European Ideas* 5:3 (1984), 257-272.

[249] See H. Ratjen, *Johann Rantzau und Heinrich Rantzau.* Kiel 1862.

activity of this period, and impressed by Luther during the diet of Worms, he became a staunch supporter of Protestantism in the Duchies.

Heinrich was only twelve years old, when his father sent him to Wittenberg. Here he occasionally dined at Luther's table and heard lectures by Melanchthon. He does not seem to have taken a particular interest in matters of theology; like most other noblemen his studies focused on law, rhetoric, history and philology, but during his stay in Wittenberg he also developed a keen interest in astrology and astronomy. In 1548-1553 he was connected to the itinerant imperial court of Charles V in Brussels, Augsburg and Innsbruck, learning not only martial and courtly skills, but also associating with the court circle of humanists led by the Antoine Perrenot de Granvelle, the Emperor's cardinal minister. When Rantzau returned to the Duchies, he entered a brilliant career as administrator, speculator, and landowner, a pioneer in forestry and the creditor of princes and cities all over Europe. Unlike his father, who described himself as a soldier and kingmaker, Heinrich also described himself as a servant of the Danish king, and martial endeavours played a marginal, not to say ornamental, role in his career. At his castle of Breitenburg he collected a library of allegedly 6,300 books, rebuilt his castles in Renaissance style, became a renowned patron of art, and found time to write (or request) treatises on astrology, health care, geography, history, warfare and Stoic moral philosophy.

Closely connected to both the German world and the court in Copenhagen, and the leading magnate in this corner of the realms, Heinrich Rantzau became an important mediator between Denmark and the cultural currents of continental Europe. Probably through his connections to the circle around Granvelle, Rantzau became acquainted with the highly influential Flemish scholar Justus Lipsius. In 1584 Lipsius sent his treatise on Stoic moral philosophy, *De constantia,* to Rantzau, and immediately after the publication of his widely read handbook on practical politics, *Politica*, in 1589, he sent two copies to Rantzau in order to make it acquainted to the young king Christian IV. Likewise, Rantzau had close connections to David Chytraeus and other professors in Rostock. He took part in the publication of geographical works like Georg Braun's *Theatrum Urbium* and Gerhard Mercator's

great atlas. He also had an edition of Patrizi's *Zoroaster* published in Hamburg in 1593,[250] and he corresponded with the occultist and physician Michael Maier,[251] who came from Holstein and with whom he may have been personally acquainted.

Rantzau's view on learning was not only influenced by Castiglione's ideals of the perfect courtier, but also by the idea of learning as self-cultivation and a means to discipline and tame the passions. He was very enthusiastic about Lipsius' *De Constantia*, but it seems that already fifteen years before its publication, he adhered to a view on learning as an instrument of discipline for individuals and princes. In the description of Breitenburg that Rantzau ordered in 1569, it says, "*If only our time had produced more of such* [learned] *men, there would be less fury and less war, and the humanist studies (bonae literae) would be less disdained and neglected. Happy are the states, whose princes do not spend their leisure on dice games and luxury, but rather cultivate worthy studies and books and thereby cultivate their souls.*"[252]

The German jurist and poet Johannes Lauterbach later expressed the same notion in a book on noble upbringing dedicated to Rantzau.[253] In the contest between martial ideals and ideals of learning, Lauterbach rules in favour of learning, for "*Studia ferociam compescunt*", an idea that was also visualised at Breitenburg where Rantzau had made wall paintings of Hercules killing the lion, symbolising the taming of the fury.[254]

Another circle of learned noblemen in 16th century Denmark was centred upon the government circles in Copenhagen. Its po-

[250] *Magia Philosophica hoc est Francisci Patricii summi Philosophi Zoroaster et eius 320 Oracula Chaldaica Asclepii Dialogus et Philosophia Magna, Hermetis Trismegisti Poemander, Sermo Sacer...Jam nunc primum ex Bibliotheca Ranzoviana è tenebris eruta et latine edita.* Hamburg 1593.

[251] An early letter of Maier's to Rantzau is in ÖN, MS. 9737[m], fol. 27-30; cf. R.J.W. Evans, *Rudolf II and his World* (1973), repr. London 1997, 206n.

[252] Georg Crusius, *Descriptio Bredenbergae*, fol. K4: "*Atque utinam tales viros nostra secula plures tulissent, minus furorum, minus bellorum esset, minus bonae literae malè audirent, & negligerentur. Etenim sint Maecenates, & erunt Marones, sint Antonini, & erunt Oppiani. Felices respublicae, quarum principes, tempora, quae negotiis suffurantur, non alae, non luxui, sed studiis honestis, sed libris impertiunt, iis animos expoliunt, iis sua ocia, iis negotia condiunt, quin eiusmodi honorem habent, ut cum hero meo de iis sic sentire & dicere non pudeat*".

[253] *Tractatus novus de armis & literis.* Wittenberg 1595.

[254] See Lohmeier (1978), 79f.

litical leader was Peder Oxe (1520-1575), the step-uncle of Tycho Brahe who in many ways was a counterpart to Rantzau.[255] Before the Reformation, the Oxe family had taken a strong hand in positions in the administration of Sees and monasteries. In the wake of the Reformation they re-orientated themselves towards the central administration. Peder Oxe's studies had taken him to France, Germany, the Netherlands, and Switzerland, with the future professor of medicine, Christian Morsing (whom we encountered in the previous chapter), as his tutor. Afterwards, Oxe was sent on diplomatic missions to Saxony and spent several years of exile at the motley court of Lorraine. He was one of the first true renaissance courtiers in Scandinavia – versatile, cosmopolitan, hard as iron in matters concerning his private economy, smooth as silk when it came to matters of ideals. Forced into exile by rivals at court, he had no scruples in plotting against his king, and was suspected of planning an invasion of Denmark at the head of a foreign army.

At the courts of Saxony and Lorraine, Oxe became acquainted with Humanist culture. He was not a scholar or philosopher himself, and his talent for foreign languages seems to have been extremely limited, but he took pleasure in the company of scholars. After his return to Copenhagen, he found learned noblemen at court, such as the royal chancellor Johan Friis, the future seneschal Christopher Valkendorf, the royal councillor Jørgen Rosenkrantz, and the chancellor of the realm Arild Huitfeldt. Connected to this circle was Niels Kaas, who came from an insignificant noble family, but who had managed to study in Wittenberg, and who under the aegis of Oxe made a glorious career in the central administration and ended his life as royal chancellor.

The learning of this court circle was mostly focused on humanist disciplines – history, poetry, and treatises on personal piety, but it was the influence of Oxe and Kaas that enabled Tycho Brahe (1546-1601), the step nephew of Oxe,[256] to establish himself at

[255] Troels-Lund, *Peder Oxe. Et historisk billed.* Cph. 1906, is the classic work on Oxe. Its interpretation was challenged by F. Jensen, *Bidrag til Frederik II's og Erik XIV's historie.* Cph. 1978, 45-82 and idem., *Danmarks konflikt med Sverige 1563-1570.* Cph. 1982.

[256] For Brahe's family background, Victor E. Thoren, *The Lord of Uraniborg.* Cambridge 1990, ch. 1.

Uraniborg on the island of Hven that eventually became the outstanding international example of a court of learned nobility.[257]

Farther removed from the European mainland, the emergence of a noble culture of learning in Sweden gained momentum only in the wake of the country's rise to a great power, but it is significant that some of the noble families who first adopted learning in the 16th century as part of their identify were the same to carry on patronage into the 17th century. Already in the 16th century, however, we can observe the adoption of learning as part of a noble identity. Even more than in Denmark, this adoption of learning seems to have been connected to attempts by the high nobility to assert and define itself culturally as well as politically within new social realities.[258]

Towards the end of his life Per Brahe (1520-1590), a nephew of Gustav Vasa, wrote an *Oeconomia*, a manual on how a noble family should be organised and educated.[259] Brahe, who cites Castiglione, emphasises that although martial skills and knowledge of politics are useful, learning and travelling are equally important and should not be neglected. Brahe followed his own advice by writing a continuation of the chronicle of Peder Svart and an unpublished theological treatise. He also owned a copy of Paracelsus' *Philosophia sagax*,[260] and the interest in Paracelsus and astronomy was carried on by his son Abraham Brahe (1569-1630), and by his grandson Per Brahe the Younger (1602-1680), both great patrons of natural philosophy to whom we shall later return.

Brahe's son-in-law was the brilliant Erik Sparre (1550-1600), who corresponded with his brother in Italian and French, and took interest in history and law and helped to finance David Chytraeus' chronicle of the Nordic countries. Finally, there was Ho-

[257] Brahe's activities on Hven have been studied in detail, most recently and brilliantly in John Robert Christianson, *On Tycho's Island. Tycho Brahe and His Assistants 1570-1601*. Cambridge 2000.

[258] Englund (1989).

[259] *Oeconomia eller Huuszholdzbook, för ungt adelsfolck*. It was written around 1580 and published in 1677 by Brahe's grandson Per Brahe the Younger, and has been published in our time by John Granlund and Gösta Holm. Nordiska Museets Handlinger 78 (1971); for an analysis of the book, Gotthardt Frühsorge, "Die Gattung der 'Oeconomia' als Spiegel adligen Lebens", *Arte und Marte*, ed. by Dieter Lohmeier. Neumünster 1978, 85-107.

[260] A. Losman, "En tämmelig myckenhet sköna böcker", *Biblis 1967*.

genskild Bielke (1538-1605), who was the most important collector of books in 16th century Sweden. The major part of his library consisted of treatises on history and patristic theology.[261]

3. Natural Philosophy and the Culture of Renaissance Humanism

We have now treated two cultural and indeed social frameworks of learning, the university and the nobility. The natural philosophers, we shall discuss in this book, were all connected to both cultures. Nearly all of them were university professors, and all were clients of noblemen or princes, whose direct or indirect support was essential to their careers and occupation with natural philosophy. Yet, the culture that fostered innovation in natural philosophy in 16th and 17th-century Scandinavia was identical to neither of these two cultures.

Apart from Tycho Brahe, no Scandinavian noblemen by birth took more than a leisurely interest in natural philosophy, and if we look for new scientific and medical theories and practices in the syllabus of the university, we shall generally look in vain. As an institution, with the explicit obligation to defend religious and social order, the Scandinavian university was conspicuously conservative. As we shall see, there were differences between Denmark and Sweden, and to a certain degree things changed in mid-17th century, but the lecture room was not the forum of innovation.

The culture to which our natural philosophers belonged can best be understood as a part of the culture of Renaissance humanism. The scholarship on humanism is immense, and there seems to be a multitude of views regarding what Renaissance humanism stood for and what it represented.[262] However, for all the diversity of Renaissance humanism, including the differences between the early Italian humanism and its Northern European varieties, there were certain key notions and traits that decisively distinguished humanist culture in our period from theologically dominated

[261] Otto Walde, 'En svensk boksamlare från Vasatiden', *Uppsala universitetsbibliotek mindeskrift 1621-1921* (1921).

[262] For surveys on studies on humanism, see P.O. Kristeller, 'Studies on renaissance humanism', *Studies in the Renaissance* 9 (1962), 7ff; A. Buck, 'Italienischer Humanismus', *Archiv für Kulturgeschichte* 52 (1970), 121-140. The surveys in *Renaissance Quarterly* give a good conspectus of the annually published litterature.

academic culture. I would therefore like to draw attention to those aspects of the phenomenon, which are most relevant to this study.

From its beginnings in Renaissance Italy, humanist studies were connected to the culture of the elites, and this connection continued throughout the early modern period.[263] In their polemics against traditional academic training, humanists often denounced the content and methods of Scholastic university teaching - and ridiculed traditional academic life - their main points of attack being the uselessness, sterility, and tediousness of such studies. Humanists were almost always connected to courts or town elites, and when they emphasised the usefulness of humanist studies, they reflected the demands of the elites.

The humanist studies (*studia humanitatis*) were also particularly useful to governments, not only in producing administrators and diplomats, but also in propaganda. Poets and historians were employed to glorify the monarch and his realm, and to legitimate his rule. Scandinavian governments in the 16th and 17th century employed royal historiographers and antiquarians, and poets served to commemorate great deeds (or make dubious deeds great), and they were used in the ruler's representation towards other countries.[264] To reward such useful servants, governments sometimes provided them with a university chair, but they remained closer connected to the culture of the court than to that of the university, and enjoyed royal support in their not infrequent clashes with university authorities.[265]

The support of the Court thus gave humanists at the University a certain liberty to promote controversial views. This is evident when Danish humanists introduced Ramism in the closing decades of the 16th century. Here it appears as a product of the 16th-century humanist preoccupation with language and teaching,

[263] For a discussion on the origin of humanism, see Walter Ullmann, *Medieval Foundations of Renaissance Humanism.* London 1977.

[264] On royal Danish historiographers in the 17th century see Karen Skovgaard-Petersen, *Historiography at the Court of Christian IV.* Cph. 2002.

[265] Two examples from 16th-century Denmark can illustrate this. The poets Erasmus Lætus (1520-1582) and Jon Jacobsen Venusin (ob. 1609) were both rewarded with various university chairs, both ending with one in theology, to which neither of them was hardly suited. On Lætus see KUH, II, 462-486, on Venusin see Rørdam in *Kirlehistoriske Samlinger* 3:I, 241ff.

which generally included hostility towards scholasticism and inspiration from Platonism. From the 1580's a number of Danish students were influenced by Ramism during their studies abroad.[266] Most prominent among them was Anders Krag, a medical student who had probably been fired by Ramism during his stay in Basel, and published a defence of Ramus against the Tübingen professor Georg Liebler.[267] Krag praised Ramus, whom he compared with Socrates, and told that he himself in his youth had won applause due to his hair-splitting, in matters that cannot be known. Now, Ramus had taught him that human knowledge could only be gained through the senses. Krag wrote further treatises on Ramism in 1583 and 1586.[268] In the latter, dedicated to students in Copenhagen, he concludes:

"All our knowledge originates from the senses, which are, so to speak, messengers between reason and the exterior things that must be perceived: Without them [the senses], that, which shall be judged... will not become firm, true, necessary"

In the years around 1600 Johannes Stephanius, a former assistant of Tycho Brahe, held seminars in Copenhagen on the logic of Petrus Ramus and his predecessor Rudolf Agricola,[269] and another assistant of Tycho, Jon Jacobsen Venusin in 1603 recommended the textbook of the Ramist Omer Talon in his lectures on rhetoric. The previous year Venusin had praised mathematics in a speech titled "God is a geometrician".[270] Here, Venusin defended the Copernican world picture, and mocked the theologians who opposed it.

At the University of Copenhagen, however, the future did not belong to the Ramists. Venusin died in 1608, Krag had died eight

[266] See William Norvin, 'Petrus Ramus og Danmark', *Lychnos.* Stockholm 1943, which ufortunately deals more with Ramism in general than with its devlopment in Denmark; Jens Glebe-Møller, 'Ramus i lyset af den nyere forskning', *Dansk teologisk tidsskrift* 26 (1963), 43-59. Ramism in Denmark is also treated in the forthcoming Carl Henrik Koch, *Dansk filosofi i renæssancen.* Cph. 2003.

[267] *Rameæ Scholæ et defensio P. Rami.* Basel 1582.

[268] *Aristotelica et Rameae.* Basel 1583 and *Laurea Apollinea Monspeliensis.* Basel 1586.

[269] Invitations to these seminars are reprinted in KUH IV, 498, 538, 590; on Stephanius see Christianson (2000), 363-365.

[270] KB NKS 271 (8°); reprinted in with other sources in KUH IV, 523-524, 552; at the University Venusin also held lectures on magnetism, KUH IV, 514-515; Christianson (2000), 99, 171, 179-190.

years earlier. With their death, died the outspoken Ramists in Copenhagen, but while Ramism played a brief and marginal role in Copenhagen, and left little impact on natural philosophy in Denmark, it is an interesting illustration of the relationship between humanist and traditional academic learning.

The humanists who defended Ramism did so as a conscious challenge to scholastic teaching. Anders Krag was a polemical character who ended his books with the motto: "Truth provokes hatred" (*Veritas odium parit*), but such provocations, and the obvious hostility that emerged amongst the targets of their ridicule, does not seem to have damaged their careers, on the contrary.[271] As long as they enjoyed the backing of the social and political elite,[272] Ramists and other humanists could relatively safely challenge Scholastic culture, but at the same time it made them odd-men-out at the university. Due to the developments in the years around 1600, to which we shall return in the next chapter, when the university's role in promoting religious discipline increased, there was little or no room left for such critical voices in the lecture room. This, however, did not mean that humanist culture disappeared or lost its backing from the elite, but rather that it unfolded elsewhere. Before we discuss this development, however, we must take a closer look at the essential differences between humanist culture and the predominant theological culture of the university.

The major concern of humanism was the literary, educational and cultural revival of ancient literature. This preoccupation with the illustrious culture of Antiquity gives humanist letters and writings of the period a particular tone, filled as they are with quotations from Classical poets and pervaded by linguistic and mythological figures of ancient Rome or Greece. However, while this clearly reflected enthusiasm of the classical models, it may often have been nothing but literary convention with no profound relation-

[271] Krag became professor of Latin in Copenhagen in 1586, and was promoted to a chair in physics in 1591. In 1589 he was appointed to accompany Princess Anna to Scotland for her wedding with King James.

[272] *Rameæ Scholæ* was dedicated to the young prince Christian, and included verses by two noblemen; a Ramist reading of Horace, *Q. Horatii Flacci Ars poetica* (1583) was dedicated to Chancellor Kaas, and the treatise of 1583 was dedicated to the royal secretary. The treatise of 1586, dedicated to the students, included a poem by the nobleman Sivert Grubbe.

ship to a view on Man or his intellectual potential that conflicted with religious dogma.

More important is the matter of classical philosophy and its connection to theology. To Evangelical theologians, the Reformation had liberated theology from its centuries-old Babylonian captivity. What mattered was to guard this theology against heresy, innovations and Jesuit and Reformed propaganda. Biblical passages as well as religious dogmas could be clarified and reflected upon, but essentially Evangelical theology was conservative once the Reformation had been carried through. This, of course, was an ideal. As we shall see, Evangelical theology underwent several changes in this period, but these were always carried out in the name of conservation rather than innovation, and in this endeavour theologians had the support of Scandinavian governments who wanted peace and order in Church as well as society.

As for Humanism, its encounter with classical philosophy, including traditions like Hermeticism, changed over time from infatuation to a more critical approach. As it turned out that there was not one, but several classical philosophical traditions, it was impossible to adopt the philosophical corpus at face value. Either an attempt must be made to show the concordance of antique philosophy behind apparent differences, as it was done in the eclecticism of the so-called 'occult philosophy' of Pico della Mirandola and other thinkers,[273] or humanists were forced to take a critical stand in the philosophical and terminological disorder inherited from Antiquity.

From its initial concern with the literary and philosophical products of the Antiquity, Renaissance humanism also came to involve medicine and mathematics. Humanists published the works of medical authorities like Hippocrates and Galen, and humanist physicians saw themselves as part of a tradition rooted in Antiquity, or even, in the case of the Hermetic tradition, in a primeval age that preceded the glory of Athens and Rome. The medical art had its practitioners in pagan Antiquity with Hippocrates and Galen, whose works both appeared in Greek editions in 1525 and were translated into Latin in the 1530s,[274] and even Muslims

[273] Yates (1991).

[274] Vivian Nutton, 'The Anatomy of the Soul in Early Renaissance Medicine', *The Human Embryo. Aristotle and the Arabic and European Traditions*, ed. G.R. Dunstan. Exeter 1990, 140.

like Avicenna, Rhazes and Averroës were recognised as medical authorities. Likewise, Astronomy and geometry were modelled on the works of the ancient Greeks (Ptolemy, Aristarchus, Euclid), and in chemistry and alchemy the great practitioners of the past, whether these were historical or imaginary figures, included men from all ages and all religions.

In the Reformation age this gave physicians, astronomers, and chemists a broader outlook than the theologians who dominated the University. While theology (or so Lutheran theologians claimed) had been liberated from centuries of darkness and perversion and returned to its point of origin, namely Holy Scripture, natural philosophers around 1600 could not make the same claim for their respective sciences. To those who accepted innovation, recent natural philosophers like Vesalius had made important contributions to improving Galen's views on the human body, as had Copernican mathematics to the study of the supralunary world, as well as Paracelsus' application of chemistry to medicine, but the framework of discussion was still Aristotelian physics, Galenic medicine and Ptolemaic cosmology. Therefore these authorities, as well as their commentators in Antiquity and the Middle Ages constituted an important part of the identity of a natural philosopher, together with the classical authors and philosophers of the general humanist culture he belonged to. Through pagan or Muslim medical authors the student of medicine would, even within the authoritative reading of his own profession, encounter thought patterns that differed considerably from the Lutheran-Scholastic corpus that dominated the university in general. Many Galenic treatises were inspired by Platonic philosophy,[275] while in a medical authority like Rhazes (al-Razi), students of medicine could find sceptical and anti-authoritarian opinions that was hardly in line with the kind of thinking governments wanted to promote in their subjects.

Physicians, even those who taught at the university, were by nature closely connected to the social elite. As is evident from the instrument of foundation for the University of Copenhagen, the professors of medicine should not only teach at university, but

[275] Andrew Wear, 'Galen in the Renaissance', *Galen. Problems and Prospects*, ed. Vivian Nutton. London 1981, 229f.

practice at court, in town, and throughout the realms as well.[276] Since only people of affluence could afford regular medical attention, physicians were connected to the royal family and the nobility.

Finally, it must be emphasised that although humanist culture in many ways differed from academic theology, Renaissance humanism was not antithetical to religion.[277] The subject matter of the *studia humanitatis* was the gifts and nature of Man as they manifested themselves in language, history, poetry and moral philosophy. Humanism itself could therefore never constitute a complete worldview, and in an age when there was no consistent rationalism or atheism to turn to, any view of Man and the world must ultimately be religiously founded. Inspired by classical thinking, humanists would often express a more positive attitude to Man and his position in this world, but even a fiery treatise on human freedom such as Pico della Mirandola's *Oration on the Dignity of Man* (1486) was written against the enemies of the Church.[278]

If the concentrate on Northern Europe, it is therefore misconceived to perceive Renaissance Humanism and Evangelism as two opposed worldviews. Northern European Humanism was strongly involved in the cry for reform in the early 16th century and closely attached to the Reformation movement, probably even decisive for its initial success.[279] Even when many German and some Scandinavian humanists decided to stay in the Mother Church,[280] and the Reformation polemics was taken over by pro-

[276] Norvin II, 26.

[277] Renaissance humanism must not be confused with 'humanitarianism' or 'humanism' in its modern and often diffuse sense of a rational, non-religious approach to life.

[278] Paul Oskar Kristeller, *Eight Philosophers of the Italian Renaissance.* Stanford 1991, 54-71.

[279] See Bernd Moeller, 'Die deutschen Humanisten und die Anfänge der Reformation', *Zeitschrift für Kirchengeschichte* 70 (1959), 46-61; Lewis W. Spitz, *The Religious Renaissance of the German Humanists.* Cambridge, Mass. 1963; Leif Grane, *Martinus Noster. Luther in the German Reform Movement 1518-1521.* Mainz 1994.

[280] As is well known Luther and Erasmus made a final break in 1524-26 concerning the matter of Man's free will, but it did not mean a separation of Reformation and humanism, as has sometimes been claimed. Most of the humanists, who abandoned Luther and remained in the Mother Church, had already done so and Erasmus' rejection of Luther only confirmed their decision;

fessional theologians, leading Protestant reformers such as Melanchthon and David Chytraeus were also humanists, and Scandinavian humanists were also religious, ultimately adhering to the Christian tenets of Man's Fall and dependence on divine grace. Alongside their flamboyant poems, generally imitations of classical models, and historical writings, we find treatises on piety, devotion, and penance.

But if the relationship between humanism and theology was not a matter of reason versus religion, if humanism cannot be seen as being in direct opposition to religiously dominated academic culture in a strict philosophical sense, it is nonetheless possible to distinguish a particular humanist culture of learning in early modern Scandinavia.

4. The Republic of Letters

We have already noticed that the culture of the high nobility in the Renaissance was cosmopolitan by nature. This outlook, however, was also a part of the general culture of Renaissance humanism, which found its most clear expression in the notion of a 'Republic of Letters' (*respublica litteraria*).[281]

This ideal, which has survived into our own times, originated among Italian humanists in the 15th century and won currency in the 16th and 17th century. No attempt was made to give a thorough definition of this community until around 1700, when it was in its decline, and it appears that it was used quite liberally, sometimes being synonymous with the *orbis litterarius* or the *Parnassus*.[282] As Renaissance humanists, particularly in Germany, initially found themselves in opposition to the scholastic learning of the

Grane (1994); Hanne Flebo, 'Har mennesket en fri vilje ? En ny synsvinkel på forholdet mellem Erasmus og Luther', Flebo and Hansen (1982), 47-60 argues that Luther and Erasmus essentially agrees that Man's soul is nothing but a medium of either good or evil.

[281] For a thought-provoking study of this ideal throughout the ages, see Sverker Sörlin, *De lärdes republik. Om vetenskapens internationella tendenser.* Malmö 1994. The best introduction to the idea of the Republic of Letters in the early modern age is Hans Bots and Françoise Waquet (eds.), *La République des Lettres.* Paris 1997; for a more thorough discussion, idem, *Commercium Litterarium. La communication dans la République des Lettres.* Amsterdam-Maarssen 1994. For a brilliant introduction to the idea of men of learning as an estate, see Erich Trunz, *Deutsche Literatur zwischen Späthumanismus und Barock.* Munich 1995, 7-82.

[282] Bots and Waquet (1997), 11ff., 18ff., 21ff., 29ff.

universities, it was an ideal that was often seen in opposition to traditional academic culture. Closely connected to life at court and among town patricians, this humanist ideal also expressed a feeling of social superiority that not only contrasted humanist studies (*bonae literae*) with scholastic culture, but also established a distinction between nobility by birth (*nobilitas generis*) and a nobility of learning (*nobilitas literaria* or *nobilitas scientiae*). Above, we have seen Erasmus propagate an ideal of nobility based on cultivation of the arts and sciences, and he was only one of many voices who, in his own time as well as through the 16th and 17th century, expressed ideas of a spiritual nobility.[283] In Germany men of learning would often be ennobled by the Emperor, and thereby connect the status of learned nobility with the traditional status of nobility, and the same applied for Sweden in the second half of the 17th century.

Despite the variety of notions connected to The Republic of Letters, we can identify certain main components of the idea. First of all, it was based on Latin as the international language of learning, and a mastery of this language was thus a prerequisite for membership of the Republic.[284] The mentality of 16th century Europeans, as that of their medieval ancestors, was dominated by the idea of a divine order of things,[285] and philosophical and political thinking witnessed an obsession for fitting things into categories placed in a hierarchy. In case of society, this was reflected in the division of people into separate estates - paupers, peasants, burghers, priests, noblemen and princes. This was of course particularly so in societies dominated by the Lutheran ideas of a calling that tied men to a specific place in society. The Republic of Letters, however, was thought to be a spiritual and universal brotherhood (and sisterhood, as it was also thought to include women of learning), which transgressed all borders of confession or nationality, a state of its own with its own code of behaviour. As such it stood outside society, a notion that was reinforced by the fact that the universities had their own jurisdiction (the *ius aca-*

[283] Trunch (1995), 12f., 49f.
[284] Bots and Waquet (1997), 12.
[285] Trunch (1995), 7f.; for se middle ages, see C.S. Lewis, *The Discarded Image.* Cambridge 1964; cf. Michel Foucault, *The Order of Things. An Archeology of the Human Sciences.* London 1992.

demicum), and academics constituted a corporation of their own and were only responsible to the Prince and his chancellor.[286]

Within this republic freedom and equality ruled, and pursuits of learning were generally thought to be a collective endeavour. This not only applied to the circles from which the idea of a Republic of Letters originated, namely humanists collaborating in uncovering, commenting and publishing ancient texts.[287] In the 16th century it was applied to physicians and other natural philosophers, and the term *Respublica medica* (or *iatrica*) was sometimes used.

Frequently, the idea of progress in civilisation, arts and sciences - at least compared with the previous centuries - was also contained in the idea of a Republic of Letters and expressed by Erasmus among others.[288] The idea of progress as well as the collaborative nature of natural philosophy, both found their most eloquent expression in the works of Francis Bacon, *The Advancement of Learning* (1605) and *Novum Organum* (1620), and transformed to a utopia in *New Atlantis* (1627), but Bacon was only the most conspicuous example of this attitude.[289]

Membership of the Republic of Letters was not due to a person's profession, but due to qualities and pursuits connected to his or her person. Membership of a university or academy, did not qualify you more than if you were a learned gentlemen. Thus, it was not the routine practices of lectures or disputations that proved your worth within this community. From its beginnings Humanist culture and the ideal of the Republic of Letters reflected a highly elitist self-perception and unfolded among the social elite. Socially, it was highly conservative and explicitly operated with a distinction between learning for the elite, and knowledge for the masses.[290]

[286] On contemporary discussions of the academic estate, see Trunch (1995), 48-49.

[287] Bots and Waquet (1997), 40f.

[288] Bots and Waquet (1997), 44f.

[289] Bots and Waquet (1997), 42f; and Adrian Johns, 'The ideal of scientific collaboration: the "man of science" and the diffusion of knowledge', Bots and Waquet (1994), 3-22.

[290] Flebo (1982), in her discussion of Erasmus' view on the free will, demonstrates how the humanist prince was abhorred of the social consequences if common man was told that Man's will was of no importance.

Not only did the emergence of ancient authors in the disciplines of natural philosophy connect natural philosophers to humanist culture and the ideal of the Republic of Letters. Also the education of natural philosophers further separated them from the dominant theological culture of the universities. Not even the Wittenberg reformers questioned that medical studies were best pursued in Italy or France, while the best mathematicians were to be found in Italy and the Netherlands. As medicine played no role in Luther's theology, but was regarded as only concerned with secular life, he had recommended medical students to go to France or Italy, and the attempts by Scandinavian governments to limit the peregrinations of students to Lutheran Germany were never extended to students of medicine. While the majority of students who travelled abroad were theological students and limited their studies to Germany, students of medicine and mathematics extended their travels to Italy and Western Europe, the most important destinations being Basel, Padua, and from 1575 increasingly Leiden.

Not only were these three universities famous for their anatomical and botanical traditions, they were also universities that had adopted a conspicuously tolerant attitude in matters of religion (as had universities like Montpellier and Orléans). What most of these universities had in common was the fact that they were not 'national' universities in the sense that the Scandinavian universities were, and though they to a certain extent were dependent on funding from local authorities they were more or less run like independent institutions, who had to manage economically in order to survive, and particularly in the case of Leiden they employed clever advertising.[291] Most of these universities had already in the pre-Reformation period attracted a great number of students from Northern Europe, which was fundamental to their survival. Therefore, an atmosphere of tolerance existed, and the numbers of foreigners at these universities were substantial, in

[291] This was done through books on Leiden and its facilities, such as the *Alma et illustris Academia Leidensis.* Leiden 1614, which appeared in several editions and consisted of portraits of the celebrated professors accompanied by commendatory biographies and listings of their literary publications, as well as copper engravings of the anatomy hall and the botanical garden. Also library catalogues were published.

Leiden between one-third and one-half of the students were non-Dutch.[292]

Connected to this conspicuously tolerant and cosmopolitan attitude was the fact that universities like Basel, Padua, and Leiden were situated in or near mercantile centres like Amsterdam, Basel and Venice, and here students from Scandinavia became acquainted with the life of a republic. These universities deliberately put students from all backgrounds on equal terms (as long as they could pay), and here students of medicine could freely associate with noblemen and attain a bourgeois self-confidence that was not yet possible in Scandinavia. Thus, professors of medicine like the Bauhins, the Zwingers, and the Platters in Basel, who were part of the social and political elite in a society that was not blessed with a noble estate or a monarchy, were important role models for Danish physicians, and may have warranted the ideal of the Republic of Letters that learning transgressed traditional social categories. In the albums of Scandinavian students we thus find numerous inscriptions, poems and illustrations by noblemen and courtiers. Rather than religious themes, which only occur as a rare exception, and more often as classical moral philosophy, we find allegorical love scenes and playful, or piquant, genre pictures, which reflect the culture of polite society.[293]

Finally, while the Scandinavian universities were modelled on that of Wittenberg, and were orientated towards theology, theology was either absent, or played a marginal and subordinate role at the Italian universities. These universities originated as schools of medicine and law, and this gave rise to the particular 'Italian school', a Scholastic tradition centred upon medicine that flourished in Padua (and before that at Bologna and elsewhere in Italy), and which we shall discuss more closely in Chapter Five.[294] Also, the university of Leiden attracted students from all over Europe through its famous physicians and philologists. In conclusion, physicians and mathematicians in early modern Scandinavia, even though they taught at university, belonged to a culture that

[292] Hilde de Ridder-Symoens (ed.), *A History of the University in Europe*, II. Cambridge 1996, 423.

[293] For the albums of Danish students, see Vello Helk, *Stambogsskikken i det danske monarki indtil 1800.* Odense 2001.

[294] For this tradition, J.H. Randall Jr., *The School of Padua and the Emergence of Modern Science.* Padua 1961.

was international and multi-confessional by nature and which furthered contacts with the social elite and its similar cosmopolitan horizon.

Also among the learned nobility, we find members who were attracted to the ideal Republic of Letters. To old noble families the new role as a courtier may feel awkward, and Per Brahe's *Oeconomia* deals with the problem of how to organise a noble family in a way that combines the ancient way of living in the country with life at court. To the Swedish magnate, education and learning is a necessity for securing the status of a noble family.[295] To Swedish noblemen like Erik Sparre and Hogenskild Bielke, who were champions of the high nobility, knowledge of law and history was also employed to promote their cause.[296] To none of these men learned pursuits troubled their identity as noblemen, and they all put great efforts into the pursuits of careers at court.

There were, however, noblemen who came too feel a tension between the career at court demanded by their social origin, and the devotion to learning. As Heinrich Rantzau expressed it:

> *What is the Court? Even if it is a wonderful thing*
> *It is a terrible burden to he who dwells there.*[297]

This may have been little more than a literary commonplace, for Rantzau still managed to benefit from the better of the two worlds of learning and noble life. The notion of a tension between the world of contemplation and study (*otium*) and the humdrum of politics (*negotium*) was rooted in classical literature, [298] and was revived with the discovery of classical texts. Thus, Jean Bodin in his influential book of the *Republic* wrote:

> *We must agree that a people enjoys the sovereign good when it has this goal in sight, to exercise itself in the contemplation of things natural, human and divine, bringing back all*

[295] Frühsorge (1978), 103.
[296] Nilsson (1952).
[297] '*aula quid est igitur, nisi res quae splendida cum sit, cultori tamen est tota molesta suo*', from a collection of poems named "de aula", see Haupt, "Zur Erinnerung an Heinrich Rantzau", Schleswig-Holsteinische Jahrbücher 1884: 10, 16, 18f.
[298] As in the preface to Cicero's *De Oratore.*

praise to the great Prince of nature... This is [also] the principal goal of the happy life of each individual.[299]

Michel Montaigne and others also shared this persuasion,[300] but while to Montaigne contemplation revealed human inconstancy and the frailty of all apparent certainties, to Bodin (writing during the debacle of the French religious wars) contemplation of the divine creation finally provided the solid bedrock of indisputable certainty that a life of political involvement could never reach.[301]

The tension between a life devoted to the affairs of this world and one devoted to contemplation of things divine, could of course also be found in the Christian tradition, but Lutheranism demanded that men should fulfil their role in society. Noble learning was thus seen as a requirement for performing this duty for the benefit of society and according to the divine order of things. Studies could contribute to the religious edification of the individual nobleman, but it could never put doubt on his place in society or his duty to serve society.

To noblemen like Tycho Brahe and Holger Rosenkrantz, however, pursuit of learning became antithetical to an administrative career. In a letter Tycho described how he felt when spending time with fellow noblemen:

I waste a lot of time, and I must hear and do many things I do not feel like doing. For now I know how different the lifestyle of these noblemen is from mine, and from that of philosophy: There are exceptions, but I wish there were more.[302]

This theme is elaborated in Brahe's poem *Urania Titani*, where the lifestyle of most noblemen is described as empty and superficial. Politics, management of the estates, and games – they

[299] Jean Bodin, *Six livres de la République*. Lyon: Jacques Roussin 1596, I, chap 1, 31.

[300] On the significance of such a sentiment in France, see Nannerl Keohane, *Philosophy and the State in France. The Renaissance to the Enlightenment*. Princeton U.P. 1980, 79ff., 99ff.

[301] Blair (1997), 21ff.

[302] Letter to Johannes Pratensis 14.2.1576, *TB* VII, 26: *...multum temporis mihi perit, multa alias ingrata audienda et facienda. Nosti enim quam sint nobilium horum mores a meis instutis alieni, quamque ab ipsa philosophia: excipio excipiendos, quos tamen plures esse mallem quam sunt.*

are all shallow, because they are all connected to the ephemeral world. Philosophy, on the other hand, belongs to the immortal and divine world.[303] And Brahe did not keep these opinions to himself, but made them a part of his self-image. They can be found in an elegy in the book of the new star, in which Brahe contrasts service to Urania with the shallow occupation with power and wealth of most noblemen.[304]

In his letters to Holger Rosenkrantz, Brahe encouraged his kinsman to turn his back on public service.[305] Rosenkrantz replied, that he would gladly abandon "*this distasteful forced labour*" and begin "*a new life*",[306] which as a matter of fact he did when he in 1628 withdrew from the Council of the Realm to pursue his theological studies at his castle of Rosenholm.

The ideals of medieval chivalry had been 'universal', and after the Reformation the culture of the high nobility was still dominated by ideals that transgressed national and confessional divisions.[307] This of course facilitated the identification between the Republic of Letters and the identity as nobles to men like Tycho Brahe and Holger Rosenkrantz, who would never dream of abandoning their privileges as noblemen. But while Europe from the 1570s became increasingly divided along confessional lines, even noblemen, who did not forget their duties towards society, embodied a cosmopolitan culture that transcended such iron curtains. At his castle of Breitenburg, Heinrich Rantzau built the first Lutheran chapel in the Duchies,[308] but at the same time he maintained a vast international correspondence. His most frequent correspondent was the Catholic priest and geographer Georg Braun in Cologne. He likewise corresponded with the learned Catholic archbishop of Zara in Dalmatia, the great inquisitor Cardinal Santori, Catholic statesmen like Alessandro Farnese and Ferdinand de Medici, with

[303] See Peter Zeeberg's brilliant introduction to his translation of the poem, *Tycho Brahes Urania Titani. Et digt om Sophie Brahe.* Cph. 1994 and his "Adel og lærdom hos Tycho Brahe", *Latin og nationalsprog i Norden 1500-1800*, ed. Marianne Alenius et al. Renæssancestudier 5. Cph. 1991, 21-31.

[304] TB, I, 1-72; Thoren (1990), 63ff, 68ff; Peter Zeeberg, 'Adel og lærdom hos Tycho Brahe', Alenius et al (1991), 21-31.

[305] TB, VIII, 9-10.

[306] Andersen (1896), 88-90.

[307] Elias (1994), 265-269 regarded courtly society as the last great pre-national social formation.

[308] Evans (1984).

Calvinist scholars like Justus Lipsius and Joseph Scaliger, as well as with Lutheran theologians like David Chytraeus in Rostock[309] and Niels Hemmingsen in Copenhagen. To friends he expressed the hope that members of all religions would embrace his publications,[310] and from 1590 he developed a major scheme for a general European peace-settlement based on freedom of religion.[311] As for Tycho Brahe, he considered settling in Basel before he received the great donation from Frederik II, and when he was forced into exile, he had no scruples in seeking his fortunes abroad, first in Sweden, and eventually at the Emperor's court in Prague.

This cosmopolitan ideal derived from renaissance humanism and the culture of international diplomacy, but it was also supported by the foreign policy of Scandinavian governments in the 16th century. The rivals of Denmark were Sweden and the Hanseatic League of German towns, and Danish foreign policy was based on peace with the Emperor and Catholic Europe. Christian III had stayed out of the various leagues of Protestant princes and forbidden his theologians to participate in any polemics between Protestant theologians. His son, Frederik II, furthermore forbade the *Formula concordia* within his realm. Religious policy thus followed the principle of *cuius regio eius religio*. Protestantism was the unshakeable foundation of Danish society, but the social elites were allowed to mingle with men and women of all confessions.

The greater intellectual freedom for noblemen, not only led to contacts with Catholics and Calvinists, but as we shall see below it also left room for intellectual currents that did not fit into the university, and in this way the culture of the Court and the high nobility constituted an important alternative to the intellectual activities of the lecture room and official church life.

5. The World of the Museum

We have now identified a humanist culture, which, as far as its members were professors, was connected to university culture, without being identical to it, due to the close connections of poets and physicians to the social elite. If this culture was not institutionalised, it still remains to determine, where it was located.

[309] Evans (1984).
[310] See Johanne Skovgaard, 'Georg Braun und Heinrich Rantzau', *Nordelbingen* 15 (1939), 107.
[311] Lohmeier (2000), 41.

First of all, this culture was mostly manifest in what it produced - in the voluminous correspondence of many of its members, in the poems that circulated among the circles of humanists and learned noblemen, and in the books and treatises they published. These literary products were produced in the study (*museum* or μουσειον) of the man of learning, and the humanist in his museum was the central unit in the Republic of Letters.[312] The *museum* was a place where the Muses dwelled and were venerated,[313] the idea was closely connected to the humanist imitation of the world of Antiquity, and the term was only rarely used during the Middle Ages. In the museum, the humanist and natural philosopher, not only read and wrote and kept his books and manuscripts, it was also here collections of cultural and natural history were located (hence the modern meaning of museum), and it was where he gathered friends of learning, with whom learned discussions were undertaken.

Whether the museum was located at Court, at a noble household, or at the residence of a professor or bishop, it differed considerably from formalised university teaching, in terms of the organisation and content of learning. This may be one of the reasons why Platonism in its various guises was so popular in the culture of the museum. The elitist and leisurely atmosphere of Platonic writings, and their dialogue and poetic form, was more suited to such social gatherings than the magisterial style of Aristotelian writings.

Let me illustrate the difference of these two settings of natural philosophy with an example. The physician and Paracelsian Johannes Pratensis (1543-1576) belonged to the circle of Tycho Brahe and wrote an introductory letter to Brahe's treatise on the new star in 1572. When in 1571 he obtained a professorship of medicine in Copenhagen, he had to promise to include the doctrines of Hippocrates and Galen in his lectures, like it was done in Leipzig and Wittenberg.[314] Obviously, the university wanted to

[312] On the term *museum* see Findlen (1989); see also Masson (1968).

[313] See e.g. Claude Clemens, *Musei sive bibliothecae tam privatae tam publicae extructio, cura, usus.* Leiden 1634, sig, 4ᵛ: *"Museum most accurately is the place where the Muses dwell."*

[314] AC I, 44: *"I. Utrum velitis vocari ad lectionem in hac schola Doctorem Johannem Pratensem. II. Anne videatur vobis utile, ut si eum vocaveritis, alium non tradat in*

keep close to the universities of Lutheran Germany. At this time, however, paracelsian ideas had already entered the two German universities,[315] and it seems that Pratensis also tried to smuggle the new ideas into his lectures. In a letter to his friend, the court physician Petrus Severinus, he jokes:

> *While I conscientiously followed the teaching of Galen and placed each of his claims on the anvil of truth, which, after all, was my duty, something strange and surprising happened, even against my intention. Often I was forced to correct his boring and incomplete explanations about natural conditions, sometimes also his mistaken claims on second thoughts, which I could give proof of through rich experience. From the beginning I was quietly happy, when through the secret and clever art of Proteus I could fetch such beautiful and splendid flowers from foreign gardens, which I planted instead of Galen's weeds to the great astonishment of worthy men, because for a long time it had escaped our teachers, that considerable obscurity was hidden in Galen. But now, when they too have had the chance to explore foreign gardens, I cannot keep quiet any longer, after the delusion has been unmasked by some inventive new philosophers.*[316]

That Pratensis introduced Paracelsianism in his medical lectures is also evident from a pamphlet published by the University at his death in 1576. Here Pratensis was officially praised for his exposition of both medical systems, *"the Galenic and the Paracelsian"*, in which "*his ingenuity, fortune and enterprise was famous and divine*".[317]

Nevertheless, when Pratensis lectured as professor of medicine in the morning and dictated the books he was teaching to his students, he *was* bound to teach within a framework of Galenic medicine and presuppose that most of his students were trained in

schola nostra doctrinam, quam Hypocratis et Galeni, sicut quoque faciunt Medici scholæ Vitebergensis et Lipsiensis.".

[315] Thus, the restrictions can hardly be seen as an attempt to effectively exclude Paracelsian ideas from Copenhagen, see Shackelford (1991), 93.

[316] Letter in Bastholm, *Petrus Severinus og hans Idea Medicinæ Philosophicæ*, quotation from 42-43.

[317] Quoted in Severinus (1979), 6-7.

nothing but scholastic philosophy, and never had witnessed a dissection or a chemical experiment. But in the evening when he gathered a host of learned men in the museum of his residence, Pratensis discussed natural philosophy in the company of friends like the court physician Petrus Severinus, Tycho Brahe and the French envoy Charles Dançay; they had access to laboratories and chemical ingredients, and were at liberty to discuss Neoplatonic, Ramist, and Paracelsist philosophy. Furthermore, it was not the one-way communication of the lecture hall, but a polite discussion between learned men, who, at least ideally, were equals.

The fact that such pursuits of natural philosophy were held in a private residence raises the question whether they can be regarded as public. As university teachers, natural philosophers like Pratensis were part of the public life of society just like clergymen, and were expected to teach according to the wishes of the government. But how far were pursuits outside the lecture room still part of public life?

To a large degree it seems that they were. Early modern Europe did not know the modern distinction between private and professional life. The idea of a professional ethos is connected to the emergence of the modern state,[318] and did only get its gradual breakthrough after the introduction of absolutism in the second half of the 17th century. The Renaissance usage of the term 'museum' emphasised its private and exclusionary character,[319] and it was regarded as a resort from the vulgar crowd and the humdrum of daily life, but Pratensis' activities outside the lecture room, his discussions with Brahe and Severinus that took place in the study (*museum*) of his residence in Copenhagen, were described in writings such as Brahe's treatise on the new star.[320] Thus, they were an important part of the self-presentation of the involved and were neither clandestine nor private in the modern sense, and like all other publications subject to censorship.[321] However, unlike disputations and theses, which were part of official academic life and aimed at students, the writings of the *museum* were aimed at men of learning all over Europe. We should therefore imagine univer-

[318] Norbert Elias (1994), 502.
[319] See P. Ariès and G. Duby (eds.), *Histoire de la vie privée*. Paris 1985-87.
[320] TB, I, 6ff.
[321] On censorship in Denmark see Appel (2001), 367-453 with references. For Sweden see Schück (1985), 53f., 165-174.

sity and museum as two different stages of natural philosophy, each with its own audience and scenery, but with some actors in common, who acted according to the stage on which they performed. Both stages were part of the self-presentation of the natural philosopher, but there was the important distinction that while every student was allowed to follow the lectures at the university, only those deemed worthy due to their social origin or intellectual merits were allowed to enter the *museum.*

A third stage for natural philosophy must also be included, namely the various writings by university professors in the vernacular, such as almanacs and explanations of comets and other extraordinary phenomena. Here, of course, natural philosophers were more than ever acting according to the wishes of the government and its attempt to avoid instability. Thus, we can establish a social hierarchy of stages of natural philosophy. At the bottom, treatises in the vernacular mainly aimed at preventing social and religious turmoil when unusual phenomena occurred. Then followed the teaching at the university held in Latin, but with its main audience being students of rather humble origins and prospects, most of them future clergymen. Finally, we have the culture of the *museum*, whether it was located in the house of the natural philosopher or at the residence his noble patron.

In early modern Scandinavia, the culture of the museum, the identification with a general European endeavour concerned with the progress in learning was essential to the development of natural philosophy and the identity of its practitioners. As we shall see, this was more so in Denmark than in Sweden, where the connection between natural philosophers and the Court and local magnates was closer.

Professor Eriksson has identified two main arguments for studying natural philosophy in early modern Sweden, namely reference to either religion or to the benefits of society.[322] While the former was most frequent in the beginning of the 17th century, the last won acceptance as the century went on, although it had long been accepted in disciplines like medicine and astronomy. In

[322] Gunnar Eriksson, 'Motiveringer för naturvetenskap. En översikt av den svenska diskussionen från 1600-talet till första världskriget', Lychnos 1971-1972, 121-170.

the following chapters we shall see examples of both motives, but especially as far as Denmark goes, we must make a distinction between arguments for the study of nature and the identity of natural philosophers. It is indeed possible to study nature for its own sake, without reference to broader issues like society or religious life, because one identifies oneself with the endeavour of the discovery of the secrets of nature. This is not uncommon among modern scientists, even though reference to the benefits of society is often included in applications for funding. In an early modern context, the study of nature for its own sake was somewhat more complicated. Since Nature was the creation of God and part of His divine plan, interest in nature could easily be rooted in religious motives (not necessarily those of the official Church), even though they were not connected to a religious persuasion, which, like that of Melanchthon, orientated natural philosophy towards theology.

One of the most important stimuli for innovation in the late 16th century was indeed religion. We have already seen the importance of religious motives to Melancthon's propagation of the study of nature. In the framework of the learned nobility and the nobility of learning, there was a liberty to include other religious notions, first of all Renaissance Platonism, in all its various guises, hence also Paracelsianism, Ramism and Cabala. It must be emphasised that Neoplatonism, and 'occult' and magic traditions were not necessarily antithetical to Lutheran learning,[323] as long as they recognised the supremacy of theology. At the lecture concerning the mathematical sciences given by Tycho Brahe at the University of Copenhagen in 1574, the great astronomer echoes Melanchthon: *"Although in our base nature much exists that proves His wisdom and majesty, nowhere is it more evident than in the eternal and immense arena of the heavens and the stars".*[324]

[323] See Robert W. Scribner, 'The Reformation, Popular Magic, and the "Disenchantment of the World"', *Journal of Interdisciplinary History* XXIII:3 (1993), 475-494 who criticises the idea of Protestantism as a deliberate attempt to take the magical elements out of religion out forward by Keith Thomas, *Religion and the Decline of Magic.* London 1971, 87. Fink-Jensen (2002), goes a long way to show the coexistence of magic and religion within a general mentality.

[324] *Tychonis Brehei de disciplinis mathematicis oratio.* Cph. 1610; printed in *TB*, I, 143-170 that, however, is based on another record of Brahe's speech. On Brahe's speech, see Kenneth J. Howell, 'The Role of Biblical Interpretation in the Cos-

Nonetheless, the Neoplatonic philosophy would often include a view on Man's role in the universe that radically differed from that of Lutheranism and was based on other metaphysical foundations. According to the Florentine humanist Marsilio Ficino, Man is the centre of a Neoplatonic universe, a Microcosm reflecting the intellectual (or angelic) world of the mind or spirit, the celestial world, and the material (sublunar) world. Endowed with the seeds of every form of spiritual and material life, the individual chooses his or her own destiny by the exercise of free will. He (or she) can live the vegetative life of the plants, the sensual life of animals, the rational life of a human soul, devote himself to intelligible truth and become like one of the angels, or even "*withdraw into the solitude of his own soul, and there be made one with the spirit of God*".[325] At the highest level, the individual is the lord of the earth, the link between matter and spirit, created by God to "*contemplate and understand the rest of creation and to unify and recreate the universe in himself*".

Tycho Brahe was strongly influenced by this tradition coming from Ficino and Pico through figures like Cornelius Agrippa and Paracelsus, and he implied in his treatise on the supernova of 1572 that this school of thought might better explain the new star, whereas other schools of his day, including the Aristotelian tradition of the scholastics, could not.[326]

Although the Platonic philosophy of the Renaissance claimed to be a revival of ancient wisdom, it was different in one fundamental aspect. When Ficino's theory of immanence replaced the transcendent dualism of Plato and Plotinus, the realms of spirit and matter were no longer seen as sharply separated, and this, of course, would find a fertile soil among men brought up with Melanchthon's view on natural philosophy. Following Ficino, Renaissance Platonists believed that divine Eros was immanent within matter, energising it, giving it form, quality, and life. To Tycho Brahe and his friends, *amor* penetrated the cosmos, charging everything with life, and the individual was a Microcosm precisely

mology of Tycho Brahe', *Studies in the History and Philosophy of Science* 29A:4 (1988), 518ff. and Wittendorff (1994), 92ff.

[325] Paul Oskar Kristeller, *Eight Philosophers of the Italian Renaissance.* Stanford 1964 and later.

[326] TB, I:18.

because all the elements of the cosmos, divine, intelligible, rational, and material, came together within a single human being.

Thus, while the natural philosophy of the Neoplatonists was highly religious, and like the philosophy of Melanchthon (who was also influenced by Neo-Platonism) connected to a more universal idea of Man's place in the World, this idea was not that of Lutheranism, or indeed anything distinctly Christian. Tycho Brahe saw himself as living in a cosmos where a divine spirit was immanent within matter, not separate and far above it, and he took as his task to probe and comprehend that cosmos. The aim was to understand God the Creator through active contemplation and even to become like a god, grasping the whole plan of creation and re-creating it within oneself, within a circle of friends. This process would lead to a cosmic reform that could eventually bring about the restoration of the Golden Age, when men lived like gods upon the earth. For these reasons Brahe established his research institute on the island of Hven and assembled his friends to help him and dedicate it.

6. The Court of Urania

Tycho Brahe was unique in 16th and 17th-century Scandinavia by being both a high nobleman and a professional natural philosopher. As such he combined humanist ideals of the Republic of Letters and Neoplatonic concepts of love with the identity of a high nobleman, although, as we have seen, he felt a certain tension between these two identities.

In Tycho's mind, ties of friendship (*amicitia)* to his learned friends formed an essential part of his ambitious plan of cosmic reform. They were demigods who could penetrate all the secrets of the heavens and earth, move through the spheres, change the world, and recreate the Golden Age when the world was young and *amor* was manifest.[327] In order to achieve this aim, Brahe established Uraniborg as a learned household where he gathered artists and men of learning around himself. To a certain degree the Rantzau residence at Breitenfeld and the Rosenkrantz residence of Rosenholm were also examples of this, but Tycho Brahe's Uraniborg surpassed them all, not only in international fame, but in its

[327] See Christianson (2000), 48-52.

thorough organisation of all available resources towards one goal – the pursuit of natural philosophy.[328]

The tradition of the learned household went back to various origins. One was the tradition of medieval bishops and abbots who gathered learned men around their table. This tradition prevailed into the 16th century among members of Brahe's friends and relatives such as Abbot Iver Bertelsen of Sorø and Tycho's great-uncle, archbishop Torbern Bille of Lund. Another was the practice of Italian humanists to assemble in "academies" and emulate the musical and philosophical banquets of Plato's *Symposium*.[329] Still another was the custom of certain princely courts of Renaissance Italy, such as Castiglione's Urbino, to involve women as well as men in philosophical discussions. Finally, the Reformation brought the model of Luther's learned household in Wittenberg.[330]

Within the framework of *amicitia* Brahe cultivated friendship with men of learning, such as the Paracelsian court physician, Petrus Severinus, to whom we shall return below, the professor of medicine Johannes Pratensis, the historian Anders Sørensen Vedel, and the French ambassador Charles Dançay.[331] Later there were all his assistants on Hven, among whom Longomontanus, Jon Jacobsen Venusin and Cort Aslakssøn eventually became professors in Copenhagen. Among the nobility, Brahe was a friend of Heinrich Rantzau to whom he fled when he had to leave Denmark, and to young Holger Rosenkrantz who, despite the general hostility towards Brahe, maintained contact with the astronomer after he had gone into exile. Furthermore, there was Brahe's gifted sister, Sophie, who was very knowledgeable in astrology and her husband

[328] See the brilliant study by John Robert Christianson, *On Tycho's Island. Tycho Brahe and his Assistants 1570-1601*. Cambridge 2000.

[329] On Tycho's contact in 1575 with academies in the Venetian Republic, see Wilhelm Norlind, *Tycho Brahe. En levnadsteckning med nya bidrag belysande hans liv och verk*. Lund 1970, 66ff. and Victor E. Thoren, *The Lord of Uraniborg*. Cambridge 1990, 97.

[330] See Steven Ozment, *When Fathers Ruled. Family Life in Reformation Europe*. Cambridge, Mass. 1983.

[331] A Biographical Directionary of the multitude of people, high and low, that surrounded Brahe on Hven is given in Christianson (2000), 251-381. On Brahe's circle, see also Jole Richard Shackelford, *Paracelsianism in Denmark and Norway in the 16th and 17th centuries*. Unpubl. Ph.D. thesis. University of Wisconsin 1989. For Dançay, H.F. Rørdam, *Historiske Samlinger og Studier*, II. Cph. 1898.

Erik Lange who wasted his life and fortune on a frantic search for the secret of gold making.[332]

It was in this circle that the Neoplatonic and Paracelsian, philosophy of nature developed in 16th-century Denmark. They embraced a study of Nature that was religious in its scope, but neither was it the mere contemplation of Creation as a means to piety, nor was it associated with Lutheran theology, the hierarchy of disciplines and emphasis on civil obedience found in Melanchthon's system of learning. The foundation for their interest in natural philosophy (particularly astronomy, mathematics and astrology), had been laid at Lutheran universities, in the case of Brahe at Copenhagen and Rostock, but the important factor was the encounter with the garland of Neoplatonic ideas.

Despite the diversity of thought currents like renaissance Platonism, Paracelsianism, and Hermeticism these held two things in common, namely that they were directed towards the improvement and fulfilment of the individual and felt aloof of dogmatic controversies. They were hostile to the sterility of Aristotelianism, both as a basis for religion and as a philosophy of nature. While all of these thought currents shared Melanchthon's idea of the study of nature as a religiously edifying, they did therefore not connect it specifically to Evangelical theology.

Surely, they saw the study of nature as useful for practical aims: The discovery of remedies to cure diseases in the case of iatrochemistry, and the aid to astrology and meteorology gained by astronomy. But natural philosophy should not be directed towards material gains. Thus, Tycho Brahe reproached his brother-in-law Erik Lange, not for wasting his fortune and abandoning his beloved Sophie, but for pursuing a base goal such as the secret of gold making.[333]

The centre of this culture of natural philosophy was, of course, Uraniborg at the island of Hven. Here Tycho Brahe not only made his astronomical observations, elaborated horoscopes and conducted iatrochemical experiments. It was first of all a Renaissance court with a court jester, entertainment and learned discussions.[334] Brahe himself was a distinguished Latin poet, and he

[332] For Sophie and Erik, see Zeeberg (1994) that contains an English summary.
[333] Zeeberg (1994).
[334] See Christianson (2000).

and his friends gave mythological names to themselves and their acquaintances: Brahe was known as *Apollo,* Sophie and Erik Lange as *Urania* and *Titan,* while the despicable *Mercurius* probably referred to the chancellor Borreby (as he was the messenger of *Jupiter,* King Christian IV).[335] It was a refined culture, but as we shall see in the next chapter, it was also a culture rooted in power structures that eventually would undo it.

7. The Domesticated Paracelsus

Before we close this chapter, it will be worthwhile to illustrate how an otherwise controversial thought current like Paracelsianism, which was originally connected to social and religious revolt, in the polite culture of Tycho Brahe and his friends could be transformed into one of harmony, disconnected from social and religious protest, and still carry on the urge for reform in natural philosophy.

Tycho Brahe has often been studied, both as an astronomer, chemist, and recently also as a Renaissance nobleman.[336] There was, however, another member of Brahe's circle of learning who is worth discussing, not only because he more thoroughly than Brahe ever did gave an exposition of many ideas current in this circle, but also because he as a commoner and physician is more representative of the natural philosopher in early modern Scandinavia.

In 1571 a young Danish physician wrote a book on the idea of philosophical medicine, *Idea medicinæ philosophicæ.*[337] The author, PETRUS SEVERINUS (Peder Sørensen, 1542-1602) was the son of an influential burgher-family from the town of Ribe in southern Jutland. He had begun his academic career in Copenhagen, followed by studies abroad.[338] He had been introduced to

[335] Zeeberg (1994), 42.

[336] The most important recent biographies on Tycho Brahe are Thoren (1990), Wittendorff (1994), and Christianson (2000).

[337] In all references to this work I use the pagination of the original, which is also printed in the margin of the modern edition (Bastholm 1979). Only in the dedication, which has no pagination in the original, I shall refer to the page numbers of the modern edition. The work was also republished in octavo in Erfurt 1616.

[338] For Severinus and the content and background of *Idea* see Grell (1995 and 1998); Jole Richard Shackelford has written several studies on Severinus and Severinian Paracelsianism, cf. biography. Most important in our connection is

philosophy by stout propagators of Melanchthon's system of learning, and yet the view on the study of medicine expressed in *Idea* differs considerably from that of Melanchthon both in method as well as in aim. The *Idea* is written from a physician's point of view, and Severinus emphasises the deplorable state of contemporary medicine. According to Severinus the remedy against this misery is 'experience'. In a much-quoted place he urges:

> *Go my sons, sell your lands, your houses, your garments, your jewellery, and burn up your books. On the other hand, buy yourselves stout shoes, go away to the mountains, seek the valleys, mark well the distinctions between animals, the differences of plants, the various kind of minerals, the mode of formation of everything that exists. Do not be ashamed to learn by heart the astronomy and terrestrial philosophy of the peasantry. And finally: buy coals, build furnaces, observe and experiment untiringly. In this way, and no other will you get knowledge of things and their properties.*[339]

From this quotation and throughout *Idea*, it is obvious that Severinus adhered to those currents within medicine that tried to break down the disdain for practical work. We find it represented in the anatomical tradition from Vesalius, which was embraced by Melanchthon, in "intellectual" surgeons like Ambroise Paré, and most vehemently in the work of the controversial Swiss physician Theophrastus Paracelsus (1493-1541).[340]

Traditionally, Severinus has primarily been perceived as a follower of Paracelsus,[341] but this is somewhat simplistic. In *Idea,* he systematises and clarifies a number of Paracelsian concepts, and propagates Paracelsus' urge for observation, experiment and the use of chemistry within medicine. Some historians have described the Paralcelsian urge for observation as an urge for "living experi-

Shackelford (1989) and idem (1991),85-109. Dr. Shackelford is currently working on a monography on Severinus and the influence of his ideas.

[339] *Idea*, 73.

[340] The classical study of Paracelsus is Walter Pagel, *Paracelsus. An Introduction to Philosophical Medicine in the Era of the Renaissance.* Basel 1982; on the Paracelsian movement see Hugh Trevor-Roper (1985), 149-199; Schott (1998); Grell, ed. (1998). For Paracelsianism in Denmark and Norway see the various studies by Jole Richard Shackelford in the bibliography.

[341] e.g. Walter Pagel, *Joan Baptista van Helmont.* Cambridge 1982, 139: *"the most genuine and reliable expositor of Paracelsus"*

ence", but this must be seen in a religious context. Experience is not "living" in itself, but only as far as one has abandoned vice and set out for the study of Nature. Severinus thus draws on an old Christian tradition rooted in pagan philosophy and ethics. Augustine perceived both medicine and astronomy as belonging to the divine sciences (or arts) due to the fact that they were not human inventions, but, so to speak, Man's discovery of Creation.[342] The emphasis on "living experience" was a concept used by Paracelsus, but it was also a concept of Renaissance humanism. Marsilio Ficino used it, as did Erasmus but in a different context. While "living experience" to Ficino is the rational soul with a privileged position in the created universe, where it gives life and awareness to the perceptible world,[343] in the Erasmian tradition it is the "Philosophia Christi" and has strong ethical implications.

In the vein of the Erasmian tradition, and in order to vindicate Paracelsian medicine, Severinus attacks contemporary medicine, which according to him has degenerated into hair-splitting. Due to indolence and love for geometry, men have removed themselves from experience, and Arab medicine has only made things worse.[344] This obviously is directed against the Galenic-Aristotelian medicine of the universities. However, new diseases have appeared which cannot be explained, let alone cured, by traditional medicine. Paracelsus' eschatological argumentation which ascribed the vehemence of new diseases like syphilis to the impending end of the world is totally omitted by Severinus, but since disease is the result of Man's fall from grace, it is to Severinus too a religious problem as well as a philosophical one.

Experience is connected to virtue, but it is more than that. In order to fit Paracelsus' medical chemistry (iatrochemistry) and urge for observation into a philosophical framework, Severinus accounts for the relationship between the physical and the spiritual world. This takes *Idea* far beyond the requirements for practical use of Paracelsian medicine. This is no hidden agenda. It is revealed in the very title of the book, and in the dedication Severinus tells that he wants to explain the philosophical basis of Paracelsian medicine.[345]

[342] *De doctrina Christiana* 2: 104ff.
[343] Kristeller (1991), 37-53; Lovejoy (1998)
[344] *Idea*, Dedication, 83f. in the modern edition.
[345] *Idea*, 85.

To account for the relationship between spirit and matter, Severinus employs the Neo-Platonic philosophy of nature. Already in the dedication he explains that the causes of disease cannot be found through the senses alone. Beyond the visible flux of birth and death, disease and regeneration, there is an invisible principle of life that permeates all Nature. As he is trying to unite different traditions, Severinus describes this principle by various names – *principium naturale vitale, quinta essentia, ultima materia*, and the *balsam*. This balsam is a spiritual entity, but body and spirit interact. Inspired by Ficino (who also inspired Paracelsus), Severinus claims that bodies arise from spirits. When bodies die and dissolve they become spiritual once again.[346]

Few people, I think, will deny that Severinus' philosophy of nature is extremely difficult to grasp, and he himself admits the difficulty of it. One of the difficulties arises from the variety of terms. Another arises from the fact that *Idea* was supposed to be read by learned contemporaries, familiar with Aristotelian, Galenic, Hermetic, and Neoplatonic concepts. Therefore Severinus is not always explicit, and we have to use our knowledge of these philosophical traditions to fill in gaps in his argument.

One prerequisite is the idea of the chain of being, the emanation from God to the world through a hierarchy of intelligent entities such as angels and stars,[347] the Biblical *logos* as perceived by the Florentine Neoplatonists. Thus, the balsam (to use one of terms applied by Severinus) is a spiritual emanation from God, and just like the Word became flesh, this balsam becomes physical when entering this world and may eventually be refined by chemical processes to a crystalline matter.[348] While this balsam accounts for the emanation of life itself from God to the world, it does not account for the diversity in Nature. Contrary to scholastic philosophy, which regarded Creation as unchangeable in principle, the Paracelsians perceived that new phenomena (e.g. new diseases) could arise. The world was created as revealed in Genesis, but all creations had not yet manifested themselves in the world.

To account for the diversity in Nature, its change and continuity, Severinus adheres to the classical idea of the *rationes semina-*

[346] *Idea*, 26.
[347] See Arthur O. Lovejoy, *The Great Chain of Being. A Study of the History of an Idea.* Cambridge, Mass. 1936.
[348] *Idea*, 20.

les. In a Christian context Augustine had used the Stoic term *rationes seminales* (in English sometimes translated as 'seminal reasons') to explain the two accounts of Creation in the first two chapters of Genesis, by interpreting Genesis I as the creation of the rationes seminales for those things that were actually brought into existence in Genesis II.[349] It was also expressed in the Hermetic treatises (which were influenced by Stoicism) and used by Ficino.[350]

Unlike the Neoplatonists, however, who reduced the philosophical place of matter to near non-existence, Severinus allowed matter a limited determinative role in the generation of bodies. In *Idea* the semina join the invisible with the visible. They are the principles that govern the unfolding of bodies according to their foreordained, divine, ideal plans.[351] Diseases are semina as well, an effect of the Fall. Semina are subtly corporeal, but their corporeality is *accidental.* Severinus thus took the incorporation of semina into natural philosophy further than his predecessors, inasmuch as he gave this doctrine a central place in medicine, fusing it with chemical philosophy.

The semina must exist in something, a womb. The nature of this womb depends on its location in the cosmos. When the semina are in a spiritual state, before or after entering the physical world, they exist in the wombs of the four elements. Like Ficino, Severinus follows the Aristotelian distinction between different spheres of the world centred on an immobile earth. The upper part of the world, the firmament, consists of fire and air, while the lower sphere consists of earth and water. Severinus rejects the essential feature of Paracelsus' rejection of fire as a mundane element, namely that by identifying fire with the elemental basis of celestial bodies, Paracelsus was breaking down the inviolable Aristotelian distinction between sublunary and superlunary realms. Fire as an element exists on earth, but it is celestial in origin. Severinus carries this process another step by dividing the physical

[349] This term was a Latin translation of the Greek term λογοι σπερματικοι, which was taken over from the Stoics by the Neoplatonists, see E. Gilson, *The Christian Philosophy of St. Augustine.* London 1961, 207f.; F.C. Copleston, *A History of Medieval Philosophy.* Notre Dame 1990, 38-39, 157, 164-165, 210.

[350] *The Cambridge History of Renaissance Philosophy,* ed. Charles B. Schmitt and Quentin Skinner. Cambridge 1996, 276.278, 293, 571-573.

[351] *Idea,* 48ff.

world into two elemental globes: fire and air occupy the upper region, earth and water the lower. This makes the heavens an extension of the terrestrial world, unifying the physics of the two.

The nature of the semina depends on the element to which they belong.[352] As the element of fire is the most perfect of the elements, its semina have produced the most perfect bodies of the physical world – the sun and the planets. And God has governed that the semina of this element are visible, namely the stars. Since stars and semina are the same, Severinus can talk of stars everywhere in nature,[353] and as the stars wander the night sky, so are the semina of the lower elements in perpetual motion. The position of the stars affect the world, and so does the position and interaction of the lower semina. This, in short, is Severinus philosophy of medicine.

In some respects Severinus shares common ground with Melanchthon. The German reformer also emphasised experience, in the study of the Bible as well as in natural philosophy. Furthermore they share the notion that Nature, as created by God, is essentially benevolent to man. But the differences overshadow the similarities. Though Melanchthon adopted the discoveries of Vesalius and contemporary mathematicians, experiment in general and chemistry in particular plays no role in his philosophy of nature and the university teaching based on it. To Melanchthon the study of nature was the study of the *arrangement* of the microcosm of the human body and the macrocosm of the universe, while to Severinus it was the study of a thing in itself.

But most striking is the difference as for the object of natural philosophy. As we have seen in the previous chapter, Melanchthon connected the study of nature to civil obedience and perceived it in the light of Lutheran theology. In Severinus we find no references to the Bible whatsoever. Christianity is never mentioned, it may, as it were, never have existed. The authorities mentioned are Hippocrates, Aristotle, Galen, Plato and, of course, Paracelsus. The philosophy of medicine described in *Idea* is not meant to prove Christian, not to speak of Lutheran, doctrines. Severinus' promise to those who sets on the road of true medicine is "*knowl-*

[352] *Idea*, 42.
[353] *Idea*, 51ff.

edge of things and their properties". It is, in short, a personal fulfilment not tied to any specific Christian dogma.

It may be argued, that Severinus in *Idea* speaks as a physician to other physicians, and that he therefore concentrates on the remedy of diseases. But the philosophy he propagates goes far beyond the requirements for practical medicine. He does not tell his reader, *how* to conduct iatrochemistry, and though he had studied in Padua and must have experienced the flourishing anatomical tradition of Vesalius, he finds little use for it, but rather rejects the terrestrial anatomy for the sake of a celestial one. A number of other expositors of Paracelsian medicine, such as Günther von Andernach who published an important treatise on Paracelsian medicine in the same year as *Idea*, rejected Paracelsian metaphysics.[354] Severinus makes it the focus of his work.

He presents himself as a follower of Paracelsus, but this was not unproblematic for a man in his position. *Idea* was written at a time when controversy over Paracelsian doctrines and remedies were intensifying, and the violent hostility to authority and attacks on established Aristotelian and Galenic philosophy found throughout the Paracelsian writings provoked great hostility from academic authorities.[355] Furthermore, Paracelsianism was frequently associated with religious heterodoxy. In Italy a number of Paracelsian writings had been confiscated by the Inquisition. As for Protestant Europe, Paracelsus (who remained a Catholic) was associated with the tradition of medieval mysticism, from which the radical Protestantism that terrified Melanchthon also derived.[356]

If we compare *Idea* with the original corpus of Paracelsian and pseudo-Paracelsian treatises, it is clear that Severinus was more than an intermediary of Paracelsianism. On the one hand, he emphasised and systematised the elements of Neoplatonism found in Paracelsus. On the other, it becomes quite clear that Severinus tried to defend Paracelsus against accusations of heterodoxy, and used a number of strategies to do so: He removed any trace of

[354] *De medicina veteri et nova* (1575).

[355] In Denmark, bishop Peder Palladius (1537-1560), a student of Melanchthon, had been strongly opposed to Paracelsianism and alchemy, *Formula Visitationis Provincialis*. Cph. 1555. The relevant sections are quoted in Panum, *Vort medicinske Fakultet*, 24-25.

[356] See Charles Webster, 'Paracelsus: medicine as popular protest', Grell and Cunningham (1993), 57-77.

mysticism, social protest and opposition against the established churches from Paracelsianism,[357] and reduced the Swiss physician's religious fervour to a matter of piety. As such it was congenial with Lutheran notions of medicine as practised piety, like we have seen it in Morsing, but in Severinus it is not explicitly Lutheran, and he is eclectic when he tries to reconcile Paracelsus with both Aristotelian and Neoplatonic metaphysics and to a certain degree even with established medicine. The result of this was a shift of emphasis from Paracelsus' vehement hostility towards authority to a moderate urge for medical reform.

In short, whereas Paracelsus propagates a philosophy of opposition, protest and radical reform, Severinus propagates one of reconciliation and harmony. Whereas Paracelsus frequently mixes medicine and religion, Severinus tries as far as possible to sever Paracelsian medicine from any controversial religious issue and assures his reader that Paracelsus does not contradict Aristotle and Plato, and medical authorities like Hippocrates and Galen.[358] So while Paracelsus had raged against the authorities of established philosophy, Severinus goes a long way to safeguard Paracelsian medicine against attacks from the keepers of that authority.

To Severinus experience and piety are connected. He did not literally mean that his readers should burn all books and abandon their houses. He never did that himself, and soon after the publication of *Idea* he was appointed physician in ordinary to the Danish king and lived at court for the rest of his life. The urge, however, is not pure rhetoric. The urging is an ethical one with an underlying schema of traditional Christian sins and virtues. Man must abandon (or must be prepared to abandon) all worldly goods – garments, lands, and jewellery. He must abandon pride and be prepared to deal with common people, and he must abandon sloth in order to seek truth.

[357] For Paracelsus' religious and social protest see Charles Webster, 'Paracelsus: medicine as popular protest', Grell and Cunningham (1993), 57-77.

[358] *Idea*, 59. This is also evident from the full title of the work - *Idea Philosophicae fundamenta continens totius doctrinæ Paracelsicæ, Hippocratæ, & Galenicæ.* Severinus was, however, criticised for not following Aristotelian physics, and in a letter to Theodor Zwinger in Basel he admitted that *Idea* is based on the revealed evidence of nature *"without considering the Aristotelian philosophy in the least - which I do not recognise as my authority and has been assessed, condemned and rejected by my opponents on the basis of the physical laws and doctrines of Aristotle"*, see Grell (1998), 250.

The reason, why Severinus purges Paracelsian medicine of social protest and religious controversy and focuses on metaphysics instead, may be inferred from the context in which *Idea* was written. First of all, the stir that the Swiss physician's anti-intellectual and anti-authoritarian tirades had aroused must somehow be calmed if Paracelsian medicine were to gain support from the princes. Since Paracelsus himself had drawn on a number of philosophical traditions, albeit fragmentarily, it was obvious to systematise the medical part of Paracelsianism into this framework. Severinus had to prevent any association with radical Protestantism since these currents often propagated opposition to social order and established churches.

But this is hardly the only reason. Written in Catholic Florence, published in Calvinist Basel and dedicated to the Lutheran king of Denmark, *Idea* was directed to natural philosophers all over Europe. As such, it may be seen as one of the period's numerous "irenic" attempts to reconcile Europe. In this period a number of scholars had abandoned any hope of reconciling Europe on a dogmatic basis. Their pessimism was warranted by the rise of Counter-Reformation Catholicism and by the schisms within Protestantism. It seems that Severinus received most of his Paracelsian inspiration from beleaguered Huguenot physicians, and in all cases his extensive travels would have given him a first hand impression of Europe at this time.[359]

In the previous chapter, we discussed the idea of the Book of Nature that the Renaissance had inherited from the past. In the ferment religious climate of the early 16th century philosophers like Marsilio Ficino, Pico della Mirandola, and Johannes Reuchlin had suggested that there was, as it were, a natural theology, a unity behind diverse philosophical and religious experiences. Over the centuries truth had been obscured, but their natural philosophy would rediscover and purify it.[360] After the Reformation this search for unity became all the more important. Severinus' reduction of Paracelsus' religious fervour to piety may well have been an attempt to find common ground among natural philosophers of different confessions, and the Paracelsian medicine propagated in

[359] For examples of Severinus' resistance to involvement in controversies, philosophical as well as religious, see Grell (1998), 249f.
[360] Yates (1991).

Idea was applicable by Protestants and Catholics alike. Thus, it not only fitted into the cosmopolitan culture of noblemen like Heinrich Rantzau and Tycho Brahe,[361] and the ideal of the Republic of Letters, but can also be seen as an attempt to reform Christianity based on the Book of Nature.

While *Idea* was concerned with the Book of Nature only, Severinus afterwards worked on, but never finished, a book *"on the whole of natural philosophy, based on those principles which can be drawn form Holy Scripture with which the Platonists generally tally, but with which the doctrines of Aristotle are at odds"*.[362]

Severinus wrote *Idea* at a critical point in his career. Having taken a doctor's degree, his studies had come to an end, and he was now looking for employment. Severinus, who had no means of his own, could not afford to write a book unless he was sure it would find an audience, a patron, at home. *Idea* was the preparation for employment, and he must have felt sure that at least somebody at home would take interest in it, somebody powerful enough to promote his career.

Long before *Idea* was published, Severinus had enjoyed support from Court. Already in 1563 he was given a prebend to support his studies.[363] Before he went abroad he had been employed at the university, allegedly lecturing on meteorology.[364] Two years later the university provided him with means for studies abroad. The king extended the support, and when the funds were allocated elsewhere, Severinus went home and managed to maintain his support.[365] *Idea* was dedicated to the king, and although Frederik II did not read Latin and had only a rudimentary education, he and Queen Sophie of Mecklenburg seem to have taken an interest in alchemy and iatrochemistry and worked in the laboratory themselves.[366] Moreover, the king had men at his side, who appreciated learning. During these years, Danish politics and the man-

[361] The urbane and civilised character of Severinus' Paracelsianism was already noted by Trevor-Roper (1986), 161.
[362] The diary of Josias Mercer (1912-1915), 298; see also Grell (1998), 250.
[363] Herholdt og Mansa, *Saml. til Medicinalhist.*, 15.
[364] Bartholin, *Cista Medica*, 114.
[365] Rørdam, *KUH* II, 575.
[366] Troels-Lund, *Danmarks og Norges Historie i Slutningen af det 16. Aarhundrede.* Cph. 1879, V, 268.

agement of finances was controlled by Peder Oxe and his circle. When Severinus returned he was employed as court physician and became connected to one of the younger branches of the Oxe-circle, namely that of Tycho Brahe, as did his friend and fellow Paracelsian Johannes Pratensis.

Some historians have interpreted the fact that Severinus got an appointment at Court rather than at the University as an expression of hostility towards Paracelsianism on the part of the government. It was quite the other way around. The government did not suspect that Severinus or Pratensis would turn academic life upside down, if they were given a chair of medicine. They had confidence that they could work on two stages and separate the demands of academic teaching from more far-flung and philosophically orientated ideas as we have seen with the example of Pratensis above.[367]

Severinus' domesticated Paracelsianism was appealing to polite cultures and men who abhorred from social and religious protest, not only in Denmark but particularly abroad. In Central Europe *Idea* was so influential that the Wittenberg professor of medicine Daniel Sennert talked of a Severinian school in Paracelsianism.[368] In France *Idea* was particularly influential among Huguenot physicians connected to the princely courts.[369] In England it was embraced by the learned circle around the Herbert family.[370] One of the men of learning connected to the Herberts was Francis Bacon, and while he generally despised Paracelsus and his follow-

[367] When Pratensis died prematurely in 1576, he was succeeded as professor of medicine by the Ramist and iatrochemist Anders Krag, whom we have met above. In 1600, Severinus was actually appointed to succeed Krag, but he died before he could take it. Grell (1998), 254ff. discusses the part played by the theologian Niels Hemmingsen. This is however irrelevant since the source material testifies that Hemmingsen played no part in Pratensis' appointment see Fink-Jensen (2002), 102f.

[368] Daniel Sennert, *De chymicorum cum Aristotelicis et Galenicis consensu ac dissensu Liber.* Wittenberg 1619, 57. Already in 1579 the professor of medicine in Heidelberg Thomas Erastus recommended *Idea* as the most palatable face of Paracelsianism. See also Shackelford (1989), 129; Debus (1991), 18f.

[369] A.G. Debus, *The French Paracelsians.* Cambridge 1991, esp. 124ff.

[370] To this circle belonged Thomas Moffett (1553-1604), one of the first English paracelsians, who visited Copenhagen in 1582. There he made friends with Severinus to whom he dedicated a defence of Paracelsianism, *De iure et præstantia chymicorum, medicamentorum dialogus apologeticus* (1584); see Shackelford (1989), A.G. Debus, *The English Paracelsians.* London 1965.

ers, *"these charcoal-burners"*, he had great admiration for Severinus.[371] He did not like the cause, but he liked the man and his motives. All that was despicable in Paracelsus - his rude and polemical language, the philosophical obscurity and mysticism - had been transformed by Severinus. Furthermore, it may be pointed out that Paracelsian concepts of nature are evident in Bacon's writings,[372] undoubtedly due to direct or indirect influence from Severinus. In conclusion, Severinus' adaptation of Paracelsian medicine and natural philosophy to a noble and humanist culture of polite learning was essential to the spread of Paracelsianism in the 16th and early 17th century, and also influenced Tycho Brahe.

Though Tycho Brahe never gave any systematic account of his view on natural philosophy, it is safe to say that it was generally inspired by Neoplatonism to which was added Severinian Paracelsianism and partly Ramism. While the latter emphasised the great importance of mathematics and connected it to Platonism and dialogue, Paracelsianism was incorporated into Brahe's Neo-Platonic ideas of the micro- and the macrocosm. At the entrance to Uraniborg were two sculptures, named Chemistry and Astronomy, which were also printed on the title page of his Mechanica (Fig. 2). Here, the figures are provided with an inscription.[373] The one at Chemistry says: *DESPICIENDO* and *SVSPICIO* ("By looking down I see up"), while that of Astronomy says: *SVSPICIENDO* and *DESPICIO* ("By looking up I see down"). To the German astronomer Christoffer Rothman, Brahe explained that the two figures depicts the heavenly and the terrestrial astronomy, of which you cannot understand one without understanding the other. For everything is

[371] See B. Farrington, *The Philosophy of Francis Bacon. An Essay on Its Development from 1603 to 1609.* Liverpool 1964, 66f: *"Only one of your followers do I grudge you [Paracelsus], namely Pertrus Severinus, a man too good to die in the toils of such folly... He took over your brayings and by the tuneful modulations and pleasant inflexions of his voice made sweet harmony of them, transforming your detestable falsehoods into delectable fables etc."*

[372] See Graham Rees, 'Francis Bacon's Semi-Paracelsian Cosmology', *Ambix* 22 (1975), 81-101. Bacon's organisation of matter into a terrestial globe (earth and water) and a celestial globe (fire and air) is most likely influenced by Severinus. In *Novum Organum* Bacon refers to ideas in the divine mind as corresponding to *"the true signatures and marks set upon the works of creation as they were found in Nature"*, and in *De augmentiis scientiarum* he says that the spirit springs from the wombs of the elements.

[373] On these inscriptions see Zeeberg (1995).

interwoven and the planets, the metals and the human organs correspond to each other:

> *All this is mutually arranged so beautifully and harmonically, that they almost seem to have one and the same function, kind, and nature. The two most sublime metals, gold and silver correspond to the sun and the moon, and in Man to the heart and the brain. The two benevolent planets Jupiter and Venus, and the metals tin and copper, takes second rank, and corresponds in Man to the liver (the organ of the blood) and the kidneys (that serves reproduction).*[374]

The legends of the two emblems were taken from the Emerald Tables of Hermes Trismegistus, but here they referred to the general idea of the micro- and macrocosm. Their application to chemistry at Uraniborg was due to Paracelsian influence, and so were the chemical activities on Hven where Brahe had numerous laboratories. In his oration on mathematics (1574), Brahe echoed Severinus and Paracelsus in claiming that there existed *"an analogy between the parts of the human body and the specific qualities of the seven planets. Approximately the same* [motion] *takes place in our body as well as in the planets above".*[375]

On cloudy nights, experiments were conducted, and iatrochemical remedies produced. But it was not only within the framework of religious philosophy Paracelsianism could connect to Brahe's astronomical work. When he pointed out that the new star in Casiopeia was indeed a new entity, he ran counter to the idea of the unchangeable character of the supralunar regions of the world. Aristotelianism could not account for this emergence of this new phenomenon, and In *De stella nova*, Brahe reflected on the fact that the theologians could not explain this new phenomenon, and continued:

> *I know, though, that some, based on a more secret philosophy that has only been uncovered in our times, claim, that it is possible that this star has until now been hidden (to use their*

[374] Letter to Rothman 17 August, 1588.
[375] *TB,* (I), 1913; Howell (1998), 520 mentions the probable influence of Severinus on Brahe.

own expression) in the old womb, and has only now matured to make itself visible to mortals.[376]

This raises an interesting problem that, to my knowledge, has not been treated by historians, probably because they, consciously or not, have adhered to a view of Tycho Brahe as a modern astronomer. Why did Tycho Brahe not, after proving that the star was indeed a new phenomenon, take it as a divine omen? Most of his contemporaries did this, when they realised that it was indeed a new phenomenon, and Brahe himself discussed the possibility in his treatise. The answer is straightforward – Brahe was influenced by Paracelsianism. To his mind the explanation of a new star (or *semina* as it would be), emerging from its elemental womb, was much more likely than a divine interference in the physical world. In other words, Brahe accepted the Paracelsian idea that Creation was completed on the first six days, but that all phenomena had not yet appeared. He accepted the idea of a living universe with an immanent divine sprit, rather than the Christian idea of a transcendent God communicating through omens. Thus, however strange the Renaissance philosophy of Brahe may seem to us, it was a matter of fact a stepping-stone to the creation of the world-view of modern science. By limiting divine interference, he took the logical consequence of measuring, weighing and distilling Nature, not only to appreciate Creation as Melanchthon has propagated, but also to control Nature.

When Brahe established his own printing press on Hven in 1584, his first publications were a series of Latin friendship poems. In one of these, dedicated to Erik Lange, Brahe described Lange's "carnal" obsession with transmuting base metals into gold and offered love's remedy of spagyric chemistry, which sought not riches but harmony in the human microcosm. He described the three spheres of activity on Hven as astronomy, chemistry, and the fine arts, and he asserted that these studies were rooted in the cult of *amicitia*.[377]

[376] Brahe 1913-29: ?

[377] Brahe 1913-29:9; Peter Zeeberg, "Amor på Hven. Tycho Brahe's digt til Erik Lange", *Renæssancen: Dansk, Europæisk, Globalt*, ed. Minna Skafte Jensen and Marianne Pade. Cph. 1988, 161-181.

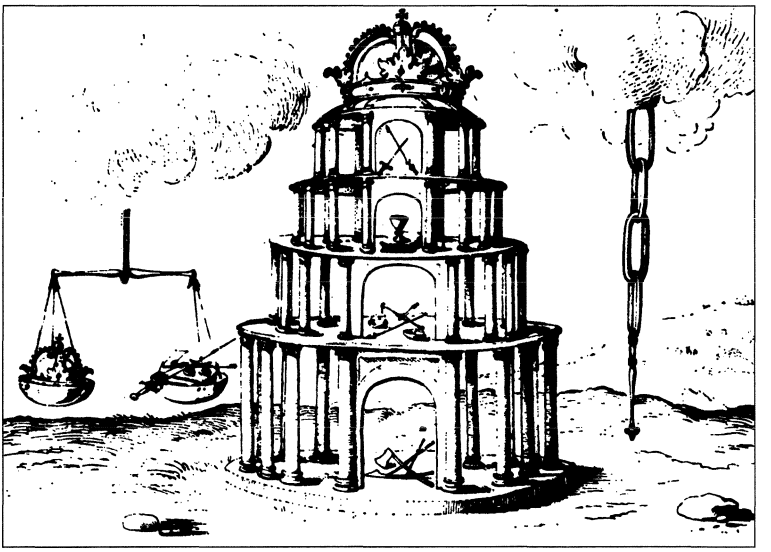

Fig. 3. Turbato ordine ruit. The Swedish nobleman Schering Rosenhane's emblem of a state based on 'mixta monarchia' (Hortus regius 1645).

The Wrath of Jupiter

You can be as brave as you want to, without patrons you are constantly sailing against the tide[378] Simon Paulli

1. Urania Exiled

Natural philosophers like Tycho Brahe and Petrus Severinus might present themselves as being above the humdrum of court life and create a self-image of a peaceful life in pursuit of the secrets of Nature. They might elaborate the virtues of such a life compared to life at Court, but eventually their philosophical pursuits were only made possible by their connections to the court and their own success as courtiers.[379] When Brahe eventually failed in the game of patronage, he found himself on the road to an uncertain future, while Urania's splendid temple at Hven was abandoned and soon fell into decay, the local peasants carrying away its stonework for their own more mundane purposes.

The example of Brahe illustrates the importance of patronage to the practice of natural philosophy in early modern Europe. Only by finding a new patron, namely the Emperor in Prague, Brahe could resume his work and attract new assistants and clients. But the story of Brahe's exile is not only the story of an astronomer's failure in the game of court favour. His fall is symptomatic of a development that took place in Scandinavia in the closing years of the 16th century, and was to have vital importance to the structure of natural philosophy in the following century.

First of all, we may notice that it was the very same process, which had enabled Tycho Brahe to create Uraniborg that eventu-

[378] In a dedication to Chancellor Christian Thomesen Sehested: *certe sine Mæcenatibus aut Patronis, etiamsi virtute ambias recteque facias, non magè proficies tamen quam si adverso amni rapidissimo natandum tibi siet.*

[379] For Brahe's patronage, see John Robert Christianson, *On Tycho's Island. Tycho Brahe and His Assistants 1570-1601.* Cambridge 2000.

ally turned out to be his Nemesis. Throughout the years, Tycho Brahe received a hitherto unprecedented funding from the Danish government. Such a massive support by the king of a relatively poor European country was only possible due to the accumulation of land and income that followed the Reformation,[380] and the emergence of a money economy. One of the main motives behind the King's support to Brahe was the prestige of the kingdom and its ruler, and the form it took was that of patronage, Brahe giving tokens of gratitude for the help he received. And it was for the sake of the King's prestige and by means of the patronage system that Brahe eventually fell.

Secondly, if we take a closer look at the circumstances surrounding Brahe's expatriation, we find that it was not only based on the government's withdrawal of its economic support. Had that been the only problem, Brahe might have continued his work, albeit on a smaller scale, since he was a wealthy man in his own right.[381] The fact is that staying in Denmark might also have brought Brahe legal persecutions.[382] A number of accusations were brought together towards Brahe and his clients, behind all of which stood the strong hand of a new government. There were allegations of mismanagement of Brahe's administrative duties and allegations of mistreatment of the peasants on Hven.[383] These allegations were accompanied by those of not having married properly (according to the ancient habits and not in front of a clergyman), of not taking the Eucharist for eighteen years, and for letting his chaplain omit the ritual of exorcism from baptisms.[384]

The mechanisms behind both Brahe's ascend and fall, as well as the array of allegations that were eventually brought against

[380] Massive support from a patron was, of course, also possible in Catholic countries, as evident from the patronage of popes and cardinals. This support, however, was also the result of a process of centralisation, i.e. the centralisation of the Catholic church in the late middle ages.

[381] Shortly after his exile from Denmark he was able to lend 10.000 thaler to the Duke of Mecklenburg; Alex Wittendorff, *Tyge Brahe.* Cph. 1994, 247f.

[382] For the circumstances surrounding Brahe's expatriation, see Thoren (1990), and Christianson (2000), 195-206 but since their focus is Brahe, none of them elaborates the fact that political persecution accompanied the withdrawal of economical support for Brahe's exile and part of a greater picture, but see Wittendorff (1994).

[383] Christianson (2000), 201-203.

[384] Christianson (2000), 200-204.

him, were part of a general *process of centralisation* that took place in Scandinavia like elsewhere in Europe. This process was connected to the genesis of the modern European state (including absolutism), but is not identical to it. The literature on the subject is vast, and I shall only draw attention to a few aspects of this phenomenon relevant to the practices and patronage of natural philosophy.

The process of centralisation may be defined as a concentration of power, both due to technological and economical developments and to a deliberate politics from central governments. The former included the development of a money economy and the so-called 'military revolution'.[385] These developments were followed by intentional attempts at accumulation of *power* by ruling dynasties and institutions, eventually with the backing of political theorists like Machiavelli, Jean Bodin, and Justus Lipsius. As the latter would put it: "*one religion, one language, one law and similar manners are the best bonds to keep a country together with*".[386] Some historians have focused on the role of the central government (or the 'power state') as *the* revolutionary agent in the process of centralisation.[387] Power usually meant control of taxation and the army, and the emergence of the power state is thus connected to an attempt by governments to monopolise violence. However, the centralisation of power also had symbolic aspects and manifested

[385] As defined by Geoffrey Parker, *The Military Revolution.* Cambridge 1988.

[386] "una religio, una lingua, una lex, iidem mores vincula optima sunt societatis", quoted Lehtinen (1979), 103. On Lipsius' influence in Sweden see Bo Lindberg, Stoicism och stat. Justus Lipsius och den politiska humanismen. Stockholm 2001. A less known but influential political thinker was the German Henning Arnisæus (1575-1636), who was court physician in Denmark from 1619, see H. Dreitzel, Protestantischer Aristotelismus und absoluter Staat. Die "Politica" des Henning Arnisäus. Wiesbaden 1970.

[387] One of the founders of this view is Niels Steensgaard in his contribution to the discussion of the general crisis of the mid-17th century, 'The Seventeenth-century Crisis', *The General Crisis of the Seventeenth Century*, ed. Geoffrey Parker and Lesley M. Smith. London 1978, 26-56. Since then, the development of the Scandinavian Power State attracted attention. For a recent contribution in English with bibliography, Leon Jespersen (ed.), *A Revolution from Above ? The Power State of 16th and 17th Century Scandinavia.* Odense 2000. For developments in Sweden see Nilsson (1990), Rystad (1983) and Runeby (1979).

itself in the development of court ceremonial,[388] and in the obsession with control that also extended to nature and the countryside as we shall see later in this book.

Like dynasties elsewhere in Europe, the Oldenborg dynasty in Denmark and the Vasas in Sweden tried to encroach on traditional privileges held by various estates and city councils. As it has been pointed out, the politics of governments were not always very coherent or efficient, but rather marked by *ad hoc* solutions.[389] So what we are concerned with is neither a smooth nor irrevocable process, but rather a certain logic within the development of power relations in 16th and 17th century Scandinavia.

Since the Scandinavian countries had only few towns of any noteworthy size, the main opposition to centralisation came from the peasants (especially in Sweden) and first of all from the old nobility. We should not, however, think of the relationship between an expanding Crown and privileged social groups only as one of perpetual confrontation. As we have seen in Chapter One, the high nobility filled the top offices of the expanding central administration, and most military commanders were still recruited from their ranks. Thus, for most of the time the relationship was one of co-operation rather than rivalry, but like elsewhere in Europe customary (or supposedly customary) privileges were jealously guarded, and when the occasion arose the guardians of these privileges tried to move (or stabilise as they themselves saw it) the demarcation line between state and tradition. The theory behind this system was the idea of the "mixed monarchy" which was predominant among the high nobility in most European countries. The Swedish nobleman Schering Rosenhane gave it expression in an emblem (see Fig. 3), according to which each estate in the realm had its own special obligations and privileges. The welfare of the country depended on the division of power and on keeping the balance between the different estates and the monarch.[390]

In both Scandinavian countries the years around 1600 marked a revitalisation of political centralisation. In Sweden, most of the previous century had been marked by political instability.

[388] For the Swedish court see Persson (1999), which also includes international discussions on the early modern court. For the Danish court see Arenfeldt (1997) and Olden-Jørgensen (1996).
[389] T. Munck, *Seventeenth Century Europe 1598-1700*. London 1990, 32.
[390] See Runeby (1962).

Since the country's independence from Denmark, three out of five kings had won the throne through civil war,[391] and due to the decision of Gustav Vasa to provide each younger son with a duchy, large parts of the country had been ruled by a Prince, who would sometimes be in outright opposition to the court in Stockholm, and establish a rivalling court.[392] To this came serious peasant rebellions throughout the century that in some locations such as Dalarna and Småland seemed endemic. With the ascension of Karl IX (effective ruler 1598) things settled, and he and his son Gustav II Adolf could initiate a number of reforms aimed at the centralisation of power backed by increasing revenues from the mining industry.

In 16th century Denmark, central government was somewhat more stable than in Sweden. This may seem like a paradox, since unlike Sweden (which became a hereditary kingdom in 1544) Denmark and Norway were *de jure* elective monarchies until 1660. However, the order of succession had *de facto* been unchallenged since 1536.[393] The line of succession was not disputed, but the accession charter (*håndfæstning*) that was composed by the Council of the Realm (*rigsrådet*), and whose provisions it guarded carefully, confined the king's freedom of action in matters of politics, warfare, and taxation.[394] At the death of Frederik II, Tycho Brahe's old patron in 1588, a regency council consisting of Tycho's kinsmen took over, and the next eight years brought him unprecedented economical support, even the prospect of making Uraniborg hereditary.

But the time of bliss for Tycho and his kinsmen changed when a young and energetic Christian IV came to age in 1596. To escape the dominant influence of the Oxe-circle, the King appointed Christian Friis to Borreby (1556-1616) as his new chan-

[391] Namely, Gustav I Vasa, Johan III, and Karl IX.

[392] An example is the court of Duke Karl in Nyköping in the 1580's and 1590's that was a centre of political and religious (Protestant) opposition to the court of Johan III and later Sigismund in Stockholm. Eventually, Karl would usurp the throne.

[393] From 1536 the kings had the right to elect his heir to the throne while he was alive, and in 1576 Frederik II made the Council of the Realm bind itself to elect the man as king, who married his oldest daughter, in case he had no son; see Jespersen (2000), 47. A similar decision was made in Sweden in 1590.

[394] See *Samling af danske Kongers Haandfæstninger og andre lignende Acter.* Cph. 1856-1858, reprint 1974.

cellor. Borreby was a tool of centralism (not to be confused with absolutism). While the previous period had witnessed a plurality of cultures, the quasi-independent culture of the University and the splendid aristocratic courts of Uraniborg and Breitenburg, all areas of life were gradually controlled from Copenhagen. The provincial towns increasingly lost their autonomy, and commercial life was concentrated in the capital. Likewise, the government took a stronger hand in matters of royal fiefs.

The economical support to Brahe was formally warranted by the fact that he was lord lieutenant of a number of fiefs and his usefulness to the kingdom. When Frederik II evaluated the achievement of Brahe, he described the astronomer as *"a faithful servant and friend (who) executed conscientiously that for which he had originally been employed. He cast dependable horoscopes for all my sons and gave me notice throughout my life as to all heavenly portents sent by God Almighty to warn me and my kingdoms"*.[395]

In other words, according to his royal patron, the main virtue of Brahe's research was its usefulness to the kingdom and his performance as a *faithful servant.*[396] Of all the elements that led to withdrawal of support to Brahe by Christian IV, the astronomer's failure to act as a loyal and humble servant (or client) was the most prominent.[397] Such a performance was antithetical to the politics of the new government. Influenced by the views of his royal brother-in-law, King James VI of Scotland, a leading advocate of divine-right monarchy, the young Christian IV believed in the 16th-century theory that God appointed kings to rule. King Christian and his advisors also believed with Jean Bodin and Justus Lipsius that all sovereignty in a monarchy must be held in one hand and sought to establish a new unity of state and church under the crown. Under the new government the provincial towns increasingly lost their autonomy, commercial life was concentrated

[395] Quoted in Thoren (1990), 339.

[396] Christianson (2000) emphasises that Frederik II perceived astrology as a matter of national security, and is undoubtedly right in assuming astrology to be one of the main motives for the support to Brahe. Christianson, however, does not discuss how far Brahe employs astrology as a means to secure patronage.

[397] Cf. Christian IV's letter to Brahe from October 1597, *TB*, XIV, 121f. Here the monarch also sarcastically mentions that if Brahe wishes to work as a court mathematician (i.e. producing almanacs and horoscopes) he can apply to the King.

in the capital, and the government took a stronger hand in the management of royal fiefs, and in matters of church and university.

Thus, the fall of Tycho Brahe was only part of a major onslaught on the conglomerate of the high nobility he belonged to. At this time his kinsmen Erik Lange, Steen Maltesen Sehested, and Steen Brahe were also stripped of some of their fiefs and had their income reduced; and the viceroy of Norway, Axel Gyldenstierne lost much of his authority when the central government took direct control of Norwegian affairs,[398] and the government tried also to encroach on the relative autonomy of Heinrich Rantzau and the local nobility.[399] By his incessant demand for royal support and his performance as an independent noble lord, Brahe the nobleman and astronomer had acted more as a master than as a servant. Neither was the fact that the prestige of Brahe in Europe seemed to overshadow that of his king to the liking of the new government, whose members had been selected for their commitment to a more centralised royal government. When Brahe's sources of influence dried out, he not only lost his support, but also was met by hostility from court that eventually forced him to abandon Uraniborg and go into exile in 1598.

A similar development took place in Sweden. The aspirations of noblemen like Hogenskild Bielke and Erik Sparre were also based on the theory of a mixed constitution and were generally connected to Sigismund I, the Catholic king of Sweden and Poland, and to enthusiasm for a reformed Catholicism as found in the Jesuit education at the Stockholm college. When Sigismund I was defeated in 1598 by his uncle Karl, these aspirations were shipwrecked, and leading noblemen like Sparre and Bielke were executed or imprisoned.[400] Others managed to steer the free of the dangerous waters and secure the fortune of their family. Abraham Brahe (1569-1630) had supported King Sigismund, but succeeded in winning the favour of Duke Karl. The price was that Brahe had to act as a judge in the Duke's bloody retaliation on his enemies. He could then enter a successful career, and his son, Per Brahe the

[398] Kristian Erslev, *Danmarks-Norges len og lensmænd 1513-1596.* Cph. 1879, 15, 59, 78, 84.
[399] Brandt (1927).
[400] See Sven A. Nilsson, *Kampen om de adliga privilegierna 1526-1594.* Lund 1952. Skrifter utg. av Vetenskaps-Societeten i Lund 41.

Younger (1602-1680) would later be viceroy of Finland and one of the greatest Swedish patrons of natural philosophy.

In the view of Duke Karl (eventually crowned as Karl IX in 1607), the council of the realm should be a loyal instrument of his politics. The candidates among the high nobility who could be expected to remain loyal to Karl if the wind changed were, however, extremely limited. Karl therefore refrained from appointing a new council and based his rule on the administration (the chancellery and the chamber).[401] When his son Gustav II Adolf ascended the throne in 1611 in the middle of a war with Denmark, the high nobility forced him to swear an oath (*konungaförsäkran*), which to a large extent codified the nobility's programme from the 1590's, giving it privileges and imposing limitations to royal power similar to those in Denmark.[402] Gustav II Adolf soon freed himself from several of the limitations of his powers, thus practising the personal kingly rule.[403] When the king shortly after signing this council-constitutional programme also began a long-lived closed cooperation with the leader of the high nobility, Axel Oxenstierna, and turned his energy to conquests abroad, the nobility renounced on the enforcement of privileges at the levies and taxation.

But despite the strengthening of the monarchy by Karl IX and Gustav II Adolf, the monarchy did not play the same role as in Denmark in terms of unifying the realm. This was made clear by Sweden's dynastic problems in the 16th century, Sigismund's Polish kingship and his long absence from Sweden, and - in the 17th century - Gustav II Adolf's stay at foreign battle-fields, two long-lasting regencies and an abdication. These circumstances strengthened the position of the Council and the estates as the bearers of continuity and guarantors of the unity of the realm.

2. The Rise of Orthodoxy

The advance of centralism in Scandinavia around 1600 also included religion.[404] There was a certain logic to it. While Scandina-

[401] N. Edén, *Den svenska Centralregeringens Utveckling till kollegial organisation i början av sjuttonde århundradat.* Uppsala 1902, 13.

[402] Carl Arvid Hessler, 'Gustaf II Adolfs konungaförsäkran', *Scandia* (1932), 167-204,

[403] See S.A. Nilsson, *Kampen om de adliga privilegierna 1526-1594.* Lund 1952.

[404] For the centralisation of the Lutheran church in Scandinavia, see the various articles in Ingmar Brohed (ed.), *Reformationens konsolidering i de nordiska länder-*

vian kings were restricted in matters of taxation and the army, the Reformation had put religion and education under secular control, and here the Crown ruled unchallenged. Not surprisingly these areas therefore became the forerunners of centralisation and uniformity. They were areas where the Crown could exert its power as well as legitimate itself. It is therefore not surprising that allegations of breaking the Church ordinance were among those brought against Tycho Brahe.

In an age well familiar with the Old Testament, an expanding state had to defend itself towards accusations of tyranny, a dangerous accusation that, according to some contemporary political theories might warrant rebellion.[405] Particularly the Swedish Vasa dynasty had a problem of legitimacy that was to haunt it throughout the 16th century not least vis-à-vis church leaders, Catholic as well as Protestant, and the histories of Sweden by writers like the reformer Olaus Petri and the exiled Catholics Johannes and Olaus Magnus were centred on the phenomenon of tyranny.[406]

Therefore, the monarchy must manoeuvre carefully. In his coronation speech in 1617 Gustav II Adolf would thus emphasise that his powers were based on full divine and popular legitimacy. In the Latin part of his speech at the coronation of Christian IV in 1596, bishop Peder Winstrup, proclaimed the divinity of kings, but significantly this part of his speech was not included in the official description of the coronation,[407] probably due to censure by the council of the realm.[408] The resistance of the nobility against developments towards absolutism was also expressed in the history of Denmark written by the noblemen Arild Huitfeldt. Already in the preface he points out that Denmark always was an elective monarchy, and throughout his work, this principle is emphasised.

na 1540-1610. Oslo 1990; for Denmark also Martin Schwarz Lausten, *Danmarks kirkehistorie.* Cph. 1987, for Sweden the various studies by S. Göransson in the bibliography.

[405] see Ingvar Andersson, 'Tyrannbegrebet under medeltid och renässans. Från Augustinus till Machiavelli', *Lychnos* 1943, 111-129 for the changing conceps of '*tyrannus*' in Scandinavia.

[406] Johannesson (1991), 120-138, 196-203.

[407] August Erich, *Klarlige og Visse Beskriffuelse/Om den Stormectige/Høybaarne Førstis oc Herris/Herr Christians den Fierdis....Kongelige Kroning/som lycksaligen bleff holen vdi Kiøbenhaffn/den 29. Augusti, Anno 1596.* Cph. 1598.

[408] See Frede P. Jensen, "Peder Winstrups tale ved Christian 4.s kroning. Et teokratisk indlæg", *Historisk Tidsskrift* 12:II (1966-67), 375-392.

A king like Christian II, who had tried to encroach on traditional privileges, is described as a tyrant who warranted the right of rebellion and was duly deposed by the council of the realm.[409]

Any government in any age legitimises its power by presenting itself as defender of something it has defined be a common good, be it peace, welfare, law and order, justice, etc. The most valuable 'common good' defended by the expanding Scandinavian power state, the one that warranted its accumulation and exertion of power, was nothing less than the salvation of its subjects. The raison d'être of the Scandinavian kingdoms in the period between the Reformation and the emergence of Absolutism was the spiritual well being of their citizens. This was a duty that overshadowed everything else, though goods like peace, prosperity and social stability often was seen as a prerequisite for it.

It was a duty, and an argument against accusations of tyranny, gathered from Lutheran theology. According to this, the main responsibility of a Christian ruler was to defend the true religion, i.e. the Evangelical church, so his subjects could embrace Faith. It was a weapon played into the hand of the sovereign by the Wittenberg reformers, when they after the experience of the social rebellions and the radical reformers, decided to support the Reformation on the Princes. It was found as the first duty of the King in the accession charters of the Danish kings after the Reformation,[410] and it was the strongest weapon of rulers in order to discipline their subjects.

Thus, it was obvious for energetic monarchs and their servants to exert themselves by tightening their grip on the Church. In the decades after the Reformation religious arguments had played only a subordinate role in the political discussions in Sweden. However, the long rivalry between the sons of Gustav Vasa included different religious sympathies. The increasingly open Catholicism of Johan III and Sigismund I was met by a Lutheran rally by Duke Karl. When he came to power in 1598, Lutheran religion became the unshakeable basis for Sweden, while Catholicism (the religion of the exiled King Sigismund of Poland) was the

[409] Arild Huitfeldt, *En kaart Historiske Beskriffuelse/På hues merckeligt/som sig Aarlige vnder Kong Christian den Tredje... haffuer tildragit.* Cph. 1595.
[410] See *Samling af danske Kongers Haandfæstninger og lignende Acter.* reprint Cph. 1974, 83, 95, 103.

great enemy and later (in 1617) explicitly forbidden.[411] Defence of Lutheranism became central to the legitimisation of Karl (who was not recognised as legitimate king by more than handful of European Princes), and eventually to his son Gustav Adolf, "the Lion of the North".

Karl IX and Gustav Adolf tried to uniform religion,[412] as they tried to increase their control over the Swedish church by establishing a so-called *consistorium generale* after the German model. This was supposed to be a government institution that was to rule supreme in religious matters, essentially not different from the other colleges in the administration, and half of its leaders were to be non-clergymen.[413] Rejected by the Swedish bishops led by Johannes Rudbeckius, the plan was finally abandoned after much controversy, but it showed the clear ambitions of the Court.

In Denmark there was no need for a consistorium generale since the government's control of the bishops was much stronger than in Sweden. Church policy was explicitly ultra-conservative. Its goal was to preserve the existing social order and the Lutheran Church against schisms. Therefore, it was highly suspicious of innovations in theology. In both Denmark and Sweden the preaching in several thousand churches would each Sunday teach that each and everyone was to be satisfied with his place in the social hierarchy, and that rebellion against the authorities would be contrary to God's will.[414]

In the closing years of the 16th century the stability of the Evangelical Church was shaken. The differences in theological outlook that had always existed between Luther and Melanchthon were polarised, and resulted in a reaction against Melanchthon's theology, the so-called Philippism frequently stamped as 'crypto-Calvinism' by its opponents due to its views, or supposed views, on human reason and will.

[411] The extent of Catholic influence in Sweden in this period is illustrated by the fact that in the years 1553-1622, 231 Swedes and Finns studied at Jesuit schools, while the number for students from the realms of the Danish king was only 115, see Oskar Garstein, *Rome and the Counter-Reformation in Scandinavia. Jesuit Educational Strategy 1553-1622.* Leiden 1992, 22.

[412] By the church handbook of 1614 and the new Swedish Bible of 1618.

[413] Lindroth, II (1997), 83f.

[414] Ingvar Kalm, *Studier i svensk predikan under 1600-talets förre hälft med särskild hänsyn til Gamla testamentets ställning.* Uppsala 1948, ch. XII.

In the closing decades of the 16th century, students of Melanchthon and Philippist scholasticism had dominated intellectual life in Scandinavia, mixed up with new currents like Ramism, Neoplatonism, and Paracelsianism. The rather dry formalism of Philippist theologians like Niels Hemmingsen may seem a world apart from the flamboyant Neoplatonism of men like Tycho Brahe and Petrus Severinus, but there was common ground to be found. This common ground was Renaissance humanism in its various guises. Melanchthon had not only been influenced by the Northern European humanism of men like Erasmus and Rudolf Agricola, but also by the Italian Neoplatonism of the Florentines and of his mentor Johannes Reuchlin. And these various branches of humanism had two things in common - an inherent belief in human reason and free will, as well as ideals of tolerance and reconciliation. Furthermore, there was a belief in the improvement of mankind. We find precious little notions of Sin or the Ending of the World in neither Tycho Brahe nor Niels Hemmingsen.

Following the death of Melanchthon, controversy arose in Wittenberg in the 1570's between followers of Melanchthon, the so-called *Philippists,* and the so-called *Gnaesio-Lutherans,* who claimed to champion orthodox Lutheranism.[415] The main point of controversy was the issue of the Eucharist, but it was also a battle between a theology connected to renaissance humanism and a theology focusing on central Lutheran tenets like the all-importance of Faith and the rejection of any place for human Will or Reason in matters of salvation. In short, it was a polarisation of the differences of opinion that already had existed between Luther and Melanchthon. Of course the outcome of this battle depended on the view of the changing rulers of Electoral Saxony. Initially the champions of orthodoxy prevailed, and Melanchthon's son-in-law, the physician Caspar Peucer and other leading Philippists were expelled from Wittenberg. Partly, the rise of orthodoxy was also a reaction against the success of the Counter-Reformation. The Jesuits' adoption of Thomist scholasticism and the schisms within Protestantism led Lutheran churches and theologians to focus more on dogma, and to try to codify Lutheranism in the *Formula*

[415] For developments in Wittenberg, see Walter Friedensburg, *Geschichte der Universität Wittenberg.* Halle 1917

concordia. At the same time Wittenberg was also influenced by a more spiritual religiosity, such as that of the Johan Arndt.

Since religious life in Scandinavia was closely connected to developments in Wittenberg, the turbulence there was bound to cause repercussions on the northern fringe of Europe. Here a reaction set in against Philippism with the backing of the Scandinavian governments, and the rise of orthodox Lutheranism became part of the process of centralisation. In Denmark, its main champion was Hans Povlsen Resen (1561-1638), who ended his career as bishop of Sealand.[416] In 1597 he was appointed professor of theology and was the embodiment of compliance to governmental control of academic and religious life. The clash between the view of human nature of this new orthodoxy and that of Philippism is reflected in the controversial issue whether the ritual of exorcism should precede baptism. Many who were brought up in the Philippist tradition abandoned the demand of Luther (and the church ordinance of 1539) that infants should undergo such an exorcism. Among them was Tycho Brahe, and this was one of the first onslaughts that the new government launched against him,[417] undoubtedly on the initiative of Chancellor Borreby,[418] since the young King himself at this time took little interest in religion.

To the new orthodoxy, the main dogmatic clash with Philippism (or "crypto-Calvism" as they coined it) concerned the issue of the Eucharist. Melanchthon had eventually moved to a position of the Eucharist close to that of the Calvinists, where the Eucharist was a symbolic act rather than a real one. This position was offensive to the Gnaesio-Lutherans. To explain the divine mysteries rationally was heresy, and it seems that the main point in Resen's campaign was directed, not so much against crypto-Calvinist views on the Eucharist *per se*, but against theological and philoso-

[416] On Resen see Bjørn Kornerup, *Biskop Hans Poulsen Resen* I-II. Cph. 1928-1968.

[417] Another was the demand that all marriages should be performed by a clergyman, see Christianson (2000), 200f.

[418] In a letter from 1599, Borreby would concede that his highest effort while in office had been the advancement of religion "*through learning as well as living*", see Wittendorff (1994), 226 who has emphasised the part played by religious reaction in the attacks on Brahe. The suggestion of Christiansson (2000), Ch. 9 that Borreby was secretly protecting Brahe is intriguing, but hardly in line with source evidence.

phical currents that tried to explain religion rationally. This is evident from a book on Christian religion that he published in 1614,[419] and he would give a part of another of his books the title "*The struggle of Faith against the beast of Reason*".[420] Resen was a great admirer of Augustine, and contrary to most orthodox theologians in Wittenberg, he was also Neoplatonist. As such he was also influenced by Ramus, but Resen emphasised the pious aspect of both Platonism and Ramism.[421] Man's Reason is insufficient as a result of the Fall, and he underlined personal Faith against all kinds of "naturalism" or rationalism. Lutheran orthodoxy was thus concerned with penance (*pønitens* in 17th century Danish), but at the same time it was an attempt to systematise and clarify religious doctrine in order to identify heterodoxy.

As religious orthodoxy turned against Philippism and rejected reason, it also severed the link between natural philosophy and theology. As we have seen above,[422] the study of Nature in Melanchton's teaching was connected to moral philosophy, both eventually pointing towards theology. And although reason had no place in connection with salvation, the humanist belief in human reason was inherent in this viewpoint. To Melanchthon, the study of Nature is an inquiry. Creation is not admired at a mere glance. Its real beauty, and the greatness of its creator, is disclosed when one penetrates the multitude of phenomena and uncovers the harmony and beautiful arrangement of the night sky and the human body.

The Lutheranism of Bishop Resen had little use of the study of Nature. He was not hostile to it, although he was hostile to novel theories like heliocentrism, but it had no place in his theology. Creation was not a matter of inquiry, but of piety as when the professor of Latin, Peder Nielsen Gelstrup, who was a client of Borreby, in 1618 published a translation of the fourth of the *Vier Bücher vom wahren Christentum*, by the German theologian Johann Arndt, who was popular among Danish propagators of pen-

[419] *De sancta fide.* Cph. 1614.
[420] *Clavis Theognosias.*
[421] Andersen, 137.
[422] Chapter Two.

ance.[423] The book was dedicated to the spouse of Christian IV, and was concerned with the Book of Nature[424], but it contains little of the early Philippist tradition's spirit of inquiry. Nature, or rather Creation since it includes all aspects of the world, is taken at face value. There is no attempt to see through things by means of mathematical analysis or systematic philosophical investigation. The observation of a benevolent Creation immediately leads to pious reflections.

In the next chapters, we shall see how some Scandinavian natural philosophers actually combined adherence to Lutheran orthodoxy (or at least some of its features) with the study of Nature, but in the end, the culture of theology and the humanist culture of natural philosophy (mostly practised by physicians) would move apart. It was not a matter of science versus religion, since most natural philosophers were deeply religious. It was a matter of theology becoming more professional and turning increasingly dogmatic, increasingly hostile to human reason and pessimistic about Man. Thus, it was essentially theology that first broke the unity of learning. At the same time as theology severed its links to natural philosophy, it also moved away from the culture of renaissance humanism that flourished at Uraniborg and elsewhere - the cult of the Muses, Latin poetry - in other words, from the Classical elements. Thereby it also moved away from the culture of courteous society.

3. And the Muses Wept

When Scandinavian governments around 1600 tightened their grip on almost any area of society, this had deep impact on natural philosophy. It was Tycho Brahe who more than anyone else had made natural philosophy an identifiable area incarnated by Uraniborg with its celestial globes, wall quadrants, and chemical laboratories, visited and praised by foreign princes like King James VI of

[423] J.O. Andersen (1896), 323; S.M. Gjellerup (1868-70), 125. For nature in connection with piety and devotion in Denmark around 1600 see Arvidsson (1990).

[424] Johann Arndt, *Liber naturæ eller Naturspeyel. Hvorledis Verden som Naturens store Bog vidner om Gud.* Cph. 1618. It was the first book of Arndt that was translated into Danish. At this time Gelstrup's patron Borreby had just died, and he had furthermore caused scandal by making a maid pregnant. The book was thus s typical example of attaining a new patron (or *in casu* patronesse).

Scotland and the Duke of Mecklenburg. No visitor to Denmark would neglect to pay a visit to the abode of Urania, which in descriptions of Denmark featured as one of the kingdom's main attractions.[425]

The immense international prestige of Uraniborg was neither lost on the young king, who was very sensible of his reputation, nor on those who orchestrated its fall, men like Chancellor Borreby and Lord Steward Valkendorf. Brahe's employment by the Emperor showed that there was an international market for his services, and there was an international market of opinions as well. Frederik II had benefited from the prestige of Tycho Brahe,[426] and the problem for the new government was to avoid the loss of this prestige due to the onslaught on Brahe.

These problems and the strategies it chose are reflected in a letter of July 1598 from the Danish nobleman Johannes Stygge in Hamburg to the book trader Hans Aalborg in Copenhagen.[427] Stygge was a friend and relative of a secretary of the new chancellor CHRISTIAN FRIIS TO BORREBY (1556-1616) and belonged to circles within the nobility that had been outmanoeuvred by Brahe and his kinsmen. He tells that many ask him about the circumstances of Brahe's departure and judge the Danish government harshly:

> *Some call it a new barbarism over which the Muses weep, some Machiavellism, some envy, some deceitful cunning, and some avarice.*[428]

Stygge does not, as a matter of fact, refute these accusations, but comments that "*this Tycho with his new and yet not seen or certain mathematics is considered an oracle*" as if "*there were not other nobles in Denmark, who have written better books than him*".[429] He has been told that the professors in Copenhagen secretly rejoice (*in*

[425] Jon Jensen Kolding (1980), 87-89; Braun (1584).

[426] Tycho Brahe was e.g. pictured on the so-called Kronborg tapestry of Frederik II by Hans Knieper ca. 1581-85 now in the National Museum in Copenhagen.

[427] Letter from Johannes Stygge to Hans Aalborg, dated 10.7.1598, printed in *DM* 5R, 192-194.

[428] ibid.,"*Nonnulli novam barbariem, ex qva exulavere Musæ, vocitant, alii Machiavellismum, alii invidiam, alii subdolam vafritiem, nonnulli avaritiam*".

[429] ibid., "*Tycho iste cum nova sua necdum visa aut explorata mathesi pro oraculo habetur*".... "*qvasi non sit alius in Dania nobilis, qvi melius literas didicerit qvam ille*".

sinu gaudeant) in Brahe's fall, and Stygge hopes that the reproach of his country common among learned and eminent men will be removed. He has faith in the book written by Claus Reymers Ursus against Brahe,[430] asks the book trader to send him this book, but warns him to "*take heed that Tycho's friends (if he still has any left) shall not discover that he has got the book from him*".[431]

Stygge's reference to the university professors bears witness to the tactics employed by the government. At this time the Danish monarchy already had a tradition of employing learning as part of its prestige and legitimisation. From the 1550s when Christian III gave substantial economic support to the university and its students,[432] he also began to employ learning as part of his self-image, as when his princely guests from Saxony and Brunswick in the autumn of 1557 were invited to witness the promotion of doctors in Vor Frue Kirke in Copenhagen.[433] At the wedding between King Frederik II and Princess Sophie of Mecklenburg many princes and noblemen included numerous men of learning in their retinue,[434] and Christian IV's visit to James I in 1606 also included a visit to Oxford where he received a collection of hand-written poems of homage from the dons. In other words, learning had become a part of the image of a 16th century prince towards foreign princes, and Frederik II's support to Uraniborg was part of this process. It was the landgrave of Hesse who initially had induced Frederik II to support Brahe, and visiting foreign princes, notably James VI of Scotland, found their way to Hven and were greatly impressed by the observatory and the chemical laboratories. But although both Uraniborg and the University were dependent on support from the Court, they were to large extent autonomous institutions.

In theory, the royal chancellor was the superior of the University, but in practice the professors in the Consistorium had enjoyed relative autonomy. Now Chancellor Borreby began to hold

[430] Ursus' *De hypothesibus astronomicis tractatus* Prague 1597 was a plagiarism of Brahe. On Ursus' and Brahe, see Christiansson (2000). Stygge's remarks illustrate indeed that envy and hostility towards Brahe were more important than hostility towards astronomy.

[431] ibid., "*Ante omnia vero cave, ne qvis ex amicis Tychonis (si qvos forte adhuc ibi habeat) resciscat, me illa explaria a te accepisse.*"

[432] Rørdam, KUH I, 236.

[433] Rørdam, KUH I, 266.

[434] The chronicle of Frederik II, ed. by Resen, 264ff.; KUH II, 123.

the University in tight reins and use it as a platform of patronage and power. Thus, he began to take over Brahe's former clients and employ them at the University. All the new professors appointed after 1594 were clients of the chancellor, and old friends of Brahe were enticed to change sides. To Longomontanus, one of Brahe's most brilliant assistants, he created an extraordinary chair in astronomy.[435] Other clients of Tycho and his circle felt the cold wind of change, such as Brahe's old praeceptor, the royal historiographer Anders Sørensen Vedel who had established his own *museum*, Liljebjerg ("Lily Hill") in Ribe, who was replaced by Niels Krag, a friend of Tycho who had won the favour of the new government.[436] The book trader mentioned above, Hans Aalborg, had once been the *praeceptor* of Brahe, and it was also rumoured that Petrus Severinus had turned against his former friend.[437]

If the turning tide collided with a Philippist view on human nature, it did even more so with the culture of Neoplatonism. On Hven, Tycho Brahe had created Uraniborg as the home of the muses, establishing himself as Apollo, surrounded by friends and kinsmen, who likewise bore mythological names.[438] In an age of centralisation there could be only one Parnassus – that of the royal court. Mythological imagery became connected to royal power, was, as a matter of fact, monopolised by the royal court as witnessed in the architecture of the royal castle of Frederiksborg (built 1602-1622).[439] In this vein, the new government build up the University at the expense of Uraniborg, but concentrated iatrochemistry and alchemy at court with other arcane studies that had political implications. The king established a laboratory in the garden of the new Rosenborg Castle just outside the walls of Copenhagen, to which the German alchemist Peter Payngk, who had

[435] KUH III, 146; AC IV, 94.

[436] Christianson (2000), 199f; other examples were Johannes Stephanius who in 1597 was rewarded with a university professorship. On the other hand, could Brahe's loyal and brilliant assistant Peter Jacobsen Flemløse not obtain a professorship. Both of these men are described in the Bibliographical Directory in Christianson (2000).

[437] Brahe suspected that Severinus had turned against him, see Christianson (2000), 200; and according to the letter of Stygge, op. cit. he did. Stygge claims that the reason was that Brahe undermined the position of the court physician by giving away chemical remedies for free.

[438] Christiansson (2000); Zeeberg (1984).

[439] For the imagery of Frederiksborg, see Heiberg (1988).

just returned from the court of Emperor Rudolph II was employed in 1609,[440] while the monopoly on almanacs was given first to the professor of mathematics, Jørgen Dybvad, later moving out of the University and given to the vicar Niels Heldvad, a client of the Rantzaus.

This was all part of the process of transferring the prestige of Uraniborg to the king to fit the European market of opinion. In 1606, when Christian IV equipped a fleet for a visit to his brother-in-law, King James, he insisted that it should not only include abundant quantities of gold, silver, silks and precious stone to show the prosperity of his realms. He brought with him representatives of learning - the theologian Hans Poulsen Resen and Jon Jacobsen Venusin, one of Brahe's assistants who had named himself after Hven.[441] These two men did not only represent learning – they represented orthodox theology and natural philosophy. Perhaps it was even a demonstration by Christian IV towards his brother-in-law that the prestige of Hven was now taken over by the monarchy and married to Lutheran religion.

After the disastrous intervention in The Thirty Year's War in 1625-27 when Christian IV tried to promote himself as the defender of Lutheran faith, the government once more felt the need to take over the prestige of learning and its emblems. In other words, the failure on the battlefield was compensated by ventures into patronage and imagery. The range of edifices that Christian IV erected in Copenhagen very tangibly illustrates this. The importance attributed to this prestige is emphasised when one considers that these buildings were erected at a time when the kingdom's finances were in dire straits due to endemic warfare.

The observatory of Uraniborg itself was reflected in the astronomical tower of *Rundetårn*, which was finished in 1642 and still towers over the Latin quarter of Copenhagen. Its official name was *Stellaburgus,* the same as one of Brahe's observatories on Hven. But whereas Brahe's observatories on Hven had been part of the Neoplatonic court of a high nobleman with parapets, ancillary turrets, and emblematic figures such as the statues of Astronomy and Chemistry (Fig. 4), Rundetårn was a high massive tower con-

[440] See Aug. Fjelstrup, *Dr. Peter Payngk. Kong Christian IV's Hofkemiker.* Cph. 1911; see also Shackelford (1991), 106-108.
[441] Vilh. Andersen, *Tider og Typer af dansk Aands Historie* I. Cph. 1907, 171f.

nected to the university church (Fig. 5). More than being an observatory as such (the government could not afford instruments at the time), it was an emblem of the wedding of Lutheran faith, royal power, and learning. On its front is carved a picture puzzle invented by Christian IV, which may be verbalised as: *Dirige Domine, justissiam & doctrinam in corde Coronati Christiani Quarti,* "Lead, O Lord, justice and learning into the heart of King Christian the Fourth".[442]

Three years later a *Domus anatomica* was erected whose interior also emphasised the unity of natural philosophy and religious edification. It was equipped with a royal box, and like contemporary anatomical theatres it was adorned with human skeletons and a picture of Adam and Eve in the Garden of Eden with the Tree and the snake between them. To emphasise piety and humility even further, a number of Latin sentences covered the wall:[443] "*Man, bear eternity in mind! The eye of God rests upon you*", and "*Live with Death on your mind – time flies, we are only shadows*".[444]

But while the expanding state used natural philosophy in creating an image as provider of learning in concordance with religion, it was not due to these measures that a tradition of natural philosophy based on experience developed in the realms of the Danish kings. The monarchy created the emblems as an attempt to profit in terms of prestige from an already existing culture of natural philosophy. Rundetårn was not equipped with up-to-date astronomical instruments until thirty years after it had been opened, and as for *Domus anatomica* the government provided insufficient funds (and cadavers) to make it function regularly.

[442] On Rundetårn and other edifices of Christian IV see M. Stein, *Christian den Fjerdes Billedverden.* Cph. 1987.
[443] cf. *Ætern. sacr. Theatrum anatomicum, Hafniæl noviter extructum...Anno 1644.*
[444] Cited from Harald Moe, "Niels Stensen. Childhood and Student Years", in *Nicolaus Steno. A Reconsideration by Danish Scientists,* ed. Jacob E. Poulsen and Egill Snorrason. Cph. 1986, 38.

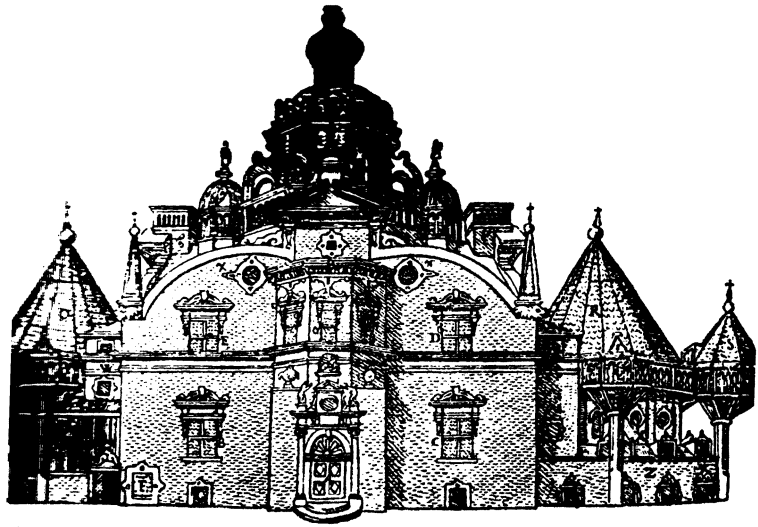

Fig. 4. Uraniborg around 1580. Shown is the east facade with the emblem of Astronomy above the entrance and the Pegasus (V) far above. The Winter Room (B, left of entrance) was in the southeast corner of the main floor, and beyond it, the Museum (M) in the south rotunda witht the chemical laboratory (L) below, the south observatory (O, N) above, and the aviary in front.

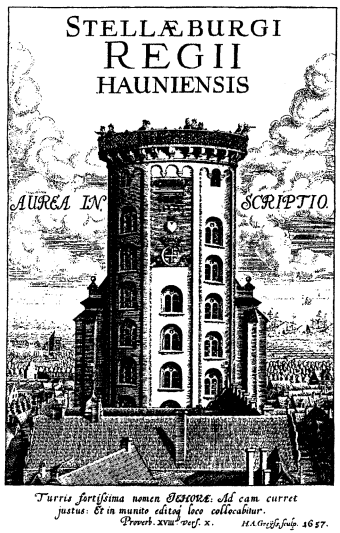

Fig. 5. The Round Tower of King Christian IV. Engraving by H.A. Greyss 1646/57, Behind the tower was the university church, the Trinitatis, and in front is seem the Collegium domus regium and a professor residence.

4. The Rise and Fall of Jørgen Dybvad

Before we close this chapter, I think it would be illuminating with a small case story. Above we have analysed the system of patronage, and seen how former clients of Tycho Brahe were either taken over by Chancellor Borreby or send out in the cold. But the changes brought by political centralisation not only demanded a change of patrons. The behaviour the new government expected from its clients was different from that required by former patrons like Niels Kaas or Tycho Brahe, and those who were not able to comply with this new agenda went into problems. An illustrative example of this is the sorry fate of Jørgen Dybvad and his son.

Jørgen Dybvad (ob.1612) came from a family of peasants in the countryside around Århus. His family does not seem to have been affluent or well connected. In any case Dybvad played the game of patronage more aggressively than most of his contemporaries, a fact that seems to have contributed to the fall of him and his son. The source material does not leave us any information on his life in grammar school and early years at university, but in 1568 we find him in Wittenberg, where he took his MA the following year. We do not know how he managed to finance his studies, but in a treatise from 1572 he mentions the support he has enjoyed from Peder Oxe.[445]

The career he intended in the first place seems to have been that of the mathematician. This was the lowest rung on the hierarchy of learning, but it offered employment in administration, at court, in commercial life and in the army. Dybvad began a long series of publications, almost each of them dedicated to a different potential patron. Two mathematical treatises from 1569 were dedicated to Duke Hans of Holstein and chancellor Johan Friis respectively, one of them a commentary to the second book of Copernicus' *De revolutionibus.*[446] Two treatises from the following years are not extant, so we do not know to whom they were dedi-

[445] *Oratio de humanitate Domini et Salvatoris nostri Jesus Christi habita Witebergæ ante prælectionem epist. D. Ignatii.* Wittenberg 1572..

[446] *Commentarii breves in secundum librum Copernici...*Wittenberg 1569 and *Tractatus breve de mensurationibus geometricis altitudinem accessibilium et inaccessibilium, longitudinem, latitudinem et profunditatum.* Wittenberg 1569; cf. Moesgaard (1972), 117f.

cated,[447] but we know that one of them was published in Copenhagen, and it seems fair to assume, that Dybvad went home to explore the possibilities of future patronage. Anyhow, Dybvad's efforts bore fruit, for he achieved the royal travelling scholarship. This scholarship was limited to theological and medical students, so Dybvad redirected his studies towards theology, the best paid and most prestigious in the hierarchy of learning. It seems also fair to assume that it was Johan Friis, Peder Oxe, or other members of their circle who provided the scholarship.

This is supported by the fact that Dybvad's next publication after his return to Wittenberg was dedicated to Oluf Rosensparre, the stepson of Peder Oxe. It is in this treatise that Dybvad mentions the support he has until now received from Oxe.[448] At this time Oxe was old and ailing (he died three years later), and the dedication to Rosensparre was probably an attempt to carry the patronage over to a young patron, who had the future ahead of him.

When the travelling scholarship expired, Dybvad returned to Copenhagen in 1575 and offered his services to the university. There was no vacant chair at the moment, but chancellor Niels Kaas, who had succeeded Johan Friis and was a client of Oxe, provided him with a chair *ad hominem*. Dybvad showed his gratitude by dedicating his next publication to Kaas.[449] The next career move was securing an ordinary chair, or possibly, a position at court. Dybvad, probably with the support of Kaas, now aimed for protection from the king himself. This was obtained when Dybvad wrote a treatise in Danish on the interpretation of comets.[450] Dybvad achieved a chair in mathematics, and got a monopoly on the publication of almanacs in the realms, an important supplement to the low salary of his chair.[451]

Dybvad's career strategy had succeeded extremely well. Coming from an obscure background, he had nonetheless managed to secure a chair at the university that might take him even further,

[447] *Liber secundus historiæ naturalis Plinii.* Hafn. 1571; *Oratio de æterna filii Dei divinitate et essentia.* Wittenberg 1574.
[448] *Oratio,* op. cit.
[449] *Quæstiones in Primum caput primi libri divini legislatoris Mosis.* Cph. 1577.
[450] *En nyttig Underuissning om den Comet, som dette Aar 1577 i Novembri først haver sig lader see.* Cph. 1578.
[451] Dybvad's privilege is published in *Danske Magazin* 4:II, 109.

and a monopoly on almanacs that might boost his income. However, Dybvad's aggressive self-promotion was not unproblematic. The chair in mathematics was only obtained through the removal of the incumbent professor, Anders Pedersen Kjøge. The professors felt their position threatened by this *novus homus* and complained until they were called to order by the king.[452] Dybvad, did not feel too confident himself, and published a series of treatises dedicated to the noblemen Sten Bille, Lave Urne, and the new rising start at court, Manderup Parsberg.[453]

But Dybvad's career was at a standstill, since he did not manage to advance into one of the higher faculties. After obtaining the royal scholarship, he had aimed at theology, but he was passed over, and other men were appointed to vacant chairs in the faculty of theology. It is possible that Dybvad tried to undermine the position of the leading Philippist theologian of the university, Niels Hemmingsen, it was anyhow rumoured that in letters to Saxony he depicted Hemmingsen as a dangerous heretic.[454] It was, as a matter of fact, accusations from Saxony that led to Hemmingsen's fall from grace, but the extant source material gives us no proof that Dybvad was involved. When one keeps in mind that several of Hemmingsen's old students and friends, like Niels Kaas and Olof Rosensparre, continued their support to both Dybvad and Hemmingsen, it seems fair to assume that Dybvad's undermining of Hemmingsen perhaps took place on a small scale, but that it was hardly decisive.

It seems that it was Frederik II himself who had obstructed Dybvad's promotion, for when the king died, Niels Kaas finally managed in 1590 to install Dybvad in the faculty of theology, once again at another man's cost. It was customary that the professor of dialectics obtained vacant chairs among the theologians, but Master Peder Aagesen now had to give way for Dybvad.

[452] NKS 752 c. fol; trykt i Holger Fr. Rørdam, "Efterretninger om Jørgen og Christoffer Dybvad", *DM* 4R/2. Kbh. 1873, s. 110f.

[453] *Doctrina meteorologica tradita et explicata.* Hafniæ 1578; *De iridis generatione, loco, coloribus, numero et figura, inquisitio optica.* Hafniæ 1578; *De iis, quæ insalubria sunt ex præter naturam, morbæ videlicet...* Hafniæ 1579. The latter dedicated to Parsberg, was published "*ne ad eos solos, qui in hac inclyta Academia literis inuigilant, laborum nostrorum fructus perveniat*".

[454] Rørdam (1873), s. 111. The vicar Johan Pistorius called Dybvad the "*æmulus, insectator et supplantator*" of Hemmingsen, Giessing III, s. 15.

Being professor of theology Dybvad had reached the summit of the academic hierarchy, but gradually his own position was undermined. His career had made him enemies, and furthermore he was cantankerous (or so his opponents claimed) and fell out with his colleagues and the bishop of Sealand, Peder Winstrup.[455] Probably, Dybvad's isolated position at the university would not have mattered much, if not his links of patronage were shipwrecked in these years. In the summer of 1594 his great patron Niels Kaas died. It seems that Dybvad was still supported by Oluf Rosensparre,[456] but although Rosensparre was a member of the royal council and enjoyed the favour of the king, his influence on matters of church and university was completely overshadowed by that of the new chancellor, Christian Friis to Borreby. We do not know whether Dybvad tried to gain Borreby's protection, but the events that followed clearly show that the chancellor certainly did not favour him.

Having obtained his chair of theology, Dybvad concentrated his immense energy on theological matters, and here he made two fatal miscalculations. First of all he misjudged the difference between official ideology and reason of state. Danish theologians were supposed to encourage greater piety and morality, but as far as they carried on controversies against foreign theologians these should always be conducted within certain limits determined by reason of state.

When Dybvad in his writings attacked the Jesuit order in general and Cardinal Bellarmine in particular,[457] he overstepped the mark. This was a good many years before Christian IV would promote himself as the defender of Lutheranism in the late 1620's, and Sweden was regarded the enemy rather than the Catholics. The Jesuits were an influential order connected to several powerful princes, and the cardinal was an influential member of the Curia. But while Dybvad in this case had gone too far, his next theses were downright explosive. Based on Scriptural evidence, he indirectly but quite conceivably, criticised the government's standardi-

[455] Rørdam (1873).

[456] When Dybvad's attempt to provide a curacy for his son's private tutor had been blocked by Winstrup, the man was employed in the grammar school of Landskrona where Rosensparre was lord lieutenant; Rørdam (1873), s. 114ff.; Konsistoriets kopibog 1530-1600, s. 82, 91-92, 112, 136f.

[457] *Theses de tertio præcepto Decalogi*...Cph. 1604.

sation of weights and measures, which he rightly perceived as a concealed increase of the tax burden and denounced as an attempt to exploit the hard pressed peasants The rector of the university, Iver Stub, was alarmed and presented the matter to the Consistorium, but before they could reach a decision, the court had got wind of the matter,[458] presumably through some of Dybvad's enemies among his colleagues.

For the time being, Dybvad received a warning, but continued undaunted by publishing in 1607 a number of theses in which he emphasised the important position of clergymen in society.[459] Now the storm broke loose and the king began a process against Dybvad, putting in charge of the prosecution a nobleman, Jens Bjelke, who had been picked from outside the circles of Niels Kaas and Oluf Rosensparre. Bjelke was a client of the chancellor, and so were professors Johannes Stephanius and Longomontanus. Both men were former clients of Tycho Brahe, who had obtained Borreby's patronage after the fall of their great patron. Stephanius and Longomontanus now summoned Dybvad before the Consistorium.[460] As could be expected Dybvad was sentenced and dismissed, and died a few years later in utter poverty, and his son suffered a similar fate.[461] The man, who took over his chair was Cort Aslakssøn, another assistant of Brahe, who had become a client of Borreby.

The verdict of the Consistorium is quite detailed and informative.[462] Dybvad's controversial theses are reproduced loyally, including his accusations against Cardinal Bellarmine and the Catholics, his claim that sons of ministers should be able to succeed the parish of their father, his condemnation of the standardi-

[458] Rørdam (1873), 122.

[459] *Theses, quibus exponitur præceptum de sanctificando Sabbatho.*.Cph. 1607.

[460] Rørdam (1873), s. 125f.

[461] Christoffer Dybvad (1572-1622) was a student of mathematics and medicine from Leiden. On the basis of a Dutch work he prepared a little treatise (*Decarithmia ded er Thinde-Regenskab*. Leiden 1602), in which decimal arithmetic is explained for the first time in Danish. He was not able to obtain a chair at Copenhagen, but was appointed as Royal Mathematician in 1618. Inspired by Jean Bodin, he was a propagator of absolutist political theory and showed hostility towards the high nobility, not least his father's nemesis Chancellor Borreby. He was sentenced to prison for life in 1620, and died two years later; see KUH III, 316-320, but the case needs to be studied further.

[462] It has been published by H.F. Rørdam (1873), 128ff.

sation of weights and measures, and his emphasis that God has raised all men, including noblemen, to what they are. The verdict can be summed up us follows: Dybvad has broken the Church ordinance through his violent accusations against Bellarmine and the Catholics; he has attacked the majesty and the council of the realm and has raised unnecessary questions about the nobility and its privileges. Theologians are supposed to keep the peace of the Church and must not attack others on their own.[463]

The message is so explicit and detailed that it sounds like an instruction to the professors in general. Borreby tightened the government's control of university life, and professors should not interfere in matters of politics or put doubt on the social order. Dybvad did not manage this balancing act. In vain he pleaded mercy to the king: "*I, poor man, have not put all words politely (politice), since I have never been trained in such matters, but stayed ignorant with theology*".[464]

Such ignorance (or idealism) was fatal in the political climate of these years, but Dybvad might have managed, if his patrons had still been in power. With the death of Niels Kaas, however, the Oxe-circle lost its hold on power. The new chancellor, Borreby, had forced Brahe into exile, taken over most of his clients, and now he purged the university of a man who insisted on the autonomy of Church and University. It was on this stage, and under these conditions, that a distinct culture of natural philosophy was established in Copenhagen.

[463] The verdict is summoned up in Rørdam (1873), 136f. Jesuits could of course be attacked at times when it was in line with the wishes of the government. In his oration from 1618 on the anniversary of Luther's death, Caspar Bartholin would attack Cardinal Bellarmine among other theologians; Caspar Bartholin, *De Luthero Panegyricus*. Cph. 1619, fol. B4r.

[464] Rørdam (1873), 126f.: "*alle ord ere icke stedse sette saa politice af mig fattige mand, som aldrig er øvitt i de ting, men bleffuen huots Theologia enfoldelig*".

The Pious and the Curious

> *First, we use our eyes to observe the divine works, which, say I, are marvellous in heaven and on earth. Then we admire them and explore them closer with the sharpness of our soul and mind, and finally we turn our praise and joy to the creator, as much as possible. Longomontanus (1622).*[465]

In the first part of this book we identified certain structures and developments, which provide the background for the questions we are trying to answer in this part. If the rise of orthodox Lutheranism broke, or loosened, the intimate connection between theology and natural philosophy, what was then the relationship between the two on an institutional level, and how did the individual natural philosopher perceive his science in relation to religion? Moreover, how far did natural philosophers represent a distinct culture, and if so, what was its values and position in society?

It would be convenient if developments in Denmark and Sweden could be lumped together into one analysis. Surely, many of the same intellectual, political and religious phenomena applied to both countries, but the study of nature had a significantly different role in Sweden than in Denmark, and this difference was decisive for the cultural history of science in the two countries. In this long chapter, we shall therefore follow the development of natural philosophy in Denmark in the first half of the 17th century, and then turn to Sweden in the next.

[465] Christian Longomontanus, *Astronomia Danica.* Amsterdam 1622, Epistola dedicatoria: *"ut oculorum adjumento, opera divina, opera inquam miraculosa in cælo & terra intueamur primum; Deinde admiramur; tertio impensius animi, mentisque acie scrutemur; postremo in laudem creatoris, nec non usum nostrum, quoad fieri potest, convertamus."*

1. The Rehousing of the Muses

The natural philosophers that concern us in this chapter were men who more or less succeeded in the game of patronage and entered the scene about the same time when Tycho Brahe and Jørgen Dybvad lost favour. To a large degree they were influenced by the same philosophical traditions as were Tycho Brahe and Petrus Severinus, but although they carried on the urge for observation and experiment, they had to do so within a different context. When Tycho Brahe went into exile, and his former clients died, fell from grace or - as in most cases -were taken over by Chancellor Borreby, natural philosophy was connected to the University and academic culture. This had the implication that it was part of the university hierarchy and system of learning. Thus, while the study of nature at Urania's court had included astronomy, astrology, and chemistry this range of activities was now divided into various disciplines.

Astronomy was the domain of the professor of mathematics at the faculty of arts, but for long he had to do without an observatory and most of the advanced instruments that were at hand at Hven. As for astrology, the casting of horoscopes was one of the most successful ways for young mathematicians to attract the attention of princes and noblemen. We have already seen its importance in the case of Tycho Brahe and Jørgen Dybvad, but there are many other examples.[466] Astrological predictions (*prognostica*), especially if they were published in the vernacular,[467] could however affect the social stability, and were therefore included in the government's tightened control, but they also became an economically lucrative privilege, which was granted according to the rules of the patronage system, although numerous unauthorised almanacs were published in Denmark or imported. In 1578 Jørgen Dybvad had been granted the monopoly on almanacs, but after his fall in 1607 the privilege was granted to a man outside the university, namely the minister Niels Heldvad in 1616.[468] In 1633,

[466] As in the cases of Thomas Fincke and Laurentius Paulinus Gothus in Sweden, cf. Chapter Six below.

[467] Almanacs in the vernacular were every year published by the thousands, and were probably the permanent bestsellers of the period; Appel (2001), Chapter 11.5

[468] Other almanacs were not expressly forbidden, but had to be censured by the professor of mathematics. Niels Heldvad (1564-1634) was a minister from the

the rules for the almanac were tightened and *prognostica* of anything but the weather were forbidden. In 1636 after Heldvad's death the university was regiven the privilege of bringing out an annual almanac *"with predictions on neither commoners nor other ranks nor persons, wars, peace nor such events".*

Chemistry was applied in medicine as far as the so-called *iatrochemistry* (the application of mineral remedies introduced by Paracelsus) went, but as the university had no laboratory, it was bound to be rather theoretical. Practical experience must therefore be gained outside the university itself, at the residences of professors and learned noblemen or abroad,[469] or at Court where Christian IV established a laboratory for his own purposes.[470]

The onslaught on Tycho Brahe was not motivated by hostility towards the study of the stars above and the secrets of minerals, at least not on the part of Chancellor Borreby. Neither did it imply a rejection of many of the natural philosophical notions that had flourished at Urania's court. While the rise of Lutheran Orthodoxy purged the church and theology, the Philippist view on the religiously edifying role of the study of nature prevailed, as did many of the Neoplatonic ideas, which had been adopted by both Melancthon and the circle around Tycho Brahe. The study of nature was given a place in the system of Orthodox learning, albeit a subordinate one. However, the transfer of natural philosophy from Uraniborg to Hven gave astronomers and chemists no chance of acting up to their ideals of observation and experiment. This was equally true in terms of anatomy was we shall see below.

This brings us back to our previous discussion of the two stages of natural philosophy - the lecture room and the Museum. The government's transfer of natural philosophy from Uraniborg to the University and the centralisation of patronage and culture, might lead us to believe that the Museum were absorbed by the

Duchies, who was very successful in the game of patronage. He became a client of the local magnates, the Rantzau family, but also gained the favour of great noble families like the Rosenkrantzes and the Ulfeldts. Finally, he also won the favour of Chancellor Borreby and Christian IV. At Christmas 1615 he was appointed *Calendariographus,* and in January 1616 he became Royal Astrologer; Gregersen (1967); Appel (2001), 410-413.

[469] Only few European universities were equipped with chemical laboratories until well into the 17th century, the first being Marburg in 1609.

[470] See Fjelstrup (1911).

University with the Court being the only alternative setting. This, however, was not the case in Denmark. While natural philosophy at university lived its life according to the division of various disciplines,[471] and - as least as far as lecture lists go - was highly conservative, a culture of natural philosophy emerged in the residences of the professors of medicine in the Latin Quarter of Copenhagen.

The circle of Tycho Brahe had had its patron in its midst, a practising natural philosopher and a friend, although dependency lay behind the ideal equality of the *amicitia* as we have seen. Natural philosophers in the 17th century had their patron, namely the chancellor or the King, at court. He was a double patron in the sense that he was the one who built up or destroyed careers at University, but he was also the one capable of sanctioning, supporting or limiting the pursuits of the Museum - or at least its literary output. It was he (or ultimately the King), who defined the liberty of philosophy vis-à-vis theology, and under the aegis of various royal chancellors, a *de facto* dividing line was established between theology and natural philosophy. While theologians were not allowed to interfere with natural philosophy, natural philosophers refrained from drawing wider conclusions from their acceptance of new theories. As we shall see in Chapter Eight, this was particularly obvious when Cartesianism emerged, and it was a *modus vivendi,* which was to change only when absolutism turned patronage and the evaluation of learning upside-down. Within these limits, however, the members of this predominantly medical culture of natural philosophy had considerable freedom as long as their links to those in power remained intact.

Thus, the difference between lecture room and Museum may seem an academic one, since the same patron set limits or gave liberties at both stages. However, in the Museum, natural philosophers were not bound to the obligations of lecturing. Here physicians established chemical laboratories and were involved in discussions that implied the transgression of disciplinary boundaries. Here lived also a humanist culture of Latin poetry and international correspondence with erudite men (sometimes women) of all confessions. Here the triumphant Muses would be honoured side

[471] Though academics moved from discipline to discipline according to the hierarchy of disciplines, which was also reflected in s hierarchy of salaries, the boundaries of each discipline was jealousy guarded, as we shall see below.

by side with the suffering Redeemer. The household of Caspar Bartholin may have been the notable exception from this, but even he would from time to time adhere to the ideals and practices of Renaissance humanism.

The fact that the patron was no longer part of the circle, also gave natural philosophers a different self-perception. Bourgeois in origin, as professors they were part of an estate of its own, and in the Museum they could furthermore identify themselves with the European Republic of Letters that transgressed the confessional borderlines that limited the outlook of their theological colleagues. We shall elaborate this point below.

2. The Rise of an Academic Dynasty

The culture of natural philosophy in 17th-century Copenhagen was essentially a family business. Nearly all its members belonged to the same extended family, which for more than two centuries provided the University of Copenhagen with professors and developed its own self-awareness. It is therefore no overstatement to talk of a dynasty of Danish natural philosophers in this period, even though the family also included men from other branches of learning. Such academic dynasties were not unusual in early modern Europe, and among other places we find them in Basel and Leiden, academies that were to have enormous importance to Danish natural philosophy, but hardly anywhere can they be said to have been so firmly established for generations as in Copenhagen.

The founder of this dynasty was Thomas Fincke (1561-1656), who came from a merchant family of patricians in Flensburg in Schleswig, which on both sides belonged to the town's elite.[472] He was sent to Strasbourg to study, and like Jørgen Dybvad he began by studying mathematics, an art that was attractive to commoners because of its application in business, navigation, administration, and fortification. In 1583 Fincke returned home, allegedly to put his finances in order, which also included cultivating one's relations, and it seems that Fincke just like Dybvad spent his stay at home to obtain patronage. Coming from

[472] This conglomerate of intermarried merchant familes included among others the families of Fincke, thor Schmeden, and Lange, see Aa. Bonde og J. Hvidtfeldt, *Personhistoriske oplysninger om borgmestre...i Flensborg 1550-1848.* Tønder 1961.

Schleswig, the Fincke-family was undoubtedly acquainted with Heinrich Rantzau, and they were both involved in the cattle trade.[473] Now, Rantzau became young Fincke's patron,[474] probably in connection with the astrological treatise, *Horoscopia*, he published in Rantzau's name.[475]

In the summer of 1583 Fincke also attended the wedding between his cousin Gertrude and the court physician Petrus Severinus in Flensburg.[476] We do not know exactly what went on at this wedding, but it is significant that Fincke's career took a different direction after his meeting with Severinus. He now aimed at a career as a physician, and his travels abroad followed the same route as Severinus had taken. It was undoubtedly thanks to Rantzau and Severinus that Fincke soon after got in contact with powerful noblemen from the court in Copenhagen, men like the chancellor Niels Kaas and his successor Christian Friis to Borreby.

The same summer he went to Basel, where he made contact with Severinus' old teachers Johann Bauhin, Felix Platter, and Theodor Zwinger. They introduced him to medicine, but his acquaintance with Rantzau and Niels Kaas also allowed him to publish a book in his own name and dedicate it to the King himself. This work, *Geometria Rotundi*,[477] deals with the theorems of the sphere and the circle. Influenced by Ramus it deviated from Euclid's axiomatic and deductive method, and introduced new terms (such as 'tangent'). The book raised considerable interest and was republished eight years later.

Geometria was, so to speak, Fincke's farewell to mathematics. He had shown himself worthy, and offered his talents to the king, or rather chancellor Niels Kaas, and now aimed at a career in the more prestigious and well-paid discipline of medicine. After his studies in Basel, he went to Padua, Siena, Pisa and around Italy, only to return to Basel for his doctor's degree just like Severinus. In 1590 he was back in the Duchies, and was employed (probably through Rantzau) as physician-in-ordinary to Duke Philip of Got-

[473] Gregersen (1978), 108f; Lohmeier (2000), 21.
[474] According to Fincke's grandson, Thomas Bartholin, *Cista Medica Hafniensis*. Cph. 1662, 584.
[475] Fincke (1585).
[476] *Peder Hegelunds Almanakoptegnelser 1565-1613*, I-II, ed. by Bue Kaae. Ribe 1976, I, 156.
[477] *Geometria Rotundi Libri XIV*. Basel 1583.

torp. When the duke died the following year, Niels Kaas arranged that Fincke obtained the chair in mathematics in Copenhagen.[478]

So far, Fincke had been a client of Heinrich Rantzau and Niels Kaas, who both belonged to the circle of Peder Oxe and Tycho Brahe, and in the preface to *Geometria*, Fincke praised Tycho Brahe's magnificent skills. But when Kaas died in 1594, Fincke proved himself very skilled in manoeuvring, and succeeded where Dybvad failed, namely in obtaining patronage from the new chancellor Christian Friis to Borreby.

Just like Severinus seems to have changed his allegiance from Brahe, Fincke realised what way the wind was blowing. Already in late 1594, he sided against Tycho in the cause célèbre of the marriage between Tycho's daughter and a university professor,[479] together with champions of centralism like Bishop Peter Winstrup and the future bishop Hans Resen. In 1597 when Tycho Brahe had fallen, the Chancellor sent Fincke to Hven to examine the instruments left by the astronomer.[480] Now Fincke rejected Tycho's instruments as being useless.[481] Tycho, himself had no doubt of what was going on, and expressed it in an Ovidian elegy later that year:[482]

He they sent with one to Hven to spy
Urania, has probed your sacred site,
Was staggered by the splendour he did see
Of instruments, though I left only few.
So ignorant a man, how can he help,
Admitting he's not seen or heard of such ?
Puzzled, stares and asks where they were made,
And how they work, and shows himself the fool;
So that his journey will not seem in vain
Criticises, full of hate, what he does not
Understand. Of course: my foe had sent him,
Long he planned evil, scheming in secret always.

[478] Letter printed in KUH, IV, 365.
[479] See Christianson (2000), Ch. 8.
[480] Instruction dated 2.6.1597, KBB 1596-1602, 163; also printed in KUH, IV, 430.
[481] KBB 1596-1602, 163, letter of 2 July 1597, 163.
[482] TB, IX, 208-211; also printed in *Danske Magazin* II, 319-20; translation by Christianson (2000), 205.

Fincke's amenability was rewarded.[483] In 1602 he obtained the chair in rhetoric, and already the following year one of the professorships of medicine, a chair he occupied until his death fifty-three years later. He became a very successful and popular physician, not least among the royal family, and earned much of a fortune.

Fincke was now able to establish his own system of patronage. As previously mentioned, the process of a patron working for his client can be hard to trace in the source material, as the negotiations were often unwritten. But patronage was not a secret, and once in a while we find it mentioned. As for Fincke, he had a number of physicians as his clients, often men who originated from the Duchies like himself. In his memoirs the physician Otto Sperling recalled how Fincke (whom he calls his patron) had secured him a canonry from the chancellor Borreby, "*by whom he* (i.e. Fincke) *was held in high esteem*".[484] In other words, Fincke the client secured a canonry for his own client, and later he would also find Sperling a wife.[485]

To Fincke, however, the most important part of his clientele were members of his own family. While relations of patronage between commoners and members of the high nobility would never include marriage (with Tycho Brahe's attempt to marry his daughter to a university professor as an outrageous exception), it was quite different when it came to patronage between two non-nobles. In this respect, daughters were important assets, a fact, which has generally been undervalued by historians. Having success and having a daughter meant that you could attach a wealthy, influential, or talented son-in-law to you, paying dowry but avoiding spending money on his education and academic peregrination.

Thomas Fincke was lucky. He had only one son, the later professor of mathematics and physics Jacob Fincke (1592-1663), as well as a foster son, the clergyman Laurids Scavenius (1589-1655) who ended his career as bishop of Sealand. But it was his four daughters that enabled Thomas Fincke to broaden his power base at the University and establish the academic dynasty.

[483] Thus, I cannot subscribe to the view proposed by Grell (1991), 89 that the animosity between Brahe and Fincke was due to a clash of personalities.
[484] *Dr. Med. Otto Sperlings selvbiografi (1602-1672),* ed. S. Birket Smith. Cph. 1885, 29, 42f.
[485] Sperling (1885), 24.

Through a combination of timing, luck, and skill he acquired four talented sons-in-law. Of these, Caspar Bartholin and Ole Worm both became professors of medicine and Jørgen Fuiren became a wealthy physician, while a fourth, Hans Brochmand became professor of theology. So it seems that Fincke in his choice of sons-in-law preferred men from his own profession, medicine, as long as suitable candidates were at hand. For sake of convenience the academic clan of the illustrious families, shall be called 'the Bartholin family' in this book.

But also more distant relatives were part of the dynasty and its power base. These included Tycho Brahe's old assistant from Hven, Longomontanus (1562-1647), who was professor of astronomy at the University for forty years and married to Caspar Bartholin's sister, but as we shall see below, his relation to the Bartholin family was problematic from time to time. Another branch of the family was the descendants of Petrus Severinus who was married to a cousin of Fincke. His son, Frederik (ca. 1587-1637), became a physician, while his son-in-law, Jonas Charisius (1571-1619), became the handyman of Christian IV, especially in foreign politics. To belong to this extended family was regarded as a privilege: "God be praised for the growth of our family" (*DEO sit laus pro familiæ nostræ incremento*) one its members would later exclaim,[486] and the same praise of the family was given in the funeral oration at Fincke's death: "*so many Fuirens, Bartholins, Brochmands, Worms... What men! What an admirable learning! What lights in the Church! What an honour to the University! What a glory to the fatherland (patria)!*"[487]

While Fincke himself cannot be said to have taken particular interest in new developments within natural philosophy, it was among Fincke's relatives and clients that a culture of natural philosophy emerged at the University of Copenhagen in the first half of the 17th century. In an age when several professors fell from grace under the suspicion of crypto-Calvinism, and when intrigues at court could make patronage a precarious gamble, the Finckes,

[486] Thomas Bartholin, *Cista medica Hafniensis* (1662), 587. At that time Bartholin counted 107 descendants of Thomas Fincke.

[487] Christian Ostenfeld, *Oratio in obitum... Thomæ Finckii* (1656), 17. The learning of the family was also praised at the death of Caspar Bartholin's wife in 1677, C.P. Rothe, *Brave Danske Mænds og Qvinders berømmelige Eftermæle,* I (1753), 105.

the Bartholins, and the Worms prevailed, and the prestige of their family became connected to that of the University (which again was connected to that of the kingdom) as is evident from the history of the University that Caspar Bartholin wrote.[488]

3. Medicine and Philosophy

Since Fincke quickly turned into an administrator and lost interest in publishing or teaching, it was left for his sons-in-law, Caspar Bartholin and Ole Worm to teach medicine at the University in the first decades of the 17th century. They lived in an age of transition in natural philosophy, and their views on natural philosophy show many similarities, but also some important differences.

First of all, the two men were academics, university professors, and despite their frequent praise of observation and experiment they regarded philosophical training as essential to anyone who wanted to engage in natural philosophy. In the *philoteca* of his future brother-in-law, Ole Worm, Bartholin had written, that "*The physician who is a philosopher, is the equal of the gods*",[489] and to both men philosophical training was fundamental for any one who tried to uncover the secrets of Nature. In a letter to the medical faculty in Basel, Worm also emphasised the connection between medicine and philosophy: "*There is an unbreakable connection between medicine and philosophy, since medicine is the child of philosophy*".[490]

But what was meant by 'philosophy' in the opening decades of the 17th century? To academics like Worm and Bartholin 'philosophy' in the first instance meant academic training, i.e. sufficient grammatical and rhetorical skills to be able to mentally structure and present the subject matter orally or in writing, combined with training in dialectics to juxtapose differences of opinion and draw conclusions. These fundamental skills were learned by all students at the Faculty of Arts when they entered university, and must be acquired before a student could move on to the Faculty of Theology, Medicine, or Law. Thus Caspar Bartholin would rec-

[488] Caspar Bartholin, *De ortu progressu et incrementis Regiæ Academiæ.* Cph. 1620.
[489] Worm's unpaginated, *Philoteca,* which is stored in Nationalmuseet in Copenhagen. In the *Investigations to Aristotle's First Philosophy* (see below) Sommer had written that "He who lives by the speculative intellect, lives like a God", cf. Wundt (1939), 52-54.
[490] OWB, I, 20.

ommend his textbooks in rhetoric and logic to the student of medicine.[491] In addition to the skills that concerned the acquisition, expression, structure, and form of knowledge (philology, rhetoric, dialectics), the Faculty of Arts also taught the subjects concerning the *content* of natural philosophy – astronomy, physics, mathematics, and geometry. According to Ole Worm, a man could never develop into a good physician without such skills, and in his letters he once and again rages against "Empirics" (*empirici*), physicians who practice without sufficient philosophical training.[492]

Originally, the Empirics had been one of the medical schools of the Hellenist world, which strongly emphasised experience over theoretical knowledge. Galen, was sympathetic towards their emphasis on experience, but could not embrace their rejection of theory in medicine.[493] In the 17th century, 'Empirics' often meant Paracelsians, but the term still referred to a man whose knowledge of medicine was derived from experience only. Worm and his likes used the word in a pejorative sense and regarded Empirics as nothing but quacks. They might cure people through a stroke of luck, but more often they would harm the patient. On the other hand, Paracelsist physicians who were university trained, like the Frenchmen Theodore de Mayerne and Joseph Duchesne (Quercetanus), were highly regarded by Worm.

Apart from referring to general academic training, 'philosophy' also had a particular meaning to physicians like Worm and Bartholin. As already noted, the academic peregrinations of medical students differed from that of the typical of Scandinavian student, who aimed at an ecclesiastical career. While the latter went to the universities of Lutheran Germany, the former studied in Western Europe and Italy. The peregrination of Thomas Fincke followed that of Petrus Severinus, and so did the peregrinations of Caspar Bartholin, Ole Worm and Jørgen Fuiren. They all studied in Padua, and they all took their doctor's degree in Basel, and precisely these two universities provided an approach to natural philosophy different from that of Northern European scholasticism.

John Randall Jr. has coined the term 'the school of Padua' as a collective name for the specific variety of scholasticism that flou-

[491] Caspar Bartholin, *De studio Medico* (1628).
[492] OWB, I, 10, 85, 348; II, 32, 266; III, 480.
[493] Temkin (1973), 15f.

rished at the Northern Italian university from the 14th century and well into the 17th century.[494] During the middle ages, the role of Aristotelianism at Italian universities such as Bologna and Padua had developed in a different way from that of Paris and other transalpine universities. At most Italian universities theology was either absent or played a marginal and subordinate role. These universities had begun as schools of medicine and law, and therefore took a particular interest in medical authorities like Averroës and Galen, who also discussed problems of logic and method and whose views on scientific discovery originated in medicine and differed from Aristotelianism in various ways. Their most significant difference to Northern European scholasticism was the emphasis put on the observation of individual phenomena, especially in terms of signs and symptoms of disease. As theologically orientated scholasticism had God as its starting point, and worked to give a rational explanation of Christian dogmas, it was mainly interested in the method of deduction treated in Aristotle's *Posterior Analytics (Analytica posteriora)*, that is, how to draw conclusions from given premises.

However, To Galen and Averroës and their commentators, who as physicians were concerned with how to establish a diagnosis based on symptoms, a special interest arose in a method that moved from particulars to universals, which Aristotle had put forward as a counterpart to deduction (and called *epagoge*)[495] and may be translated as 'induction'. Furthermore, there was in the medical tradition an appreciation of mathematics, partly inherited from Galen who highly appreciated geometrical axioms.[496] Knowledgeable of both the Aristotelian and medical tradition, as well as giving a prominent place to geometry, Renaissance physicians were - as Neal Gilbert has pointed out - in forefront of the controversies of scientific method of their day, while at the same time being the

[494] J.H. Randall, Jr: *The School of Padua and the Emergence of Modern Science.* Padua 1961; see also, N.W. Gilbert, *Renaissance Concepts of Method.* New York 1960, esp. 98ff; for an introduction to Galenism in general, see O. Temkin, *Galenism. The Rise and Decline of a Medical Philosophy.* New York 1973. The most comprehensive study of Averroism is still E. Renan, *Averroës et l'Averroïsme.* Paris 1866, though partly outdated.

[495] Aristotle, *Topics* 105a 13, 156 a 5; *Posterior analytics* 67 a 23, 71 a 21.

[496] Temkin (1973), 11.

most prominent antagonists of Humanist inventions in logic and method, such as Ramism.[497]

The Italian school of medicine had no intent of turning 'empiric' by abandoning theoretical knowledge and terminology altogether. Generally, the aim was to combine a deductive method (the demonstration *propter quid*) with an inductive method (generally referred to as the resolutive method, the demonstration *quia* or syllogism from sign), based on experience in pathology, pharmacology and the new flourishing art of anatomy. The culmination of the Paduan concern with method was reached with Jacopo Zabarella (1533-1589), whose views dominated discussions in Padua, when Thomas Fincke and his sons-in-law studied there, and whose portrait Fincke had sent from a friend in the Northern Italian town.[498] Zabarella was a great expert and admirer of Aristotle, but he was also aware of lacunas and obscurities in the works of the Peripatetic. He clarified the discussion of method, partly by drawing on other Greek writers, and limited the number of scientific methods to two, namely deduction and induction, both methods moving from the known to the unknown. Zabarella's treatises on logic were widely read, also in Northern European countries such as Germany and England, and he was the period's most systematic writer on inductive method. However, the impact of Zabarella and the Paduan discussions on method to the emergence of the experimental scientific method can be overestimated. To Zabarella as an Aristotelian logician, scientific demonstration, whether deductive or inductive, was the right application of syllogisms.[499] His serious and systematic discussion of induction was important, but methods of studying the particulars within the various sciences were beyond his domain, and he was no prominent advocate of observation and experiment.

Zabarella was only one voice in a 16th-century chorus that for various reasons and from various positions put greater emphasis on practical experience in the study of nature. A substantial number

[497] Gilbert (1961), 99.
[498] OWB, III, 213.
[499] Gilbert (1961), 172; cf. Ernst Cassirer, *Das Erkenntnisproblem in der Philosophie und Wissenschaft der neueren Zeit.* Berlin 1906, I, 146 and particulalry H. Mikkeli, *An Aristotelian Response to Renaissance Humanism. Jacopo Zabarella on the Nature of the Arts and Sciences.* Helsinki 1992; on Zabarella's views on method, see Gilbert (1961), 167-173.

of such voices came from Basel, which had influenced the views of Danish natural philosophers like Christian Morsing, Tycho Brahe, Petrus Severinus and Johannes Pratensis.[500] To the physicians in the Bartholin family the medical faculty in Basel provided an ideal for scientific method, and if Thomas Fincke and his sons-in-law initially had a role model, it was the famous medical families who ruled in there - the Zwingers, the Bauhins, and the Platters.

In the 16th century Basel was a melting pot of thought currents, and reflected the hectic intellectual activity that had seized Central Europe. Erasmus had lived there for several years, both Paracelsus and Petrus Ramus had stayed there for a while and won followers, and first of all the Swiss city was one of the major European centres of book printing and dominated publications of Paracelsian, alchemical and Hermetic treatises.[501] Here the works of Renaissance Neoplatonists like Pico della Mirandola, Marsilio Ficino and Johannes Reuchlin were published together with numerous Paracelsian, Pseudo-Paracelsian and Ramist treatises. As has been shown in a thorough study by Antonio Rotondó, this extensive publication of philosophical treatises that stood outside the Scholastic tradition of Aristotelian, Galenic and Averroist natural philosophy contained two elements of protest vigorous in the intellectual environment of the Swiss city.[502]

First of all, it was a protest against the religious monopoly of the established churches reflecting the protest found in early Lutheranism, Zwinglianism and in the views of many radical reformers. Secondly, and in connection with this, it was a protest against the authority of Aristotle and Galen. To a certain degree it was an extension of the humanist battle against Scholastic philosophy and authority, and like that battle it also contained religious, sometimes social, overtones with Paracelsus as one of its most prominent examples. In the 16th century, the battle between Paracelsians and Hermeticists on the one side and University authorities on the other was closely linked to religion, and once and again Paracelsists, Hermeticists, Neoplatonists, and Sceptics were accused of working against true religion.

[500] For medicine in Basel in this period see Burckhardt (1917).
[501] See Gilly (1977), 64ff.
[502] Antonio Rotondò, 'Pietro Perna e la vita culturale e religiosa di Basilia fra il 1570 e il 1580', *Studi e Ricerche di storia ereticale italiana del Cinquecento.* Turin 1974, 273-391, esp. 342ff; see also Gilly (1977), 66ff.

Within medicine the conflict accentuated the problem of individual experience vis-à-vis established medical authority, and out of this conflict a distinct Basel approach to medicine evolved. One of the most important figures in its development was Theodor Zwinger (1533-1588), very famous in his own day as a representative of humanist medicine.[503] Before he turned to medicine, which he studied in Padua, Zwinger pursued the study of languages in France, had been in contact with Petrus Ramus and been apprenticed to a publishing house. His medical dissertation in Basel was an attack upon the Paracelsian application of mercury as a remedy for syphilis,[504] but from the 1560s, his experiences during plague epidemics gradually began to shake Zwinger's confidence in established medicine. As a good humanist, he turned to what he considered the original source of medical knowledge, and published a commentary to Hippocrates.[505] He thus bypassed authorities like Galen and Averroës, who played such a prominent role in discussions in Padua, and like most humanist scholars who turned to the original sources, Zwinger found incongruence between the "original" (as he saw it) Hippocrates and later commentators.

As a humanist and Protestant, Zwinger turned against scholastic sophistry, which was only concerned with empty speculation, and as a physician he took a more concrete approach to induction than Zabarella. In his commentary to Hippocrates he claimed that Man has three instruments for exploring all arts and sciences. We have an innate ability to discover, judge and learn (*ingenii acumen*), which is a gift from God. This ability can be stimulated and enforced through teaching (*institutione et doctrine*), but to get proper knowledge of things, we must make our own experience through the practice of the things in our hands, χειροτριβιη or *scientia operum naturae.* This practice, which in medicine means practical experience in treating disease and applying remedies, distinguishes true science from sophistry, and is also

[503] For Zwinger, the standard biography is J. Karcher, *Theodor Zwinger und seine Zeitgenossen.* Basel 1956, but see also C. Gilly, C: 'Zwischen Erfahrung und Spekulation. Theodor Zwinger und die religiöse und kulturelle Krise seiner Zeit', *Basler Zeitschrift für Geschichte und Altettumskunde* 77 (1977), 57-137.

[504] Burckhardt (1917), 90, 94; Gilly (1977), 92ff.

[505] Theodor Zwinger, *Hippocrates Coi Asclepiadeae gentis sacrae coryphaei Viginti duo Commentarii Tabulis illustrati* etc. Basel 1579.

important for abstract thinking since abstract terms derive from sense experience.[506]

Zwinger had an eclectic approach to science in general, and to medicine in particular, and emphasised that no individual philosopher or school of philosophy knows everything.[507] Here he was in line not only with Galen (who combined Platonic, Aristotelian, and Stoic thinking), but also with numerous contemporary thinkers like Melanchthon and Paracelsus, as well as Giovanni Pico della Mirandola, whose collected works were published in Basel during those years. In the second part of his celebrated *Oration* (and repeated almost verbatim in his *Apologia*) Pico had insisted that he was not bound by the doctrines of any master or school, but has investigated all of them and chosen something from all of them.[508]

It was this general eclectic tradition of picking something from all schools of philosophy that influenced Francis Bacon and numerous other contemporary philosophers, among them Danes like Petrus Severinus,[509] Caspar Bartholin,[510] and Ole Worm, not the specific Renaissance idea of a *prisca theologia* that lay at the root of Hermeticism as propagated by Marsilio Ficino. This wide-

[506] Zwinger (1579), 85f.

[507] Gilly (1977), 103.

[508] Pico, *De hominis dignitate, Heptaplus, De ente et unom e Scritti vari*, ed. E. Garin. Florence 1942, 138-162; Pico's *Apologia* is found in *Opera.* Basel 1572, 117-124. Some scholars, among them Frances Yates, have put too much emphasis on Pico's 'occult' and Neoplatonic humanism. As Dr. Kristeller has rightly emphasised, Pico was closer to scholasticism than to humanism, and thus possible to embrace by men who wanted to reform scholasticism, but held back from Neo-Platonism, see Paul Kristeller, *Eight Philosophers of the Italian Renaissance.* Stanford 1964, 54-71.

[509] Severinus had undoubtedly been influenced by Zwinger, but although the problem has not yet been thoroughly studied, it also seems that Zwinger was influenced by Severinus, and that the Danish physician, with whom he corresponded for the rest of his life, stimulated his accept of certain Paracelsian ideas. Zwinger regarded Severinus' *Idea* as the best Paracelsian work, but was afraid that it was too learned for the Paracelsians, and too critical for the academic physicians; Gilly (1977), 126; Grell (1995), 81.

[510] Caspar Bartholin would thus echo Zwinger in emphasising that wisdom must be sought from numerous sources since '*nature has not given all knowledge to one man*': "*Neq. n. uni mortali omnen scientiam prodigiosa quadam prodigalitate infudit natura...*", Caspar Bartholin, *De studio medico inchoando, continuando et absolvendo.* Cph. 1628, 5a

spread idea, "*one of the great clichés of Renaissance culture*" in the words of Anthony Grafton, went that God had given a complete understanding and mastery of nature to certain virtuous men of the ancient past, beginning with Adam. Due to the Fall of Man this knowledge had generally been diminished over time, but it had been transmitted by individual sages among the ancient cultures of Babylon, Israel, Egypt, and Greece.[511] Some philosophers like Guillaume Postel and his followers also included the ancient Celtic druids in this series of transmission, or the ancient Goths as did the Swede Johannes Bureus with whom we shall deal in the next chapter. The idea of the *prisca theologia* did not necessarily imply that knowledge could not advance through the ages,[512] but it definitely contained the notion of a corruption of Man's knowledge of nature over time, of a golden age of knowledge and magic in the ancient past, and (perhaps most importantly) the idea that there was one, and only one tradition of true understanding of nature from which all ancient traditions were derived - astronomy, astrology, Cabala, magic, Pythagoreanism and Platonism.

One of the first onslaughts on the idea of a *prisca theologia*, partly based on religious notions, came from Pico who had once been one of its own propagators.[513] He denounced the Egyptian and Babylonian inventors of astrology for their failure to develop a sound scientific method and criticised their arbitrary application of mathematical procedures and random creation of explanatory analogies, instead of working by the proper method of trial and error.[514] More important in our context, however, is the fact that Pico not only devalued the supposedly perfect Babylonian astrology/astronomy, and saw the Greeks as the true founders of that science. He claimed that the science of astronomy had not been revealed by God in its fullness to ancient sages, but was the product of a perfection by generations, even centuries, of human effort.

[511] See Yates (1991), passim; Walker (2000), 23 and passim.

[512] As in Ficino: '*Hence there is one ancient theology (prisca theologia)...taking its origin in Mercurius and culminating in Divine Plato*'), see Yates (1991), 14.

[513] *Disputationes adversus astrologiam divinatricem* (1494). This first part of the book was the only one he finished. Though it was left unpolished it was included in his *Opera omnia* that were published in Basel in 1572 and proved highly influential. As noted by Dr. Grafton, his critique of the astrologers strikingly resembles Aristotle's critique of the Pythagoreans (*Metaphysics* 985 b 23 ff).

[514] Opera omnia (1572), XII.3-XII.5, 721-727; see Grafton (1983), 218ff. for a more detailed account of Pico's critique of ancient astrology.

This sense of progress in natural philosophy ran counter to the idea of the *prisca theologia* and was taken up by the great French philologist Joseph Scaliger, for whom Worm and his friends had unlimited admiration,[515] and they were well familiar with Scaliger's numerous publications.[516] In his commentary to Manilius' treatise on astrology, Scaliger took up and elaborated the idea that although the Greeks undoubtedly had inherited astronomical data and elementary concepts from the Near East, astronomy had become much more sophisticated after the Greeks set to work upon it and had developed mathematical methods and geometrical models of their own.[517] Thereby he rejected the widespread assumption, that priority in time implied superiority in doctrine. Rather, priority meant crudity, and astronomy had advanced as a result of trial and error rather than declined as time passed. Furthermore, though this is not central from our point of view, Scaliger's commentary was a minute refutation of the call of Ramist mathematicians for an astronomy without hypotheses - an astronomy that merely recorded events in the heavens without relying on the geometrical models of planetary theory.[518] In short, from men like Zwinger, Pico and Scaliger, Danish physicians learned that the various sciences could and did improve during the ages, and that this improvement was not the result of divine inspiration, but of generations of work on the trial of hypotheses. As a result, useful knowledge of natural philosophy could be gathered from a number of sources and one must take into account the historical context in which they were produced.

Finally, influenced by humanism Zwinger made a distinction between active and inactive knowledge (σοφία *otiosa et negotiosa*), and only the latter that serves everyday life, can be called true science, not an abstract (μέθοδος ἄτεχνος), but a practical knowledge that leads to action (μέθοδος τεχνική).[519] In this way,

[515] OWB I, 44; Worm (1619), fol. H4r; for Scaliger, see the brilliant study of Grafton (1983).

[516] During his studies at Marburg, Worm followed Goclenius' lectures on the commentaries to Julius Caesar Scaliger's (the father of Joseph) commentary on Cardano's *De Subtilitate.*

[517] Grafton (1983), 210-223.

[518] Grafton (1983), 215ff. In the 1580s also Tycho Brahe, whom Ramus had tried to win over for his view on astronomy, rejected it, see Brahe, Opera omnia (1919), 88f.

[519] Zwinger (1579), 81.

Zwinger not only turned against traditional academic medicine, but by focusing on the practical aspects of medicine, he also removed it from logic and theology. On the other hand, he did not wish to abandon deduction, and he was aware of the dangers of anarchy in the sciences, which in his opinion would be even more intolerable than dogmatic tyranny.[520] Thus, Zwinger, and with him Danish natural philosophers like Severinus, Caspar Bartholin and Ole Worm, was a conservative reformer. Academic freedom, i.e. the right to criticise authorities and make innovations, was only allowed for the elect few. These few were not only supposed to be talented men, they were also supposed, and this needs to be emphasised, to refrain from futile controversy and social protest and subordinate themselves to sound theological dogmas (i.e. those based on Biblical authority). Innovation in natural philosophy was not supposed to turn society or religion upside down.

4. The Return of Metaphysics

In the years around 1600 induction and experience was thus emphasised by many European intellectuals, given a foundation in logic by Zabarella, applied to medicine and married to eclecticism and moderate humanist critique of established authorities by Zwinger and moderate Ramists and Paracelsians. Furthermore, there was the anatomical tradition established by Vesalius, and the urge for careful and systematic astronomical observation propagated by Tycho Brahe. All these men were moderate reformers, who despite their careful scrutiny of established academic opinions, were not engaged in social protest or religious reform, although many of them were influenced by Neoplatonic ideas. Furthermore, there were numerous (al)chemists and physicians, many of them influenced in varying degree by Paracelsus, who were concerned with experiment and the solution of practical problems without connecting it to a coherent philosophy of nature. Finally, there were men like the French surgeon Ambroise Paré (1510-1590), who had no academic training, but gathered his experience of wounds on the battlefields of Europe, and despite opposition from the Medical Faculty in Paris, published numerous works on wounds and disease.

[520] Zwinger (1570), 102; idem (1579), fol. β 3r.; Gilly (1977), 105f., 108f.

However, the decades around the turn of the century also witnessed a movement in the opposite direction, namely towards greater emphasis on metaphysical speculation. This endeavour was mainly connected to theology, but it would be simplistic to paint a double portrait of the intellectual currents of that period - growing emphasis on induction and sense experience in natural philosophy on the one hand, and deductive metaphysical speculation on the other, with no connection between the two. This is evident in the example of Caspar Bartholin, a physician who was clearly influenced by the urge for experience, but at the same time was the man who introduced the new metaphysics into Denmark.

In 1594 Tycho Brahe had received an Introduction to Aristotle's Metaphysics dedicated to him by Daniel Cramer, a young professor of logics in Wittenberg.[521] Cramer (1568-1637) had been the mentor of Tycho's relative, Holger Rosenkrantz, during the young nobleman's studies in Rostock and Wittenberg. He had visited Uraniborg, and the book was an attempt to win the favour, probably patronage, of Brahe. In the dedication Cramer pleads for the study of metaphysics, and goes a long way to vindicate the companionship of Astronomy and Metaphysics. The latter *"...contemplates the sky with you; it looks at the motion, it does not quantify the celestial bodies (as does astronomy), but investigates the principles of their motions, and brings together the movers and the motion, the secondary (movers) with the secondary (motion), the prime (mover) with the primary (motion) so that you may raise your head towards something higher".*[522] In other words, metaphysics aimed at finding the universal, divine and higher causes from the phenomena.[523]

Apart from this, Cramer elaborates the virtues of contemplative life, its stability and peace of mind, compared to the stormy

[521] Danielis Crameri, *Isagoge in Metaphysicam Aristotelis; Quæstionibus rotunde & dilucide comprehensa: In usum & gratiam Tyronum qui ad lympidos ipsius Philosophi fontes primum contendunt.* Hanover 1594.

[522] Cramer (1594), 5: *...quæ tecum cælos contemplatur: motus aspicit: non quidem ut τὸ πόσον in iis numeret, (hoc enim ad tuam Astronomiam) sed ut aliquanto altius assurges, principia illorum motuum quærat, & ex motu motores, ex secundo secundos, ex primo primos colligat.*

[523] Cramer (1594), 5f: *...ut ex posterioribus his Effectis, causas universales, Entia diviniora, Ens supremum indaget & inveniat.*

life of a courtier, and flatters Brahe unashamedly. At a glance Cramer's preface may look as little more than just another attempt to flatter a potential patron, but actually his defence of metaphysics was not as commonplace as it may seem, and was in fact a forerunner of the general return of metaphysics to academic life. And despite the fact that Cramer's aspirations with metaphysics appear philosophical and religious in a general sense, rather than strictly theological, the return of metaphysics was closely linked to theological developments.

To the Wittenberg Reformers metaphysics had been the very embodiment of scholastic absurdity. Martin Luther had vehemently turned against it, and also Melanchthon had ejected it from his system of learning (although metaphysical terms were extent in his textbooks on physics and psychology).[524] Petrus Ramus had been disgusted by its artificial language and endless distinctions, and Zaberella and other Italian propagators of 'original' Aristotelianism had likewise omitted it. In the wake of the Council of Trent, however, the Catholic Church adopted the new Italian Aristotelianism (in combination with Thomism), revived metaphysics, and used it as one of the weapons of the Counter-Reformation. It was employed in the highly successful educational and missionary program of the Jesuit Order, and metaphysics was regarded as essential to theological polemics.

It was, one could say, an intellectualisation of theology at a time when both Catholic and Protestant church leaders were in despair. Despite advances deep into France and Central Europe, the Reformation had been haltered and split into various sects, and the Council of Trent proved that the schism between Protestants and Catholics was beyond redemption, a reconciliation of (Western) Christianity impossible. In this situation, theological polemics became a warring zone. Here metaphysics was highly useful, and Iberian Jesuits like Petrus Fonseca and Francisco Suarez wrote elaborate treatises and commentaries on metaphysics.

Protestant theologians were naturally not immune to this development, and a Philippist like David Chytraeus could point out that also Melanchthon had acknowledged the value of meta-

[524] The following is based on Max Wundt, *Die deutsche Schulmetaphysik des 17. Jahrhunderts. Heidelberger Abhandlungen zur Philosophie und ihrer Geschichte 29.* Tübingen 1939, esp. 34-69.

physics.[525] The rally of the Catholic Church and the success of the Jesuit Order in winning back some of the territory lost during the Reformation was in itself disturbing. Against the claim of Catholic theologians that the Word of God is Scripture as well as "verbum Dei non scriptum" and the claim of mystics like Schwenckfeld and Weigel of the superiority of "the inner word", Protestant theologians began from the 1590s to insist on the authority of the Bible.[526] This insistence on the principle of "sola scriptura" was, however, not a return to the theology of Luther, but marked a new and more intellectual kind of theology. Despite his high reverence for Scripture, Luther had not identified Scripture with the literal Word of God. This Word, the Holy Spirit, permeated the Bible, but was only present in preaching within a community of believers. The self-proclaimed 'Orthodox' Lutherans, on the other hand, identified Scripture with the Word of God, and gave de facto primary importance to reading instead of preaching. It was an intellectualisation of theology, which in many places coincided with political centralisation and the decline of the ideal of the priesthood of all believers in official church life.

This intellectualisation of theology was reinforced when metaphysics also began to return to the curriculum of Protestant universities. Both the theological treatises (such as the *Loci communes*) and the philosophical treatises of Melanchthon, proved too unsystematic and diffuse to form the basis of dogma, particularly against the onslaught of brilliant Jesuit missionaries. In Germany, particularly in Wittenberg, the return of metaphysics was inspired both by the Aristotelianism of Zabarella and the theologically orientated scholasticism of the Jesuits, but some coexistence between a philosophical emphasis and a theological one seems to have been possible. Cramer's arguments for pursuing metaphysics were religious but not specifically Lutheran. Another example is *Investigations to Aristotle's First Philosophy* that appeared in Wittenberg in 1596[527] with a foreword by the professor of theology Salomon Gesner. While Gesner only sees metaphysics from a Lutheran

[525] According to Jacobus Thomasius, *Erotemata metaphysices.* Leipzig 1705, 75f.

[526] On Protestant Orthodoxy, see H.E. Weber, *Reformation, Orthodoxie und Rationalismus,* I-II. Gütersloh 1937 and H. Leube, *Die Reformideen in der deutschen lutherischen Kirche zur Zeit der Orthodoxie.* Leipzig 1924.

[527] *Quaestiones in primam Aristotelis philosophiam.* Wittenberg 1596; see Wundt (1939), 52-54.

point of view, and emphasises its usefulness as a weapon against the Calvinists, the author, Zacharias Sommer, talks enthusiastically about Man's striving for knowledge. While Gesner claims that ancient philosophers like Heraclitus, Democritus and Epicure were inspired by the Devil, Sommer praises ancient philosophy. In other words, even in Wittenberg, a philosophical and theological application of metaphysics could co-exist.

It was Caspar Bartholin who imported the new metaphysics to Copenhagen, where a chair of metaphysics was eventually established in 1619. During his years abroad Bartholin had had to earn his living as a private teacher, and had written student manuals for various disciplines within the Faculty of Arts, including physics, astronomy, and logic.[528] In Wittenberg where he studied theology under Jacobus Martini, however, he also became acquainted with the new metaphysics, and soon wrote some of the most popular textbooks on metaphysics in this period.[529] Bartholin was talented, and his textbooks were highly popular in Northern Europe and had several reprints in Wittenberg, Strasbourg, and Rostock, despite the fact that they contained nothing original, or rather *because* they contained nothing original. Bartholin's talent was a clear exposition, while his method was compilation. The verdict of historians of logic has been harsh on these textbooks,[530] but to point out that Bartholin was unoriginal is to miss the point.

While Bartholin in logic and metaphysics was essentially a scholastic,[531] he compiled technical terms and opinions from the

[528] Caspar Bartholin, *Exercitatio physica de natura.* Wittenberg 1605; idem, *Exercitatio de stellis* etc. Wittenberg 1606, new enlarged edition Wittenberg 1607 and 1609. Republished under the titles *Astrologia seu De stellarum natura.* Wittenberg 1612 and *Astrologia seu siderum natura.* Wittenberg 1616 and Cph. 1624; idem, *Enchiridon logicum ex Aristotele.* Strasbourg 1608, new editions Wittenberg 1618, Strasbourg 1631 and under a new title *Logica major locupletata ex Aristotele.* Cph. 1635.

[529] Caspar Bartholin, *Enchiridion metaphysicum* (1608); *Enchiridon metaphysicam ex philosophorum coryphæi Aristotelis.* Strasbourg 1610, new editions Geneva 1611, 1613 (no place of publication), Cph. 1619 and 1624, Strasbourg 1625, and Rostock 1644. Later he also published a textbook on moral philosophy, *Enchiridon ethicum seu epitome philosophiæ moralis.* Cph. 1615, reprint 1618. New edition Rostock 1618, reprinted 1630 and 1635.

[530] Such as Wundt (1939), 111 and Risse (1964), 458: '*Martinis Schüler Bartholinus schrieb dann in seinen äusserst bescheidenen, aber viel gelesenen Lehrbüchern lediglich aus besseren Werken ab*'.

[531] For an analysis of Bartholin's books on logic, Sten Ebbesen (2001).

whole thesaurus of Western philosophy. When giving a philosophical term, Bartholin translates it into all philosophical schools of his day, with no thought as to the different context of each term. In a preface to his book on metaphysics, Bartholin gives a list of "the name of those who by their writings have illuminated the Metaphysics and reached our hands".[532] These include the Byzantine Michael Psellus and other medieval philosophers such as Alexander of Hales, Albertus Magnus, Thomas Aquinas, Duns Scotus, as well as his contemporary Clemens Timpler. As it has been pointed out,[533] it is doubtful whether Bartholin had read all these authors, but by mentioning them he placed himself within the general tradition of European thinking.

Bartholin's textbooks were specifically designated for classroom use, and were a continuation of the textbooks of medieval universities. But while medieval textbooks in philosophy were almost exclusively concerned with the Aristotelian corpus, Bartholin lived in an age with a much greater variety in philosophical traditions and terminology.[534] The purpose of Bartholin's philosophical textbooks was not only to train students in philosophy, but also to enable them to counter the arguments of opponents. This was probably the reason for their success in Protestant Europe. By making students familiar with a number of definitions and technical terms, they could relate the terms used by their opponents to the system they were familiar with. Most students would later move on to theology, and in an age when Lutheranism was on the defensive against the polemics of highly educated Jesuit and Calvinist theologians, Bartholin's textbooks were useful indeed. They were not inspired by 'Man striving for knowledge' (in the word of Zacharias Sommer), by the urge for a consistent system of philosophy, but by a formalism directed at practical aims - the student's need to get around in an intellectual climate of theological controversies and an infinitude of philosophical terms.

[532] *Enchiridion Metaphysicum*, unnumbered page: '*Nomina eorum qui Metaphysicam scriptis illustrarunt, & ad manus nostras pervenerunt*'.
[533] Ebbesen (2001), 209.
[534] For philosophical textbooks in the middle ages and the Renaissance see Charles B. Schmitt, 'The rise of the philosophical textbook', *The Cambridge History of Renaissance Philosophy*, ed. Charles B. Schmitt and Quentin Skinner. Cambridge 1996, 792-804.

Metaphysics was also useful to practical religious problems. In 1631, the bishop of Ribe, Jens Dinesen Jersin, who had held the first chair in metaphysics in Copenhagen, was faced with a surge of religious revival in his diocese. Numerous miracles, portents and omens were reported, and the good bishop wrote a manual to his vicars of how to distinguish between genuine revelations from God and the works of the Devil. The manual was written in the vernacular, and avoided technical terms, but I think it is evident how metaphysical thinking underlies most of Jersin's distinctions.[535]

At the University of Copenhagen, Bartholin employed this eclectic method and became a very popular teacher. Also Ole Worm used the method in his lectures in Copenhagen, for example in his discussion of the term 'Nature' (*natura*).[536] He gives six meanings of the term:

1. The divine spirit that is the creator of all things (*Natura naturans*) as used by Cicero and the Stoics.
2. The meaning of all things.
3. The totality of all created things as used in Aristotle's *Metaphysics* chapter 12.
4. Natural causes, as when we say that God and Nature never acts without a cause, or that Nature does not allow an empty space.
5. The temperament of every spiritual being, as used in the pathology of Galen.
6. The birth of living beings, the literal meaning of birth, just like φύσις derives from φύειν, thus meaning the inner principle of all things.

Then Worm proceeds to a critical scrutiny of the six definitions of the term given by the Portuguese Jesuit Petrus Fonseca. The eclectic philosophical method applied by Bartholin and Worm was not intended to discover anything remotely original,

[535] Jens Dinesen Jersin, *Om Miracler, Tegn oc Obenbaringer, og deris udleggelse.* Cph: Melchior Marzan 1631. This manual and the religious awakening in Jutland in the 1620s still needs to be studied, but some information is provided by the biography on Jersin, S.M. Gjellerup, *Biskop Jens Dinesen Jersin.* Cph. 1868-70.

[536] KUH III, 387f.

but as a canon to give future clergymen the tools to oppose religious opponents (such as students of Fonseca) by scholastic arguments.

Worm, and especially Bartholin, were highly successful in applying this method in creating useful tools for official church policy. When they moved on to the faculty of medicine, however, the framework changed somewhat. The few students who moved from the faculty of philosophy to the study of medicine were meant to become future physicians, moving around the elite of society, and a greater spirit of enquiry was allowed.

Despite the attacks directed against Aristotle and scholasticism from Paracelsians, Ramists, religious reformers, and others, the scholastic structure and way of teaching still dominated European universities, not least for the simple reason that there was no coherent alternative. Ramists could criticise Aristotelian dialectics, and men like David Chytraeus in Rostock and Rudolph Goclenius in Marburg could try to fit Ramist logic into the general scholastic framework, but neither Ramism nor other new currents could replace the comprehensive scholastic system of teaching and knowledge.

But while Worm and Bartholin could adhere to the traditional structure and form of scientific discourse, new discoveries made it increasingly difficult to uncritically accept the cosmology of Ptolemy or the medical system of Galen. The discovery by Brahe and others that comets transgressed the assumed crystalline spheres that were thought to keep the celestial bodies in their orbit, and the increasing conformation of heliocentric cosmology by astronomers like Kepler and Galilei raised serious questions, not only about Ptolemaic cosmology, but about Aristotelian physics as well. These questions would only be settled with Newton. The same applied for medicine with the anatomical discoveries made by Vesalius and his successors and the introduction of Harvey's theory on the circulation of the blood. Furthermore, iatrochemistry was unknown to traditional university medicine, just like the occurrence of new diseases (like syphilis), as were phenomena like magnetism (as described by William Gilbert in De magnete, 1600) and the discovery of a multitude of new plants and animal species in the New World natural philosophers a sense of moving into territory uncharted by the ancients.

The answer of Bartholin to all this was basically to apply the same eclectic approach in natural philosophy as he used in his

philosophical manuals. As we have seen such eclecticism was also sanctioned by Theodor Zwinger and his successors in Basel. Bartholin wrote an anatomical textbook that became one of the most widely read of its kind in Northern Europe and to which we shall return in Chapter Six. Historians of medicine have not directed the same severe criticism of Bartholin's anatomy as that directed against his philosophical textbooks by historians of logic, but his anatomy was based on the same method as these textbooks. It contained nothing original either,[537] but it had the same clear exposition as that Bartholin employed in his philosophical textbooks and put together the opinions of various anatomists. The book included most, if not all, of what was known of anatomy and physiology. Different opinions were brought together, and while the general framework was Galenic medicine, discoveries and opinions that contradicted Galen were brought in as well.

But the fact that Bartholin and Worm were colleagues, friends and relatives, and both represented Aristotelian philosophy and metaphysics rather than the Paracelsianism of a man like Severinus, has made scholars lump them together and made them blind to the fact that a profound difference developed in the context into which they put natural philosophy.

5. The Pious Physician and the Lord of Rosenholm

Melanchthon had connected the study of nature to religious edification, and so had Tycho Brahe and his circle, though from a Neo-Platonic point of view. Growing political centralisation and the rise of Lutheran orthodoxy led to attempts to uniform religion in the Scandinavian kingdoms. Theology became more intellectualised, more systematic, more dogmatic, and severed many links to the garland of humanist currents that had influenced both Melanchthon and his students as well the circle around Tycho Brahe.

It would, however, be simplistic to picture the religious development in Lutheran Europe around 1600 as nothing but a movement towards intolerance, intellectual censure, self-proclaimed conservatism, and sterile dogmatism employing revived metaphysics as its main instrument. Lutheran orthodoxy was also concerned with spirituality and piety as evident from the flood of devotional

[537] Bartholin was even accused of copying everything from the textbooks of Aquapendente and Caspar Bauhin, see Bartholin (1628b), fol. 5v.

books published during these years. In our context this is significant because it also led to an emphasis on practical piety, especially within medicine. It was a continuation of Melanchthon's view on natural philosophy, but it was also a transformation of the essentially contemplative character of that natural philosophy, to one concerned with a pious living both in daily life and in the application of medicine to the benefit to fellow man. And here, religiously inspired natural philosophy connected to the views of Theodor Zwinger, Paracelsus and others, who emphasised the practical applications of natural philosophy.

An example of this religiously inspired natural philosophy is Caspar Bartholin whose life began in theology and ended in theology.[538] The son of a clergyman in Malmø in Scania, Bartholin aimed initially at an ecclesiastical career. He then changed his studies to medicine, became professor of medicine in Copenhagen, a chair he changed to one in theology during the last years of his life. Thus, the course of his life described a full circle with theology as its starting point and end, and even during his years as a physician, religion was the unshakeable centre of the sphere, which coloured his view on the study of nature.

Bartholin did not come from an affluent or well-connected family, and when he went to Wittenberg in 1604 it was on a very scarce funding. During a short stay at Leiden, he decided to concentrate on medicine, and followed the route of Severinus and Fincke, that is first Basel and then Padua, and then returned to Basel for his medical degree. During his studies he had had to teach to manage, but faced with the realties of life, Bartholin knew that he must make his name known in order to win a patron.

In spite of spending less than a month in Leiden, Bartholin managed to get nearly all the famous professors to sign his *album amicorum*,[539] and as soon as he had dabbled in anatomy, Bartholin in 1611 published his anatomical textbook.[540] The book was dedicated to the nobleman Holger Rosenkrantz. In the preface Bar-

[538] A biography of Caspar Bartholin is yet to come, but see O.P. Grell, 'Caspar Bartholin and the Education of the Pious Physician', Cunningham and Grell (1993), 78-100 and Morten Fink-Jensen (2002), *Fornuften under troens lydighed.* Unpubl. thesis, University of Copenhagen, esp. chapters VII and VIII.

[539] The Royal Library Copenhagen MS, Ny Kgl. Saml. 359 (8°), *Thesaurus fautorum et amicorum Caspari Bartholini.*

[540] Caspar Bartholin, *Institutiones Anatomicæ.* Wittenberg 1611.

tholin says, that though he knows that the theologians call Rosenkrantz their own, he has heard from sons of the Muses who have returned more learned from him that he has an excellent library, a herbarium and a great understanding of pharmacy. Although, he himself is unknown, he knows that Rosenkrantz has shown interest in him, wherefore the book must carry his name.[541] It was inappropriate that an obscure student should make direct contact with a member of one of the leading noble families. First the possibilities must be explored somewhat carefully. To apply for patronage out of the blue would be downright rude, and increase the risk of rejection. An informal request would have to be made, not to the patron wanted for, but through a patronage broker. This is what Bartholin refers to, when he speaks of "Sons of the Muses".[542]

Rosenkrantz accepted Bartholin as his client, and the same year he obtained the university chair in Latin,[543] and married a daughter of Thomas Fincke. Thereby Bartholin acquired a patron within the university, namely his father-in-law, while Fincke on his side cemented his position through a talented son-in-law with connections to the powerful Rosenkrantz, and a chair of his own. Two years later Bartholin obtained a professorship of medicine.

HOLGER ROSENKRANTZ (1574-1642) was an obvious choice of patron. After the exile of Tycho Brahe, he became (apart from the Chancellor) the leading patron of learning in Denmark. A relative of Brahe, Rosenkrantz belonged to the high nobility, and was sent abroad to study in order to prepare himself for service in

[541] Ibid., dedication of December 18, 1610.

[542] A good candidate for Bartholin's broker would be Johannes Stephanius (1561-1625) a former assistant of Tycho Brahe, now professor of dialectics, whose father-in-law bishop Winstrup was a friend of Rosenkrantz. This would not be the first time Stephanius acted as a broker between Rosenkrantz and a young scholar, Rørdam (1930), 23.

[543] Fink-Jensen (2002), 165 points out that Bartholin was called home to a chair, before the publication of his anatomy with its dedication to Rosenkrantz. This, however, does not exclude that his appointment was furthered by Rosenkrantz. Usually negotiations took place between a patron and a potential client before it found expression in a book dedication, and Bartholin may already have come in contact with Rosenkrantz or the broker during his stay in Denmark in 1607. The new edition of his astrological treatise from the same year thus contains a greeting from Olaus Rosæcranzius: *Exercitatio de stellarum*...Wittenberg 1607, 14-16. The acts of the Consistorium shows that the direct instigator of the appointment was Chancellor Borreby, see AC V, 112.

the government.[544] In the 1590s he went to Rostock and later to Wittenberg with Daniel Cramer as his praeceptor (the same Cramer who would later send his metaphysics to Tycho Brahe) and took a deep interest in theology. In the beginning, he embraced the new orthodox Lutheranism, but shortly before the turn of the century, he experienced a religious crisis that made him turn against dogmatic theology.[545] Rosenkrantz was anxious about the theological controversies of his time and the multitude of theological terms. In his pursuit of a theology that would lead to piety, he followed the orthodox theologians in insisting on the principle of sola Scriptura and the abandonment of philosophical terms in connection with theology. Like Johann Arndt and other theologians of his time, he also insisted that Christianity should lead to a pious life. So far, Rosenkrantz was hardly original and in line with Orthodox Lutheranism, but furthermore he believed in a double justification through Faith and deeds, insisted that the Christian teachings in themselves should be pious, and began to elaborate an entire new teaching. About 1616 he had completed two treatises, and was met with sympathy by leading German reformers like Arndt, Mentzer, and Ratke.[546] In the following years he wrote a number of treatises in Latin, German, and Danish, some for laymen, and some for theologians.

Rosenkrantz organised his castle of Rosenholm in Jutland (and momentarily in Odense when he was lord lieutenant there) into a boarding school for young men from noble as well as non-noble families,[547] and was highly influential on learning in Denmark in this period. An English visitor wrote to John Dury in 1633 that "...all the great scholars of Denmark having their first ground of learning from this house...", and Dury tried to win the support of Rosenkrantz for his scheme of reconciling the Protestant churches.[548]

[544] On Holger Rosenkrantz, see J. Oskar Andersen, *Holger Rosenkrantz den Lærde.* Cph. 1896; on his theology, see Jens Glebe Møller, *Doctrina secundum pietatem. Holger Rosenkrantz den Lærdes teologi.* Cph. 1966. With an English summary.

[545] Glebe Møller (1966), 9.

[546] Andersen (1896), 145ff.

[547] Letter of 7.11.1597; Andersen (1896), 114. Apart from the children of the Rosenkrantz family about 25 nobles and 50 Danish and German non-nobles lodged at Rosenholm during the years.

[548] G.H. Turnbull, *Hartlib, Dury and Comenius.* London 1947, 159; later, Dury would write that Rosenkrantz: "*..is reported to bee ye greatest man for Learning &*

From a pamphlet that Rosenkrantz himself published in 1631 we are informed of the activities on Rosenholm,[549] and it seems that it was more influenced by Luther's household than by the Florentine academy or Tycho Brahe's Uraniborg. Edifying meetings were held, at which Rosenkrantz "*daily inspired the community of the house to love and noble deeds*". Then there were morning and evening prayers as well as the sermon itself.[550]

Nonetheless, the source material hints that the activities at Rosenholm also included natural philosophy, which should not come as a great surprise. As we have seen in Chapter Three, Rosenkrantz' studies at Philippist Rostock under Chytraeus and others had made him familiar with Philippist natural philosophy. Furthermore, he had visited Tycho Brahe on Hven in 1592, and after his marriage to Brahe's niece five years later the two men wrote frequently. He was the first Dane to write to Brahe after his going into exile, he visited Brahe at Breitenburg in 1598 and helped him with his *astronomical investigations* and calculations. He wrote a poem to the preface of Brahe's book *Mechanica instauratæ Astronomiæ*, and kept in contact with Brahe until his death. Later on, we hear of a "mathematical" (probably astronomical) collection of instruments on Rosenholm, and in the pavilion "Perkentavl" at Rosenholm he established a chemical laboratory.[551] The library he collected seems to have included Aristotelian books on natural philosophy, probably the majority of Tycho Brahe's works[552] and books by Petrus Ramus, despite Rosenkrantz' hostility to Ramism.[553]

Tycho Brahe's assistant, the astronomer Longomontanus, lived for a while at Rosenholm[554] and many former boarders of Rosenholm showed great enthusiasm for mathematics after they left the household. Jacob Hasebard became (though briefly) pro-

Pietie of all Germanie, & in Denmark the man of greatest Authoritie & power with Clergie y:t euer was in it...", Westin, *Negotiations about Church Unity 1628*-1643. Uppsala Universitetets Årsskrift. Uppsala 1932, 279

[549] *Hør danske Mand.* Cph. 1631. 12°, [55 pages].

[550] Andersen (1896), 286f.

[551] Letter from Jacob Mathiesen, dated Wittenberg 1625. Royal Library in Copenhagen, Ny kgl. Saml. 1291.4° 101.

[552] Walde (1920), 299; Breve n. 10, 14. 3. Thieles Danske folkesagn I- 138. For Perkentavl ,see. Tr. Lund, *Danmarks og Norges Hist.* VI, 183.

[553] Walde (1920), 296 n.2., 324.

[554] See the funeral sermon on Holger Rosenkrantz.

fessor of mathematics in Copenhagen,[555] and Svend Pedersen turned down an offer to become headmaster of the grammar school in Odense, by insisting that he would devote himself to mathematics and oriental languages.[556] The future bishop Jakob Matthiesen Aarhus was a teacher in the Rosenkrantz household as well as being taught himself by Rosenkrantz in matters of theology. When he went to Wittenberg in 1624, he found a theological environment quite different from that at Rosenholm. In his letters home, he complained about the cantankerous and argumentative atmosphere in Wittenberg. To escape this, he chose to devote himself to the study of mathematics, and regretted that he had not used the facilities in the Rosenkrantz household.[557] Furthermore, when Rosenkrantz was lord lieutenant in Odense, he tried to entice the celebrated Wittenberg-physician Daniel Sennert to settle there.[558] Just like the so-called Occult philosophy of the 16th century had been an attempt to find common ground among learned Christians of all camps,[559] so did natural philosophy in early 17th century Denmark as elsewhere often contain an urge to find a truth that was not based on religious doctrine, but on practical piety with a strong emphasis on godliness and eschatological urgency.

To Caspar Bartholin, Rosenkrantz not only became his patron, but also inspired him religiously. The household of Caspar Bartholin at his professor residence in Copenhagen seems to have mirrored that at Rosenholm. Psalms were sung, and the professor would read chapters of the Bible to the assembled household, emphasising the obligation to lead an active and pious life.[560] Thus, it was only natural when Bartholin in 1624 took the unusual step of exchanging his Chair in medicine for one in theology.[561]

[555] Andersen (1896), 118.
[556] Andersen (1896), 119.
[557] Andersen (1896), 275f.; Krs. S. 3.R. 5. 197; Zwerg: Sjæll. Cleresie 577; Letters to Thomas Bang 27/10 (Bøllings S.); Letter no. 138.
[558] Letters no. 104, 1/10-1623.
[559] See Frances A. Yates, *The Occult Philosophy in the Elizabethan Age.* London 1979, that sums up her earlier books.
[560] Jesper Rasmussen Brochmand, *Vita et Mors Caspari Bartholini.* Cph. 1629, fol. B2ff.
[561] That Bartholin perhaps not regarded a chair in theology as the best platform for his religious work may be inferred by Worm's comment to the appointment; OWB, I, 86. and well as his own words in *De studio medico* (1628), 1r. Bartho-

Initially, there was no conflict between Rosenkrantz and Danish Orthodox Lutherans, many of whom had boarded at Rosenholm. Rosenkrantz, however, was more concerned with continuing the endeavours of the Reformation, than with fighting heretical dogma. He regarded himself as continuing the religious tradition of Augustine, Luther, Melanchthon and a leading Danish Philippist like Niels Hemmingsen. Thus, Rosenkrantz and followers like Bartholin did not focus on dogmatic clashes, but on pious living, the Bible and not least on education. It was therefore no coincidence that when Rosenkrantz was made a Councillor to the King in 1617, he concentrated all his efforts on the reform of education in Denmark. His influence in this field proved considerable and was recognised abroad as can be seen from Samuel Hartlib's *Ephemedires.* Here Hartlib states that Rosenkrantz was *"framing by Education and learning a New Commonwealth being the father of every one in particular".*[562] His influence on Danish education was further enhanced when in 1623 he became the director of the newly established academy for sons of the nobility in Sorø.[563]

On Rosenkrantz' instigation and in some cases with his assistance, Bartholin wrote new textbooks and manuals in logic, rhetoric, ethics, and metaphysics for the elementary schools as well as the new 'Gymnasiums', which the King had ordered issued in 1619,[564] partly in response to the great success of Jesuit schools like Braunsberg (Po. Braniewo) in Poland. The influence of Rosenkrantz and Bartholin is also evident in the Instruments of Foundation, which they provided for a number of Latin schools and Gymnasiums in the early 1620s. In the case of the school in

lin's theological writings are analysed in Fink-Jensen (2002), ch. VII. Bartholin's most systematic treatment of his view on theology is *De studio theologico.* Cph. 1628.

[562] Sheffield University Library MSS. Samuel Hartlib MS 29/3/15A; Grell (1991), 92.

[563] In his dedication to Rosenkrantz in his *Præcepta rhetorica et oratoria* Caspar Bartholin calls Rosenkrantz *'Academia nobilium Regiæ soranæ director'*. Rosenkrantz' dislike for religious controversy is witnessed when in August 1623 in he tried to entice the famous professor of theology in Jena, Johann Gerhard, to the chair of theology in Sorø. In this connection he emphasised Gerhard's piety and dislike for futile religious controversies; Andersen (1896), 184.

[564] Andersen (1896), 176-177. These textbooks, which were published during the 1620s, were abridged versions of his philosophical textbooks for undergraduates, published from 1608 onwards.

Odense, the Instrument of 1621 stated that the school should have a physician, who took them on botanical excursions, while during the winter he should give them lessons in anatomy *ex scheleto.*

The purpose was obviously to provide pupils with a comprehensive and direct experience of God's creation, especially Man, the crown of the achievement. For Bartholin, it was yet another avenue, apart from the study of the Bible, which would lead to true Protestant piety. Furthermore, Rosenkrantz moved the King to issue an order to the effect that anyone who wanted to become a country parson ought to have a basic knowledge of human anatomy.[565] It was in short a continuation of the Philippist connection between natural philosophy and piety.

While professor of medicine, Caspar Bartholin – together with his brothers-in-law Ole Worm and Jørgen Fuiren who had also studied in Basel – retained an interest in botany and botanical excursions, undoubtedly influenced by Caspar Bauhin in Basel.[566] But Bartholin's decision actively to further the new experimental medicine in areas such as anatomical dissection, applied botany, and iatrochemistry is more closely connected with the religious revival, which his association with Rosenkrantz brought about around 1620. According to his funeral sermon, it was on the instigation of God, *"as someone whom God would use in better medical practice to heal the souls of many people with the sound and true reason and teaching of salvation, like he had restored the bodily health of so many people with healing drugs",* that Caspar Bartholin made the decision to abandon medicine for theology. Instead, he wanted to concentrate with all his *"Meditationes, Studia et Labores on the Word of God, which is the soul's true medicine, nourishment and cause".*[567]

[565] N.D. Riegels, *Små Historiske Skrifter,* 3 Parts. Cph. 1796, I, 143.

[566] OWB I, 14. The close contact between members of the medical faculties in Basel and Copenhagen can be seen in the correspondence between Worm and Bauhin, ibid. pp. 14, 25, 28f., 32, 35f., 40f., 41f., 43f., 48f. When Worm received the news of Bauhin's death in 1625, he wrote: *"I mourn the death of this man, who was the leading light of botany and anatomy in our era and who showed me great friendship. Basel has lost an immense light, and I cannot see what excellency within the field of medicine can now be expected from there",* OWB, I, 97.

[567] Jens Dinesen Jersin, *Enochs Leffnit oc Endeligt, betragtet udi en Ligprædiken over Dr. Caspar Bartholin.* Cph. 1632, fol. Fiiijr. Andersen (1886), 242 has shown that Bartholin was already contemplating a move away from medicine to theology in

Together with another Rosenkrantz pupil, Jesper Brochmand, professor of theology, Bartholin drafted new Statutes for the University in 1621. They were primarily concerned with the study of theology and medicine and aimed at radically changing the curriculum. In medicine, the traditional hierarchical order of the two professors of medicine should be changed. The leading professor should in future lecture on practical medicine and cover the whole subject in a year's lectures. Bartholin added in an appendix that it would be useful, if he would concentrate on botany for half of the year and on iatrochemistry (*rebus metallicis et mineralibus*) for the other half. As far as possible the first *Medicus* should gear his botanical instruction *ad domestica remedia.* Likewise he should take the students on botanical excursions during the summer and have responsibility for a botanical garden which should incorporate rare and exotic plants. The professor should have an *adjunctum pharmacopaeum,* who for an hour a day should teach the medical students the *Pharmacopaea* and *Chymica, vulgaria et rariora*, which belonged in a well-stocked pharmacy.

The second professor of medicine should lecture on medical theory, covering the whole topic in one year's lectures. Every winter he should give anatomical instruction through dissections or demonstrations from a skeleton. This professor should have an assistant who could help him in his dissections and instruct the medical students in surgery for an hour every day, teaching them all the techniques used by barber-surgeons.

Apart from the intended improvements of the medical curriculum the draft evidently aimed at reform and control of the way surgery and pharmacy were practised in Denmark, guaranteeing that such practitioners received some basic education in the vernacular at the University.

However, when the so-called *Novellae Constitutiones* for the University were issued by Christian IV in May 1621 very little of the original and extensive draft was included. Instead, the *Constitutiones* were primarily concerned with securing doctrinal orthodoxy among future ministers and schoolmasters. Thus, students of theology who wanted to study abroad were to be restricted to

1619. Bartholin's religious revival has traditionally been connected with his unexpected recovery from the serious illness he suffered in 1623, Jersin (1632), fol. Fiiijv.

universities which corresponded in doctrine with Lutheran Denmark, if, as was to be expected, they wanted to become ministers or schoolmasters. Students of medicine, however, together with sons of the nobility were expressly excluded from these restrictions because they had to visit foreign universities, 'for *Excercicia* and other reasons'.[568] This was a step towards a separation of the cultures of theology and medicine.

Why did Caspar Bartholin's plan for a reformation of the study of medicine, and for that matter Brochmand's for theology, come to nothing in 1621? Were they too dramatic and therefore unacceptable to the more conservative and orthodox wing within Church and University who, under the leadership of Bishop Hans Povlsen Resen, had recently purged the country of a number of suspected crypto-Calvinists ? In the case of medicine, however, it is more likely to have been a simple question of money. A reorganisation of the medical curriculum as envisaged by Bartholin would have meant the employment of additional staff, the building of new auditoria, not to mention an anatomical theatre and a botanical garden. By 1621 Christian IV was already toying seriously with the idea of entering the Thirty Years' War as the leader of the Protestant party, having been constantly encouraged by his brother-in-law James I of England and by Maurice of Nassau, Stadholder of the United Provinces. With such expensive military plans the King would not have been tempted to spend large additional sums on the University.[569] As we shall see, it was only after military defeat that the King found it useful to invest in the icons of natural philosophy as part of his self-image.

Despite the fate of his draft, Caspar Bartholin continued to develop his ideas about an improved medical education. This was a natural consequence and integral part of his Protestantism, as can be seen from a comparison between his treatises on the study of medicine and theology respectively, which he published simultaneously in 1628. In his manual for the study of theology Bartholin complained that letters from the Apostles, which had been

[568] The draft for the new statutes of the University and the so-called *Novellæ Constitutiones* of 1621 were published by H.F. Rørdam, 'Aktstykker til Universitetets Historie i Tidsrummet 1621-60', *Danske Magazin* 5:I (1887-88), 37-47; for medicine, see especially 38, 43 and 44; See also Andersen (1896), 189-198.

[569] See E. Ladewig-Petersen, 'The Danish Intermezzo', in G. Parker (ed.), *The Thirty Years' War*. London 1984, 71-81, esp. 73.

fully comprehensible to all the original recipients, could nowadays only be understood through commentaries and interpretations, and even then people were often more confused when they had finished reading them than when they began, because of the conflicting views of the commentators. All the theological commentaries had to be abandoned in favour of an exegetical study of Scripture alone. True godliness depended on such a change. It determined the study of Theology as much as the study of medicine. Both subjects were firmly anchored in the continuous study of Scripture, which through faith and grace generated piety. For Bartholin this personal religious experience was a necessary precondition for ministering to the body as well as to the soul.[570]

This pious religiosity and humanist insisting of going to the original sources is also evident in Bartholin's treatise *On the Study of Medicine*, written to his sons and foster son at a time, when his life was coming to an end. Here Bartholin makes a distinction between carnal man (*homo animalis*) and spiritual man (*homo spiritualis).*[571] The former, who defies God and is helplessly drawn to vanity, does not want to serve mankind and in the long run he is bound to a life in melancholy, anxiety and unrest, and all his work dissolves into nothing. To be a good physician, you are bound to be a spiritual man, who is pious and daily studies the Bible, as "*whoever you are, you are nothing but an ephemeral flower, who can wither in a brief moment, you do not know what the late evening brings, and no one can account for tomorrow.*"[572]

As for the study of medicine itself, Bartholin states that the student should have adequate knowledge of Latin and Greek in order to determine what was good and bad in Hippocrates and Galen. Only the original texts should be relied on. This was the same conviction of the value of returning to the original sources, which had taken him back to a rigorous and regular study of Scripture, but it was also an opinion vehemently propagated by Theodor Zwinger. In this connection Bartholin also took the opportunity to point out that the Arabic authors had borrowed their

[570] Caspar Bartholin, *De Studio Theologico.* Cph. 1628, fols. A1r-A3v.

[571] Caspar Bartholin, *De studio medico inchoando, continuando et absolvendo.* Cph. 1628; reprinted in Th. Bartholin (1662, 1982).

[572] Bartholin (1628b), 2r-2v: 'Nescis enim qvisqvis es, qvia flos es evanidus, dicto citius deflorescens qvid serus vesper vehat, & nemo crastinum sibi polliceri poterit'.

most valuable information from the Greeks, but in the process often missed even more important stuff.[573] On these points, Bartholin proved himself in total accordance with Morsing's lecture-list of 1537, which had excluded Avicenna and Rhazes.

Bartholin finds little use for rhetoric and metaphysics for the future physician and emphasises that "*the patient is not cured by words, but by herbs*". This emphasis on an empirical approach to medicine was in line with medicine as practiced in Basel, but also with Ramism, which (despite the hostility to Ramism at large) influenced the structure of Bartholin's textbooks and his emphasis on the practical application of natural philosophy.[574]

When mentioning the importance of botany for the physician, Bartholin stresses the need for the physician to collect plants and make herbariums, rather than reading extensively in the botanical literature. Similarly, in anatomy Bartholin places the emphasis on dissections, pointing out that students ought to *"dissect animals and parts of their bodies privately and, as often as possible, to attend public dissections of humans"*. His advice about pharmacy and surgery correspond neatly with this. Students ought to obtain a solid practical knowledge of how drugs are made in pharmacies, while a direct experience of surgery, especially from France and Italy, where the best surgeons were to be found, is considered essential.[575]

Despite the fact that Bartholin introduced metaphysics in Copenhagen, it can therefore not be said that Bartholin was hostile to practical natural philosophy. On the contrary, he was a propagator of experience and experiment, but always as a religious undertaking. In his treatise on the study of medicine he emphasises the importance of physics and mathematics and almost echoes Worm in claiming that *'Where physics ends, the physician begins'*. Arithmetic is important in iatrochemistry, and so is astrology (the so-called *iatromathematics*). Bartholin does not explain the use of the latter, but refers to a number of writers including Marsilio

[573] Bartholin (1628b), 3r-3v.

[574] Bartholin (1628b), 3v-4r: *'Non enim verbis sed herbis æger curatur'*. Caspar Bauhin had written almost exactly the same words in the philoteca of Ole Worm (25 August 1608) and Petrus Ramus more than once used a citation from Celsus: *'A farmer or navigator is not created by disputations, but through practice'*.

[575] Bartholin (1628b), 6r-7v.

Ficino, Caspar Peucer, and Johannesinus,[576] so there is no doubt that he recognized the potential use of astrological forecasts. Neither can it be said, as has sometimes been claimed, that Bartholin was opposed to Paracelsianism. He warmly recommends the works and *arcana* of Severinus and others, referring also to his own considerable alchemical library. He acknowledges the negative attitude among some physicians, who prefers traditional Galenic medicine to chemical medicine, but he stresses that *"while one should be pursued the other should not be neglected"*. In this connection, Bartholin once more underlines the need for direct empirical experience of the subject, stating that students should always personally practise alchemy *"with its charcoal and glass flasks"*. Echoing Severinus he adds that *"no one should be ashamed to seek information from old wives and barbers about their remedies, as long as they had been successfully tested."*[577]

When Bartholin died in 1629 his proposals for reform had yet to be officially introduced in Copenhagen. The realisation of at least some of his plan eventually fell to his brother-in-law Ole Worm and his son Thomas Bartholin in the 1640s, but as we shall see, their religious agenda was somewhat different.

6. Cort Aslakssøn and the Nature of Heaven

Another man whose natural philosophy was explicitly connected to religious concerns was the Norwegian Cort Aslakssøn (Cunradus Asclacus Bergensis, 1564-1624), who had been one of Tycho Brahe's leading assistants on Hven.[578] As an orphan he had depended on patrons for making his way in this world. He managed to get to Copenhagen and win the favour of Petrus Severinus,[579] who acted as his broker and established contacts to Tycho Brahe and the government. Aslakssøn enlisted as an assistant of Tycho Brahe at Hven, where he spent the next two and a half year. Afterwards he went abroad together with two young nobles from the Brahe clan, and visited Rostock, various Central European univer-

[576] Bartholin (1628b), 4r-5r.
[577] *De Studio Medico* 7v-8r. This phrase was also nearly identical to one used by Paracelsus, see Reeds (1991), 102.
[578] For Aslakssøn, see Garstein (1953); Shackelford (1996), 188-192; Christiansson (2000), 252-253.
[579] *Kirkehistoriske Samlinger* 2:V, 64.

sities (Herborn-Siegen, Heidelberg, Basel, and Geneva), as well as France, England and Scotland.

When Aslakssøn returned to Denmark, things had changed. His former patron had been forced into exile, but Severinus was still around, and it was probably through him that he won the favour of Chancellor Borreby. He was appointed professor of Latin at the University in 1600, gradually ascended the academic hierarchy, and after the fall of Jørgen Dybvad (in which he was involved as we saw in the previous chapter) he was made professor of theology in 1607 due to support from Borreby.[580]

Like Bartholin, Aslakssøn was both a natural philosopher and a theologian, but along very different lines. While Bartholin did not put much faith in Man's reason, Aslakssøn was influenced by the Neoplatonist culture of Uraniborg and trusted Man's intellectual ability to grasp creation. Initially, his theological point of view was in line with that of Melanchthon, as when he advocated that the baptismal ritual of exorcism should be abolished,[581] and he tried to establish concord between Urania and Scriptures. While Brahe had dismissed the biblical creation account as a myth intended for laymen,[582] Aslakssøn took the Bible seriously as a source of knowledge of the world, a notion that undoubtedly was stimulated by the rising Lutheran orthodoxy's insistence of a literal reading of the Bible. When passages in the Bible apparently was incongruent with the discoveries made at Hven, there must be an explanation for it, and Aslakssøn set out to create a synthesis of observation, philosophy and revelation. His approach to natural philosophy was eclectic, but unlike Bartholin who was generally focused on curing the diseased and satisfied with compiling opinions to weigh them against each other, Aslakssøn tried to find genuine answers, and was as a matter of fact the only natural philosopher in the twin kingdoms of Denmark and Norway in the 17th century, who tried to work out a comprehensive cosmology.

Aslakssøn's synthesis was put forward in his De natura cæli triplicis (1597) and later elaborated in three disputations, as well

[580] Just like Dybvad had done, Aslakssøn passed over the professor of dialectics who was traditionally promoted to the faculty of theology when a vacancy arose, see Garstein (1953), 212, 231.
[581] Garstein (1953), 145-160.
[582] TB, VII, 231.

as in Physica et Ethica Mosaica (1613).[583] Here he makes the traditional Renaissance division of the upper regions into the aereal, sidereal and eternal heavens. He is not concerned with the movement of the celestial bodies or the positions of the stars, but with the nature of these three heavens. His thinking contains a fascinating combination of observations from Hven, logical arguments, and his reading of the Bible. In his discussion of the airy heaven, he rejects the idea that it should consist of fire. He knows that Plato thought so, but instead of claiming that the divine philosopher was wrong, he insists that Plato was talking metaphorically of the sun.[584] If the upper regions of the airy heaven consisted of fire, we would be able to observe it, and furthermore it would burn up everything it touched. Aware that his idea of the airy heaven goes against a widespread theological opinion, shared also by Luther, that placed the origin of rain in the starry heaven with the sun and the moon, Aslakssøn claims that Genesis 1, verse 6 and 17 gives two different meanings of the Hebrew word for 'heaven' (רקיע). So he feels confident that both observation and his reading of the Bible warrant his rejection of Luther's opinion: "Since it seems not only against what Moses meant, but also against other passages of Holy Scripture, as well as against all reason and experience."[585]

In his discussion of the starry heaven he rejects any idea that it should consist of either one of the four elements or all them. Those who have claimed that it consisted of fire based on scriptural passages, Aslakssøn dismisses as misreading the Bible. The opinion, shared by some astronomers, that the starry heaven consisted of elemental air, he rejects on arguments based of his knowledge of refraction. In order to reject the claim of some theologians that the stellar air consisted of water, he ventures into Hebrew etymology,[586] and the antique theory that it consists of all four elements, Aslakssøn rejects by arguments of reason based on the

[583] *De natura cæli triplicis, libelli tres, quorum I. de cælo aëreo, II. de cælo sidereo, III. de cælo perpetuo* etc. Siegen 1597; *De mundo disputatio prima, quæ erit D.O.M.A. ad diem XXIII. Februarii* etc. Cph. 1605; *De mundo disputatio secunda, quæ erit D.O.M.A. ad diem XI. Octobris* etc. Cph. 1606. *De mundo disputatio tertia, quæ erit D.O.M.A. ad diem 1. Augusti.* Cph. 1607; *Physica et Ethica Mosaica.* Hannover 1613.

[584] Aslakssøn (1597), 16ff.

[585] Aslakssøn (1597), 23-25: "*cum id non tantum contra sensum Mosis, sed etiam alia scripturæ dicta, et rationem omnem ac experientiam esse videatur*".

[586] Aslakssøn (1597), 49-76.

Biblical creation account.[587] No, says Aslakssøn, the sidereal air is essentially different from the sublunar world. Like Aristotle and contemporary philosophers like Rudolf Goclenius, he claims that it consists of a fifth element (quinta essentia) and brings in ideas from chemical philosphy. Its precise nature is hidden from men, but it must be extremely thin and fine (*tenuissime et subtilissime*), totally pure and incorruptible.[588] This is also supported by the fact that the stellar heaven itself is invisible, and Aslakssøn ascribes the changing colours of the sky to an optical illusion and once more he puts forward Biblical passages to support his opinion.[589]

Despite the subtlety of the sidereal heaven, Aslakssøn rejects the theory (propagated by Averroës and others) that it should be without body or form. When something as thin and fine as angels, according to the Bible and the Holy Fathers, have a body, so can also the stellar heaven have both matter and form. He draws on a number of authors such as Hermes Trismegistus, Plato, Cornelius Agrippa and Petrus Severinus in order to suggest that the heaven is endowed with a kind of "energetic" or "active" faculty (ἐνέργετικε quadam facultate) or soul (ἐνέργετικε anima quoque); "For what is life other than energy (ἐνέργεια) implanted in created things by God?"[590] Accordingly, Aslakssøn also turns against the idea that the sidereal heaven consists of solid matter, by once more employing his knowledge of refraction as well as Tycho Brahe's observations of comets and his reading of Biblical passages.[591]

When Aslakssøn rejected that the stellar heaven consisted of stellar matter, he accentuated a problem already raised by Tycho Brahe's observations of comets. If the stellar heaven did not consist of solid matter or crystalline spheres, how comes that the celestial bodies conduct their circular motion and does not change their course? A mathematical and mechanical answer to these problems would only be given by Kepler and Newton.[592] Aslakssøn attempted nothing of the kind, but based his solution on his general

[587] Aslakssøn (1597), 76-86.
[588] Aslakssøn (1597), 86-90.
[589] Aslakssøn (1597), 173-180.
[590] Aslakssøn (1597), 100. As noted by Shackelford (1996), 189 note 26, Kepler used the same Greek terms to denote the divinely implanted activity responsible for astrological influences.
[591] Aslakssøn (1597), 90-123.
[592] See I. Bernard Cohen, *The Birth of a New Physics.* London 1992.

Neo-Platonic world-view, also shared by Severinus. He viewed the entire cosmos as being permeated by a psychophysical principle (*virtus vivifica*) that gives life to everything in the world - plants, beasts, men, minerals, metals, and elements,[593] an idea that he found warranted by a phenomenon like magnetism[594]

Accordingly, the circular motion of stars and planets is due to their inner life, the nature God has implanted in them.[595] Furthermore, he repeats the traditional scholastic view on the role of mathematics by saying that we must put in mind that their circular motion is only imaginary, not real.[596] Nonetheless, Aslakssøn realises that his theory on the stellar heaven goes against established views and tries to find support for it by his interpretation of passages in the Bible.[597] He argues that the stellar heaven itself must be immovable, and accordingly he, unlike Tycho Brahe, adheres to the Copernican picture of the world.[598]

As for the eternal heaven, the abode of the blessed, Aslakssøn claims that our only source to its nature comes from the Holy Bible.[599] Yet, based on metaphysical arguments he emphasises that it is different from God himself, and therefore constitutes a part of nature and creation. On the ground that the human and corporeal nature of Christ, according to the Bible, has ascended to Heaven, it must be able to contain bodies, and therefore it must be physical, i.e. placed in space, but even though it has a beginning (creation, that is) it is infinite in time.[600]

Thus, Aslakssøn concludes his description of the nature of the heavens. By drawing on arguments from (his interpretation of) the Bible, partly by use of Hebrew philology, observations made by Tycho Brahe and Hermetic and Paracelsian terms and concepts, Aslakssøn felt positive that the new developments in astronomy could be harmonised with revelation and connected to Neoplatonic metaphysics. Implicit in his argument was also an optimistic view on Man's abilities to uncover the nature of the world.

[593] Aslakssøn (1605), 22-25.
[594] Aslakssøn, *Orationes* 134.
[595] Aslakssøn (1597), 142ff.
[596] Aslakssøn (1597), 159.
[597] Aslakssøn (1597), 143f.
[598] Aslakssøn (1597), 166-173; see also Moesgaard (1972).
[599] Aslakssøn (1597), 183-193.
[600] Aslakssøn (1597), 193-200.

While Aslakssøn's synthesis seems to have made little impact in Denmark, he was well received elsewhere in Europe by men like Johannes Piscator in Herborn and Rudolf Goclenius in Marburg. His De natura was translated into English,[601] and his Physica et Ethica that emphasised the divine origin of Man, the idea of the spiritus mundi and the synthesis of the Bible and natural philosophy substantially influenced and became part of the tradition that has been coined as 'Mosaic natural philosophy'. This Renaissance tradition was eclectic by nature and desired to construct a new natural philosophy, freed from slavish adherence to any single authority, be it Aristotle, Plato, Zabarella, or Ramus. The solution it proposed was based on a literal reading of the Bible with particular emphasis on Genesis. It flourished on all sides of the confessional iron curtains of the period and reached its climax within the circle of Jan Comenius and Johann Heinrich Alsted, who were well known to Holger Rosenkrantz and his circle.[602]

As such, Aslakssøn's pious natural philosophy, and the tradition to which it belonged, was explicitly Christian but not distinctly Lutheran. Rather it was, like Severinian Paracelsianism and to a certain degree also the theology of Rosenholm, aimed at winning acceptance by members of all Christian confessions, and the Norwegian corresponded with German academics like Eilhard Lubin and with the Heidelberg professor David Pareus, who shared his idea of the spiritus mundi and who tried to reconcile the various Protestant camps. Contributing to the interest Aslakssøn arose was probably also the fact that De natura was put on inquisitorial Index (though more according to the authorities Aslakssøn cited than to his own opinions).[603] It was brought into the Portuguese indexes of 1612 and 1624 on the same level of

[601] *The Description of Heaven. Or, A Diuvine and Comfortable Discourse of the Nature of the Eternall Heaven, the Habitation of God, and all the Elect. Composed in Latine, by Cunradus Aslachus. And conuerted into English, by Ralph Jennings.* London 1623.

[602] M. Blekastad, *Comenius. Versuch eines Umrisses von Leben, Werk und Schicksal des Jan Amon Komenský.* Oslo/Pragh 1969, 68, 179; Wilhelm Schmidt-Biggemann, *Philosophia Perennis. Historische Umrisse abendländischer Spiritualität in Antike, Mittelalter und Früher Neuzeit.* Frankfurt 1998; Ann Blair, 'Mosaic Physics and the Search for a Pious Natural Philosophy in the Late Renaissance', *Isis* 91:1 (2000), 32-58.

[603] Garstein (1953), 88-91

heresy as Luther, Calvin, and Zwingli, and on the Spanish index of 1632 and later.

Aslakssøn's aspirations reflected the courtly and cosmopolitan culture of Uraniborg, but he soon found out that times had changed. In 1607 he was appointed to a chair in theology, and from this position he tried to advocate his synthesis between natural philosophy and theology as evident from the oration he gave at the university in 1605[604] on the world soul and from Physica et Ethica Mosaica (1613), where he tries to fuse his Neoplatonist cosmology more closely with the account of creation in Genesis. However, at the faculty he soon collided with the strong man among Danish theologians, Hans Resen, who had entered a ferocious battle against those theological opinions that he regarded as being 'crypto-Calvinist', generally meaning too rational. During the following years, a number of controversies arose between Resen and various professors and ministers, every time with Resen on the winning side due to government support.[605] Aslakssøn was clearly on the side of the victems of Resen's crusade. More than once he had confrontations with Resen, and worked secretly against him at several occasions.[606] The two men had different opinions on several theological issues, differences that showed that Aslakssøn stood in the tradition of Melanchthon and his disciples, while Resen adhered to the Lutheran orthodoxy (though not emphasising dogmas to the same extent as the orthodox Lutherans in Wittenberg).

To Resen the main target of his crusade were not specific dogmas, but the faith in reason as such. This was a point he once and again emphasised during his struggles against various opponents.[607] In his endeavour Resen was supported not only by the King and the Chancellor, but also by Holger Rosenkrantz as well,[608] and Aslakssøn witnessed how, one by one, his friends were purged from University and Church, leaving him the last 'crypto-Calvinist' in the faculty of theology. Neither was Aslakssøn spared the suspicion of Resen, who lumped him together with Conrad

[604] *Oratio de anima mundi, habita in promotione baccalaureorum Anno 1605, die 27. Julii.*
[605] Garstein (1953), 231-301; Kornerup (1928-1968), I, ch. XI and XIII.
[606] Garsten (1953), 253-263
[607] Garstein (1953), 273.
[608] Garstein (1953), 248.

Vorstius, a Dutch theologian who had attempted to rationalise the Christian dogmas.[609] In face of the support Resen enjoyed from the powers to be, there was little Aslakssøn could do, unless he wanted to add to the number of professors and clergymen who were dismissed and often forced to go into exile. From around 1614, he changed his view on theology, abandoning Melanchthon in favour of Luther, distancing himself from Calvinism and more rational interpretations of various dogmas, and embracing the use of exorcism at baptisms. Finally Aslakssøn also abandoned his attempt to create a synthesis between theology and natural philosophy,[610] an impossible endeavour in the intellectual and religious climate in Denmark in the first half of the 17th century.[611] Theology and natural philosophy moved apart. Natural philosophers could still write devotional books or interpret epedemics and omens from a religious point of view, but generally such treatises were written in the vernacular, and had little connection with their general work in natural philosophy.

7. Intermezzo: The Troubled Waters of Patronage

As we have seen, political realities were immensely important to the development of natural philosophy. The natural philosophers who succeeded in winning support from the great men of the day and in finding a *modus vivendi* between theology and natural philosophy were those who found room, both economically and in terms of intellectual freedom, to develop natural philosophy. Those who failed faded into obscurity, either in exile or as vicars, administrators, physicians or school teachers in remote parts of the realm with little time to pursue the study of nature and neither the intellectual freedom nor economic opportunity to make their views public. While history of philosophy may take interest in ideas for their own sake, history is primarily concerned with forces, ideas and persons that had importance in their own time or led to future developments, which *moved*, so to speak, society.

[609] Garstein (1953), 284f.
[610] Garstein (1953), 308f., 338ff.
[611] Thus I cannot subscribe to the conslusion by Shackelford (1996), 203f. that *"some accommodation between Paracelsianism and Lutheran orthodoxy was possible, as the cosmology of Kort Aslakssøn shows..".* Theologically Aslakssøn was not an orthodox Lutheran, when he elaborated his cosmology, and abandoned his cosmology when he moved in that direction.

Since the relationship between ideas and society is ultimately connected to power, the historian who takes interest in intellectual history must therefore take power structures into account in order to understand why and how certain ideas were transmitted, accepted or turned down, and in what way they ultimately connected to and influenced society outside the study chamber. Before we continue our discussion of the development of natural philosophy in 17th-century Denmark, it is therefore necessary to have a brief look on the mechanisms in the relationship between power and natural philosophy in that period.

Ole Worm (1588-1654) was professor of medicine in Copenhagen for the last thirty years of his life, and with Fincke ailing and Bartholin dead, he was from around 1630 the leading member of the medical faculty. Due to his connections at Court, to the fact that he became the foster father of Bartholin's sons and to his views on the practice of natural philosophy, Worm became the central figure in the emergence of a distinct culture of natural philosophy in mid-17th century Copenhagen.

Apparently, the position of the Bartholin family at the University was firmly established in the second decade of the 17th century, but in 1616 they ran into troubles. That summer died Chancellor Borreby under whose aegis the family had consolidated itself at the University. As we have seen, Borreby had been instrumental in the fall of Tycho Brahe and had taken over many of the former clients of the great astronomer. When Borreby died, a reaction set in at the University directed against the Fincke family. It all began in 1616 few months after Borreby's death, when Worm was in turn to take over the deanship of the faculty of philosophy.[612] Members of the faculty now claimed that Worm could not qualify as dean since he was neither Master nor Doctor of Philosophy. Another attack concerned the rights of students to choose their own supervisor (praeceptor) when they entered the University. Initially, the University designated a supervisor for a new student, but in practice students were free to choose among the professors of the faculty of philosophy. Now, some students wanted the freedom to choose a supervisor from one of the higher faculties, in

[612] KUH, III, 302ff; AC V, for 1/2, 8/2, 1/3, 19/4, 23/4, 30/4 1617.

particular Caspar Bartholin.[613] This was firmly opposed by members of the philosophical faculty.

Both the resistance to Worm's taking over the deanship and to the liberty of students to choose their own supervisor was lead by the astronomer Christian Longomontanus[614] and the professor of logic Hans Jensen Alanus.[615] These men had both been connected to the Brahe family, the former as Tycho's assistant on Hven, Alanus as a client to another branch of the Brahe family. They seem to have prevailed when the tide turned, but apparently they felt themselves overshadowed by the rise of the Bartholins. When the great patron of that family died, they struck.

Apart from personal animosity,[616] the two controversies seem to have one thing in common – the relationship between philosophy and medicine. Worm claimed that a Doctor's degree in medicine implied the mastering of philosophy as well, but his opponents rejected this. The popularity of Caspar Bartholin likewise threatened the position of the faculty of philosophy. As it turned out, this would be the first (but certainly not the last) skirmish between the Bartholin family and other groups at the University, controversies that also implicated the position of Medicine in the hierarchy of learning.

For a while things looked gloomy for the family, especially when Worm found out that the acting Chancellor of the University, Breide Rantzau (a son of Heinrich), was: "...my worst enemy, to such a degree that this matter seems to be treated more out of personal hatred than according to the laws of justice".[617] In this situation, Worm bewailed the loss of Borreby. All now depended on whether support could be secured from the new Chancellor,

[613] KUH, III, 303f; OWB I, 21f.
[614] Christiansson (2000), 313-319.
[615] KUH, III, 609-615.
[616] Longomontanus may for example have been embittered by Thomas Fincke's refutation of his claim to have solved the problem of the quadrature of the circle few years earlier. Longomontanus published his 'solution' in *Cyclometria ex lunulis reciproce demonstrata* (1612), but in a letter to Chancellor Borreby (October 20, 1612), Fincke harshly refuted Longomontanus' findings; letter printed in KUH IV, 622-625. Longomontanus most likely felt betrayed by such an insidious attack from a colleague who was furthermore a relative.
[617] OWB, I, 17.

Christian Friis to Kragerup (1581-1639),[618] and Worm chose to present his case through the theologian Jesper Brochmand, who was the teacher of the crown prince, a pupil of Holger Rosenkrantz, and whose brother was married to Fincke's youngest daughter. In other words, Brochmand acted as a broker between Worm and his potential patron, Kragerup.[619] At first, the efforts of Worm and his broker did not bear fruit, since the Chancellor confirmed the appointment of Longomontanus as new dean.[620]

Eventually, however, Worm and his family secured the patronage of Kragerup, probably by means of the speech he held at University in connection with the centenary of the Reformation, and possibly with the help of Holger Rosenkrantz to whom the speech was dedicated. At the insistence of Kragerup, the speech was published and was the only religious text Worm ever produced.[621] Soon the chancellor had Alanus degraded to a lower chair, in 1621, while Longomontanus saved his position by publishing his Astronomia Danica in 1622 with a dedication to the King. For many years this book was a standard work of astronomy in Northern Europe.[622] It continued the work and methods of Tycho Brahe. Apart from giving the observations of Tycho Brahe continued by Longomontanus, it gives an introduction to spherical geometry, and an account of methods of calculations as well as astronomical instruments. In the appendices new discoveries (such as the observations by Galileo) are included, but at the same time Longomontanus appears highly conservative. Instead of applying the new method of logarithms (invented by John Napier in 1614), he sticks to the old method of prosthaphæresis developed by Brahe and the Silesian astronomer Paul Wittich. Furthermore, despite the fact that he brings Galilei's discoveries of the mountains of the

[618] On Kragerup, who was not from the same family as Borreby though he was married to his foster daughter, see Ole Degn, *Christian 4.s kansler.* Viborg 1987; Ditlev Tamm, *Christian den Fjerdes kanslere.* Cph. 1987.

[619] OWB, I, 17, 18, 21-24. Brochmand also acted as a broker between clients of Worm and the King, OWB I, 25.

[620] OWB 24.

[621] KUH, III, 212; OWB, I, 39-40.

[622] *Astronomia Danica.* Amsterdam 1622, with reprints in 1640 (Christiansson 2000, mistakingly gives it as 1643) and 1663. Longomontanus' new found favour is evident from the fact that his chair in mathematics was transformed into an extraordinary chair in astronomy, which he occupied until his death and became director of the Copenhagen observatory, which was completed in 1642.

moon, Longomontanus did not ascribe any great significance to the telescope.[623]

In Longomontanus' dedication to Christian IV, the astronomer compares Man, who is bound to his mortal body, to a prisoner in a cell who have been sentenced to death by a just king.[624] There are, however, two kinds of prisoners. One who is bitterly complaining his fate, and spends his remaining lifetime in idleness, letting the prison walls surround him like a tortoise in its shell, spending the nights lamenting like a night owl, and producing nothing but dirt.[625] The other prisoner gladly subjects himself to the will of God, and instead turns his eyes and mind to the great theatre of the world, with its marvellous works in heaven and on earth. The wonders of Creation are namely created for our joy and comfort and daily testifies to the glory and wisdom of the allmighty.[626] As is seen from the quotation at the beginning of this chapter, Longomontanus thus follows Melanchthon, Vesalius and others in regarding the study of nature as religiously edifying. First we use our senses and observe, then we admire, then we use our mind to further investigate what we observed, and finally we turn to God in praise.

The particular context of the letter of dedication, the attempt to secure the patronage of the King, makes it of course problematic to use it as a declaration of Longomontanus' views on the study of nature. It was written at a time, when Christian IV let Lutheran Orthodoxy stand uncontested in church life and tighten its hold on schools, churches and the daily life of his subjects. The reli-

[623] *Theatrum Astronomicum,* Cph. 1639, 55; logarithmic calculation was shortly afterwards introduced to Denmark by Hans Willumsen Laurenberg, who was professor of mathematics and geography at the Academy of Sorø, but at the university it would not win general acceptance for more than a generation.

[624] Longomontanus (1622), Epist. Ded.: *"Et nos quum in hoc mortali corpore captivi sumus, quippe talem nostram conditionem, quam tristis parentum lapsus omnibus nobis attulit, circumferentes, adeo ut cum captivis Plautinis fataliter ad mortem usque, his vocibus ingemiscamus, Nos fugiamus ? quo fugiamus ?"*

[625] ibid: *"alter eandem animo plus quam impio, stolido & refractario spernens, in cellulam carceris sui, velut testudo solet, se recipere, ibique noctuæ instar perpetuo hebetari, lamentationes lugubres edere, & tandem tabe, turpi situ, ac squalore confici mallet..."*

[626] ibid: *"Proinde quum tanta clementia Dei omnipotentis fruamur, ut non solum pulcherrimum huius mundi Theatrum, in usum nostrum ab initio condiderit, sed etiam post deplorandam prævaricationem ac captivitatem, quæ eam merito subsequuta est, idem jugiter sustentarit, quotidieque verbo omnipotenti sustentet.."*

gious emphasis on the study of nature is therefore hardly surprising. What is more interesting is the outspoken Platonism that pervades the letter. Longomontanus was the last Danish assistant of Tycho Brahe, who still took a professional interest in natural philosophy, and the letter shows the mentality of Uraniborg surviving into an age of Orthodoxy.

Longomontanus' allegory of the prisoners is obviously a Christian version of Plato's allegory of the prisoners in the cave (Republic VII). He follows Plato in emphasising the importance of the eyes, but only as a means to knowledge of the divine.[627] This striving for knowledge of the divine is pious, but highly personal. While the piety of Caspar Bartholin and the Rosenholm circle was based on a community of believers and founded on common praying and worship, acts of mercy and compassion that of Longomontanus is concerned with the individual. It may come as a surprise that Longomontanus in his letter to the enterprising Christian IV does not dwell on the value of the mathematical sciences in practical life, but it is in line with the letter's spirit of elitist Platonism. Furthermore, he emphasises the support to astronomy and mathematics from great princes throughout the ages, ranging from Julius Cesar to Frederik II.

Longomontanus' greatest use of Plato is connected to his vindication of the mathematical arts of the quadrivium - arithmetic, geometry, music, and the astronomy.[628] These disciplines give a progressive knowledge of the heavens above. The first two teach us how to measure the celestial bodies, music in concerned with harmonies, while astronomy transforms these measurements and harmonies into a system.

One use of mathematics that Longomontanus does not dwell with is astrology. As we have seen, astrology was one of the most efficient ways to attract the interest of patrons, and the monopoly on almanacs could be lucrative. Its brief treatment in Longomontanus dedication, however, should not lead us to assume that he

[627] ibid: *"Nec in eodem versando negligat vim suam per carceris huius, seu bina foramina corporis (ut Plato oculos vocat) masculè exerere."*

[628] ibid: *"Ab oculis itaque initium, sed medium, quod ad finem perducit, ab artibus ac disciplinis sumendum[628] est, inprimis vero, (nisi vehementer fallimur) Mathematicis: His namque naturam ipsam indissolubili nexu devinctam esse, post sacras paginas, quæ Deum, omnia mensura, numero & pondere disposuisse affirmant, Plato in Epinomide his verbis testatur* etc."

was not in favour of astrology, at least certain kinds of it. After the fall of Jørgen Dybvad, Longomontanus published yearly almanacs, Calendaria, which was not surprising since he was after all professor of mathematics.[629] He may have hoped to turn this into a permanent privilege, but as already mentioned, this privilege was given to the minister Niels Heldvad in 1616, though the almanacs were to be censured by Longomontanus. In other words, compared with Tycho Brahe or even Jørgen Dybvad, Longomontanus' means of asserting himself and the domain of natural philosophy he covered was diminished.

If we return to Ole Worm, his success in the game of patronage enabled him to do the opposite, namely to expand the domain of his natural philosophy. Chancellor Kragerup was a learned nobleman who had visited most of Western Europe and stayed at several universities, and whose close identification with learning even extended to the way he lived and chose to be portrayed. His residence in Copenhagen was situated in St. Kannikestræde, next to the residences of the professors, and in his portrait (from 1634 or later), Kragerup is depicted, not as a modern nobleman with a goatee and plain collar, but as a nobleman of the Reformation period with a ruff and square beard.[630] He was a great patron of mathematics,[631] and also helped Longomontanus publish Astronomia Danica through his connections in the Netherlands. In the early 1620s he also initiated botanical expeditions to the Danish provinces,[632] had Icelandic clergymen to send him descriptions of

[629] Christianson (2000), 318 somewhat misleadingly writes that Longomontanus "published astronomical almanacs including one for 1610". As a matter of fact, he also published *Calendaria* for the years 1611, 1612, and 1613.

[630] Ole Degn, *Christian 4.s kansler. Christen Friis til Kragerup (1581-1639) som menneske og politiker.* Viborg 1988, 163ff.

[631] See Hans Resen, *Oratio fun. de Chr. Friis Dn. de Kragerup...* Cph. 1640, D 3b.

[632] See Walter Brieger and John W.S. Johnson (eds.), *Otto Sperlings Studienjahre nach dem Manuskript der Kgl. Bibliothek zu Kopenhagen herausgegeben.* Cph. 1920, 45; Carl Christensen, *Den danske botaniks historie,* I. Cph. 1924, 16f; ibid, II. Cph. 1926, 7f; universityprogram by Wulfgang Rhuman reprinted in Th. Bartholin (1662), 272-276.

minerals, herbs and natural wonders of their island,[633] and tried, in vain, to have Severinus' manuscripts published.[634]

But the Chancellor's major interest was the Danish past, and this may well have contributed to Worm's success in winning his patronage. In 1618, when Worm was in the process of winning the Chancellor, he visited the widow of a learned nobleman, and in the castle garden he discovered a rune stone, which he drew down. This is the first indication of Worm's interest in the remote Danish past. This may or may not have been done as part of this search for patronage.[635] In any case, the Chancellor's interest in Danish antiquity proved to be Worm's major asset in their relationship, especially after 1624 when they became neighbours. Worm was ordered by the Chancellor to study and translate runic inscriptions all over the kingdom, and thus he became the major authority of this subject, which he virtually monopolised. This position not only strengthened his standing with the Chancellor, it also gave him a semi-official position of great importance, since the 'national' past had become essential in the propaganda of European princes and governments. Thus, Worm's two major books on the ancient Danish past were not only dedicated to the King, but also bore the portrait of the sovereign on their title pages.[636]

8. Seducing Visions and the Hard Work of Progress

Ole Worm had not only secured his position at the University, but also strengthened it through his close connections to the Chancellor and semi-official position as the authority on the ancient Danish past. This not only enabled him to continue his career, but also gave him the opportunity to develop an identity as natural philosopher.

[633] See letter from Gísli Oddson to Ole Worm, OWB I, 349f.

[634] See Julius Petersen (1898), 2f; *Programmata rectoris Academiæ Hafniensis* in Bartholin (1662), 114-116.

[635] Worm was not the only one to employ the Chancellor's interest in history in his search of patronage. Also in 1618 Anders Kjeldsen Tybo dedicated a comedy with a historical subject-matter to the Chancellor: Tybo, *Absalon.* Cph. 1618, fol. A VII.

[636] *Fasti Danici, universam tempora computandi rationem antiquitus in Dania et vicinis Regionibus observatam etc.* Cph: 1633; *Danicorum Monumentorum Libri Sex.* Cph: 1643.

Apparently, Worm was influenced by much the same currents as we find in Bartholin – the new scholasticism, Paracelsian iatrochemistry, the anatomical tradition of Vesalius and the medical tradition from Basel.[637] To be sure Worm, too, saw a strong connection between medicine and religion and regarded the work of the physician as a pious vocation. This conviction would eventually cost him his life, when during a severe plague epidemic in 1654 he decided to stay in Copenhagen in order to care for the inflicted, unlike the court and most other physicians who had fled the city at the outbreak of the disease. However, the point of interest is that while Evangelical piety was the pivotal point of the natural philosophy of Caspar Bartholin, the same cannot be said of Ole Worm, and a brief look at his background will help to explain why.

Bartholin, the son of a Lutheran clergyman, had been brought up in Denmark and began his studies at Copenhagen and Wittenberg. His outlook was Lutheran theology combined with Philippist humanism and belief in the study of nature as religiously edifying. He began with theology and ended his life as a professor of theology. Worm, on the other hand, came from a different background, and while his academic peregrinations to a great extent brought him to the same intellectual centres as that of Bartholin, his natural philosophy got a different emphasis. Like his father-in-law, Thomas Fincke, Worm came from a family of provincial patriarchs who were involved in the lucrative cattle trade.[638] This traffic of oxen went every spring from Denmark to the markets in the Netherlands and Northern and Western Germany.[639] The commercial links were followed by cultural links that trans-

[637] While no biography exists on Worm, Schepelern (1971) almost amounts to one. For an introduction to Worm in English see Shackelford (1996).

[638] No modern biography exists on Ole Worm, and most of our factual knowledge of his life comes from a program published by the University at his funeral; the program is not extent, but an abbreviation of it was later reprinted in Thomas Bartholin, *Cista medica Hafniensis*. Cph. 1662, 579-82; while the whole speech is printed in *Olai Wormii Epistolæ*. Cph. 1751, I, i.-xxxvi. On his family's background in the cattle trade, Gregersen (1978), 95, 96, 98. His biography is also given in the English summary to Schlepern (1971), 367-383 and the three-volume edition of his letters, OWB, naturally provides much information on his life.

[639] On the cattle trade, E. Ladewig Petersen, 'The Danish Cattle Trade during the sixteenth and seventeenth centuries', *SEHR 18* (1970).

gressed confessional borderlines. At the age of thirteen, he was sent to school in Lüneburg, and afterwards to Emmerich on the Rhine that was split between Catholics and Calvinists.[640] Religiously, Worm may have been a Lutheran, but philosophically his view on natural philosophy was founded at schools and academies on the frontier between Calvinism and Catholicism.

Instead of matriculating at the University of Copenhagen, Worm went to Marburg and studied under Rudolph Goclenius the Elder (1547-1628). When the University of Marburg was split between Calvinists and Lutherans (the latter establishing the University of Giessen), Worm followed the Lutherans, but left soon after, and his further academic peregrination did not bring him to Lutheran universities. He studied at Strasbourg and Basel, travelled through Italy, France, the Netherlands, as well as England where he practised as a physician. After a short stay in Denmark in 1610, he went back to Marburg to study under Johannes Hartmann, who had established Europe's first university chair in chemistry, and in neighbouring Kassel he also visited the Kunstkammer of Moritz of Hesse and associated with the learned men of the court.

His education abroad might have made Worm something of an outsider, and his visit to the Jesuit school in Emmerich might have caused troubles. At this time there was a growing suspicion in Denmark against students from Jesuit schools.[641] What he needed was a patron, and just like Bartholin he got in contact with Holger Rosenkrantz. It is not possible to say who established the contact,[642] but anyway Worm visited Rosenholm in the summer of 1610 and brought with him a recommendation from the royal councillor that enabled him to matriculate at the University with no questions asked (it seems from the extant source material) and get in contact with Thomas Fincke.

[640] Schepelern (1971), 47-52.

[641] See Vello Helk, *Laurentius Nicolai Norvegus S.J.* Cph. 1966, 314-330; Oscar Garstein, *Rome and the Counter-Reformation in Scandinavia. The Age of Gustavus Adolphus and Queen Christina of Sweden.* Leiden 1992.

[642] The castle of Rosenholm was close to Worm's native town of Århus, so his connection to the Rosenkrantz family may have originated from his family background. Another possibility is that the connection was established while he studied abroad, in March 1610, Palle Rosenkrantz wrote in his philoteca.

In May 1619 Ole Worm gave a long oration at the University as dean of the philosophical faculty.[643] This text is worth studying carefully, since it is a key to the intellectual world of contemporary Europe and to the development of natural philosophy in Denmark.

As evident in the title, the oration is concerned with the Rosicrucian brotherhood, which had emerged in the previous years and greatly excited Worm.[644] The oration is a vehement rejection of the Rosicrucians, while at the same time being a statement of Worm's own view on natural philosophy. The mysterious Rosicrucian movement had strong connections to Paracelsian circles in Germany, and since Worm's studies abroad had brought him into contact with such circles, he got wind of the fraternity at an early stage. According to Worm, he had heard of the Fraternity in 1611 and read its manifesto, the Fama, in manuscript three years before it was published. While the manifesto was given to Worm by "a famous iatrochemist at a certain German university", most likely Johannes Hartmann in Marburg under whom Worm studied chemistry, he may also had heard of it during his visits to Paracelsian circles in Kassel.[645] In the circles of medical Paracelsianism and Hermeticism news of the Fraternity caused great expectations and excitement, not least after the publication of the Rosicrucian manifestos, Fama (published in German 1614, in circulation from at least 1612) and the Confessio (published in Latin 1615).[646] The promises of these manifestos are essentially given in the opening lines of the Fama:

[643] 'Oratio inauguralis de Fratrum R.C. philosophiam reformandi conatu 10. maj 1619', in *Laurea philosophica summa in Regia academia Hafn. 15 lectissimis magisterii philosophiæ candidatis tributa 6. Id. Maji 1619. Habes hic inter alia fratrum Roseæ Crucis varia* φιλοσοφήματα *eorundemque philosophiam reformandi conatum examinatum.* Cph. 1619, fol. G2^{v}-K1^{r}.

[644] For Worm's attitude to Rosicrucianism and Paracelsianism see Shackelford (1996). In my opinion no satisfactory study yet exists of the Rosicrucian movement; Yates (1996) is fascinating for its conjectures, but must sometimes be read with a caveat, and the same goes for Peuckert (1973) and particularly for Waite (1924, 1961) and Schlick (1942).

[645] Worm (1619), fol. G4^{v}: *"In manibus quorundam qui Medicinæ Hermeticæ sacramentum dixerunt, antequam publicè typis divulgaretur, annis aliquod erat famosa hæc de Fratribus Fama; ac mihi quidem anno 1611 singularis secreti insta, communicata est á celebri quodam cujusdam Academiæ Germaniæ Chymiatro".*

[646] The two manifestos are printed in an English translation in the appendix of Yates 1996 (1972), 235-260.

Seeing the only wise and merciful God in these latter days hath poured out so richly his mercy and goodness to mankind, whereby we do attain more and more to the perfect knowledge of his Son Jesus Christ and Nature, that justly we may boast of the happy time, wherein there is not only discovered unto us the half part of the world, which was heretofore unknown and hidden, but he hath also made manifest unto us many wonderful and never heretofore seen, works and creatures of Nature, and moreover hath raised men, imbued with great wisdom, who might partly renew and reduce all arts (in this our age spotted and imperfect) to perfection; so that finally man might thereby understand his own nobleness and worth, and why he is called Microcosmus, and how far his knowledge extendeth into Nature.[647]

As is evident from this passage, Rosicrucianism was a fascinating rattle-bag in which knowledge of Christ and knowledge of Nature went hand in hand, together with a celebration of the discoveries and the dignity of Man and great promises of advancement in arts and sciences. Though centred on the two Rosicrucian manifestos, Rosicrucianism with its Hermetic and Cabalist ideas and transformation of ancient and medieval traditions into the years of anxiety and unrest that preceded the outbreak of the Thirty Years' War, became a catalyst of numerous religious, political, and philosophical aspirations.

In a recent study Susanna Åkerman has identified three branches of the Rosicrucian tradition.[648] First there was the attempt to deepen the Protestant reformation, developing through theologians like Johan Arndt and Johann Valentin Andreae (the author of the Fama, which he later claimed to be a joke). Andreae was a great admirer of Johann Arndt, whose influence on Danish religious thinking in this period, has been described above. Secondly, there was a Rosicrucian tradition dominated by theosophy and Joachimite millenarianism centred on Rosicrucian circles in Tübingen, and finally there was what we might call the 'magic' Rosicrucian tradition based on Paracelsism and on planetary, angelic, and talismanic magic as taken over from Arabic-Latin tradi-

[647] Yates 1996, 238.
[648] Åkerman (1998), 95f.

tions by Renaissance philosophers like Johannes Trithemius and John Dee, and represented in the Rosicrucian movement by men like Robert Fludd, Michael Maier, Joachim Morsius, and Johannes Bureus.

While this academic distinction can indeed be useful, it was not clear to Worm and his contemporaries. To them the Rosicrucians built on already familiar traditions and aspirations, and the idea of a renovation in arts and sciences, particularly of natural philosophy, was shared by all three branches of Rosicrucianism. Thus perfection of Man's knowledge of Nature was connected to a perfection of the Christian religion, in the Rosicrucianism of Andreae the perfection of Protestantism.

If we return to Worm, it is hard to trace his contact with Rosicrucians in the years after 1611. Most of his letters from the following years are lost, but at least he acquired books by authors who sympathised with the movement, such as the German physician and occultist Michael Maier, who believed in a non-religious renovation of the arts and sciences,[649] and the French Paracelsian physician and diplomat Quercetanus (Joseph Duchesne), whom he had probably met in person and greatly admired, belonged to an alchemical group of Huguenot refugees in Basel with connections to the movement.[650]

From August 1616, his letters reveal that Worm was greatly interested in news of the Rosicrucians. It may be a coincidence that his interest can be traced to that period, but it is not unlikely that it was connected to the death of Chancellor Borreby (in July 1616), the champion of centralism and Lutheran orthodoxy. Perhaps, the death of the old chancellor and patron, who more than anyone had supported the rise of Lutheran orthodoxy, gave hope of greater intellectual freedom. Worm begged Danish students in Giessen and Strasbourg to bring him any news of the Fraternity,[651]

[649] A copy of Maier's *Arcana Arcanissima, hoc est Hieroglyphica Ægyptio-Græca* in the Royal Library in Copenhagen bears a dedication to Worm dated London 1614; on Maier and the Rosicrucians, Åkerman (1998), 88-91; Yates (1996); Craven (1901, 1968).

[650] In Mach 1609 when Worm was going to France, he had asked Jacob Zwinger for an introductory letter to Quercetanus, OWB I, 2; on Quercetanus' connections to the Rosicrucians, Åkerman (1998), 211.

[651] OWB, I, 11, 15, 27, 31

and probably he made inquiries of the Fraternity to the German Joachim Morsius who visited Copenhagen in the summer of 1617 and in whose album amicorum he wrote an entry.[652] From his letters, a manuscript book,[653] and the oration, it is also clear that he was familiar not only with the manifestos, but with a number of Rosicrucian treatises.

Worm also seems to have somewhat championed the Rosicrucian cause in Copenhagen, and he lent treatises on the Fraternity to his former broker the theologian Jesper Brochmand, who somewhat sourly replied that "To explain the new things of which you speak, would require an Oedipus".[654] After much hesitation, Worm finally sided against the Rosicrucians in the summer of 1618: "I now hardly doubt that the society of these mad Cross-bearers shall eventually incite even their advocates against them, since they have for so long put off the credulous with an empty hope. What have they given us after so many bombastic promises, so many boastings about renovations in languages and learning, apart from some empty tales and pages smeared with sweet visions? If they do not keep what they have promised in such gaudy manners of speaking, all their efforts shall end up in smoke".[655] One year later, he concluded: "this whole Society of the Rosicrucians, if it does indeed exist, is an amalgamation of all sects; although they declare themselves to be Lutherans in other writings, there is much that smells of fanaticism and Anabaptism mixed together with Paracelsus.....I am fairly convinced that this Society almost has dissolved into nothing".[656]

The emergence of the Rosicrucians had clearly excited Worm, as they for a while excited many learned Europeans at the outbreak of the Thirty Years' War. As for Worm he moved from initial curiosity and a certain enthusiasm to great disappointment. Why is that? It has been claimed by Frances A. Yates that the Rosicrucian furore was connected with the Protestant movement and aspira-

[652] Heinrich Schneider, *Joachim Morsius und sein Kreis. Zur Gestesgeschichte des 17. Jahunderts.* Lübeck 1929, 108. Morsius had already got in contact with the Rosicrucians in Rostock from at least 1616, see Schneider 31f.
[653] MS Rostgaard 33 8°, Royal Library; see Shackelford (1996), 184ff.
[654] OWB, I, 28.
[655] OWB, I, 33f, 34.
[656] OWB, I, 49.

tions around the Elector Palatine,[657] and it is evident that it came to a sudden end after 1620, coinciding with the collapse of the Bohemian venture, the invasion of the Palatine, and the suppression of the court of Heidelberg.

In the case of Worm, it is true that he seems to have lost any interest in them after 1620, but we can hardly ascribe it to general political developments. When Worm directed his speech against the Rosicrucians in May 1619, before the Battle of The White Mountain, the future might still lay ahead of the Palatine movement. It would be tempting to see Worm's rejection of the Rosicrucian movement as the result of outside pressure from the government and the church. The official academic context of the oration surely required caution on Worm's part, but as we shall see below he also in private letters and in practice distanced himself from the movement and its ideas. Furthermore, while the rise of Lutheran Orthodoxy and church discipline undoubtedly created a climate unfavourable to Neo-platonic thinking in Denmark, it still has to be documented that the Danish government took a particularly hostile view on Rosicrucianism. I have not found any evidence of it, though it may well be there, and in all cases the young librarian from Rostock, Joachim Morsius who was a supporter of the Rosicrucian movement, was welcomed at court more than once during the years.[658] In lack of other evidence, we have to use Occam's razor and conclude that Worm's turning against the Rosicrucians was his own decision. He clearly expressed disappointment of the movement, so it is worthwhile to ask what Worm (like many of his contemporaries) initially expected from the movement.

The Rosicrucianism of the manifestos contained two promises - the perfection of religion and the perfection of Man's

[657] Frances A. Yates, *The Rosicrucian Enlightenment.* London 1996 (1972), 92.

[658] Schepelern (1971), 117f. suggests that the Rosicrusian sympathies of Morsius may have been unknown to his Danish hosts. While, it is true that most of them hardly sympathised with the Rosicrucian movement, I find it unlikely, in this period so sensitive to heterodoxy, that they should have been ignorant of Morsius' sympathies. Morsius was several times in Copenhagen, last time in 1634-35 when several prominent men wrote in his album. Later, in 1643, Christian IV arranged that Morsius was released from the mental asylum in Hamburg in which his family had put him, Schneider (1929), 70 and he was probably at the Danish court in the 1640s acting as a secret envoy of the Danish king, see Blekastad (1969), 377.

knowledge of nature. While they were connected, it is a question whether Worm's interest and rejection of the movement was primarily based on religious or philosophical sentiments, and the two excellent scholars who have studied the problem have drawn different conclusions.[659] No clear answer can be given. First of all, while it is clear that most of Worm's rejection of Rosicrucianism is concerned with philosophy; this is hardly surprising since the oration was given ex officio as dean of the faculty of philosophy. In Worm's letters, religion plays a relatively small role, but most of these were written to learned friends, many of them non-Lutherans. What we can conclude, however, is that both philosophical and religious sentiments played a role in Worm's expectations and disappointment of the movement, and that this experience clarified his view on the relationship between philosophy and religion.

If we begin with the latter, the promise of a Christian philosophy of nature, originating in Lutheranism, but being above confessional schisms, may have appealed to a man, who lived in an orthodox Lutheran society, but had been educated at Calvinist and Catholic academies, witnessed the clash of confessions first hand and subscribed to the ideal of the Republic of Letters. At a time when Aslakssøn, who was a friend of Morsius,[660] was abandoning his attempt to create a synthesis between new discoveries in natural philosophy and the Genesis, Rosicrucianism represented a vision for a new unity between religion and natural philosophy. Rosicrusians like Morsius and Joachim Jungius in Rostock were men who took interest in both religion and natural philosophy, the latter having established a secret society, whose members were to learn 'The art of inventing things'[661]

These men were also in contact with the Scotsman John Dury and his attempts to reconcile Christianity, and it seems that he found an audience in Denmark. He met with Tycho's widowed sister, Sophie Brahe,[662] and in Dury's letters from 1628 onwards

[659] Schepelern (1971), 115ff. primarily regards Worm as a scientist, and therefore connects his rejection of Rosicrucianism to its scientific sterility; Shackelford (1996), 192ff. regards religious sentiment as the main motive.
[660] Blekastad (1969) 152n.
[661] The *Societas Ereunetica* or *Zetetica*, or *Protoneutica*, see G.E. Guhrauer, *Joachim Jungius und sein Zeitalter*. Stuttgart 1850, 69-78
[662] Blekastad (1969), 281.

Holger Rosenkrantz is mentioned several times as his protector.[663] So it seems that the idea of reconciling Christianity was well received among Danish men and women of learning during these years, and despite their different positions, both Caspar Bartholin and Cort Aslakssøn aspired to this, as did Longomontanus (if we are to believe his preface to Astronomia Danica).

Already at an early point, however, voices were raised that regarded the Rosicrucians as disruptive to such efforts.[664] Physicians like Andreas Libavius, whom Worm mentions in his speech, had associated the movement with the Anabaptist heresy,[665] and it is also likely that Worm was influenced by the negative attitude among leading Danish theologians like Brochmand.

As for natural philosophy the Rosicrucian promise of a perfection of the knowledge of nature, reflected notions that were widespread among educated men in an age that had already developed an awareness of its own merits. Such notions were few years later propagated by Francis Bacon in his Novum organum (1620), Instauratio magna (1620) and New Atlantis (1624), but he was only one of many contemporary voices. Similar ideas had been expressed by men as different as Jean Fernel, Michael Maier and Johann Kepler,[666] and they were particularly current in the circles of Paracelsian medicine, which was undeniably a science unknown to antiquity.

Worm's rejection of Rosicrucianism led him to reflect on his view on scientific method and the relationship between philosophy and religion, and the oration gave him the opportunity to propagate his position to the students and the academic body. Apart from their empty promises, Rosicrucian treatises also contained objections to established natural philosophy, which they shared with many contemporaries, and which Worm found it worthwhile to deal with in his oration. They can be summarised in two points:

First of all the Fraternity (according to Worm) criticised the disunity of contemporary philosophy and the fact that the universities depended on the pagan traditions of Antiquity by using au-

[663] G. Westin, *Kyrcoh. Årsskr.* 1933m 204, 261, 278f., 293f., 338; Blekastad (1969), 281.
[664] Such as the anonymous *Fama remissa ad Fratres Rosae Crucis.* s.l. 1616,
[665] Worm (1622); see Shackelford (1996), 202f.
[666] For Kepler see Jardine (1984).

thorities like Aristotle and Galen. Against this they held the promise of their own, though yet unaccounted for, Christian philosophy of unity[667] To Worm, however, philosophical diversity and disagreement is not a sign of crisis, but a prerequisite for intellectual progress. Thus he also defends philosophical disputations (*studia concentionis*), and follows Joseph Scaliger in comparing them with a vessel on which problems can be brought to light and cleansed of ignorance and doubt.[668] Worm thus defends the dialectical method of finding truth and asks: "What has uncovered the hidden nature of things? Philosophical disagreement. What has revealed what should be examined and followed, and what should be despised and avoided? Philosophical disagreement."[669]

Worm believes in progress in Man's knowledge through philosophy and praises new developments in natural philosophy and their icons: "If the Lyre of antiquity was once false, it has now been tuned to such sweet harmony so it like Orpheus attracts stones and beasts. This is confirmed by the cures of the physicians, the theatres of the anatomists, the gardens of the botanists, the laboratories of the chemists, the experiments and observations of the physicists, the calculations of the astronomers."[670]

Against this, Worm holds the Rosicrucian philosophy as sketched in the Fama. Building on the idea of the Prisca theologia, it is here claimed that the philosophy of the Fraternity goes back to Adam and was practised by Moses and Solomon. Since it is divine, it has been carried on by both Old Testament prophets and

[667] Worm (1619), fol. H4ᵗ: *"Primo conqueruntur Philosophiam nostram contentionibus & diſſidius esse refertiſsimam; nosq; Lyræ antiquæ modulos sequi, dum in nostris scholis & Academiis potiores partes sibi vendicent Aristoteles & Galenus, quam clariſsimum veritas jubar".*

[668] Worm (1619), fol. H4ᵗ.

[669] Worm (1619), fol. H4ᵗ: *"Si etenim quæras: Quid Philosophis tantam suppeditavit in utramq; partem probabiliter disserendi copiam ? Philosophica dissensio. Quid abstrusas rerum naturas in apricum protulit ? Philosophica dissentio. Quid detexit quidnam probandum & sequendum, quidve detestandum & fugiendum? Philosophica dissentio".*

[670] Worm (1619), fol. H4v: *"Quin si quæ olim fuerit Lyræ antiquæ dissonantia, ea nunc ad tam svavem deducta est harmoniam, ut concentu, instar Orphei, saxa & feras trahat. Testes sunt Medicorum curæ, Anatomicorum theatra, Botanicorum horti, Chymicorum, πονητιζα, Physicorum experientiæ & observationes, Astronomorum calculationes".*

Greek philosophers. Thus, it represents an ancient union of philosophy and theology.[671]

This brings Worm to the relationship between philosophy and theology. He points to Man's perverted nature, wherefore human knowledge can never be perfect, and rejects that theology and philosophy is one. He points to the many miracles narrated in the Bible - the virginity of Mary, the Sun that stopped its passage over the horizon and turned back when Joshua conquered Gibeon, the childbirth of Sara in her old age, the Trinity etc.[672] These things did not happen naturally (*naturaliter*), and can according to Worm not be treated by philosophy, but although philosophy is the servant of theology to which it owes ultimate obedience, it still constitutes a discipline of its own in matters of natural things.[673] This distinction was in no way original, but interesting in its context. Not only was it directed against attempts at creating a Christian philosophy, it was also a formal statement in the heydays of Lutheran Orthodoxy of the relative independence of philosophy. Since the domain of philosophy was the natural world, Worm and his contemporaries took a strong interest in monsters and prodigies, which challenged the distinction line between miracles and omens on the one hand and the natural world on the other. We find this interest in Worm, in Thomas Bartholin in the next generation, and among numerous contemporary natural philosophers.[674]

Finally, Worm in his oration also turned against Paracelsian speculations on the macrocosm and the world soul.[675] Here he was

[671] Worm (1619), fol. I^{v}: *"In hac non valet: Hoc per Philosophiam verum est, sed per theologiam falsum. Sed ex unione eorum in quibus Plato, Aristotelis, Pythagoras, scopus attigerunt, Enoch, Abraham, Moses, Salomon vera protulerunt..."*

[672] Worm (1619), fol. I2^{v}: *"Virginem naturaliter concipire, utero gestare & parere posse ? Solem naturaliter subsistere & retrogrado ferri motu ? Vetulas decrepitas, elanguidas, omni succo ac sangvine destitutas concipere, fætum utero gestare, nutriere, & in lucem vitalem robustum ac sanum edere valere ? Cavete ne vos rideat Sara; exsibilet Elisabet".*

[673] Worm (1619), fol. I2^{v}: *"Licet enim imperio dominæ se subjectam fateatur ancilla; tamen idem utrinq; nolle & velle, vix ubiq; & semper reperitur."*

[674] See K. Park and L. Daston, 'Unnatural Conceptions: The Study of Monsters in France and England', *Past & Present* 92 (1981), 20-54; J. Céard, *La nature et les prodiges. L'insolite au XVIe siécle en France.* Geneva 1977.

[675] Worm (1619), fol. I4^{r}: *"Si hisce missis ex harmonia majoris & minoris Mundi a Paracelsus & aliis tenata Philosophiam suam eruere tentent, quo successu id sint facturi videant".*

in full agreement with the metaphysics of Lutheran Orthodoxy, which was connected to Aristotelianism. The idea of Man as a microcosm, containing the whole universe and a divine spark, was essentially incongruent with Lutheran theology that established Faith (or rather Grace) as the only link between Man and God, and the metaphysics of Protestant Aristotelianism, which upheld a clear distinction between God and His creations.

Worm certainly did believe that the age in which he was living had moved farther within some sciences than those that preceded it,[676] but at least from the time of his rejection of Rosicrucianism, this was based on the appearance of new discoveries within the sciences as well as discoveries of the world and new technologies rather than divine revelation. While he adhered to Paracelsian iatrochemistry and the emphasis on practical experience in medicine and chemistry, he held back from connecting it to Hermetic and Neo-Platonic traditions. Furthermore, he adhered to the eclectic idea that no single man or tradition has a monopoly on truth or has avoided errors.[677] While this attitude was extended by some Renaissance philosophers to include religion (revealed truth, that is), Worm prudently (and probably sincerely) restricted it to natural philosophy. Despite the fact that Worm was in line with theology in his rejection of Rosicrucian speculation, his attitude to natural philosophy may be contrasted with the rising theological orthodoxy and intolerance of these years. While theology narrowed its method and dogma, natural philosophers like Ole Worm basically widened the scope and horizon of the study of Nature.

What Worm basically defended was the Aristotelian approach to the study of Nature, namely that truth consists in a large number of true statements and that here is no universal key to unlock the secrets of the variety of arts and sciences.[678] It was to be based on the traditional academic method of teaching, but as progress in

[676] For the idea of progress in medicine and a discussion of the term see Thomas Rütten, 'Hippocrates and the Construction of "Progress" in Sixteenth- and Seventeenth-Century Medicine', Cantor (2002), 37-57.

[677] For this Renaissance attitude, which found expression in the ancient saying *"amicus Socrates, amicus Plato, sed maxime amica veritas"* see Henry Guerlac, 'Amicus Plato and Other Friends', *Jour. Hist. of Ideas* 39 (1978), 627-633; *Leonardo* Tarán, 'Amicus Plato sed magis amica veritas. From Plato to Aristotle to Cervantes', *Antike und Abendland* 30 (1984), 93-124.

[678] See Gilbert (1960), 8.

philosophy was based on disagreement, one should not blindly adhere to the opinions of Aristotle, like the Averroists, who had followed him to closely that they had become his slaves.[679] This was an attack on the school of Padua, and Worm claimed that such adherence to authority is against the true philosophical quest for truth.

Worm was thus in favour of eclecticism[680] and innovation, but it had to be done by employing precise and well-defined philosophical terms. Philosophical obscurity was one of his main objections to both Rosicrucian and Paracelsian philosophy. Furthermore he was strongly opposed to the idea of esoteric knowledge. This is evident in his questions for a disputation in 1622.[681] Here he dismissed the concept of a living or vital philosophy advocated by Severinus and other Paracelsians as nonsense.[682] He not only followed men like Scaliger in criticising Paracelsus' homemade medical terms, but also criticised the esoteric aspects of Paracelsianism represented by chemists like Oswald Crollius, who claimed that Paracelsus' style was 'magical' and not intended for the common crowd, but for the sons of wisdom, brought up in the school of magic.[683] Worm stamps this attitude as 'arrogance' and mischievously asks why Paracelsus then wrote in German, if it were not intended for the common man, and why write anything at all, if the intended readers were already initiated?[684]

Furthermore, Worm rejects that the theory on the elements that Petrus Severinus had given in his Idea should bring anything new.[685] In a disputation from the following year Worm propagates the examination of natural objects as the only way physics can

[679] Worm (1619), fol. H4^{v}: *"Dudum enim explossa est secta Averroica, cui in Aristotelis verba jurare volupe fuit, Quid enim magis à Philosophicæ gravitate dignitateq; ..."*

[680] His favourable opinion of eclecticism was already expressed in the preface to his doctoral thesis in Basel, where he declare himself to be the adherent of no school, but dedicated to truth alone: Ole Worm, *Selecta controversarium medicarum centuria.* Basel 1611, *proemium.*

[681] Ole Worm, *Questiones micellarum decas.* Cph. 1622; see also Shackelford (1996), 195f.

[682] Worm (1622), fol. 2^{v}. *"A Chymicis non ita pridem excognitata haec est distinctio, ad sua inventa exaggeranda, hactenus vero receptam philosophiandi rationem extenuandam".* For those ideas Worm is targeting see Hannaway (1975).

[683] Oswald Crollius, *Basilica Chymica.* Frankfurt a.M. 1609, 77.

[684] Worm (1622), fol. 4^{r}.

[685] Worm (1622), fol. 8^{r}-9^{v}.

make progress by way of the senses, and arrive at principles through experience. The essence (essentia) of things is reserved for metaphysics. Furthermore, the physicist must discover the truth of Nature without consideration for practical purposes.[686]

For the rest of his life, Worm adhered to the view on the position and method of philosophy that he had presented in the oration. As for natural philosophy this may be illustrated by a few examples. The first concerns Worm's reception of William Harvey's theory of the circulation of the blood (1628) that ran counter to Galen's view of the human body. This example does not only illuminate Worm's view on medical discovery, but also the way new discoveries were circulated and eventually accepted in the first half of the 17th century. As usual, Worm got most of his information from Danish students studying abroad. In the summer of 1631 he asked a Danish student in Leiden how the physicians there thought of this new theory.[687] The bewildered student answered:

> *This matter (Harvey's theory) made me so anxious that for eight days I was intensely lost in deep thoughts. Since I could hardly nourish my breast by myself, I put the whole matter forward to a studious young student named (Hermann) Conring, who is a friend of mine. He showed me Harvey's treatise and spoke so excellently and shrewdly on the circulation of the blood, that he almost seemed to share the same heretical opinion [...] Later, I also conferred with Heurnius and Falcoburg, who gladly with both legs (as you say) shared Conring's opinion, but added that in matters that changes the old and recognises the new, we should rather be too careful and hesitating than to daring and rash.*[688]

Worm subscribed to the prudent view of the two Dutch anatomists,[689] and concerned himself with the problem in the following years. In 1632 he rejected Harvey's theory in a disputation,[690] but quite significantly he neither invoked the authority of

[686] Ole Worm, *Exercitationum physicarum I de naturalis philosophiæ constitutione.I* Cph. 1623.
[687] OWB, I, 242.
[688] OWB, I, 247f.
[689] OWB I, 253.
[690] Worm, *Controversiarum medicorum exercitatio sexta.* Cph. 1632.

Galen or other medical authorities nor used aesthetic or qualitative arguments, but attacked weaknesses in the theory itself. Since the capillaries had not yet been discovered, Harvey had not been able to give an adequate explanation of how the blood crossed from the arteries to the veins and had put forward the hypothesis that a crossing took place either through a direct connection between the blood vessels (anastomosis) or through porosity in the flesh or either way.

Against this explanation, Worm raised several objections. How could the blood cross through porosities when it coagulates as soon as it leaves the blood vessels? Another problem concerned the small circulation. How could the thick venous blood be ejected through the narrow mouth of the veins, enter the lung tissue, be filtered through this and finally be absorbed in the smallest of the arteries? Harvey claimed that the blood moves from the heart through the arteries and back to the veins. Thus it must be the same blood in both kinds of blood vessels, but why has Nature then provided the arteries with thick walls, while providing the veins with thin walls? In short, Worm's objections were based on his knowledge of the human body and were perfectly sound even by modern standards. After ensuring that the theory had been taken serious by contemporary medical authorities, whom he knew and trusted, he carefully weighed the theory against his own empirical knowledge.

Worm's vehement rejection of the Rosicrucians also throws light on his attitude to the unpublished manuscripts of Petrus Severinus. Supported by the King, Chancellor Kragerup in 1620 told Worm in person that these manuscripts should be collected and published, and asked Worm to encourage Severinus' son Frederik Severinus to publish the manuscripts and help him in this endeavour.[691] Excusing himself with being overworked, Worm, however, left the publication to the son and it came to nothing despite admonishments from the Chancellor. As such Worm did not reject the project, but he did not employ an obvious opportunity for strengthening his ties to the Court.

Worm's decision to go against the wishes of his patron in this matter cannot have been undertaken light-heartedly. At this time he was still not certain of his favour with the new Chancellor, and

[691] OWB, I, 46, 47.

in a matter where the King was also involved, it took courage to decline. That Worm did so must undoubtedly be seen in connection with his rejection of Rosicrucianism and those currents of Paracelcianism that went beyond iatrochemistry. It seems that Severinus' extant manuscripts included commentaries to Aristotle's Physica, and thus the more theoretical aspects of Paracelsianism.[692] Perhaps it was not even Severinus' ideas as such that held Worm back, as it was the fact that the name of Severinus had become connected to the Rosicrucian movement. The physician Anton Hobenweschel von Hobenfeldt in Hamburg, who was the custodian of some of Severinus' manuscripts, was deeply involved in the Rosicrucian movement, and when in 1622 he published the Pseudo-Paracelsian prophecy of the Lion of the North together with the Swede Johannes Bureus, it had a preface by Morsius, who connected the prophecy to the circle around Severinus and Tycho Brahe,[693] and a French pamphlet from the following year numbered Severinus among the Rosicrucian ancestors.[694] Finally, the Rosicrucian propagation of the theory of signatures, also integral to Severinus' natural philosophy, may have made it suspect to Worm.[695]

This approach was also extended to this study of the Runes. Michael Maier had connected the Runes to hermetic philosophy, and in the next chapter we shall see how Johannes Bureus incorporated the ancient Scandinavian-Germanic alphabeth into his Hermetic, Cabalist and Rosicrucian philosophy. Worm, however, persistently refrained from connecting the study of the Runes to such speculations, and persuaded others to do the same. Inspired by writers like Lipsius, Scaliger and Gruterus, the headmaster of the school in Malmø, Bertel Knudsen Aqvilonius (1588-1650), had taken an interest in Runes and collaborated with Worm. It seems, however, that he was attracted to cabalist interpretations of the ancient symbols,[696] probably stimulated by

[692] OWB, I, 46.
[693] The prophecy is reprinted in Nordström (1934), 36-40. According to Morsius (hidden under the pseudonym Anastasius Philaretus Cosmopolita), the prophecy had arrived in Hamburg through Tycho's heirs and Cort Aslakssøn; Blekastad (1969), 112f.
[694] Åkerman (1998), 139-144, 175.
[695] *Confessio,* Yates (1996), 257f.
[696] Schepelern (1971), 119ff.

Morsius, who paid him a visit in the summer of 1617, and it seems that Aqvilonius was in doubt as to the interpretation of the Runes. Later the same year Aquilonius visited Worm in Copenhagen, and afterwards he would thank Worm for giving him peace of mind.[697] From now on he stuck to a historic interpretation of the Runes.

From the source material it is not possible to determine how far the abandoning of occult speculation by men like Worm and Aqvilonius was purely due to convictions on the right method of science, and how far it was influenced by the intolerant political and intellectual climate of those years. At least from a statement by Aquilonius it is clear that his speculations had also provoked slander,[698] but the matter definitely needs to be studied further and new source material disclosed.

Another Danish Paracelsian was Ambrosius Rhodius (1605-1696), who during his studies in Wittenberg had studied under the moderate iatrochemist Daniel Sennert. When Rhodius came to the University of Copenhagen in 1635, he published a treatise on Pythagoras and astronomical medicine.[699] Also after his appointment as physician in Kristiania (modern-day Oslo), he continued his studies in natural philosophy, developing a particular interest in Paracelsianism, culminating in 1643 with a book in which he continued the Paracelsianism of Severinus, though he corrected him on a number of points.[700] Rhodius was married to a granddaughter to Severinus and was thus also related to Worm and his family. Therefore, it was natural that he corresponded with Worm and wanted to discuss Severinus' theory of the elements

[697] OWB, I, 25, 44.

[698] OWB, I, 13: *"Even though I as far as possible have destroyed or removed my writings, much has escaped me. I am afraid, you shall see me before you wish to, as the slander of some of my assistants is spreading".* Aquilonius was, however, a very sensitive man. There was undoubtedly a general political and cultural climate unfavourable to occult speculation, and in 1617 a severe law on sorcery and witchcraft had been issued. It remains however, to be proved that this also extended to the circles of learning supported by the Court.

[699] *Disp. astrologia de astorum influxu etc.* (1635) and *Dialogus de transmigratione animarum Pythagorica etc.* (1638); on Rhodius, see I. Ingerslev, *Ambrosius Rhodius og hans hustru.* Cph. 1916.

[700] *Disputationes supra Ideam medicinæ philosophicæ Petri Severini* (1643).

with the learned professor. Despite their relationship, however, Worm declined.[701]

What Worm attempted was thus to stick to Aristotelian natural philosophy as the general theoretical framework combined with discoveries gathered from anatomy and medical practice. Paracelsianism was accepted only as iatrochemistry, and here he was in line with a major tradition in contemporary medicine.[702] He had no desire to connect it to religious or mystical insights and vehemently stamped the works of the prominent Belgian iatrochemist Jean-Baptiste van Helmont as "a Paracelsian madness aimed at overturning the principles of the medical art, which have been confirmed through long experience", and he wondered how "his experiments can be praised, when he does not pass anything of them on, so that they others could perform the same experiments".[703]

9. The Rise of Curiosity

There was another intellectual, or rather cultural, development that was formative on the view on the study of nature held by Ole Worm and the next generation of Danish natural philosophers. It was a development that transcended academic discussions and is connected to cultural history, namely the re-evaluation of 'curiosity' (*curiositas*) that took place in the Renaissance.[704]

Though views on curiosity reflected mental and cultural developments, they were in the forefront of discussions on the status of philosophy. In Chapter Two we saw how Christian Fathers regarded the study of creation for its own sake, i.e. without connection to religion, as vana curiositas. In the context of his struggles against pagan philosophy, Augustine had condemned intellectual curiosity as an expression of desire for pleasure (voluptas) and a

[701] OWB, II, 215, 222, 238f.; see also Shackelford (1996), 184 note 11.

[702] Debus (1965 and 1991) concluded that in Britain and France Paracelsian pharmacy was generally accepted, whereas theory was denigrated or ignored, and the same was largely the case with the Bartholin circle.

[703] OWB III, 283, 477. Neither had Worm a high opinion of another prominent Paracelsian chemist, Hartmann, who held Europe's first chair in chemistry in Marburg, see OWB, I, 9, 38, 77 and Shackelford (1996) for sit relationship with Hartmann.

[704] See Hans Blumenberg, *Der Prozeß der theoretischen Neugierde.* Frankfurt a. M. 1980; Lorraine Daston, 'Neugierde als Empfindung und Epistemologie in der frühmodernen Wissenschaft', Grote (1994), 35-59.

stepping-stone to the deadly sin of pride (superbia), an opinion that was followed and expanded by religious authorities like Berhard of Clairvaux[705] and Jean Calvin.[706] The rise of Aristotelian philosophy at the University of Paris and elsewhere in medieval Europe, and the tensions between philosophers and religious authorities had accentuated the problem, but it was not until the Renaissance that curiosity was thoroughly re-valued. When this happened it was part of a fundamental revaluation of human psychology.

The central thing about intellectual curiosity, both to Augustine and to 17th-century philosophers was the fact that it is essentially unending. When it has taken hold on some truth, it moves on to something new. This was the reason why theologians could put it together with lust (voluptas), since it not only led to pride but also endangered the stability of the soul. Behind this was a religious ideal that praised stability and contemplative life. To Augustine Man in this world is on a pilgrimage away from God (peregrinantes a domino), and he must use the physical world rather than enjoy it.[707] Man has to travel back, to find what was lost by the Fall and return to God. Thus, in the Catholicon, a dictionary of Medieval Latin printed in the early Renaissance, the term *curiosus* is defined wholly pejoratively, as a person concerned with external matters rather than with self-knowledge.[708]

This religious aversion towards curiosity was also reflected in literature. In his chronicle of the bishops of Hamburg from about 1075 Adam of Bremen described how travellers who had dared to explore the remoteness of the Northern seas had met horrible

[705] Daston (1994), 38f; on the reflection of this attitude in the interpretation of Romans XI, 20, see Carlo Ginzburg, 'High and Low: The Theme of Forbidden Knowledge in the Sixteenth and Seventeenth Centuries', *Past and Present* 73 (1976), 28-42.

[706] Eginhard Peter Meijering, *Calvin wider die Neugierde. Ein Beitrag zum Vergleich zwischen reformatorischem und patristischem Denken.* Nieuwkoop 1980; Heiko Oberman, *Contra vanam curiositatem. Ein Kapitel der Theologie zwischen Seelenwinkel und Weltall.* Zürich 1974; Blumenberg (1966); Ginzburg (1976); Kenny (1998).

[707] *Corpus Christianorum* XXXII (1962), 8: *"...ut de corporalibus temporalibusque rebus aeterna et spiritualia capiamus."*

[708] Balbus de Janua, 1506. First printed 1460, but had been completed in 1286. On the different semantics of *curiositas*, see Neil Kenny, *Curiosity in Early Modern Europe World Histories.* Wolfenbütteler Forschungen 81. Wiesbaden 1998.

currents and whirlpools or other dangers. Only by calling upon God had they escaped the danger of being pulled into chaos. For Adam these sea voyages were warning examples of curiosity, and he concluded his description of the secrets of nature in the north in these words: "For me it is enough to say with the prophet: How manifold are Thy works, O Lord. With Wisdom Thou hast made them all...thy judgments are as the deep sea; rightly they are therefore called impenetrable:"[709] In the Swedish version of the Alexander romance from the end of the fourteenth century we find a continuous hesitation as to whether man ought to try to discover nature's laws and secrets.[710] Penetrating India to satisfy his burning desire for knowledge, the Alexander of this romance oversteps his limits and suffers punishment. Similarly, Dante in The Divine Comedy depicts Ulysses, who in the shape of a burning flame tells the two pilgrims in Hell how his desire to know the world drove him once again to break up from Ithaca.[711] He put to sea and persuaded his men to sail west beyond the Pillars of Hercules, the limit that seemed set to human striving, with the appeal: "Consider your origin: you were not made to live as brutes, but to sue virtue and knowledge". Dante's Ulysses is like Alexander of the romance a tragic hero, whose curiosity eventually makes him perish in the deep waters of the forbidden seas.

In the 16th and 17th century such introspective ideals gave way to a new psychology characterised by motion and a praise of the vita activa. Such notions were already expressed in the 14th century, but only hesitatingly. Petrarch could echo Augustine (Confessiones X, viii) and ask, to what purpose he should know the nature of the beasts if he ignored the nature of Man, the reason why we are born, whence we come and where we go.[712] Alongside traditional virtues of peacefulness, self-restraint and contemplation, however, we find in Petrach values such as curiosity, restlessness, and capac-

[709] Kurt Johannesson, 'Adam och hednatemplet i Uppsala', *Adam av Bremen.* Stockholm 1984; Götz Pochat, *Der Exotismus während des Mittelalters und der Renaissance.* Stockholm 1970.

[710] On the Swedish Alexander romance, see *Skrifter udtgivna av Svenska fornskriftsällskapet* 12.

[711] *The Divine Comedy*, Canto XXVI.

[712] Petrarch, *Le traité De sui ipsius et multorum ignorantia*, ed. L.M. Capelli. Paris 1906, 24f.

ity for persistence.[713] In the following centuries, this duality continued, also in Northern Europe, and gradually a dynamic view of Man won terrain, though it never totally exiled introspection.[714] In Leviathan Thomas Hobbes defined curiosity as the desire, or passion, to know why and how, and made it unique to Man. He acknowledged that it was unending ("continuall and indefatigable generation of knowledge"), but valued it positively as exceeding carnal pleasure,[715] and similar ideas were also expressed by a man like Marin Mersenne.[716] So while the never-ending nature of curiosity was acknowledged, curiosity became legitimate in Late Renaissance and was even commercialised by the production of great numbers of popular descriptions of natural philosophy and nature often directed towards 'the curious'.[717]

This revaluation of curiosity was connected to the idea of the progress in arts and sciences, stimulated by the experience of the discovery of the New World and the realisation that the modern age had produced new knowledge (such as Vesalius' Fabrica, optics and chemistry) and inventions (the printing press, gunpowder, the compass, new powerful ships) unknown to the ancients. To this may be added the notion that the classical geographers had had little knowledge of the Northern lands and seas.[718] Amerigo Vespucci's Mundus novus was published in 1503. It was soon available in German, Dutch and Czech editions,[719] and 'new', in the meaning of unknown to the ancients, became a catchword for authors and publishers alike.[720] In 1545 the French physician, Jean Fernel, who was well known to Worm, had characterised the new age by the circumnavigations of the earth (by Magellan 1519-21), the discovery of new continents, the invention of book printing

[713] See C. Trinkaus, 'Renaissance and Discovery', *First Images of America. The Impact of the New World on the Old*, I, ed. F. Chiapelli. Berkeley, Calif. 1976, 6-8.
[714] In the humanist dictionaries of the 1530s and 1540s, *curiosus* as a label which can be either positive or pejorative, see Kelly (1998), 53.
[715] Thomas Hobbes, *Leviathan* (1985), 124.
[716] Daston (1994), 41.
[717] See Blair (1997), Ch. 1.
[718] Thus when he wrote his description of Denmark (printed 1594), the vicar Jon Jensen Kolding realised that Strabo had known very little of the lands north of the river Elbe, Kolding (1980), 41.
[719] D. Beers Quinn, 'New Geographical Horizons: Literature', Chiapelli (1976), 639ff. A discussion of the impact of the discoveries is also found in Rüegg, 14.
[720] Ridder-Symoens (1997), 15.

and of firearms, the rediscovery of ancient books and the restoration of the sciences.[721] When the Basel physician and collector Felix Platter in 1584 had his larger-than-life portrait painted, he had himself depicted with Vesalius' Fabrica beneath his right hand, and with a potato plant on the table in front of him.[722]

There has been a tradition, especially among American scholars, of simplifying the impact of the discoveries upon early modern thinking. According to this tradition the shock of discovering hitherto unknown customs and people (some of them highly organised like the Aztecs and the Incas) as well as vast amounts of plant and animal species unknown to the ancient authorities of learning, discoveries initiated by practical men outside the realm of learning, forced European scholars of the early modern period to liberate themselves from the authority of the classical texts and enabled them to made naked experience take the place of written authority. As some recent studies have shown, things were a bit more complicated than that,[723] and Dr. Grafton has eminently mapped the complex relationship between discovery and the classical authorities.[724]

First of all, it has been shown how scholars generally tried to assimilate or even unite new discoveries with the classical tradition. Furthermore, it needs to be emphasised that the corpus of classical texts around 1600 was very diverse and contained several conflicting theories on the world and nature, and that this outcome of Renaissance philology was as instrumental in provoking a crisis within the learned world as the discoveries themselves.

[721] E. Garin, 'Die Kultur der Renaissance', in G. Mann and A. Heuss (eds.), *Propyläen Weltgeschichte*, vol. VI. Frankfurt a. Main/Berlin/Vienna 1964, 468.

[722] See E. Landolt, 'Materialien zu Felix Platter als Sammler und Kunstfreund', *Basler Zeitschrift für Geschichte und Altertumskunde* 72 (1972), 245-306.

[723] See J.H. Elliott, *The Old World and the New.* Cambridge 1970; G. Gliozzi, *Adamo e il nuovo mondo.* Florence 1977; M.T. Ryan, 'Assimilating New Worlds in the Sixteenth and Seventeenth Centuries', *Comparative Studies in Society and History* 23 (1981), 519-538.

[724] Anthony Grafton, *New Worlds, Ancient Texts. The Power of Tradition and the Shock of Discovery.* Harvard U.P. 1992. For a recent analysis of the importance of the discoveries to the relationship between archaic and modern reason see Fernando Flores Morador, *Mellan åsikt och vittnesbörd. Amerika och Västerlandets arkaiska rötter.* Lund 2001.

Finally, it is also clear that the world of learning and the world of practical life were not separated by watertight shutters.[725] Generally explorers and merchants adhered to the world-view of the scholars, they were often well read and when describing discoveries, they generally tried to fit what they saw into a traditional framework. Even when merchants wrote books aimed at practical life they often set it into a larger context. Dr. Grafton mentions the 15th-century Italian merchant Goro Dati who wrote a book that was generally thought as a manual for navigators of the Mediterranean.[726] Yet Dati also describes the universe as a whole, the whole array of spheres that hold the stars and move the planets, the astrological properties of the twelve signs of the Zodicac and seven planets, and analyses in detail the weather, the seasons, and the human temperaments. And in his description of the world at large, Dati's view is essentially based at those of contemporary natural philosophy.

This conjunction of practical and scholarly aims continued throughout the early modern period as the example of the 17th-century Danish merchant Hans Nansen (1598-1667) illustrates. Like Thomas Fincke, Nansen came from a family of merchants in Flensburg , but he never received any kind of academic training.[727] As a young man we was sent on the northern route to the White Sea and spent two winters in Russia. Afterwards he was employed by a Russian company, the Petsora Company, one of the several mercantile ventures initiated by Christian IV, and later he became involved in another mercantile venture, namely the Iceland Company. Nansen was a well-travelled man, whose life was spent on annual voyages to Iceland and management of the company's sales in Glückstadt. In his middle years he was made burgomaster of Copenhagen and was fully occupied with the daily problems of a bustling commercial city.

Nansen belonged to the world of practical life and was not a man from whom one would expect academic speculation. A

[725] Grafton (1992), Ch. 2.
[726] Grafton (1992), 66ff.
[727] Though Nansen is well known in Danish history due to his involvement in the introduction of absolutism in 1660, the only biographical study on him is F. Hammerich, 'Præsident Hans Nansen den ældre', *Historisk Tidsskrift* (Denm.), 3:1 (1858-59), 131-260.

French aristocrat described him as a "Man without letters",[728] and the Imperial ambassador in Copenhagen regarded him as little more than a sailor, though with some good natural judgement.[729] Yet in 1633, when he was still actively engaged in commercial life, Nansen took time to write a large cosmography.[730] On the one hand the book reflected the practical character of the culture Nansen belonged to. It was written in Danish, its third part was directed to pilots and navigators and included various kind of useful information, and despite its bulk (419 pages) it was published in the handy small octavo. However, the first part of the book is a proper cosmography, describing the heavenly spheres and the elements. The second part is a geographical survey of "all the kingdoms and countries in the world". The fourth and final part, which was added to the second edition (1635), and updated in the third and fourth edition (1638 and 1646), is a chronology of everything important that has happened since the Creation.

Apart from the third part on navigation, Nansen necessarily took his information from books, and many of his sources are truly large books,[731] such as the atlas published by Gerardus Mercator,[732] Theodore de Bry's popular illustrated work on America,[733] Gemma Frisius' revised version of the cosmography of Petrus Apian,[734] and the popular cosmographies of Sebastian Münster and Johann Rauwen,[735] books that were all available in German or

[728] Quoted in C.O. Bøggild-Andersen, *Statsomvæltningen i 1660.* Cph. 1936, 185.

[729] Bøggild-Andersen (1936), 194.

[730] Hans Nansen, *Compendium Cosmographicum.* Cph. 1633. The book was reissued, also in Copenhagen in 1635, 1638 and 1646. It was also translated into Icelandic. For an analysis of the book, see Steensgaard (1995) and Lassen (2002).

[731] On Nansen's sources, see Steensgaard (1995), 434ff.

[732] Gerardus Mercator, *Atlas, sive Cosmographicae meditationes de fabrica mundi* and *Atlas minor, das ist Ein kurze jedoch gründliche Bescreibung der ganszen Welt* were published in several editions and translation into Durch and German after 1606.

[733] Theodor de Bry, *Zwölfter Theil der Newen Welt. Das ist Grundliche Vollkommene Entdeckung aller der West Indianischen Landschafften...* Frankfurt 1623. On his book, see Grafton (1992), Ch. 3.

[734] *Cosmographie, ofte beschrijvinge der geheelder Werelt...gheschreven door Petrus Apianus. Gecorrigeert ende vermeerdert door M. Gemma Frisius.* Antwerpen 1561, Amsterdam 1609.

[735] Johann Rauwen, *Cosmographicia, das ist Eine schöne richtige und vollkommliche Beschreibung des göttlichen Geschöpffs Himmels under der Erden.* Frankfurt a.M.

Dutch and which Nansen could acquire from Dutch publishers such as Jan Janszon and the Elzevier Company, who published catalogues specifically for the Danish market and held sales in Copenhagen.[736] Since he did not master Latin, Nansen had not read Tycho Brahe's findings himself, but he probably became acquainted with his findings through the navigation manuals.[737]

The first part of Nansen's cosmography begins with a treatment of the heavenly spheres and then moves on to describe natural phenomena like the eclipses of the sun, the moon and the comets. According to the preface Professor Longomontanus had seen through the book and corrected mistakes. As far as comets go, Nansen is almost up-to-date with contemporary theories: "*This is the correct opinion on comets, according to the honourable Tycho Brahe's dedicated observations, even though Aristotle and the ancients were of the opinion that comets were made from matter, extracted from the earth by the sun and the moon*".[738] Nansen knows the size of the planets, and their distance from the earth, and he gives credible explanations for phenomena like wind and rain, thunder and earthquakes. In his discussions on the celestial bodies, on the other hand, he is a little outdated, using a Ptolemaic hybrid rather than a Tychonic world picture, yet it was the first full exposition of a Ptolemaic/Tychonic world picture in the vernacular.

In his treatment of the geography of the world, Nansen somewhat surprisingly gives no tales of monsters and cannibals, but shows his enthusiasm for commerce and city life. According to Nansen, Europe is the best part of the world: "*This is because it surpasses the other parts with many large cities, with mighty warlords and common soldiers, with many wise and judicious men in several arts, with many costly ships, with the inhabitants of Europe visiting all the other parts of the world, also there are not so many wastelands in Europe as in Asia or Africa, but it is inhabited by people nearly*

1597; Sebastian Münster, *Cosmographei oder beschreibung aller Länder*...was published in several editions and translations from 1544 onwards. On Münster's cosmography, see Grafton (1992), 97-111.

[736] See Camillus Nyrop, *Bidrag til den danske Boghandels Historie*, I, Cph. 1870, 167-168; Steensgaard (1995), 438.

[737] Willem Janszon Blaeus, *Licht der Zeevaerdt* (1608) contained new tables of the declination of the sun according to Brahe's observations.

[738] Nansen (1638), 32; I use Professor Steensgaard's translations of the text, which are taken from the first complete edition (1638).

everywhere. The princes of Europe now rule over a large part of Asia and Africa and besides over all of America."[739] Nansen's geographical description is not restricted to Europe; he fills out the whole globe from the Banda Islands and Japan in the East to Virginia and Peru in the West. As far as Greenland is concerned he, as an Iceland merchant, is better informed than most of his contemporaries. He was thus the first to introduce his fellow countrymen to the world geography as it looked after a century of discoveries. As Professor Steensgaard has pointed out, there is a naïve analogy between the Cosmos of Hans Nansen and the Earth of Hans Nansen. He has not seen it all, but he has read about it in his large books during his voyages on the Northern seas, he fills out the void, no place is empty. What is still undiscovered, he fills in, Borealis in the north, includes all land to the north of Europe, Asia and America, Magellanica all lands to the south.

The third part of the book is a short handbook for navigators. It enumerates courses and distances for a number of West European sailing routes covering the waters from the White Sea and Iceland in the north to the coasts of Spain and France in the south, and of course, including the Baltic Sea and the interior Danish sea routes. His sources are, undoubtedly, the highly respected Dutch rutters[740] whose sequence in the enumeration of various routes he follows, while he silently corrects them in several instances, probably from his own experience or from the experience of other informants. Furthermore, this part contains good practical advice on navigation.

The three parts that made up the original edition of Nansen's cosmography were thus concerned with how to orientate in space, but went far beyond the practical requirements for conducting navigation. This was even more so with the fourth part on chronology that was added in 1635 and updated in further editions. Nansen's chronology is the traditional one from contemporary Danish and Norwegian almanacs. The world was created in the year 1, Christ was born in 3963, and so the world was 5598 years old at the time of the publication of the second edition of the cosmography.[741]

[739] Nansen (1638), 64f.
[740] Lucas Waghenaer, *Spieghel der Zeevaerdt...*, First complete edition Leiden 1585 and Willem Janszon Blaeu, *Zeespieghel....*1623 and later.
[741] Nansen (1638), 331.

Hans Nansen did not provide his cosmography with any dedication. It was in other words not an attempt to win a patron. Neither can the fee have counted much to the successful businessman. Nansen's driving force was curiosity. In the preface he tells us that to understand the world and the ways of God, we firstly have the Bible, "*but also several cosmographical and geographical books, and out of these I have for some years written a summary or short extract for my own information...And when some time ago I read through these notes, it occurred to me, that there might be others, who were interested in reading about such matters, but that some of these, because of other business did not have time or occasion to find it in large cosmographical books where it is spread out in great detail, while there might be several, that do not own such large books. So, to serve them I had this book published in print after it had been read and corrected by the famous, honest and learned man, Christian Longomontanus, professor of mathematics at the University of Copenhagen.*"[742]

Hans Nansen's book certainly found an audience. It was issued in revised editions at least three times, and at the time of his death it was sold out, according to the funeral sermon. A manuscript translation into Icelandic has been preserved, which may have been used by seventeenth-century Icelandic annalists when referring to matters outside Iceland.[743] Soundings in Danish estate records also indicate quite a large diffusion of the book, which became one of the most popular non-religious books of the century,[744] and more than once is the later owner referred to as 'master' (handelsmand), which would indicate something less than a merchant, but more than a shopkeeper.

The popularity of the book was partly due to its usefulness as a navigator's manual,[745] but this was hardly the only reason. Early modern publishers generally had a keen eye for the market, so

[742] Nansen (1638), Fol. A2r-A4r.

[743] Jón J. Adils, *Den danske monopolhandel på Island 1602-1787.* Cph. 1926-27, 124, n.1.

[744] This is based on a large sample of books, about 1500 registered in Aarhus estates 1678-1701, see Palle Birkelund, 'Noget om Læsning og lidt om Boghandel i Aarhus i Slutningen af det 17. Aarhundrede', *Aarbøger udgivne af Historisk Samfund for Aarhus Stift*, vol. XXXII, Århus 1939, 25; also Appel (2001), II, 560, 601, 757f., 764, 768, 789, 827, 874.

[745] See Steensgaard (1995), 433.

when Peter Andersen had Nansen provide the new edition of the cosmography with a part on chronology, he was no doubt confident that this would increase the sale potential of the book. There was in other words, an audience for books in the vernacular that was somewhat closer to academic literature than the numerous and widely read popular books like Lucidarius.[746] It was in such a cultural climate, that the famous astronomer Ole Rømer, the son of a navigator from Århus, would later learn mathematics before he entered the University.[747]

The interest in the great world is also evident in the geography by Hans Hansøn Skoning from 1641.[748] Amounting to 778 quarto pages it was a description of several "eastern" countries and peoples, such as China, India, and America. It is much less precise and well-informed than Nansen's cosmography - America is, for example, often confused with India - but it shows the same awareness of a widening and exotic world, dangerous but possible for European man to master. Other works of the wide world that appeared in the vernacular in this period included the Greenland chronicle of the poet Claus Lyschander,[749] Jens Munk's relation of his expedition to the Hudson Bay in 1619-20,[750] and the eyewitness description of Russia, Caucasus, and Persia by the German Adam Olearius, who was employed by the Duke of Gottorp.[751] As

[746] On 17th-century Danish literature in the vernacular see Appel (2001).

[747] Rømer (2001), 602.

[748] Hans Hansøn Skoning, *Geographia Historica Orientalis, Det er: Atskillige Østerske Landis oc Øers/met detz Folckis Beskriffuelse*...Århus 1641. The book was dedicated to its two sponsers, noblewomen Utte Marsvin and Mette Brahe.

[749] Claus Christoffersen Lyschander, *Den Grønlandske Chronica.* Cph. 1608. In 1605-1607 Christian IV mounted expeditions to re-establish the contact with Greenland that had been lost since the late middle ages; the eye-witness accounts of the first expedition still exist in manuscript (KB GKS 996 2°). Lyschanders book is written in verse and consists of two parts, the first being a chronological survey of Greenland, the second a thorough account of the recent expeditions to Greenland.

[750] Jens Munk, *Navigatio Septentrionalis. Det er: Relation eller Bescriffuelse/om Seiglads oc Reyse/paa denne Nordvestiske Passagie, som nu kaldis Nova Dania.* Cph. 1624. Munk had been sent out by Christian IV in 1619 to find the Nortwest Passage, north of America to China. The expedition turned into a disaster with only Munk and two other sailors surviving of the original 64 crew members.

[751] Adam Olearius, *Offt begehrte Beschreibung der Newen Orientalischen Reise.* Schleswig 1647. The book also appeared in Dutch, French, and English translations. Olearius (1603-1671) had been secretary to the expedition of 1633-1639

Olearius would write in his preface to the second edition of his book, it was in demand by "so wol hohes als niedriges Standes personen".[752]

Even a man like the good Hans Resen, the future bishop of Sealand and champion of Lutheran Orthodoxy and penance, drew a large map of Greenland decorated with small drawings of the native Greenlanders with kajaks, dodsledges, and hunting weapons.[753] A world inhabited by a multitude of peoples, plants, animals and monsters thus increasingly entered the literature of even those who knew only the vernacular. It was in many ways an exotic and dangerous world, but it was also a world that contained a number of possibilities in trade, natural philosophy, and even religion (as far as the heathens could be christened). First of all, it was largely a world unknown to the classical authors.

Let us return to Ole Worm. Coming from a mercantile background himself, all his life he kept close contacts with merchants. He used merchants to carry letters between Copenhagen and his correspondents abroad, mostly distinguished scholars at universities, courts and private residences all over Western Europe, students on their peregrination and a number of Icelandic scholars. Merchants also brought him plant and animal species as well as curiosities from their travels to the Northern Seas and the Far East. So while he was an academic, Worm was also closely related to the culture and outlook of merchants such as Hans Nansen.

There is no reason to assume that Worm embraced a sympathetic attitude to curiosity and discovery as the result of profound religious and philosophical reflections. While he clearly expresses an indirect enthusiasm for curiosity in many places, we never once find him reflecting on curiosity itself. Thus, it was not an idea he embraced, but rather a mentality, a culture, which flourished in the environments he lived in, from his mercantile background in

sent by Count Frederik III of Gottorp to establish direct trade connections with Persia.

[752] The second and enlarged edition appeared in 1656 and has been republished as *Vermehrte Newe Beschreibung Der Muscowitischen vnd Persischen Reyse*, ed. D. Lohmeier. Tübingen 1971.

[753] Hans Poulsen Resen, *Indicatio Grønlandie (et) vicinarum regionum, versus Septentrionem (et) Occidentem* (1605). The map is now in the Map Collection of the Royal Library in Copenhagen. It was dedicated to Christian IV.

Jutland to his visits to intellectual centres like Basel, Padua, and Leiden, situated in or near mercantile centres like Amsterdam and Venice. Here a man like Worm could find evidence of an expanding world of new innovations and discoveries, plants and animals unknown to the ancients, and developments in optics. He also spent a year and a half in London in the house of Robert Rich (later to become Earl of Warwick). In such an environment it was not hard to embrace curiosity, but it depended on the eye that saw. Caspar Bartholin, who also visited Padua and Leiden, does not seem to have developed a similar enthusiasm for discoveries, but had his eyes fixed on his pious vocation as a physician.

In the end, it was a difference between two perceptions of the world. No one doubted that the world was moving (metaphorically speaking), but the question was in what direction. On the one hand we find a mentality occupied with the decline of the world, often connected to eschatological views. The world was drawing towards its end; things were falling apart, evil and moral chaos ruled - a view that could easily find confirmation in the debacle of The Thirty Years' War. On the other, we find an attitude connected to the idea of progress, a dynamic view of man coupled with enthusiasm of discovery and curiosity. It was the difference between a positive and a negative evaluation of Man's place in this world, it was the fundamental difference between the natural philosophy of Caspar Bartholin and Ole Worm, and it is a difference that still dominates Western culture.

10. The Museum of the World

The enthusiasm for the wonders of the world, the emphasis on personal observation, and perhaps also the identity as natural philosopher between University and Court, led Worm to establish a great collection of plants, animals, minerals and artificial (archaeological and ethnological) items. It was the first significant collection of its kind in Scandinavia.[754]

During his academic peregrinations, especially in Basel, Italy, Kassel, and the Netherlands, Worm had got acquainted with a number of collectors. In Basel, the professor of medicine Felix

[754] Worm's collection and its background has been analysed in H.D. Schepelern, *Museum Wormianum. Dets forudsætninger og tilblivelse.* Århus 1971 and idem, 'The Museum Wormianum reconstructed', *Journal of the History of Collections* 1990:1.

Platter had taken over the major part of the collection of the natural historian Conrad Gesner in 1565,[755] and other teachers of his like Theodor Zwinger and Caspar Bauhin collected plants. Through his teachers in Basel, Worm had also come in contact with the Accademia dei Lincei in Rome. Bauhin, corresponded with the founder of the Accademia, the Italian aristocrat Federico Cesi,[756] and during travels at the Rhine Worm met Johannes Schreck, who under the name Terrentius was a leading member of the academy and had written a commentary to Hernandez' natural history of Mexico.[757]

In Italy Worm possibly visited Francesco Calceolario's famous museum in Verona, and probably that of Ferrante Imperato in Naples.[758] He may also have visited or heard of Andrea Vendramin's collection that included whelks, shells and conches from various parts of the world, minerals, animals, fish, birds, and plants.[759] In Bologna he probably saw the botanical garden established by Ulisse Aldrovandi (also, of course, one of the greatest collectors of natural history items), and in Enkhuizen in the Netherlands he visited the collector Bernhard Paludanus.[760]

It is hardly coincidental that Worm began to establish his collection of natural phenomena in 1621, few years after his rejection of the Rosicrucians. It was at the same time Caspar Bartholin increasingly turned towards theology, eventually changing his chair in medicine with one in theology. Worm chose another path. Having mastered the perilous waters of patronage, he was firmly established at the University and like Fincke and other physicians, he received a substantial income from his rising popularity as a physi-

[755] Schepelern (1971), 55; Ackermann (1985), 65ff.
[756] Schepelern (1971), 27, 205.
[757] Giuseppe Gabrieli, "Il Carteggio Linceo Della vecchia Academia Di Federico Cesi (1603-1630)" in *Memorie Della R. Accademia Dei Lincei classe Di Scienza Morali, Storiche e Filologiche Serie VI*, vol. VIII Fasc. I-IV. Rome 1938-42, 1003-1004.
[758] Schepelern (1971), 63f.; J.E. Kristensen, 'Det kuriøse og det klassificerende blik - naturens indsamling og forordning fra Renæssancens samlere til det moderne naturhistoriske museum med Museum Wormianum som udgangspunkt', *Den jyske Historiker* 64 (1993).
[759] See E. Jacobs, 'Das Museo Vendramin und die Sammlung Reynst', *Repertorium für Kunstwissenschaft* 46 (1925), 15-39; T. Borenius, 'More about the Vendramin collection', *The Burlington Magazine* LX (1932), 140-145.
[760] Schepelern (1971), 69-71.

cian, perhaps to such an extent that it blurred the division lines towards the nobility. While the nobility still stood politically far above the middle-class, economic realities made the relationship somewhat ambiguous. Thus, Thomas Fincke was the largest non-noble creditor of Holger Rosenkrantz, and among the creditors we also find other members of the family, such as Jacob Fincke, Ole Worm and Caspar Bartholin.[761]

Furthermore, there was what we might call the 'cultural capital', the prestige associated with learning as we have treated in Chapter Three. Money capital and cultural capital combined to give men like Ole Worm a self-awareness of belonging to an elite of the elect. While they did not aspire to the life style of the nobility who increasingly leaned towards fashion, luxury and conspicuous consumption, they did neither feel themselves as part of the common crowd. In a letter to his son who travelled abroad with two noblemen, Worm wrote: "Life among courtiers is difficult. We shall avoid their vices and copy their virtues. Do not mingle too much with the crowd, as you shall thereby loose respect".[762]

Stern thoughtful faces with a cassock, long beards and unadorned black dress are how we meet the professors of this period in paintings and engravings, a style increasingly contrasting to the dress of fashion-minded courtiers, clean-shaven or equipped with a neat moustache or well-trimmed pointed beard often taking a martial position. There were noblemen like Chancellor Kragerup who deliberately chose to be portrayed in the old style out of reverence for the old culture of learning, but they were exceptions and an endangered species.

Behind this unadorned appearance, however, men like Ole Worm developed a self-conscious and self-awareness not unlike that of those professors and collectors he had met in Basel, Padua, and Leiden. There was, of course, the great difference that their equals in these cities lived in Republics. Worm was not blind to this, and to the fact that his position rested upon his patronage at court, but the cultural capital he possessed blurred the power structures somewhat.

[761] Svend Aage Hansen, *Adelsvældens grundlag.* Cph. 1964, 141; see also Knud Fabricius, *Skaanes Overgang fra Danmark til Sverige I (1645-1660).* Lund 1906, 74-76.
[762] OWB, III, 479.

It is against this background we must see Worm's activities as a collector. In the middle ages, collections had been private and reserved for princes and religious institutions, and in the Renaissance Italian and Central European princes continued to establish great collections. The arrangement of these collections contained a sharp division between items of nature and things that were made by man (artificalia). Their principle of order was largely symbolic and centred on man rather than the natural world, and they were (in the words of Guiseppe Olmi) "an arena of competition between art and nature".[763] In the 17th century most of these collections were opened to the public, serving to legitimise and glorify the prince, and accordingly their arrangement was largely based on aesthetic principles.[764]

Worm represented a new type of collector that arose during the Renaissance with men like Ulisse Aldrovandi in Bologna, Ferrante Imperate in Naples and Conrad Gesner in Basel. Although some artificialia were included in their collections, they were predominantly collections of natural objects. None of these collectors belonged to the old aristocracy and none had regular connections with princely courts. They had all studied medicine and botany at university and entered professions, which naturally followed from such studies.[765] The initial driving force behind their collecting activity was botanical, i.e. the need to know and identify medical plants, something that was accentuated by the arrival of a number of new species from America, Africa and the Far East. Thus, the criteria for arrangement were purely functional rather than symbolic, and the collection consisted of an orderly succession of numbered cupboards, each one bearing a description with details of the contents. Furthermore, these collectors lived in the age of printing, and men like Aldrovandi took great pains to have the catalogues of his collections properly illustrated.

The Italian, Swiss, and Dutch physicians and botanists who established collections were often connected to a university, but the collections themselves belonged to their private domain. We have already seen how the circles of natural philosophers who existed outside the University of Copenhagen (though including

[763] Olmi (1985), 5; Krzysztof Pomian, *Collectors and Curiosities. Paris and Venice 1500-1800.* Engl. trans., Cambridge 1990, chapter 1.
[764] Olmi (1985), 12f.
[765] Olmi (1985), 5-6.

members of it), met in a museum, the library or study chamber of their home. As such, it was a forum where the philosopher established contact with the Muses, Urania the muse of astronomy and Hermes, the quasi-classical magus connected to chemistry.

According to the distinguished historian of collections, Krzysztof Pomian, collections in ancient and medieval times was a bridge between the visible and invisible world,[766] between the present and a reality that was removed in space, time or layer of reality. And this was likewise the role of the Museum (both as a study and library and as a collection), in the early modern period; it was a place where the man of learning and his friends uncovered the invisible world by means of emblems and signatures, or (once again in the words of Guiseppe Olmi) "an attempt to transfer the entire world of nature from the often inaccessible outdoors to the restricted interior of a museum".[767]

To philosophers of the 16th and early 17th century an ever-present problem was the question of the connection between the visible and material reality to the invisible and spiritual world. This was the problem Petrus Severinus dealt with, when he put the Paracelsian ideas of experience and iatrochemistry into a Neoplatonic framework, claiming that the Universe with all its beings is pervaded by *semina* that mature, unfold and return to their womb in the spiritual world. To Severinus and the Paracelsians the Book of Nature was written with signs, God-given signatures imprinted on every plant, mineral and creature (or part of creature) that indicated its inherent powers, whether healing or toxic.

But this interest in the visible thing itself as a key to something invisible was not only propagated by those currents of thought that flourished outside the universities. It was also at the heart of Aristotelianism itself. Despite the shifting emphasis put on various parts of the Aristotelian corpus in the middle ages, the starting point of Aristotelian natural philosophy was biological, wherefore it was concerned with the birth and transformation of beings as expressed in the idea of the potential of things.[768] So, despite the clashes between Paracelsians and Aristotelians, there

[766] Pomian, *Collectors and Curiosities. Paris and Venice, 1500-1800.* Cambridge 1990, 20-25.
[767] Olmi (1985), 7-8.
[768] See Eckhard Keßler, 'Metaphysics or Emperical Science? The Two Faces of Aristotelian Natural Philosophy in the Sixteenth Century', Pade (2001), 79-101.

was common ground to be found in the idea that in things themselves, in plants, creatures, minerals, and objects, there is a hidden power (or potentiality) that can be uncovered. And both could agree (unlike Neo-Pythagoreans and some Ramists) that this was not to be done through mathematical analysis or pure speculation.

During the 16th century this interest in individual things and their powers began to flourish, and the reasons for this cannot be ascribed solely to philosophical developments. Already antique and medieval philosophy contained the impetus to examine the visible world's individual phenomena as is evident in Pliny's *Natural History* and the numerous bestiaries of the middle ages. In the Renaissance it was stimulated by the discovery of new species from hitherto unknown (or little known) parts of the world, combined with the development of new techniques of illustrations (from woodcuts to etchings and engravings) that enhanced the capacity for reproducing detailed pictures of items. Just like the printing press enhanced the authority of the written word, the new techniques of reproducing pictures dramatically changed the book market. New genres such as emblematic books and copiously illustrated catalogues of collections arose, while others such as travel descriptions became more magnificent. In natural history the discoveries of new worlds and of hitherto unknown ancient texts (Dioscorides, Theophrastus) spawned carefully illustrated works; examples ranging from Leonard Fuch's history of plants (1543) to Aldrovandi's mammoth publications.

This was also the beginning of the visualisation of natural philosophy that has been so important to the popularisation of science well into the 20th century. In early modern Europe this increasing focus on pictures, not only led to the establishment of inseparable links between a science and its icons - the quadrant, the telescope, the globe, the anatomical theatre etc. - it also led to an increased awareness among some natural philosophers of the visible and material aspects of nature.

To Tycho Brahe, astronomy and chemistry were not only letters and mathematical symbols. We have discussed the two statues of Astronomy and Chemistry at the entrance to Uraniborg. These emblems he reproduced in his Astronomiæ instauratæ mechanica (1598), in which he also gave elaborate illustrations of his instruments of observation, thus being one of the pioneers in creating icons of natural philosophy. In the following generation, icons of natural philosophy were connected to ideals of the elites.

In 1594 Francis Bacon would thus imagine the ideal dwelling of the perfect gentleman:[769]

> *First, the collecting of a most perfect and general library, wherein whosoever the wit of man hath heretofore committed to books of worth...may be made contributory to your wisdom. Next, a spacious, wonderful garden, wherein whatsoever plant the sun of divers climate, or the earth out of divers moulds, either wild or by the culture of man brought forth, may be....set and cherished: this garden to be built about with rooms to stable in all rare beasts and to cage in all rare birds; with two lakes adjoining, the one of fresh water the other of salt, for like variety of fishes. And so you may have in small compass a model of the universal nature made private. The third, a goodly, huge cabinet, wherein whatsoever the hand of man by exquisite art or engine has made rare in stuff, form or motion: whatsoever singularity, chance, and the shuffle of things hath produced; whatsoever Nature has wrought in things that want life and may be kept; shall be sorted and included. The fourth such a still-house, so furnished with mills, instruments, furnaces, and vessels as may be a palace fit for a philosopher's stone.*

To a Neoplatonist like Brahe such icons were the visible connection between the visible world and higher layers of reality. To Aristotelians like Worm, being and unity were coextensive. He was, as we have seen, not immune to promises of one all-embracing system of natural philosophy, but after the disappointment of the Rosicrucian movement, he returned to the idea of natural philosophical truth as a collection of individual insights. Just as Worm in his view on philosophy in general was in favour of a dialectical process that tested various opinions against each other, he applied the same view to the study of nature in regards to specific phenomena. This was, of course, very different from the teaching at the faculties of Philosophy and Medicine, concerned with general frameworks of acquiring knowledge, and the activities in Worm's Museum were intended for the elect few.

[769] Francis Bacon, *Gesta* Grayorum (1594); see also Arne Losman, 'Vetenskap och idéer i Per Brahes d.y:s och Carl Gustav Wrangels bibliotek', *Lychnos* 1971-72, 86, with a German summary.

Thus, Worm's collecting activities belonged to the quasi-private domain of the museum discussed in Chapter Three. It has been claimed, that his collection of natural philosophical objects was intended for use in university teaching.[770] The source material poorly supports such an interpretation of the collection that intends to make a modern university teacher out of the 17th century professor. While we have little evidence that the collection of natural phenomena was used in Worm's teaching until 1636, years after it was established, quite a number of foreigners in Copenhagen, mostly Frenchmen, but also German notabilities like the Duke of Württemberg, visited the Museum and described it is a private enterprise.[771] Furthermore, if the purpose of the Museum was teaching, it seems strange that Worm bequeathed it to the King, who put it in his Kunstkammer out of the reach of most students.

But while the collection was hardly directed at university teaching at first, it was no doubt accessible to his young relatives and to those few other students, who won the favour of their professor. Furthermore, it became accessible to the Republic of Letters, professors and learned gentlemen around Europe. Catalogues of the collection were published in 1642 and 1645,[772] while a great folio catalogue was published in 1655, the year after Worm died.[773] It was published by the famous Elzeviers of Amsterdam, thoroughly and very beautifully illustrated, and its frontispiece (Fig. 7) contains one of the few illustrations of the interior of 16th and 17th-century collections.

[770] H.D. Schepelern, *Museum Wormianum.* Århus 1971; Ejnar Hovesen, *Lægen Ole Worm.* Århus 1987. Both with an English summary.

[771] Charles Ogier, *Det store bilager i Kjøbenhavn 1634.* Memoiner og Breve, ed. Julius Clausen and P.F. Rist. Cph. 1914, republ. 1969, 54-58; D'Avaux, *Voyages en Hollande, Allemagne et Danemark* (unpubl. manuscript now in Brussels); Pierre Daniel Huet, *Iter Svecicum, ad Johannem Capelanum.* S.l. 1662, idem. *Commentarius de rebvs ad evm pertinentibvs.* Amsterdam 1718, 79-94, 116-119; Raimondo Montecuccoli, *Viaggio in Svezia. Opera inedita pubblicata a cura di Adriano Gimorri e preceduta da una notizia sulla vita e sulle opera dell'autore.* Modena 1924, 1-36; OWB III, 357.

[772] *Museæ Wormiani catalogus.*

[773] *Museum Wormianum seu HISTORIA RERUM RARIORUM tam Naturalium, quam Artificialium, tam Domesticarum, quam Exoticarum, quæ Hafniæ Danorum in ædibus Authoris servantur* etc. Amsterdam 1655. The words 'in ædibus Authoris' emphaises the private character of the collection.

The items of natural history in the Museum Wormianum were divided into Minerals, Plants and Animals, reflecting the Aristotelian idea of the scale of nature (scala naturae), a gradual and continual progression from lower to higher entities.[774] Aldrovandi and other early modern collectors had employed the same principle of classification. Worm's museum, however, also included a fourth category - Artefacts, man-made-items ranging from runic inscriptions and souvenirs. Here the principle of classification was material, and it was not clearly separated from items of natural history. It also included a good deal of curiosities, items that illustrated the playfulness of Nature (*lusus naturae*),[775] and man-made items that imitated Nature such as a mechanical mouse or an eye made of parchment.

This interest in curiosities and the playfulness of Nature was not only connected to the humanist and gentleman culture to which Worm belonged and which we have analysed above, but was also philosophically founded. It was an attempt to define the limits of what was natural (*naturaliter*) and thus natural philosophy's field of study. Just as Aristotle had taken a great interest in beings that apparently were both plants and animals, natural curiosities challenged and stimulated discussions on the categories of natural world. Here the travels of natural philosophers was important as was the improved techniques of illustration, the development of a naturalistic rather than symbol presentation as it is found in Worm's catalogues, as well as the contacts with merchants and sailors from distant parts of the world.

Thus, it is well known that Worm proved that the horn of the mysterious unicorn, sold at great prices around Europe, in reality was the tusk of a narwhal. This had already been claimed by Gerhard Mercator and other writers, and when Chancellor Krageup in 1636 gave him a narwhal skull from the Northern Seas with tusks Worm joined that view and reported his findings to French acquaintances[776] and later published them.[777] Thus, the

[774] C. Mordhorst: 'Systematikken i Museum Wormianum', *Fortid og Nutid* 2002:3, 204-218.

[775] Cf. Paula Findlen, 'Jokes of Nature and Jokes of Knowledge: The Playfulness of Scientific Discourse in Early Modern Europe', *Renaissance Quarterly* 43 (1990).

[776] OWB III, 98f. (to Isaac Lapeyrère) and ibid, 154 (to Du Buisson) .

fabled unicorn with all the religious and mystical symbolism that was attached to it,[778] was replaced by the narwhal, a great beast of the Northern Seas, yet nothing but an animal.

More interesting is perhaps the case of the so-called glossopetrae, which were found in the mountains of Malta. Today we know they are fossilized shark teeth, but to Worm and his contemporaries, their origin was unknown; they were also known as 'snake tongues' and thought to be capable of protecting against snake bites and sorcery as well as possessing healing powers and therefore caught the attention of physicians.[779] A student had sent Worm a glossopetrae from Malta, and in a letter to Henrik Fuiren in Padua, Worm discusses its origin.[780] He adheres to the opinion that it is probably a fossilized shark tooth, but in his collection Worm has the head of a shark (canis carcharius) with hundreds of such teeth none of them as big as the glossopetrae.[781] This leads him to the conclusion that in certain parts of the world, the soil and the mud contain certain powers (petrifying juice or vapour) that turn teeth to stone, and furthermore that the playfulness of Nature produces stones, which look like teeth, and he gives several examples from his collection. Then he goes on to praise the marvellous construction and diversity of Nature and concludes: "To investigate the nature and coming into being of such things is to me a rather delightful occupation for a free-born man".

The glossopetrae were brought back to Copenhagen by several Danish students such as the young Bartholins and Fuirens. As an argument against the idea that they were fossilized shark teeth, Worm had pointed out that they could also be found in places such as Verona that lay far from the sea. Nicolaus Steno had seen glossopetrae during his years as a student in Copenhagen in the late 1650s, and they had awoken his interest. Later he dissected the head of a shark in Italy and concluded that the glossopetrae

[777] Worm, 'An os illud, qvod vulgò pro cornu Monocerotis vendidatur, verum sit Unicornu ?, Worm (1638), Chap. XIII.
[778] See Axel Garboe, 'Enhjørningen, især i Natur- og Lægevidenskabens Historie', *Medicinsk-historiske Smaaskrifter* XII, ed. V. Maar. Cph. 1915.
[779] Garboe (1949), I, 70f.
[780] OWB III, 36-38.
[781] This is probably due to the fact that the fossilized shark tooth belonged to a different and probably extinct shark species.

were indeed fossilized shark teeth.[782] Then he drew the radical conclusion that parts of the earth, which was now land, had once been covered by the sea, which again stimulated him to geological expeditions in the Italian landscape that led to his theory that the earth underwent constant changes. Unfortunately, these groundbreaking discoveries were not published, but only written in a summary to his patron the grand duke of Tuscany.[783]

Thus, the collections of Worm and others were important in stimulating discussions of natural philosophy, but although they were eventually used in university teaching, they belonged to the culture of the museum, the study of the learned gentleman. As has been recently argued by Camilla Mordhorst, the walls of the Museum Wormianum, not depicted on fig. 7, also contained Worm's library and ancient manuscripts.[784] It was logical that collecting items of various kinds should be integrated in humanist culture, and we have to overcome the distinction between texts and objects.[785] The enthusiasm for the world of antiquity was not only stimulated by the rediscovery of manuscripts. The ruins in Rome and ancient coins and inscriptions played were equally important. And when the interest in the past was extended to ancient Scandinavia, ruins and artefacts played a similar role, and as Paula Findlen has pointed out: "collecting was about the confrontation of ideas and objects",[786] regardless if it were man-made things or items of natural history.

Therefore, Worm as a collector of items of natural history and as a collector of runic inscriptions and artefacts cannot really be separated. Both activities arose from the same humanist effort to discover, collect and represent items separated in space or time, in other words to bridge the invisible. It was an expression of an attitude that combined enthusiasm for curiosity and discovery with the essentially immobile life of a university professor. After his

[782] Steno, *Elementorum myologicæ specimen seu musculis descriptio geometrica.* Florence 1667, appendix; see Arne Noe-Nygaard, 'Nicolaus Steno: Paleontologist, Geologist, Crystallographer', *Nicolaus Steno. A Re-consideration by Danish Scientists*, ed. J.E. Poulsen and E. Snorrason. Gentofte 1986, 167-190.

[783] Steno, *De solido intra solidum naturaliter contento dissertationis Prodromus.* Florence 1668; see A. Noe-Nygaard, 'Niels Steensen som geolog og krystallograf', *Bibliotek for Læger* 149. Cph. 1957, 187-193.

[784] Mordhorst (2002), 213.

[785] See Findlen (1989).

[786] Findlen (1989), 61.

return from his academic peregrination, Worm never went abroad and only grudgingly left the handful of streets that constituted the Latin Quarter in Copenhagen, expressing great annoyance when his duties as a physician (in particular to the royal family) forced him to leave town. But in the museum of his residence, his "model of the universal nature made private" (to quote Bacon), he gathered specimens and curiosities from all over the world, artefacts from all ages. The age of discovery and the icons of learning had moved into the study chamber of the gentleman, and there they were to remain until the professionalisation and specialisation of academic life in the 19th century.

Fig. 6. The Museum Wormianum. Frontispiece to the final catalogue of 1654.

The Lion of the North

1. A Model of National Style

If we turn our attention to Sweden in the first half of the 17th century and look for a distinct culture of natural philosophy centred on the university, similar to that of the Bartholin family in Copenhagen, we shall look in vain. Due to civil war and political turmoil, the University of Uppsala led a troubled existence in late 16th and early 17th century, and had no Faculty of Medicine, which could form the core of such a culture. Surely, natural philosophy was contained in various disciplines at the Faculty of Arts, but this faculty was little more than a prep school to the study of theology, and its teachers generally moved on to theology or positions elsewhere as soon as possible.

This did not mean that experimental science and new currents in natural philosophy did not flourish in Sweden in this period, but we shall have to look elsewhere, and we shall find that their focus was quite different from that of Danish and Norwegian natural philosophers. Even when a medical faculty was established at Uppsala and other Swedish universities, and the Rudbeck family in Uppsala in the last half of the century attained much the same position as the Bartholins in Copenhagen; it was done within a different cultural framework than that in Denmark. So despite the fact, that Swedish natural philosophers travelled to the same centres of learning as their Danish colleagues, and were subject to almost identical influences, there were structural differences between the two Scandinavian kingdoms, which determined the practises and direction of natural philosophy.

Historians of science have long been aware of the importance of the national context. This has led to a reassessment of the notion of the exclusively cosmopolitan character of science. While scientists belong to an international community, the practises and organisation of science differ from country to country. This does not only concern the material and political framework of scientific

practice, but also a country's general cultural traditions. Such local variety of scientific culture has been labelled 'the national style' and is applicable to both the modern and the early modern period.[787]

In our analysis of the structural differences between the cultures of natural philosophy in Sweden and Denmark, we have the benefit of a previous study. Twenty years ago Andrew Jamison compared the national styles of science and technology in Sweden and Denmark.[788] Dr. Jamison's approach is mostly analytical and mainly based on Marxist influenced sociology of knowledge, while the empirical material of his study mainly draws on existing studies of the intellectual history in Scandinavia. His dependence on existing studies of the development and structures he was analysing was bound to limit his findings, particularly since Danish history of science has until recently been concentrated on particular scientists and disciplines and refrained from reflections on wider developments and their connection to social, material and political structures. Furthermore, the influence of Marxist social theory sometimes has the disadvantage of leading Dr. Jamison to a Procrustean description of developments, such as his search for a rise of 'bourgeois mentality' everywhere, but at the same time this influence has the advantage of leading to an interest in the connection between scientific thinking and technology, between science and economic and social formations.

In his analysis of national styles, Dr. Jamison identified three major components, which are useful tools in our comparison of natural philosophy in Denmark and Sweden in the 17th century:

[787] The interest in national style has mainly been developed by American scholars and connected to modern science. A forerunner to the discussion was Thorstein Veblen, *Imperial Germany and the Industrial Revolution.* Ann Arbor 1915. Major contributions to the discussion include P. Forman, 'Weimar Culture, Causality, and Quantum Theory, 1918-1927', *Historical Studies in the Physical Sciences,* III, ed. R. McCormmach. Philadelphia 1971, 1-115; Nathan Reingold, 'National style in the sciences: The United States case', *Human Implications of Scientific Advance,* ed. Eric Forbes. Edinburgh 1978; Jonathan Harwood, *Styles of Scientific Thought. The German Genetics Community1900-1933.* Chicago 1993; S. Shapin, 'Here and Everywhere - Sociology of Scientific Knowledge', *Annual Review of Sociology* 21 (1995), 388-408.

[788] Andrew Jamison, *National Components of Scientific Knowledge. A Contribution to the Social Theory of Science.* Lund 1982.

1) *The Material Component* concerns the particular scientific interest stimulated by geographic conditions and economic needs. Here we find an important difference between Denmark and Sweden. While the former was an agricultural and sea-faring society (despite the establishing of some mining industry in Norway), Sweden had a growing mining industry from medieval times, which was also reflected in literature. In the revelations of Saint Birgitta, mining is mentioned more than once, and in the 16th century a member of her order wrote one of the first technical handbooks on mining.[789] While chemistry in Denmark was mainly connected to medicine (*iatrochemistry*) or gold-making, in Sweden it was connected to solutions to practical problems in the mining industry (and later arms manufacturing) and placed in a framework outside academic life.

2) The Institutional Framework is the organisation and structure of teaching and research. We have already noticed the importance of this in our discussion of natural philosophy in Denmark and the relationship between University and Museum. This component reflects the two other components in the national style, and as we shall see, also in this area remarkable differences can be notices between the two Scandinavian states.

3) The Metaphysical bias. This somewhat misleading term refers to a nation's general cultural traditions. Here Jamison, following Sten Lindroth, who is the main source of his analysis, reaches back into the Middle Ages to identify a Swedish tradition of systematic mysticism already evident in the 14th in the revelations of Saint Birgitta and in the writings of members of her order.[790] This tradition continued into the early modern period at least as far as Swedenborg and is all the more significant since we find nothing of the kind in Denmark.[791] Another ingredient in the Swedish 'meta-

[789] Jamison (1982); Sten Lindroth, *Svensk lärdomshistoria. Medeltiden. Reformationstiden.* Stockholm 1975, 181-186.

[790] Jamison (1982), 198-202; Sten Lindroth, *Svensk Lärdomshistoria. Medeltiden. Reformationstiden.* Stockholm 1975, 38; idem, *Löjtnant Åhls äventyr.* Stockholm 1967.

[791] A number of Scandinavian scholars have recently endeavoured to uncover the existence of mystic, esoteric, and magical ideas in the early modern period, and have generally found that these were much more widespread than has generally been assumed. An example is Dahl (2001), who has pointed to a number of Norwegian thinkers in this period. The conclusion remains however, that in Denmark such currents remained peripheral to the general trends at Court and Uni-

physical bias' is the development of the Gothicist ideology. This was but one of many national mythologies developed by Renaissance humanists, but the Swedish tradition was older and much more influential than most of its European counterparts.

No analytical model is perfect, and one essential flaw of the model of national style proposed by Dr. Jamison is the fact that it tends to treat nations as closed systems.[792] It is evident that the circulation of ideas and technology plays an instrumental role in the development of natural philosophy in the two Scandinavian countries, and while it is true that existing mental and socio-economic structures contributed to whether or not these found fertile soil, and the way they were transformed, the frequency of contacts between a nation and its neighbours are so essential that they can be said to constitute a component of their own. A study of national style must therefore take into account the degree of innovation or narrow-mindedness in the particular country, its integration into a general international framework, and whether the country is introspective or orientated towards the world outside its borders perhaps to a degree that drastically changes its national style. We can call this component the *Cultural outlook*, and it is of course connected to both metaphysical bias and scientific interests. We shall therefore begin with a short description of Sweden's dramatic integration into the political, economic and cultural life of the European continent in the early 17th century.

2. Widening Horizons

Until the 16th century Sweden had been but a regional power. When Swedish rulers broke with the Catholic Church it led to cultural decline, and Sweden moved further out in the cultural periphery of Europe.[793] Apart from diplomatic contacts with France and certain Protestant German states her political and economic horizons were limited to the Eastern Baltic. The realms of the Danish kings and the Hanseatic League more or less controlled the lands and sea routes that connected Sweden with Western

versity, while in Sweden mystics such as Birgitta, Bureus and Swedenborg were intimately connected to government circles and national identity.

[792] This is probably influenced by the widespread notion of Sweden as a receiver of European culture, cf. Sörlin (1994), 33-38.

[793] See Schück and Warburg (1985), 50ff.; Lindroth (1976), 15.

Europe, and apart from merchants from the coastal towns of Northern Germany and the Netherlands, Sweden was to most Europeans an '*ultima Thule*', an exotic and strange country somewhere beyond the Baltic and the deep forests of Småland. On their side, few Swedes had crossed the Baltic and visited the European continent, and far the majority of Swedes had at best a second-hand knowledge of European cultural, technological, and intellectual developments, either through books and pamphlets, through immigrants and foreign envoys or through hearsay from soldiers, sailors or merchants.

This situation changed dramatically with Sweden's rise to a European great power in the 17th century.[794] Initially, Sweden's conquests across the Baltic and involvement in great European politics were largely circumstantial. Like most empires through history, the Swedish empire owed its beginnings to a defensive war. The deposed Sigismund and his heirs, who now ruled Poland and Lithuania, presented a continual threat to Karl IX and Gustav Adolf, and for half a century war raged across the Baltic. The Swedish government decided to take the initiative, and the rich commercial cities on the eastern Baltic seaboard gave ample opportunity for Swedish expansion. Thus, from 1605 Sweden fought almost an almost continual war in the Baltic States (in rivalry sometimes alliance with Russia), which was only interrupted by truces.

Another development drew Sweden closer to European politics and culture, namely the growing importance of the Baltic to the economy of Western Europe. In an age when European shipping expanded greatly, access to timber, timber products, hemp, and tar was vital to nations such as the Netherlands, Britain and France. These commodities were shipped from Stettin and Memel and other ports in the Eastern Baltic, and the importance of such commodities was only overshadowed by the need for grain by the growing city populations of Western Europe. The most important trade route within Europe at the beginning of the 17th century was that from the ports of the southern Baltic to the west and south. It was by the rivers leading to Stettin, Riga, and Danzig that grain

[794] For Sweden's integration in Europe see the essays in Göran Rystad (ed.), *Europe and Scandinavia. Aspects of the Process of Integration in the 17th Century.* Lund 1983.

was exported from Poland and Eastern Germany to the Netherlands. This traffic was directed from the Amsterdam bourse and was not only vital to Dutch shipping, but to the food supplies of the Netherlands and a number of other European states.

The passage to the Baltic from the Western Seas was controlled by the Danish King due to his control of the Sound. To the Dutch, who dominated the Baltic trade and to whom it was vital, this brought them closer to the Swedes in an attempt to break the Danish monopoly. In 1614 Sweden and the Netherlands entered into an alliance, which was renewed several times, and the great powers of Western Europe began to involve themselves in the Swedish-Danish conflict both directly and as mediators. The War of Kalmar (1611-1613) was still fought almost exclusively between Denmark and Sweden, but afterwards no conflict would take place in Scandinavia without the participation or interference of one or several of the great European states.

In his war against Sigismund, Karl IX had employed religion by presenting himself as a champion of the Protestant cause against his Popish rival. When political alliances in Europe at the outbreak of The Thirty Years' War predominantly became based on religious affiliations, Sweden was drawn closer to Europe. Sigismund's Poland was the most powerful Catholic power outside the Habsburg lands, and Protestant diplomacy came to include Sweden in the policy of containment against Habsburg Catholicism.

These political and economic developments dramatically changed the contacts between Swedes and Europe. In particular, they stimulated the personal relationships between the elites of Sweden and the Dutch Republic, which was not only literally the warehouse of Northern Europe, but also a great provider of technology and a melting pot of ideas.[795] Gustav Adolf was greatly influenced by the military inventions of Moritz of Orange,[796] future Swedish commanders such as Jacob De la Gardie, Gustaf Horn, and Lennart Torstensson studied the science of warfare (especially fortification) in the Dutch Republic, and in connection with this Swedes

[795] For a study of Swedish-Dutch contacts in this period, see E. Wrangel, *Sveriges litterära förbindelser med Holland under 1600-talet.* Lund 1897.
[796] See *Rikskansleren Axel Oxenstiernas skrifter och brefvexling*, I, Stockholm 1888, 248.

began to take great interest in Dutch mathematics. Furthermore, a permanent diplomatic network was established between the two countries, and a number of Swedish emissaries and diplomats were either Dutch (such as Hugo Grotius) or had strong ties to the Netherlands. Finally, numerous Dutchmen served in the Swedish armies that fought in Poland and Germany.

These contacts between the Netherlands and Sweden were also vital to the development of the Swedish mining industry.[797] The great copper mine of Falun became a source of wealth, which expanded rapidly enough in the first half of the 17th century to transform the fortunes of the Swedish Crown. In 1628 the Dutch financier Louis de Geer (1587-1652), already a shareholder in the company, was given what soon amounted to complete control, and he was likewise instrumental in the development of the iron industry.

From his control of the copper industry, de Geer came to dominate the whole economic life of Sweden.[798] He was not the first Dutch entrepreneur in Sweden, and neither was he the only one, but he was far the most important. Not only was he involved in all aspects of the mining industry; he also ran textile and paper manufactures; he produced salt, sulphur, and rope; he built and owned merchant ships; he established a bank and, without much success, an African trading company. He financed and equipped Gustav Adolf's expedition to Germany, as well as Danish, French and Dutch armies. When de Geer died, he was a member of the Swedish landed nobility and perhaps the richest subject Europe had yet seen.

The development of the mining industry and the establishment of numerous manufactures facilitated by the abundant access to water power led to an interest in technology and applied science on a scale that was unknown in Denmark. Furthermore, it led to an interest in disciplines connected to technology – chemistry, mathematics and mechanics. As we shall see, most natural philosophers in Sweden were involved in mining and manufacturing, and while they once in a while took interest in theoretical and philoso-

[797] For the Swedish mining industry, see E.F. Hecksher, *Economic History of Sweden.* Cambridge 1954; M. Roberts, *Gustavus Adolphus*, vol. I. London 1953, 89.
[798] On de Geer, see Carr, Raymond: 'Two Swedish Financiers', *Historical Essays 1600-1750 presented to David Ogg,* ed. H.E. Belland R.L. Lollard. London 1964, 18-34.

phical problems, their everyday concern would be the solution to practical problems.

While natural philosophy in Denmark was rooted in a certain cultural diversity, namely in the difference between the University and the Museum, Danish natural philosophers were academics and thus part of a culture in which theology was ultimately supreme. Apart from the royal laboratory and the rather small mining industry in Norway there were no other stages for natural philosophy than the University and the Museum. Despite their success, the members of the Bartholin family must therefore always be careful to avoid clashes with theological dogmas.

Sweden's industrial revolution led to a greater cultural and religious diversity. The mines and the manufacturers depended on the technical skills of French, German and Dutch immigrant workers, and in the first half of the 17th century certain Swedish towns became multi-cultural and multi-confessional societies. Dutchmen and other immigrants were also important in Denmark, but not in near the same degree as in Sweden, and not with similar cultural consequences. In the small piece of land around the mouth of the Göta River that was Sweden's only outlet to the Western Seas, Gustav Adolf established the town of Gothenburg in the 1620s. It contained a network of canals like those of Amsterdam, it was ruled by Dutch merchants and Dutch was also the language of administration. There were also Dutch communities in Stockholm and towns like Norrköping, Nyköping, and Kalmar. These immigrants constituted a middle class connected to commerce and industry and continued having strong connections to their original homeland. This, of course, was of great importance to the exchange of ideas and technology between Sweden and Western Europe, and it also proved a challenge to the monopoly of the Lutheran Church. The immigrants were given a limited freedom of religion, and Louis de Geer supported the attempt by John Dury and other to reconcile the Protestant churches.

Finally, Sweden's integration in Europe was not only limited to the social elite. During Sweden's long engagement in the Thirty Years' War (1630-48), numerous Swedes, Finns and Balts from all levels of society spent years in Central Europe.[799] On their return home, these men not only brought booty, new mores and fashi-

[799] Schück and Warburg (1985), 135-141.

ons. To many of them their long stay in Europe also changed their horizons and an awareness of belonging to a greater European culture. When visited by foreign diplomats the Swedish elite deplored the lack of refinement among the peasantry,[800] and Swedish commanders and administrators, most of them practical men whether they were noblemen or commoners, adopted the cultural interests of Central European elites by taking a great interest in acquiring books, manuscripts, and items of art and curiosity.[801] At the same time the rest of Europe also began to take a greater interest in Sweden,[802] and she was visited by increasing numbers of diplomats, merchants, adventurers and scholars.

3. The National Project

If the background for Sweden's expansion and integration in Europe was initially circumstantial and governed by *ad hoc* solutions, her rise to one of Europe's leading military powers from the reign of Gustav Adolf was part of a conscious government politics, which can be labelled 'the national project'. This project was not 'national' in the Romantic sense of a deep awakening of an indigenous national sprit, but in the sense that all available resources were systematically mobilised towards a politics managed by the elites.[803] As formulated by a Swedish historian, the war economy worked *"to the advantage of the ruling classes, and not only the generals, but also those - the regents, the high aristocracy - who above all found their advantage in an active foreign policy".*[804]

The expansionist politics was based on an alliance between the monarchy and the high nobility and thus connected to the general process of political centralisation. Paradoxically, Sweden was much more politically centralised than Denmark (at least until 1660), but at the same time contained a greater variety of cultures and power bases. First of all, far the majority of peasants in Swe-

[800] Ankarloo (1983), 242.
[801] For books and manuscripts stolen by Swedish armies, see Walde (1916-20),
[802] For English interest in Sweden, Aylmer (1983), 182ff.
[803] For a critical materialist analysis of this policy and its consequences see Strindberg (1937); Gustafsson (1956), esp. 174ff. is primarily concerned with propaganda, literature and political philosophy, and the same goes for Nordström (1934). The various books by Michael Roberts in the bibliography provide the general political background.
[804] S.E. Åström, 'The Swedish Economy", in M. Roberts (ed.), *Sweden's Age of Greatness* (1973), 73.

den were either yeomen or farmed lands owned by the Swedish crown. Local landlords had therefore little control over the local peasants and did not constitute a buffer between the peasantry and the Crown. While social rebellion in most European countries, including Denmark, would often begin as a rebellion against local landlords, rebellions in Sweden often began with attacks on the local representatives of the Crown.

During the 16th century the existence of independent duchies within Sweden ruled by princes of the royal family had proven to be highly damaging to the stability of the realm. They provided alternative power bases to Stockholm, including patronage systems that rivalled those of the royal court. This proved an obstacle to the introduction of central government and also gave the high nobility more space for political manoeuvres. However, when Duke Karl ascended the throne, he had learned the lesson, and from now on younger sons of the royal family would be connected to state service rather than gaining independent duchies. The same applied to the high nobility. Previously, we have seen how leading noblemen like Erik Sparre and Hogenskild Bielke paid for their political involvement with their lives. From now on, the only way for Swedish noblemen to assert themselves politically was through service to the state, either in administration or in the army. A new noble ideology and self-perception emerged that was centred on government of the state, [805] and obviously the values of noble patrons would also extend to their clients.

Thus, the interests of the Swedish nobility were closely connected to the expanding central government and army of Sweden, but since the old Swedish nobility was not numerous enough to provide sufficient administrators and military commanders, the Swedish government, especially from the 1640s, began to ennoble useful men in order to fill the ranks. Some of them were native Swedes, a great many of them were immigrants, but all of them was totally dependent on favour from great men or women at Court.[806]

[805] K. Strömberg-Back, *Lagen-rätten-läran.* Lund 1963, 58-101 refers the views of historians on this development; see also S.A. Nilsson, *Kampen om de adliga privilegierna 1526-1594.* Lund 1952; E. Hjärne, *Från vasatiden till frihetstiden.* Uppsala 1929.

[806] Østerud (1981), Polisensky (1978), 12. The creation of new noblemen has been studied by Elmroth (1982).

With the backing of the king and the high nobility led by Axel Oxenstierna the national project came to include all areas of society. At the meetings of the estates (the *Riksdag*) in the decades before the German war, the clergy were repeatedly called upon to explain and defend the national policy to their congregations, and at the annual intercession days printed proclamations were distributed by the government to be read from the pulpits.[807] Also, a growing middle class of state servants, petty bureaucrats and officers in the Swedish countryside was beginning to assist in the arduous work of creating a favourable public opinion and overcoming popular resistance against new taxes and levies.

Soon, this mobilising of resources and loyalty also came to involve culture and learning by the creation of a national identity based on national pride and self-confidence.[808] The students of Uppsala were admonished not to degrade themselves and their country and admire everything foreign,[809] and professors were called on to write books in the vernacular.[810]

As such the national project conducted by the government incorporated two strings. The one was concerned with the mobilisation of economic and military resources, the other with ideological mobilisation or propaganda. Both of these strings were essential to the framework of natural philosophy in Sweden, and to our analysis. Before we discuss them further, we must, however, first take a look at the institutional component of Sweden's national style.

[807] S. Arnoldsson, *Krigspropagandan i Sverige före trettioåriga kriget.* Göteborgs Högskoles Årsskrift XLVII 1941:7, 10-13; Gustafsson (1956), 90ff.

[808] The cultural aspects of this agenda, which are our concern, has been studied by Nordström (1934), and given a materialist interpretation by Axel Strindberg, *Bondenöd och stormaktsdröm.* Stockholm 1937. This somewhat simplistic interpretation of the national project as a expansionist class ideology has been criticised by Lars Gustafsson, *Virtus politica.* Uppsala 1956. See also S.A. Nilsson, *De stora krigens tid. Om Sverige som militärstat och bondesamhälle.* Uppsala 1990.

[809] Constitutions of Uppsala 1626, see Annerstedt, bihang I, 281.

[810] While professors were reluctant to debase themselves by writing in the vernacular, the call was followed by many non-nobles around Sweden, who patronised translations into Swedish. See Stina Hansson, 'Böckernas beskyddare under svenskt 1600-tal', Platen (1988), 64-74 and idem, *Svenskans nytta Sveriges ära. Litteratur och kulturpolitik under 1600-talet.* Gothenburg 1984. Also Johan Skytte's brother, Ericus Schroderus, translated several Latin treatises into Swedish, see Runeby (1962), 50, 110.

4. The Reform of Uppsala

After the Reformation the re-established University of Copenhagen was modelled on Melanchthon's reform of Wittenberg, and though changes occurred during the 17th century, the structure of the university remained essentially unchanged throughout the century. The University of Uppsala was not reopened until the 1590s, at a time when Philippist religious humanism had been replaced by orthodox theology. In both countries the post-Reformation university was established through heavy royal support and interference, but the Danish university reflected the situation in the mid-16th century, before political centralism escalated, and its statues reflected ideas that recognised the autonomy of the academic estate. Even though the Danish government after the fall of Tycho Brahe took control over the University and limited its autonomy, there still was a cultural autonomy that enabled the Bartholin family to establish its own culture of natural philosophy. They were dependent on patronage, but apart from Ole Worm's position as an authority on the ancient Danish past, they played a marginal role in the political ambitions of the government.

In Sweden the late reestablishment of the University led men of learning to seek their fortunes elsewhere, predominantly in the Church or at the court of the King or other great men. This did not change, when the University was revitalised in the decades around 1600. The road to patronage went through careers in the administration in Stockholm or the provinces, at Court or in the Church. Therefore a semi-autonomous culture of learning could hardly develop in Sweden. Furthermore, the revitalisation of Uppsala, and the establishment of other Swedish universities in the 17th century, took place at a time when political centralisation was on its way, and the academics were enlisted in the propagation of the national project. At the same time, however, the Swedish bishops retained a much greater degree of autonomy and control over their dioceses than their Danish counterparts.

Accordingly, a semi-autonomous identity of learning could not develop in Sweden in this period. An exception to this was the many men of learning imported to Sweden in the 17th century, who brought with them their humanist identity, but they were dependent of the court and closely connected to court life. Natural philosophers was thus caught between the government and its ambitions on the one hand, and powerful bishops on the other and found no room to establish an identity of their own. This was

also reflected in the fact that while the education of future administrators in Denmark was located at the academy of Sorø from the 1620s, the University of Uppsala combined the training of academics, mainly clergymen, with the training of administrators. This was an essential difference between the cultural frameworks of natural philosophy in the two Scandinavian kingdoms. It did not necessarily prove a hindrance, but it definitely gave Swedish natural philosophy a different character.

The reign of Gustav Adolf not only led to Swedish expansion abroad, but also witnessed a reform of the University of Uppsala. The privileges from 1595 were confirmed (1612), a printing press was established (1613), a bookseller was connected to the university, who exempt from duty could import books from Germany (1616),[811] and the university was reorganised. Since this took place almost simultaneously with similar reforms in Copenhagen, one may suspect that the rivalry between the two Scandinavian states was reflected within the educational system. In 1620 the number of professors was increased, among them two physicians. Scholarships were founded, and a library was created. Uppsala received a large donation from the King in 1624, and new privileges and statutes the following years.

The reform of the University was preceded by administrative reforms, and has generally been interpreted as an attempt to create civil servants for the apparatus of government.[812] While the need for civil servants undoubtedly formed an important motive for the reforms, it was hardly the only reason. When Gustav Adolf ascended the throne he not only had to legitimise his rule and his policy towards foreign princes, but to his own subjects as well. Peasant rebellion was endemic in certain parts of Sweden and the high nobility was only in the process of being domesticated and connected to state service.

Early modern rulers and political thinkers regarded a well organised church as essential to social stability. The Swedish Church, which had led a turbulent life due to the various religious preferences of the sons of Gustav Vasa, was much more independent than its counterpart in Denmark, but at the same time much

[811] Annerstedt ((1877), I, 152ff.
[812] Roberts (1992), Ch. 6.

less organised and Lutheranism much less secure as the religion of the realm. On the one hand a reversion to Catholicism still threatened from the exiled Sigismund and the forces of the counter-Reformation, on the other Calvinism in various shapes was the religion of most of the Dutch and French immigrants.

The young king must therefore not only win the support of the church, but also strengthen its hold on his subjects, and actually the initiative to the reform of the University did not come from the government. At the Diet of Nyköping that acknowledged Gustav Adolf's coming of age, the clergy and the professors called on the government to return the privileges to the University and give it a sound economic foundation. But even though the King in his coronation charter (Sw. *konungaförsäkran*) solemnly promised to support the University, the clergy, led by Bishop Rudbeckius, once more had to plead its cause to Chancellor Oxenstierna in order to get things done.[813]

Reason of state and the needs of the church thus came together in a desire for the improvement of higher education, but this endeavour was not as uncomplicated as one might think. Around 1600 two functions of higher education provided the background for the establishment of institutions in Northern Europe. The one was the university with its academic culture, established methods of teaching, and theological predominance. The other was the school for noblemen, the academy, such as those in Kassel, Sorø and the Stockholm College, aimed at preparing its students for careers as courtiers and administrators. Any government who reflected on the education of its subjects was forced to come to terms with the relationship between these two purposes of higher education. In Denmark the government chose to separate them by turning the Latin school of Sorø into an academy for the nobility, while the University retained its function as a training school for clergymen.

Also the Swedish government faced the problem. The Stockholm College (see Chapter Two) had provided a solution to the problem of the education of the nobility, but after it was shut down, Swedish noblemen had to go abroad or enter the University of Uppsala in order to receive higher education. Due to the remoteness of Sweden and the expenses and dangers of travelling

[813] Annerstedt (1877), I, 151ff.

caused by warfare, many of them chose the latter, at least for a certain period of their education, and this accentuated the tension between the education of clergymen and the education of the nobility at Uppsala.

Nothing illustrates this more clearly than the dramatic and embarrassing brawls that raged in Uppsala between professors Johannes Messenius and Johannes Rudbeckius in the first decades of the 17th century.[814] Messenius was a student from the Jesuit College in Braunsberg and the arch-Catholic University of Ingolstadt. Afterwards he had established his own Catholic school in Danzig and was apparently a successful product of the attempt of the Counter-Reformation to recruit talented proselytes. Then, however, Messenius decided to seek his fortunes at home and won the favour of Karl IX by writing a letter that eloquently but harshly condemned Catholicism. Such a man was indeed of use to the King, who employed Messenius in his polemics against Sigismund of Poland.[815]

In 1609 Messenius was appointed to the chair of law at Uppsala, but chose to focus on history and politics and gathered a great number of students around him. Messenius had no respect for academic conventions whatsoever, claiming that he was far more valuable than the rest of the professors altogether. Then Johannes Rudbeckius entered the University. He had just returned from Wittenberg where he had embraced the new Lutheran orthodoxy. From the beginning he ran counter to Messenius, whom he (implicitly but quite conceivably) accused of being a papist. Rudbeckius was an energetic and charismatic man, and soon he too attracted a number of students. Like Caspar Bartholin in Copenhagen he introduced the new Protestant Aristotelianism, and likewise had opportunities for founding an academic dynasty similar to the Bartholin clan.[816]

Both Messenius and Rudbeckius now established private seminars in their residence where they taught their disciples, Messenius focusing on history and politics, while Rudbeckius concentrated on the Biblical languages, philosophy and theology.

[814] For this conflict, see Annerstedt (1877), I, 136-164.

[815] Annerstedt (1877), I, 134.

[816] Annerstedt (1877), I, 159. Rudbeckius' group of relatives at the University included his brother Petrus Rudbeckius, professor of physics as well as his brother-in-law Jacobus Buræus, who was professor of logics.

Their rivalry increased, and their confrontation ascended to dramatic and violent heights. It was, personal enmity apart, a conflict between a culture of noble education that despised the theological and academic culture represented by Rudbeckius. Generally, Messenius refused to conduct disputations, and when he did, he filled the lecture room with song and music. When University authorities called him to order, he showed himself diffident, claiming that he had been ennobled by the Emperor and only paid obedience the King. When Rudbeckius had his students perform Latin comedies, Messenius responded by having his students perform comedies in the vernacular.

Messenius was responsible for the royal grants and used this position to give them to students, who were thereafter bound to him by a personal oath of allegiance. When Rudbeckius called him a 'Jesuit', he challenged the good theologian to a duel, and as the controversy escalated Messenius' students armed with swords harassed people in the streets of Uppsala.

In the end, both men were removed from the University, but this, of course, only removed the symptom not the roots of the malady. Attempts were made to create special institutions for noblemen and other future administrators, most prominently the so-called *Collegium illustre* that existed in Stockholm 1626-29, but without much success.[817] As it turned out, Uppsala came to combine theological and noble education, and was always known, as an "academy" during the 17th century,[818] but for the rest of the period it was haunted by the two functions it contained, and below we shall follow this more closely. For now we need to emphasise that from the 1630s great numbers of noble sons were found at Uppsala, and this gave the university another function, and eventually also another role in society than its counterpart in Copenhagen, a structural difference that was to influence the different development of natural philosophy in the two Scandinavian countries.

[817] See Herbert Lundh, *Symbola litteraria* (1927); William Sjöstrand, 'Grunddragen av den militära undervisningens uppkomst och utvecklingshistoria i Sverige till år 1792', *UUÅ* (1941); Lars Gustafsson, 'Den litterate adelsmannen i den äldre stormaktstidens litteratur', *Lychnos* (1959).

[818] B. Lindberg, 'Tre ord: akademi, universitet, högskola', *Den akademiska gemenskapen.* Upps. univ. Inst. för idé och lärdomshist. Skrifter 21. Uppsala 1999.

5. The Rule of the Bishops

The reforms of Uppsala in the 1620s ensured that for the first time since the Reformation, Scandinavia's oldest university would have a functioning faculty of medicine, which also included disciplines like botany, chemistry and - unlike in Copenhagen - also physics. The University, however, was not the only educational institution important to natural philosophy in Sweden. In the first half of the 17th century the unstable political situation in Sweden, the vastness of the countryside, and the fact that her rulers were often occupied with matters abroad resulted in the growth of the power of Swedish bishops. This not only led to many dioceses gaining an autonomy that far exceeded the independence of their Danish colleagues. The towns of Swedish cathedrals like Västerås, Strängnäs and Åbo (Turku) often developed into cultural centres, and the schools established here became a fertile ground for the development of natural philosophy in Sweden.

After he had to leave the University, the strict and energetic Johannes Rudbeckius (1581-1646) entered an ecclesiastical career, first as court chaplain and from 1619 as bishop of Västerås. Rudbeckius had studied in Wittenberg when the new Lutheran orthodoxy emerged and adhered to Protestant Aristotelianism,[819] and he was a man who fearlessly stood by his opinions. These included harsh condemnation of Catholics and Calvinists. He insisted on the original Lutheran separation of the spiritual and secular government and was the champion of a strong and independent church. In the 1620s and 1630s, he ferociously resisted the government's attempts to control the Swedish church through a so-called *consistorium generale* and was successful despite the enmity he awoke from Axel Oxenstierna and other leading forces at court.[820] His own diocese he ruled as he saw fit, and in fiery sermons and church regulations he fought a veritable war against he wickedness in the souls of the good people in Västerås, insisting on church discipline and penance, but also working energetically for relieving the poor.

At the same time Johannes Rudbeckius was also a versatile and well-educated man, and strikingly similar to Caspar Bartholin.

[819] Billing (1923); Hägglund (1992).

[820] On Johannes Rudbeckius' views on the church, see Hans Cnattingius, *Johannes Rudbeckius och hans europeiska bakgrund. En kyrkorättshistorisk studie.* Uppsala 1946.

Like the Dane, he was one of the men who introduced the new Protestant Aristotelianism in his home country, his household was a model of Lutheran piety and frugality, while at the same time he was deeply impressed by the culture of Antiquity and humanism. Despite his claims that the Bible contained everything worth knowing, his fiery sermons would sometimes contain praise of Homer, Aristotle, Pindar and Cicero. At his diocese he established the first Swedish primary school for girls, and he also directed his energy towards the higher education. At the time he studied at Wittenberg and other German universities, Philippism was in decline, but still some of Melanchthon's disciples prevailed, and the reformer's enthusiasm for natural philosophy was about. Rudbeckius himself took great interest in mathematics (which he taught in Uppsala), he built his own instruments, and in his diocese he established the first Swedish *gymnasium* in 1623. Unlike in Denmark, where gymnasiums like all other branches of education were under government control, the Swedish gymnasiums were under surveillance of the local bishop, who could dictate the content of the teaching.[821] At the gymnasium in Västerås, bishop Rudbeckius organised lectures not only on the three Biblical languages, but also on humanist disciplines as well as astronomy, optics, geography, and even medicine.[822]

Similar in many ways to Rudbeckius, and the other pillar of the Swedish church in the first half of the 17th century was Laurentius Paulinus Gothus (1565-1646).[823] After studies at the Stockholm College he went to Rostock, where he studied under David Chytraeus, under the mathematician and physician Heinrich Brucaeus, and under the Scotchman Duncan Liddel who lectured on the three world systems. Later he also studied under Liddel at

[821] On the Swedish gymnasiums, see A.G. Hollander, *Svenska undervisningsväsendets historia* I. Uppsala 1884; on Västerås see B. Rud Hall, *Johannes Rudbeckius.* I. Uppsala 1911.

[822] Eriksson (2002), 22, 25-30.

[823] On Paulinus Gothus, see Herman Lundström, *Laurentius Paulinus Gothus*, 3 vols. Uppsala 1893-1898. His Latin poetry has been published by B. Bergh, 'Laurentius Paulinus Gothus: en svensk latinpoet från 1500-tallet', *Filologisk Arkiv* 18. Stockholm 1973 wirh an English summary. See also idem, *Den levende antiken.* Lund 1973 and Johannesson (1968).

Helmstadt and was well versed in the cosmologies of Ptolemy, Copernicus, and Tycho Brahe (preferring the latter).[824]

After his return to Sweden in the early 1590s, he received a chair at Uppsala (probably due to the almanac he dedicated to the sister of King Sigismund in 1592), and took over the chair in mathematics and astronomy in 1594. In both Rostock and Helmstedt he became acquainted with Ramism, and in his inaugural lecture he (like a true disciple of Ramus) praised the usefulness of mathematics, not only to disciplines like optics, physics, and astronomy, but also to medicine and theology. Among the textbooks he used was Ramus' geometry, and in his lectures on astronomy he lectured on all the three world systems, and was the first in Sweden to treat Copernicus thoroughly.[825] When Duke Karl ascended the throne, he won the favour of the new ruler by dedicating an almanac to him in 1598. In the almanac from 1592, he (like Tycho Brahe) sharply condemned the so-called *astrologia judiciaria*, the kind of astrology that tried to predict a man's future from the position of the stars. In the almanac dedicated to Duke Karl, an enthusiastic believer in astrology of all kinds, he praised all kind of astrology (later, after the demise of Karl, moving back to his original position).[826]

At first Paulinus Gothus was successful in winning the patronage of Duke Karl, and in 1600 he moved on to a chair in theology. Six years later, however, Karl grew suspicious of the sympathies of Paulinus Gothus and exiled him to a small vicarage. But already the following year, 1607, the emergence of a bright comet (Halley's Comet) on the night sky, offered Paulinus Gothus the opportunity to win back favour. The king who was anxious of the meaning of this portent sought him out, and when he was able to calm the sovereign, Paulinus Gothus was appointed bishop, and even ended his life as archbishop.

Paulinus Gothus was a harsh moralist, who believed in penance, and in line with Luther and as a convinced Ramist he detested philosophical sophistry, particularly within theology, and abhorred the rise of Lutheran Aristotelianism. To Paulinus Gothus, philosophy had no value of its own, but must be seen in a

[824] N.V.E. Nordenmark, *Astronomiens historia i Sverige intill år 1800.* Lychnos-bibliotek. Uppsala 1959, 11-18.
[825] *Scholæ Ethicæ.* Stockholm 1616, fol. B 4r f; Sandblad (1943), 154.
[826] *Historiæ arctoæ libri tres.* Strängnäs 1636.

wider perspective. As such it is either pagan or Christian - *tertium non datur.* Though his theological outlook was somewhat different, Paulinus Gothus was very similar to Cort Aslakssøn (treated in the previous chapter) in so far as he tried to establish a cosmology that combined new developments in astronomy with Scriptural evidence and Neoplatonic notions of a world soul, a principle of love and harmony that pervaded the universe. This is evident from Paulinus' *History of the North*, which is much like a medieval chronicle of the northern lands. In the preface to this work, Paulinus Gothus proclaims Moses to be the highest authority in natural philosophy, while the fourth chapter of the work describes the cosmos according to the Tychonian world picture, but pervaded by the world soul.[827] Furthermore, both men took a keen interest in history and chronology, and both men influenced Comenius and his circle.

Like Rudbeckius, Paulinus Gothus was also important to the development of natural philosophy in Sweden, due to the school that was established in his diocese and which he ruled indefatigably and with an iron hand. In 1626 Sweden's second gymnasium was established in Strängnäs, like in Västerås with its own printing press. In the constitutions of this school, Paulinus Gothus demanded that the older pupils should be lectured on astronomy according to the hypotheses of Ptolemy, Copernicus, and Tycho Brahe.[828] As archbishop (and thereby chancellor of the University) he suggested that Holy Scripture should replace the existing textbook in astronomy,[829] and he also demanded that no one should be employed as a minister unless he had proven to be knowledgeable of geometry, spherical astronomy and ecclesiastical computation.

6. Johan Skytte: The Usefulness of Learning

The most prominent mediator between government politics and academic life in early 17-century Sweden was Johan Skytte (1577-1645).[830] As the son of a successful cloth merchant and mayor

[827] Laurentius Paulinus Gothus, *Historiæ arctoæ libri tres.* Strängnäs 1636.

[828] *"ex hypothesibus Ptolemæi et Copernici nec non Tychonis Brahæi"*, quoted in P.E. Thyselius (ed.), *Handlingar rörande svenska kyrkans och läroverkens historia.* II. Örebro 1841, 89.

[829] Lindroth (1943), 78.

[830] For the biography of Skytte, see Tor Berg, *Johan Skytte. Hans ungdom och verksamhet under Karl IX:s regering.* Stockholm 1920, which unfortunately only

from Nyköping, Skytte came from a bourgeois background, but rose to the highest ranks of government due to the patronage of Duke Karl to whose duchy the town belonged. After studies at the Stockholm College, he undertook an academic peregrination that brought him to a number of German academies and schools, most importantly Marburg.

During his studies Skytte became an enthusiastic supporter of Ramism.[831] Already when he attended the school in Nyköping, he became acquainted with it in the shape of Olaus Martini, whose father was a friend of David Chytraeus, and he improved his knowledge of Ramism at the Stockholm College.[832] At the gymnasium at Lemgo in Western Germany his knowledge of and enthusiasm for Ramism was elaborated, and in Marburg in Hesse he followed the seminars of Rudolf Goclenius, who like Chytraeus adopted Ramist dialectics into a general Philippist system of learning.[833] In 1593 Daniel Cramer in Wittenberg had his pupil Holger Rosenkrantz defend a thesis that strongly opposed Ramus. Two years later, Skytte wrote an answer in which he defended the way Ramus applied the three Aristotelian dialectical laws.[834]

Skytte's view on learning was not only developed in the lecture room. His connection to and dependency of Duke Karl destined him for state service from an early age, and his approach to natural philosophy derived from a government's point of view and emphasised utility and technology, control over nature rather than pious contemplation, religious edification or the strive for knowledge for its own sake. Moreover, despite his bourgeois origin and visits to various universities, Skytte's connection to the Duke brought him closer to the culture of administration and diplo-

covers the first part of his career. On Skytte and Uppsala see Annerstedt (1877), I, Chapter IV; on Skytte's view on science see Frängsmyr (1997); Sellberg (1979).

[831] On Skytte's Ramism see Berg (1920), Sjöstrand (1940), Sellberg (1979), Frängsmyr (1997).

[832] Skytte would later describe his old teachers Bothniensis, Skinnerus, and Kenicius as being *"ex scholis Socraticis"*, which meant Ramists, Berg (1920), 38n.

[833] Berg (1920), 31, 49. Skytte later published his recordings of these lectures, *Rodolphi Goclenii professoris logici et mathematici in Academia Marpurgensi Analyses in exercitationes aliquot Julii Cæsaris Scaligeri, de Subtilitate*, etc. Marburg 1599.

[834] Johan Skytte, *Animadversiones modestæ in primam disputationem M. Danielis Crameri...de præcipuis logicæ Aristotelicæ partibus pro Aristotele contra Ramum*, etc. Frankfurt 1595.

macy, dominated by the nobility, but in Sweden also consisting of many bourgeois parvenus.

First of all, it was no coincidence that of all the academies of Germany, Skytte chose to go to Marburg, for it was a favourite destination for Swedish students who were supported by Duke Karl.[835] Moreover, the landgraves of Hesse took a strong interest in learning and were patrons of many prominent philosophers. Landgrave Wilhelm had been an able astronomer himself, and at his court in Kassel he had astronomers like Christoph Rothmann and Paul Wittich, who were both acquaintances of Tycho Brahe.[836] There was in other words a strong mathematical tradition in Hesse, which was also connected to practical problems. Hesse was not only one of the leading Protestants states; it was also a role model of political centralisation. In 1527 Marburg had been established as the first new Protestant university, and in 1599 a military academy (*Collegium Mauritianum*) was established in Kassel.[837] Here a Ramist tradition flourished, which emphasised the practical application of learning to an extent that was even unheard of among Ramists, and Skytte became one of its first students.[838]

When Skytte adopted Ramism, it was therefore in connection with an emphasis on the practical application of learning, particularly rhetoric and mathematics, and therefore he was strongly opposed to the hair-splitting and formalism of Scholastic Aristotelianism. It was in other words the tension between the theologically orientated teaching of most Northern European universities and the humanist learning associated to the needs of princes, governments and the social elite. In his oration at his promotion to master in Marburg in 1598, *De mechanicae artis praestantia*,[839] Skytte claimed that knowledge and talent must be combined with eloquence to be of any importance in society, particularly in political life. He attacked "*the darkness of Aristotelianism*", praised the art of

[835] One of the reasons for this may have been that the Duke's wife was related to the Landgrave Mauritz of Kassel; Berg (1920), 48.

[836] On Wittich see Gingerich and Westman (1988), 8ff. On the court in Kassel as a centre of Paralcelsist chemistry see Moran (1991).

[837] For Hesse-Kassel in this period see K. Malettke (ed.), *Frankreich und Hessen-Kassel zur Zeit des Dreißigjährigen Kriges und des Westfälischen Friedens.* Marburg 1999; W. Keim, *Landgraf Wilhelm V von Hessen-Kassel...*Marburg 1961.

[838] Berg (1920), 79ff.

[839] Johan Skytte, *Dissertatio mathematica de mechanicæ artis præstantia* etc. Lemgo 1598; Berg (1920), 60ff.

mechanics and put forward a plan for the reform of Uppsala based on the needs of Swedish society. Back in Nyköping he gave a speech the following year in which he praised rhetoric that makes us the equal of gods.[840] The difference between this view and that of the Bartholin family in Denmark is striking. To Caspar Bartholin and Ole Worm it was 'philosophy'- meaning the whole range of subjects taught at the philosophical faculty of the university - that raised Man to divinity. To Johan Skytte it was the art of rhetoric, that is, the presentation of the subject matter.

In Denmark Ramism as a distinct current had died out with the death of the members of Tycho Brahe's circle and the rise of Protestant Aristotelianism. In Sweden it lived on due to the support it received from members of government like Skytte and the Rosenhane family, as well as from Nils Chesnecopherus (1574-1622), a mathematician who had studied with Skytte in Germany, served as court mathematician to the Landgrave of Kassel, and ended his life as Chancellor of the Court in Stockholm. When Skytte was appointed teacher of the future king Gustav Adolf in 1602, he used Ramist textbooks and emphasised the use of applied mathematics for princes and civil servants in the treasury, the custom office and the army. The following year Skytte strengthened his position through his defence of Duke Karl against the polemics of the dethroned King Sigismund, and an apology of the coup was also translated into German.[841] He was ennobled and became a member of the Royal Council.

It has rightly been claimed that in 17th-century Sweden, the introduction of novelties at Uppsala always happened on government initiative, and the government did not encourage learning for its own sake.[842] Like in Denmark, the King's grants to the uni-

[840] Johan Skytte, *Oratio Johannis Schroderi Skytte Sueci in qua ostenditur artium liberalium majestas et nobilas eloquentiæ dignitas, quæ habita fuit Nycopiæ mense Octob. Anno etc. 1599.* Stockholm 1604.

[841] Johan Skytte, *Oratio, darin außführlich erkläret und dargethan wird, wer anfenglich Ursach geben zu dem Tumult, Zwyspalt, und Uneinigkeit...in dem...Königreich der Schweden...* Stockholm 1609.

[842] Bo Lindberg, *Stoicism och stat. Justus Lipsius och den politiska humanismen.* Stockholm 2001, 190f. Thus the only text by Lipsius, which was printed in Sweden was a manual on how to compose a letter - *Institutio epistolica.* Uppsala 1639, which was published together with an edition of Cicero's rhetorical texts. See also Stina Hansson, *Svensk brevskrivning. Teori och tillämpning.* Gothenburg 1988.

versity was accompanied by increased government interference in academic life, and the rector of Uppsala complained that he had no authority over those professors who enjoyed patronage from Court.[843] When Skytte became chancellor of the newly reformed University in 1622, he had the opportunity to carry his ideas into practice and tried to force Ramism on the professors.[844] Already eleven years before he had strictly admonished the professor of logics, Jacobus Bureaeus to follow Ramist method in his teaching.[845] He emphasised that learning must be connected to its practical application, and therefore particularly encouraged the study of mathematics and rhetoric. Undoubtedly influenced by Skytte, Gustav Adolf provided Uppsala with three chairs in mathematics, among them one in astronomy.

Skytte's insistence on Ramist textbooks and teaching was eventually met with opposition. In the decades around 1600 Ramism had entered schools and university through students from Rostock and the academies of Westphalia, and initially there was little resistance. Following the example of German semi-Ramists like David Chytraeus and Rudolf Glocenius, it was attempted to fit Ramist dialectics into the general Aristotelian framework. Ramus was recommended for young students due to his pedagogical gifts, while Aristotle was thought to be suited for the more advanced students.[846] It was only with the rise and the new and more theoretical Protestant Aristotelianism, which we discussed in the last chapter, conflicts broke out. The new Protestant metaphysics had been brought to Sweden from Wittenberg and Helmstedt by theologians like Johannes Rudbeckius and Johannes Canuti Lenæus, and in his private seminars Rudbeckius used the logical and metaphysical treatises of Zabarella and Suarez.[847]

This re-emergence of metaphysics went counter to Ramist aspirations, and at Uppsala controversies broke out between Aristotelians like Johannes Rudbeckius and Johannes Canuti Lenæus

[843] Letter from rector Johannes Raumannus of January 11, 1614 see Annerstedt (1877), Bihang, no. 55.

[844] Skytte's enormous influence on education in the Swedish empire has not been thoroughly studied, but see Sellberg (1997) and Runeby (1962).

[845] Annerstedt, I, 151.

[846] On Ramism in Sweden see Sjöstrand (1940).

[847] See Billing (1923); Hall (1911). Later Rudbeckius also published his own logical textbook *Logica.* Västerås 1625.

and a party led by Skytte and consisting also of Laurentius Paulinus Gothus, who as a client of Skytte probably was influenced by the views of his patron,[848] later also of the professor of physics and logic Johannes Chesnecopherus, a brother to Nils, who like Skytte had studied at Marburg.[849] When Skytte visited Uppsala in 1605, he and Paulinus Gothus condemned the new Protestant Aristotelianism, and the Chancellor personally intervened in a disputation by accusing Professor Stigzelius: *"Are you perhaps bringing in metaphysical rubbish and sophistry?"*[850]

It was essentially a crusade against traditional and predominantly theological academic learning and reflected the tension between the two functions of learning, which we have already seen in the fierce contentions between Messenius and Rudbeckius, and it was no coincidence that many Swedish Ramists were former students of the Stockholm College and closely attached to Court.[851] There were, however, other aspects. Just as Skytte saw no conflict between Christian morality and reason of state,[852] the theologian Paulinus Gothus was convinced that learning could and should be useful to both the church and the state,[853] but he also criticised Aristotelianism for being unchristian, whereas Ramus was praised for being a true Christian (i.e. Protestant) philosopher, and ten years later he suggested that all pagan philosophy should be purged from the schools.[854]

If the mathematical arts were one leg in Skytte's programme for useful learning, the other consisted of the disciplines concerned with government, diplomacy and administration. In 1622 he established a still existing chair of politics, eloquence, and history at Uppsala, and explicitly stated that the professor should teach by way of the 'Ramist method' (*methodo Rameus*). It is worth noting that Skytte had separated the teaching of politics from moral phi-

[848] On Ramism in Sweden: see Wilhelm Sjöstrand, 'Till ramismens historia i Sverige', *Lychnos* 1940; Tor Berg, *Johan Skytte.* Stockholm 1920; Herman Lundström, *Laurentius Paulinus Gothus,* I-II. Stockholm 1893. Also Sellberg (1997 and 1979) have some valuable reflections.
[849] Lindroth (1943), 276ff.
[850] Annerstedt, Bihang, 356.
[851] Around 1580 a book of Ramus existed in the library of the Stockholm college.
[852] Gustafsson (1956), 48; Berg (1920), 96ff.
[853] See Sjöstrand (1940).
[854] Annerstedt (1877), 171.

losophy to which it traditionally belonged. This again was to emphasise its practical rather than theoretical nature. It was a separation that had been recommended by the Dutch humanist Justus Lipsius and was introduced most places in Europe during the 17th century, also in Denmark, but few places earlier than in Sweden.[855]

Skytte's educational programme was not restricted to Uppsala. His attempt to establish education fit for the training of administrators and diplomats in the growing central administration was also reflected in his attempt to create a noble academy, the *Collegium Illustre*, in Stockholm in 1626. This institution was to imitate similar academies in Denmark (Sorø), Kassel and elsewhere in Germany, and was led by Johannes Matthiae, but it existed for only three years.[856] Furthermore, Skytte also took interest in the education of the lower classes and founded many primary schools in the Swedish province.[857]

When Skytte in 1630 became Swedish governor in the recently conquered Livonia, he was responsible for the establishment of the University of Dorpat (Tartu). At his oration at the opening of the university, he claimed that the professors should not waste the students' time with theoretical speculation, but should always have the demands of life and the practical use of learning in mind.[858]

However, while Skytte's view on learning undoubtedly stimulated the interest in mathematics and the prestige connected to it, Uppsala and Dorpat were hardly up-to-date with recent developments in the mathematical arts. It is telling that the professor of one of the three chairs in mathematics at Uppsala, that in astronomy, had the title "professor Ptolemaicus", and in the university statues from 1626 Copernicus is only one among a number of, predominantly older, *authores probatissimi.*[859] Thus, in the particular directions for the teaching of astronomy, only three textbooks are mentioned, all based on classical cosmology - Sacroboscos *Sphæra*, Heinrich Brucæus' *De motu primo,* the manual of Peur-

[855] Lindberg (2001), 196f.
[856] See H. Holmquist, *D. Johannes Matthiae Gothus och hans plats i Sveriges kyrklige utveckling.* Uppsala 1903.
[857] Frängsmyr (1997), 21.
[858] Bergman (1932), 33; see also Sandblad (1975-76).
[859] C. Annerstedt, *Uppsala universitets historia, Bihang I.* Uppsala 1877, 277.

bach.[860] Although Copernican cosmology was often touched in dissertations at Swedish universities in this period, Henrik Sandblad has concluded that they do not bear witness to any profound knowledge of astronomy or the problems involved in the discussions on the world picture.[861] An example is the professor in mathematics in Uppsala, Martinus Erici Gestrinius, who held Galilei in esteem but stuck to a geocentric world-picture - preferably the Tychonic - with arguments based on Aristotelian physics, and in his various discussions on the world picture never touched upon the central astronomical argument against Copernicanism, namely the apparent lack of a stellar parallax.[862]

So while Skytte's propagation of the practical application of science vis-à-vis scholastic speculation may seem appealing, it hardly led to any immediate progress. What it did do was to marry natural philosophy, particularly the mathematical sciences, to the 'national project'. While universities used to be training schools for the clergy, the ambition of Skytte and like-minded men also made them schools for civil servants, whether these were administrators, clergymen or soldiers. For reasons of state Skytte eventually allowed Ramist philosophy to be ousted from Uppsala, but as late as 1640, he would still praise his old teachers at the Stockholm College, who had trained him in the philosophy of Ramus, and he would continually work for an educational reform based on Ramism and aimed at the practical needs of the state.

Finally, it must be noted that there was also another side to Skytte's view on learning than that which emphasised its practical application. He had a relatively high opinion of the female intellect, took interest in the education of women and had both his sons and daughters write Latin letters from an early age.[863] All this indicates that he was also influenced by courtly humanism as it is found in Castiglione. This is not surprising as he spent much time in court circles during his studies abroad as well as in during his career as a diplomat. But this was not the official view on learning Skytte championed.

[860] Annerstedt (1877), 278.
[861] Sandblad (1943), 160.
[862] Sandblad (1943), 160-163.
[863] Frängsmyr (1997), 21f.

7. Prophecy and Propaganda

If one side of Sweden's national style in the 17th century was the demand that learning should be applicable to practical life, i.e. administration, warfare and industry, a side easily conceivable to the modern reader, the other side appears wildly exotic. Nonetheless, it was equally important, and as we shall see later on, the two apparently incongruent sides converged in some of the period's leading scientists. This side concerns what is generally known as 'the Gothicist tradition'. As the impatient reader may well point out, this had little to do with natural philosophy or science as we understand it, but it should become clear that it was essential to the culture of natural philosophy in 17th century Sweden.

In the Renaissance national mythologies emerged in nearly every European country due to increased interest in the past and its use in propaganda. Just like the ancient (or allegedly ancient) origin of a philosopher gave authority, ancient origins gave prestige and authority to rulers and their countries. To establish the ancient lineage of a ruling dynasty was therefore also essential to its legitimisation. Accordingly humanists on their own initiative, or more often on behalf of their aristocratic patrons, would attempt to uncover the glorious origin of the ruling dynasty.

While rulers in Southern Europe and the Holy Roman Empire could present and perceive themselves as heirs to the Roman Empire, rulers in those parts of Europe, which had never been blessed with the *Pax Romanum*, must see themselves as successors to the 'barbarians' who had defeated Rome. Accordingly, humanists in Northern Europe tried to glorify these peoples - the Germans, the Goths, the Batavians, the Celts - by giving them their own history and by claiming that these ancestors had embodied the virtues of *sapientia et fortitudo.* In the Reformation period, this also had an edge towards the Papacy. The barbarians were generally depicted as simple and uncorrupted peoples, who had defeated a decadent Roman civilisation. Among German humanists Tacitus' *Germania* became in vogue, but the national mythology drew on a great variety of sources. Historical source criticism had not been developed, so the accounts of Jewish, Greek and Roman writers were indiscriminatingly brought together, and also the Biblical accounts were taken at face value. National history was essentially textual archaeology employing all available sources.

Since the later Middle Ages Swedish intellectuals had developed a particular historical fiction concerning the ancestors of the Swedish people stimulated by the discontent with the supremacy of the Danish kings.[864] Scandinavia was seen as the fabled far northern land of the Hyperboreans, which according to Greek writers such as Pindar was inhabited by a race of Apollo-worshippers. Unfortunately, the Hyberboreans had vanished from recorded history, but in the 16th and 17th century, they were connected to the Goths, and some authors would also attempt to trace the lineage of the Hyberboreans back to Biblical persons and tribes. Thereby a historical lineage had been established that by way of the Hyberboreans and the Goths connected the Swedes to the Biblical narrative. This lineage was the essential claim of what has been called the Gothic Renaissance.[865]

As we have already discussed, Swedish kings like Karl IX and Gustav Adolf had problems with legitimising their rule. Not only had the Vasa dynasty ascended the Swedish throne through rebellion against its rightful king, but its internal conflicts had further undermined its prestige, and enemies like King Sigismund of Poland and Christian IV of Denmark issued a flood of pamphlets that stamped Karl and Gustav Adolf as usurpers and tyrants and invited their subjects to rebel.

Hence, it is no surprise that the Gothic mythology was taken up as a useful tool. When Gustav Adolf was crowned in Stockholm during a war against Denmark, he was dressed as a Gothic king,[866] and Gothicist ideology was employed to justify the expressed political aim (also an aim of Danish foreign policy) of establishing a final rule over the Baltic Sea (*dominion maris Baltici*),[867] a formula that governed Swedish foreign policy until it was secretly given up in the Westphalian Peace Treaty. As the Swedish monarchy was involved in endemic war against Catholic Poland ruled by the deposed King Sigismund, and later when it was fighting the Imperial and Spanish armies during The Thirty Years' War, Gothicism was partly redirected not only against Catholicism, but

[864] The idea of Gothicism was first put forward in Ericus Olai's *Chronica regni gothorum* from the 15th century.
[865] On the Gothic Renaissance, see Johannesson (1991).
[866] Åkerman (1998), 159.
[867] See Ursula Voges, *Der Kampf um das Dominium Maris Baltici 1629-1645*. Greifswald 1939.

also followed Tacitus in contrasting the virtuous barbarians of the North with the civilised but depraved peoples of Southern Europe.

Thus, Gothicism connected intellectual life with the needs of the state (i.e. the requirements of the government), a connection established through patronage and censure. This is evident in the career and work of Johannes Bureus (1568-1652), one of the most prominent propagators of the 'occult philosophy' in Northern Europe in this age. The ideas of Bureus have been studied carefully, including their connection to contemporary intellectual currents,[868] but two aspects of his work have been downplayed. First of all, Bureus' connection to what Dr. Jamison calls the 'metaphysical bias' of Sweden, i.e. the medieval tradition of systematic mysticism identifiable from at least the 14th century. It is no coincidence that characters like Bureus, and with him the contemporary Finnish mystic Sigfridus Forsius, appeared in Sweden and not in Denmark.

There were men and women in Denmark and Norway who were attracted to religious mysticism and occult speculations on the world, but their limited importance can, in my opinion, not only be attributed to the hostility of the Danish Church towards religious mysticism. First of all, mysticism was not incompatible with Orthodox Lutheranism as exemplified by Johann Arndt, who despite the controversies he awoke, was influential in Wittenberg as well as in Denmark during the same years that orthodoxy replaced Philippism. Moreover, religious orthodoxy in Denmark was less dogmatic than its German counterpart, and as we have seen the hostility of a leading figure like Bishop Resen was essentially directed towards the '*beast of reason*', the Philippist confidence in Man's reason. But even though there were people in Denmark who had mystical and spiritual experiences, Caspar Bartholin was said to be one of them,[869] they did not try to connect these experiences to a systematic religious outlook. We here touch upon one of the

[868] Sten Lindroth, *Paracelsismen i Sverige till 1600-talets mitt.* Uppsala 1943; Susanna Åkerman, *Rose cross over the Baltic. The Spread of rosicrusianism in Northern Europe.* Leiden 1998.

[869] According to his funeral oration, it was a religious experience during illness that led Caspar Bartholin to change his chair in medicine with one in theology, Jens Dinesen Jersin, *Enochs Leffnit oc Endeligt, betragtet udi en Ligprædiken over Dr. Caspar Bartholin.* Cph. 1632.

essential differences in the 'metaphysical bias' between Sweden in Denmark, a tradition of systematic mysticism vis-à-vis a tradition that refrained from systematizing such experiences but rather turn an example out of one's life. Dr. Jamison sees, in my opinion correctly, this as a pre-Reformation tradition that continues throughout the early modern period and at least as far as the 19th century.[870] If this is correct, this tradition transcends political and socio-economic formations and can therefore not be explained from the different structures of such formations in the two countries only.

Secondly, Bureus has not been adequately related to the power structures of contemporary Swedish society. Generally, he is portrayed as a solitary mystic who developed his ideas independent of patrons and his function in Swedish society.[871] That Bureus inarguably was a remarkably original thinker and a major figure in the theosophical tradition in Renaissance Europe only makes his position in the Swedish culture of learning the more interesting.

Bureus was a figure who did not fit into traditional academic culture. He took no interest in scholastic philosophy, never took a university degree, and had to make his living as a free agent on the patronage market. As the son of a learned minister from a village outside Uppsala, young Bureus could possibly draw on his father's connections to the archbishop. He was essentially was a courtier, albeit a very independent-minded and well-read one, and totally dependent on royal patronage. It seems that he studied at the Stockholm College in the 1580s,[872] and he entered he royal administration in 1590. During these years, however, the political situation in Sweden made the game of patronage more precarious than usual. King Johan died in 1592, his son Sigismund departed for Poland, and civil war broke out between his followers and those who supported Duke Karl. In 1594 Bureus moved to Uppsala, presumably to watch over the printing of the new Swedish Bible, but most likely he also tried to establish himself at the uni-

[870] Jamison (1982), 220. While in Denmark later thinkers like Grundtvig and Kierkegaard turned their life into an example, Swedes like Swedenborg and perhaps even Strindberg tended towards a more systematic approach to mystic experiences.

[871] See for example the treatment of Bureus in Lindroth (1943), 82-252.

[872] Lindroth (1943), 83f.

versity. If that were the case, he was disappointed and felt that he was met with opposition from the professors.[873]

During these years of insecurity, Bureus began to develop a strong interest in extraordinary events, dreams and prophecies and laid the foundation for his theosophical thinking. According to his own account the decisive moment came 1591 with his reading of the mysterious *Arbatel*, whose provenance is unknown, though it was probably written in the early 16th century.[874] The Arbatel was an enthusiastic account of white, divine magic based on prayer and performed with the assistance of God. The mage must be pure and pious in order to be successful and work with the seven Olympian (planetarian) spirits, and the work included Paracelsian (and Pseudo-Paracelsian) and Hermetic ideas as well as Christian Kabala.

His reading of Arbatel led to an interest in astronomy, astrology, alchemy, physics and numerology, and to his reading of other Paracelsian treaties,[875] and inspired Bureus to formulate his position on philosophy and magic. Moved by religious zeal, he started to object to Aristotelian philosophy and its explanation of Man as a rational animal, and urged a return to Scripture and its sense of the soul as a harmonious entirety endowed with a spirit. Bureus thus took up ideas that were common among the Paracelsians - the two natures of Christ, his status as the first and second Adam, and the concept of the Homo Triplex, the idea of three natures in man animated by a fourth principle, the inner life-giving sun (*Lux*) that separates the pure from the impure and illuminates the whole.[876] Like Cort Aslakssøn and Laurentius Paulinus Gothus he began to scrutinize Scripture for evidence of his doctrine, and like them he found what he was looking for. Inspired by *Arbatel* Bureus believed that a white and benevolent magic was possible

[873] Lindroth (1943), 89 n. 4.
[874] *Arbatel* or *De magia veterum* was the fragment of a manuscript, of whose nine parts only the first was extant. Though it was not composed by Agrippa of Nettesheim it was included in his *Opera*, and a new edition was put forward in Basel 1575 by Thedor Zwinger.
[875] Such as Gerard Dorn's edition of Paracelsus' ideas on the signatures of nature, *Archidoxis magica.* Basel 1570.
[876] See Åkerman (1998), 54f.

through Faith and purity and was confirmed in this conviction by his reading of the Pseudo-Paracelsian *De occulta philosophia.*[877]

All these lofty speculations had little interest to those in power, but a part of Bureus' work was useful to the Swedish government. From his time in Uppsala in the 1580s Bureus had taken an interest in the Runes, the ancient Northern alphabet inscribed on runic stones, a heritage from a past clouded in myth and legend. The interest in the Runes was stimulated by the Cabbalist doctrine of Temura (*alphabetica revolutio*) in which one letter can be replaced by another, thereby revealing new meanings to a text, a technique employed by Christian Cabbalists to find hidden meanings in Scripture.[878]

After his victory over Sigismund at Stångebro in 1598, and his purge of a number of high noblemen in the following years, Duke Karl was the effective ruler of Sweden, but his position was by no means secure, and to remedy this he decided to fight a war on two fronts. On the battlefield he launched an invasion of Polish Livonia in the autumn of 1600, but at the same time he also tried to win the war of propaganda. He presented himself as the champion of Protestantism against the Popish Sigismund, and at the same time he sought to enhance the prestige of Sweden by providing her with a glorious past also directed towards the historiography and polemical pamphlets produced on the order of the Danish king.

At his time Bureus moved back to Stockholm and managed to win the patronage of the new government by offering a simple method of deciphering the Runes. As usual, the circumstances of how he precisely obtained the patronage are, to my knowledge, not revealed by the extant sources, but it was most likely through a patronage broker. Nils Chesnecopherus or Johan Skytte are likely candidates, and in November 1604 Bureus was appointed to assist the latter teach Prince Gustav Adolf and his sister.

Scholars who endeavour to study Johannes Bureus are faced with the problem that most of his manuscripts were never published, were undated and subject so considerable reworking through the years. It is therefore hard to establish a chronology of

[877] Lindroth (1943), 93.
[878] See J. Blau, *The Christian Interpretation of the Cabala in the Renaissance.* New York 1944.

his intellectual development. Nonetheless, it seems fairly evident that the universal ideas he took over from Arbatel and the various Paracelsian writings, turned more national at the time he became a client of the new government. As in the case of Ole Worm, he was undoubtedly already familiar with national mythologies, but like the Dane his interest in such matters arose at a time, when he was trying to win or secure patronage.

His first major work, the unpublished *Antiquitates Scanzianæ*, which consisted of three treatises, was composed sometimes between 1604 and 1617 and was dedicated to Gustav Adolf.[879] The French orientalist and cabbalist Guillaume Postel and his followers had established a Celtic mythology, which concerned the allegedly ancient origins of France, and in the *Galliade* by La Boderie it was claimed that the druidic bards had influenced the early Hebrews, and that the wisdom of the Psalms passed to the hymns of Orpheus and more concretely to Pythagoras in the form of sacred geometry.[880] And as sacred geometry it had returned to Gaul in the sacred geometry of the high medieval renaissance used by the builders of cathedrals and transmitted by singers of the Gregorian chants. Thus, culture had described a full circle, originating in ancient Gaul, being passed on to ancient Greece by way of the Hebrews, and returning to its home of origin in the middle ages.

In *Antiquitates Scanziana* Bureus now advocated a similar cyclical influence from ancient Scandinavia. The Runes of the Scandinavian shamans had through the legendary Thracian sage Abaris reached the Pythagoreans in Italy. The sacred patterns of the original alphabet had contributed to Etruscan literary culture that was now returning to the north in the form of ideas on the origin of the Gauls and Hyperboreans, thus completing the cultural circle. The mystical origin of the three crowns of the Swedish coat-of-arms (whose right of using was one of the *casu belli* for the war between Sweden and Denmark in 1611-1613) was likewise found in Sweden's ancient past. Moreover, Bureus offered an Hermetic interpretation of the Nordic pantheon by claiming that the three crowns corresponded to a universal Trinity with Thor, Othin and Freya being the Father, the Son, and the Holy Spirit

[879] Lindroth (1943), 96.
[880] Guy Le Fèvre de la Boderie, *La Galliade ou de la revolution des arts et sciences.* Paris 1578.

but also respectively the Paracelsian *Lumen*, the *sapientia* of the Pythagoreans (as well as the word of God), and the Diana of the Ephesians.[881] Appealing to Hermetic chronology he claimed that Uppsala had been founded before the time of Abraham. In his likewise unpublished *Adulruna et Alruna Baltica Scanziana*, dedicated to the memory of "Gustavus Hero Baltica", the wanderings of the Goths (Getes) are traced, by way of land to Scandinavia.[882] Both these manuscripts were preparations for his secret manual of kingship, which he presented to Prince Gustav Adolf and his younger brother Duke Carl Philip at the death of their father in 1611.[883] After the death of Gustav Adolf in 1632 he would also offer a gilt-edged Swedish version of this manual to Axel Oxenstierna, who led the interim government.

At the request of the king, Bureus was sent around the countryside to make inventories of rune stones like those later created in Denmark by Ole Worm. However, while Bureus was useful to the government as a propagandist of Gothicism, and thereby in legitimising the Kingdom of Sweden and her control over the Baltic, his ventures in Kabala and 'white magic' were unwanted and perilous. Karl's victory and the triumph of Protestantism (i.e. Orthodox Lutheranism) led to attempts to conform religious life. At the same time as Bureus began to make an inventory of Swedish rune inscriptions, a number of his relatives were accused of sorcery. His brother-in-law was executed in 1603, and the very same day another relative of his was found dead in prison. Bureus' position at court was not strong enough to prevent these calamities, but in the following years he proved still more useful to the Swedish throne. He was asked to demonstrate his alphabetic rendering of the Runes to foreign emissaries, beginning with the reception in the summer of 1602 for the envoys of the Ducal court of Hesse-Kassel. He was also asked to join Nils Chesnecopherus' embassy to Germany, but after a visit by Danish diplomats, it was decided that the loss of Bureus' skills could not be risked. Instead he was given the office of royal antiquarian to accomplish the task of translating ancient Scandinavian documents of law and king-

[881] Åkerman (1998), 33-34.
[882] Åkerman (1998), 34.
[883] *Adul-Runici Clypei quinarius penetralis seu Adulruna Rediviva de quinque Alphabeti seeri dispositionibus.*

ship, valuable to the propaganda in the cold war between the two Scandinavian kingdoms and against Polish propaganda.[884]

During these years Karl IX's promotion of himself as a champion of Protestantism led a number of Protestant writers around Europe to look towards the far North for relief against the Counter Reformation, and as the royal antiquarian Bureus was involved in this. In 1604 he was involved in translating a Latin pamphlet sent to him by the illegitimate son of the king, Carl Carlsson Gyllenhielm, *A Warning delivered by one of the Pope's secretaries.*[885] Its author treats of a feared Protestant setback in Austria and Württemberg and of the formation in Rome of two colleges for Counter-Reformation propaganda. In October 1605, when the King had lost the skirmish at Kirkholm in Livonia, he was written to in Stockholm by a preacher from Stralsund, Michael Lothich, who delivered the prophecy of '*Der Löwe aus der Mitternacht*' expounded by Paracelsus and others spelled out from the Sephirothic tree of the Cabbala. Lotich instructed Karl to receive him in person in Stockholm so that he could explain the Divine intention behind his rise and the deposing of Sigismund from the throne.[886]

In the years 1606-1609 Bureus kept on revising his Runic system, and in 1609-1610 on a more massive scale he began to coordinate the views of the Hermetic philosophy of Pico della Mirandola, Marsilio Ficino, and the *Pimander* with the Runes and Gothicist ideology. Likewise he drew on Christian cabbalists such as Johannes Reuchlin in order to represent some central Runes as "stations" in a sevenfold descent from the superior to the inferior world. Throughout the period, he also kept astronomical records, made optical measurements, and experimented in alchemy, sometimes at the presence of Gustav Adolf.[887]

While Ole Worm ended up rejecting the Rosicrucian movement and consciously separated his interpretation of the Runes from kabala and similar occult traditions, Bureus took a different position. Shortly after the publication of the first Rosicrucian

[884] Åkerman (1998), 53, 158.

[885] *En Waarning som en påfwens sekreterare, hwilken Gud hafver hulpit ifrå påwens wilfarelse...hafwer ställt till alla konungar, evangeliska furstar, och potentater...efter herr Carls, Sweriges Rijkes arffurstes etc. befaling.* Stockholm 1604. On Gyllenhielm, see Bureus' diary, *Samleren* (4), 1883, 36.

[886] Åkerman (1998), 111-122.

[887] Lindorth (1943), 93.

tracts, he borrowed a copy and enthusiastically requested more copies from the playwright Johannes Messenius in Riga. In the previous chapter we argued that Rosicrucianism became a catalyst of Europe's chaotic intellectual life and visions at the outbreak of The Thirty Years' War, and Bureus is an example of this. In three treatises from the years 1616 to 1618, he connected his claim about the secret of the Runes and their Gothic past to the already messy thesaurus of Rosicrucian ideas.[888] The second Rosicrucian manifesto, the *Confessio*, had mentioned that the new age would bring forth a new alphabet. In one of his treatises, the *FaMa*, Bureus interpreted this promised alphabet as the Runes.[889]

Everything seemed to make sense. The old world was drawing towards its end, and the birth of a new and golden age was at hand. His knowledge of the Runes had provided the last piece of the millenarianist puzzle laid down by the Rosicrucians, and Bureus now took the dangerous step of turning from a courtier, propagandist and author of unpublished theosophical manuscripts into a prophet. He sent the FaMa to Paracelsian circles in Rostock, Greifswald, Frankfurt, Wittenberg, Jena, and Altdorf, and in March 1617 he held a three days course at Uppsala on the apocalyptic meaning of the *Buccina*.[890] In the summer of 1618 he had one of his texts consecrated on the high altar in the cathedral of Uppsala, and set up a placard of prophecy on the door to the cathedral.[891] These ventures, however, overextended the goodwill Bureus enjoyed with the authorities, and his millenarianist ideas were condemned as fantasies (*nugas et errores*).[892] The government could make good use of prophecies that proclaimed Gustav Adolf to be the saviour of Protestantism, but millenarianism was an invitation to social unrest and political instability. Bureus escaped punishment, but thereafter he was forced to seek other, more private channels through which to disseminate his ideas.

What saved Bureus from persecution or marginalisation was his usefulness to Swedish propaganda. Gustav Adolf had inherited the Polish war in the Eastern Baltic from his father. From the early

[888] Åkerman (1998), 40.
[889] *F.R.C. faMa e sCanzIa reDUX* etc. n.p. 1616. A new edition was published in 1618; Åkerman (1998), 43f.
[890] Åkerman (1998), 58.
[891] Åkerman (1998), 59.
[892] Åkerman (1998), 59.

1620s this regional war was increasingly connected to the Thirty Years' War through connections (or imagined connections) between Poland and the Habsburgs.[893] Thereby a war that had begun as a traditional dynastical war assumed religious overtones and became a fertile ground for millenarianism and prophecy.

In 1621 Gustav Adolf commissioned Bureus to prepare an edition of the Swedish coronation charter (Sw. *Konungastyrelse*) that would be of much use in arguing for the legitimacy of Swedish supremacy in the Baltic.[894] The next year, Bureus published his own "Key of David" in which in tabular form he describes the measurements of Solomon's Temple, to further predict the Apocalypse.[895] In the following years he was closely in touch with the King, and he created new emblems concerning "The Lion of the North".[896] So Bureus did not abandon prophecy, but it was to be connected to the needs of Swedish foreign policy, and his theosophy must not go against Lutheran religion.[897]

Throughout his long life Bureus continued his work that was partly connected to government propaganda (though he may have been sincerely convinced of its truth value), and partly followed his own interests. These were mainly Hermetical, but it is worth noting that Bureus was the first Swede who wholeheartedly embraced Copernican cosmology, although this was more rooted in philosophical speculation and influence from Nicolaus Cusanus than mathematical observation, and he was convinced that all the celestial bodies were inhabited by living beings.[898]

Bureus was the most prominent but by no means the only political prophet active in Sweden during these years. In 1619 the Finnish Sigfridus Forsius dedicated a prognostic to Abraham Brahe and his brother Magnus. Forsius wrote of an age of great

[893] Swedish spies had heard that the Polish army would join forces with Wallenstein and take control of the Baltic.
[894] Åkerman (1998), 161.
[895] *Then Utlovade Morgonstjernan...Buccinat ut redeas EOAE vocula, SURGE.* n.p. 1622; Åkerman (1998), 138.
[896] Åkerman (1998), 162-164.
[897] In an undated letter archbishop Kenicius warned him against publishing a Paracelsian treatise if it went against the Bible. (Lindroth 1943, 95). The letter must have been in the years between 1609 and 1636 when Kenicius was archbishop of Uppsala.
[898] Sandblad (1943), 156-158.

reform that was soon to commence,[899] and also believed that all celestial bodies were inhabited. In his *Prognosticon astrologicum* (1610) he mentions the three world systems (i.e. the Ptolemaic, the Copernican and the Tychonic) and gives an account, although rudimentary, of the Copernican world picture in the vernacular.[900]

8. Court and Cosmos

In 1644 Queen Kristina ascended the Swedish throne, after the country for twelve years had been ruled by a regency government led by Axel Oxenstierna. Not only was the emergence of a new ruler as always a momentous event in the world of patronage, but the young queen was also much better educated and intellectually gifted than any of her predecessors and adhered to cosmopolitan religious and philosophical ideals.[901] Needless to say, this challenged the national focus of Swedish intellectual life, and soon it also turned out to challenge the Lutheran Church.

Unlike her father and grandfather, Kristina was already from her infancy destined to ascend the throne. Her education was therefore that of international court culture and differed radically from that of the high nobility, and the fact that she was a woman and therefore not joined Sweden's numerous military campaigns, further limited her horizon to the court, and also made Stockholm the only place where aspiring clients could seek out the ruler. Her intellectual and cosmopolitan leanings were further stimulated by the vast number of books that Swedish armies brought to her from Prague and elsewhere in Europe,[902] to which she added numerous book collections which she bought, among them the collection of Gerhard Vossius and part of Cardinal Mazarin's collection. In this way, a library was established at Court, which contained hardly any Swedish book or manuscript, but numerous unique books and manuscripts from all parts of Europe, many of which could never have entered Sweden due to censure. This not only influenced the

[899] Åkerman (1998), 126.

[900] Forsius also dealt with cosmology in his unpublished *Physica Eller Naturlighe tings Qualiteters och Egendomars Beskrijfuelse* (written 1611), where he seems to prefer the Tychonic world picture.

[901] For a recent study of Kristina see Susanna Åkerman, *Queen Christina of Sweden and her Circle. The Transformation of a Seventeenth-Century Philosophical Libertine.* Leiden 1991, which also includes an extensive bibliography.

[902] See Walde (1916-20).

intellectual horizon of the queen, but also that of men and women at court.[903]

As is well known, Kristina not only collected books, she also imported numerous intellectual celebrities to Sweden. Most famous was René Descartes, but the majority were philologists and librarians.[904] It would be fair to assume that this *brain gain* gave a vital stimulus to Swedish intellectual life and seriously challenged its national orientation. This was not the case. They remained creatures of the court, and so far as they had any contact with Swedish intellectuals, this was mainly antagonistic. It is telling that when Kristina established a court academy, it included no Swedes among its members, and, unlike its French model, it was not concerned with the cultivation of the vernacular, but concerned with Latin literature and philosophy. While enthusiasm for Cartesianism among members of the Bartholin family (as we shall see in Chapter Eight), was influenced by their personal acquaintance with the philosopher in the Netherlands, his stay in Stockholm seems to have made little impact on the development of Cartesianism in Sweden.[905]

There was, however, one aspect of intellectual life in which the culture of Kristina's court had important consequences after her abdication in 1654, departure and conversion to Catholicism two years later. Until Kristina's reign the 17th-century Swedish court had not represented an alternative to the Lutheran Church.[906] The educational needs of noblemen might conflict with those of theological students, and reason of state might lead the government to tolerate religious minorities and support ideas that troubled stout Lutherans, but the Lutheran Church was consi-

[903] It also seems that many books disappeared from Kristina's library. When the library was to be sent to Kristina in Italy, it appeared that titles were missing, probably stolen by court servants. Soon, many of these books could be acquired at Stockholm book traders. Also creditors like Magnus Gabriel De la Gardie had acquired parts of the library, see Schück (1985), 147f.

[904] These included the Dutch humanists Isak Vossius and Nicolaus Heinsius, Germans like Johannes Freinshemius and Christian Ravius, and Frenchmen like Huet, Samuel Bochart, Claudius Salmasius and Gabriel Naudé, the latter the former librarian of Cardinal Mazarin.

[905] See Chapter Nine below.

[906] For the highly religious culture of the Swedish court during the reign of Karl IX and Gustav Adolf, see Persson (1999), part. 14ff. If anything religious ceremonies at court were even more frugal than those of the Swedish church in general.

dered the unshakeable fundament of political and social stability, and men like Johan Skytte and Johannes Bureus saw no conflict between their philosophical views and Lutheran religion. During Kristina's reign Lutheran supremacy was challenged, not only by court culture, but even more so by the church policy, which reflected her cosmopolitan ideas.

At her side Kristina had her old teacher Johannes Matthiæ (1592-1670), whose career was intimately connected to the high nobility and the court. As a student he had joined Messenius' controversial seminars at Uppsala, and as a præceptor for a group of young noblemen he had made friends with men of all confessions and was influenced by the cosmopolitan ideals of humanist religious and philosophical thinking. Matthiæ managed to win the patronage of Gustav Adolf himself, and as a rector of the Collegium Illustre he emphasised humanist learning.

At an early point Matthiæ became a propagator of religious reconciliation,[907] the so-called Syncretist movement which originated from Helmstedt and tried to find common ground among the various Christian confessions,[908] and he stood in close contact with men like John Dury and Jan Comenius. Naturally, this provoked fierce resistance from orthodox theologians, but Matthiæ enjoyed the support of the king himself and became the house preacher of Gustav Adolf and later the teacher of the young princess Kristina, who promoted him to the see of Strängnäs. As a bishop and with the backing of Kristina, he now propagated syncretist views, as in his draft for a new church ordinance, *Idea bona ordinis* (1644), which was closely modelled on that of the Bohemianm Brethren, undoubtedly due to influence from Comenius. Together with another of Kristina's clients, Johannes Terserus, professor of theology (later bishop) of Åbo, he also attacked the *Formula concordia*

[907] Already in his *Libellus puerilis* (1622), Matthiæ complains about the devastating theological controversies and cried out for a return to Erasmus' humanist piety.

[908] For the controversies on Syncretism in Sweden, see S. Göransson, *Ortodoxi och synkretism i Sverige 1647-1660.* Uppsala 1950, and idem. *Den synkretistiska striden i Sverige 1660-1664.* Uppsala 1952.

at the diet of 1647, and afterwards he published several syncretist treatises.[909]

Kristina's abdication and conversion proved a fatal blow to the syncretist aspirations, and finally led to the sack of Matthiæ and Terserus in 1664. The result was apparently a strengthening of Orthodox Lutheranism, and in the 1650s and 1660s the Church tightened its dogma and discipline – Catholism, Calvinism and Anabaptism were expressly forbidden in 1655, and censure was severely tightened in 1662. As we shall see in Chaper Nine also the links between Lutheranism and Scholastic philosophy were tightened, and this was important to the contentions that surrounded the introduction of Cartesianism in Sweden.

Accordingly, the relationship between theology and philosophy was determined by the claims of an aggressive Lutheran church, increasingly connected to Protestant Aristotelianism. As in Denmark, it was the church, rather than the natural philosophers, which moved the demarcation line between philosophy and religion.

9. Georg Stiernhelm

The two sides of Sweden's national style, which we identified above – Skytte's demand for applied science and learning focusing on mathematics and rhetoric, and the Gothicism of Bureus which employed a range of mystical, cabalist and Paracelsian traditions – may seem incompatible to the modern mind. They were, however, not only the two predominant aspects of the national style, but came together in some of Sweden's most gifted natural philosophers in the 17th century. In the following as well as in Chapter Nine, we shall therefore take a closer look at the symbiosis between the two sides.

As the most prominent illustration of this in the years around Kristina's reign, we shall turn to the fascinating character of Georg Stiernhelm (Jöran Lilia, 1598-1672),[910] who is generally regarded

[909] The most important of these was *Ramus olivae septentrionalis*, which was widely read in the circle in Amsterdam centred around Lorens de Geer (the son of Louis) to which both Durie and Comenius belonged.

[910] No modern biography exists of Stiernhelm, apart from the popular introduction by Olofsson (1998), which pretty much sums up existing studies. Swartling (1909), is the standard biography, generally outdated but still useful. Existing studies are also summed up in various chapters of Lindroth (1997). An intro-

as the father of Swedish poetry, but who was also an important mathematician and contributor to the Gothicist tradition. Coming from a well-off family in Dalarna, Stiernhelm visited Rudbeckius' private seminars at Uppsala, and was imbued with a never-ending love for the world of Antiquity. And not only did Rudbeckius influence his young pupil; he also became his patron and financed at least part of his academic peregrination. When Stiernhelm returned to Sweden after studies abroad, his old teacher and patron had become bishop of Västerås and employed him as teacher in his gymnasium. Stiernhelm had never matriculated at Uppsala, and at this point his intellectual horizon was humanist culture, particularly Dutch humanism. It has plausibly been suggested that his travels abroad also included studies in Catholic Europe, which was strictly forbidden, and from his letters it is evident that he shared some of the key notions connected to Republic of Letters. In the spring of 1626 he thus wrote to a friend, who had been expelled from Sweden due to his studies at Jesuit schools: *"The strong has all the world as his fatherland"*.[911]

Stiernhelm, however, was an ambitious man and to fulfil his ambitions, he was bound to win the patronage of one of the great men or women at court. Probably with Rudbeckius as a broker, he managed to become a client of Johan Skytte and was employed at *Collegium Illustre*, the short-lived noble academy that Skytte tried to establish in Stockholm. Whatever the depth of his identification with the ideal of the Republic of Letters, he was now attached to the national programme of his patron. In 1630 he followed Skytte to Livonia, was ennobled and for several years he held various offices in the Swedish administration in Dorpat.

Significantly, it was after his employment by Skytte that Stiernhelm's interests became less cosmopolitan and more centred on Sweden. Without abandoning the humanist learning of his youth, he now employed his philosophy and philological skills in

duction to Stiernhelm and his philosophical outlook is also given by Johan Nordström in his edition of Stiernhelm's philosophical fragments (1924). For Stiernhelm as a poet see Friberg (1945) and Ohlsson (1974). For his work in surveying and measuring see Ohlon (1989). Part of Stiernhelm's correspondence have been published and commented by Wieselgren (1968).

[911] See Wieselgren (1968).

the Gothicist tradition.[912] We have already seen how Johannes Bureus propagated the ancient origins of Sweden. Stiernhelm – who was acquainted with Bureus,[913] elaborated this Gothicist mythology by making the ancient Swedes identical to the Hyperboreans mentioned by Herodotus and other classical writers.[914] Like Bureus he brought 'evidence' that Sweden, and particularly Uppsala, was the cradle of culture, but he also took interest in Gothic philology. During the 16th century, European scholars had looked for the original language of man, universal among all peoples before the fall of the Tower of Babel.[915] Not surprisingly most scholars pointed to their own native tongue (or that of their patron) as this language,[916] and when we keep the Gothicist mythology and its importance to Swedish propaganda in mind, it is not surprising that Stiernhelm should endeavour to raise the Swedish vernacular to this prominent place.

In Stiernhelm's mind, his contributions to Gothicist mythology was undoubtedly solid humanist science intended to solve a practical problem – namely Sweden's origin and past. Gothicism may seem utterly outlandish to the modern mind, but most of the men who elaborated this mythology presented serious work and employed advanced philosophical, historical and philosophical techniques. This is important to emphasise if we are to understand that to men like Bureus, Stiernhelm and later Olof Rudbeck, Gothicism was not essentially different from their other scientific pursuits.

Just like his patron, Stiernhelm held the mathematical sciences in high esteem, and he was probably the most talented Swedish mathematician of his age, undoubtedly the most innovative. He wrote a number of mathematical treatises, all but one

[912] Stiernhelm never completed the great philological work he dreamed of. A few fragments were published during his lifetime, and a few unpublished fragments are extant in Swedish libraries. For Stiernhielm's philological work, see Nordström (1934) and Carl Ivar Ståhle, 'Språkteori och ordval I Stiernhelm's författarskap', *Arkiv för nordisk filologi* 1951.

[913] Their acquaintance probably adhered from 1617 when Stiernhelm followed the three-day course Bureus held at Uppsala in 1617, see Åkerman (1998), 58.

[914] These ideas were put forward in the posthumously published *De hyperboreis* (1685) and *De Othino* (1763).

[915] For an enjoyable account of this search, see Umberto Eco, *The Search for the Perfect Language*. London 1995f.

[916] Such as Goropius Becanus in his *Origines Antwerpianae*. Antwerp 1569.

unpublished, which shows that he was no mean mathematician. He mastered algebraic letter symbolism, was enthusiastic about decimal arithmetic and invented Swedish names for mathematical terms. In his mathematical treatise, *Archimedes reformatus* (1644), dedicated to Queen Kristina,[917] he elaborated the celebrated Archimedian experiment with the bathing tub by combining it with weights and a scale in order to control the content of various substances. He thus found that a specific quantity of gold, silver, and copper displaced the water respectively 14, 25, and 29 points.[918] Towards the end of the 1650s, Stiernhelm continued his endeavour by attempting to introduce a standardisation of weights and measures, like the one later established by Ole Rømer in Denmark. It came to naught, but it illustrates Stiernhelm's endeavour to apply his mathematical skills to the government's practical day-to-day problems.

That Stiernhelm chose to publish *Archimedes reformatus* in 1644, the only mathematical treatise he ever published, was no coincidence. That year saw namely the end of the long regency, and the ascension of Queen Kristina, so the publication must be seen as an attempt to win the patronage of the new ruler. Even though he lived across the Baltic, Stiernhelm like any capable client had managed to keep in close contact with the royal court in Stockholm, and already before Kristina's ascendancy he had tried to win her favour.[919] In 1647 he wrote his longest and most famous poem, *Hercules*,[920] was later appointed to compose librettos to the court masques, and in 1648 he succeeded Bureus as Royal Antiquarian. As such he was obliged to work in the Gothicist tradition. Since our concern is natural philosophy, there is no need to go further into Stiernhelm's Gothic philology.

[917] Georg Stiernhelm, *Archimedes reformatus* (1644).

[918] See Ohlon (1989); F.W. Hultman, 'Svenska aritmetikens historia', *Tidsskrift för matematik och fysik* 2-5 (1869-74); Ludvig Falkman, *Om mått och vigt i Sverige*, vol. 2 (1885).

[919] Both in 1643 and 1644 he sent panegyric poems to Kristina, see Schück (1985), 325.

[920] The poem circulated in manuscript and was already famous when it was published in 1658, and again in 1668 as part of his collected poetic works, *Musæ suethizantes thet är sång-gudinnor nu först lärande dichta och spela på swenska.* Schück (1985), 333f. argues that he poem was already begun in 1643. In that case it may well have been intended for winning the favour of Princess Kristina.

What is interesting, however, is the strong national orientation of Stiernhelm's work. We have already identified Kristina's indifference to the Swedish vernacular and enthusiasm for Latin culture. It seems therefore surprising that a client or aspiring client like Stiernhelm, chose not to write his major opus in Latin, which he mastered perfectly, but produced the first major poem in the Swedish vernacular instead. Though *Hercules* followed classical literary conventions and employed the well known theme of Hercules at the parting of the ways between vice and virtue, it includes themes found in the Gothicist tradition. Virtue (*Fru Dyd*) is thus depicted as a simple Swedish country woman, while Vice (*Fru Lusta*) echoes the depravity of Roman civilisation. Stiernhelm's interest in philological archaeology is also apparent in the poem, since he used many words and phrases that had become obsolete or forgotten at his time.

As was the case of Bureus, the preoccupation with Gothicism did not made Stiernhelm abandon more universal thinking. From the 1650s he was occupied by theosophical speculations, and inspired by Marsilio Ficino, Giordano Bruno, Robert Fludd, and Jan Comenius, he reflected on the role of Man in the Cosmos. Most of this endeavour came to little more than unpublished reflections.[921] Influenced by Giordano Bruno, Stiernhelm adopted the idea of an infinite universe without any centre, but he never published his views,[922] one of the reasons probably being the uselessness of such speculations in the game of patronage.

Similar speculations were also undertaken by another client of Skytte, the German Friedrich Menius (ob. 1659), who taught history at Dorpat.[923] After accusations of bigamy he had to flee Livonia, but later appeared in Sweden as inspector of a mine in Småland and began to write natural philosophical treatises, the unpublished *Pandora sophica* (dated 1639) and the pseudonymous *Consensus Hermetico-Mosaicus* (1644). In these treatises Menius tried to give a systematic Hermetic interpretation of Genesis, inspired by Comenius, but also by alchemical speculation and by

[921] Published by Nordström (1924).

[922] Johan Nordström, *Georg Stiernhelm. Filosofiska fragment* I. Stockholm 1924, CCCXXXIX ff.

[923] On Menius, see Johan Nordström, 'Friedrich Menius', *Samlaren* 1921 and Gustaf Fredén, *Friedrich Menius und das Repertoire der englischen Komödianten in Deutschland* (1939).

German mystics like Weigel and Böhme. His thinking contained appalling heretical views, and despite his use of pseudonym, charges were put against him, and he had to recall his opinions. Nonetheless, Menius' pansophism was aimed at the Swedish court, as is evident from the title page of *Pandora sophica*. The religiously curious Queen Kristina had invited Comenius to Sweden, and members of her circle, notably her teacher Johannes Matthiæ adhered to syncretism.

10. Patriotic Identities

A Swedish historian of ideas has concluded that there was not any independent humanist identity and self-awareness in 17th-century Sweden (apart from that imported by foreign humanists). Rather than feeling themselves as part of an international Republic of Letters, the identity of Swedish humanists was closely connected to that of their king.[924] This does not imply of course that humanist techniques, themes, topoi and guises were not adopted by Swedes, but humanist literature was meagre compared with the situation in Denmark - though much research still needs to be done - and the two first Swedish collections of poetry, Laurentius Petrus Gothus' *Aliquot Elegiae* (1561) and Georg Stiernhelm's *Musae suethizantes* (1668) were not only patriotic, but pervaded by Gothicist mythology.[925] They were connected to the national style and appeals for patronage. This was not unusual in contemporary Europe, what is unusual is the lack of other orientations. Even an author who severely criticised the Swedish king, the exiled Catholic Johannes Magnus, would write his *Historia de omnibus Gothorum Sueonumque regibus* (1554) in a highly patriotic vein, and was as a matter of fact one of the essential figures in the creation of Gothicist mythology.[926]

The impression of the national orientation of humanist culture in Sweden is further enhanced if we compare the voluminous

[924] Bo Lindberg, 'Die gelehrte Kultur in Schweden im 17. Jahrhundert. Das Problem der Rezeption', Bohn (1994), 12f: *"Diese konnten nie wie ihre deutschen Kollegen ein selbstbewußten Korps mit starker Identität schaffen. Sie waren nicht so zahlreich und hatten miteinander weinig Berührung, besuchten einander selten, schreiben wenige Briefe an einander. Sie fühlten sich immer mehr als Undertanen des Königs als Mitglieder der internationalen 'res publica literaria."*

[925] See Bergh (1973); Johannesson (1968).

[926] Johannesson (1991).

international correspondence of Danish natural philosophers like Ole Worm and Thomas Bartholin with that of their Swedish counterparts. It must be emphasised that this is only a first-hand impression, which may be distorted by the fact that the letters of Danish natural philosophers have been collected and published to a far greater extent than that of the Swedes. Nonetheless a comparison between Ole Worm and Georg Stiernhelm is informative. Stiernhelm was surely influenced by humanist culture, but his correspondence after his years abroad shows a marked lack of contact with humanist circles abroad. In the list given by Per Wieselgren of more than hundred men and women who wrote to Stiernhelm, only a handful came from abroad, and only two of these were men of learning, namely Henry Oldenburg of Royal Society and the reformed theologian David Blondel.[927]

Unlike the situation in Denmark, there was thus no internationally orientated humanist culture, which natural philosophy could be attached to. This changed somewhat in the second half of the century, as we shall see in Chapter Nine, but although individual Swedish philosophers may have felt themselves as part of the Republic of Letters, the way natural philosophy and learning in general was presented and orientated - the culture of learning so to speak - was closely attached to the national project. This situation was rooted in structures of patronage and under its aegis many different and apparently incompatible currents were united.

Both Johan Skytte and Johannes Bureus wrote manuals for the education of the future King Gustav Adolf.[928] The former was seen from the viewpoint of a diplomat and administrator and emphasised the importance of rhetoric, history and mathematics to society and its elites, while the manual of Bureus taught the Prince of the glorious and sacred past of his people. Both were useful during the years, when Sweden emerged out of the darkness beyond the Baltic to become one of the great powers of Europe, economically dependent on its conquests, diplomacy, administration and mining industry.

[927] Stiernhelm (1968), 411-413.

[928] Johan Skytte, *En kort Vnderwijsning Vthi Huad Konster och Dygder Een Fursteligh Person skall sig öfwe och bruke.* Stockholm 1604; reprinted by B. Rud Hall in *Årsböcker i svensk undervisningshistoria* 33. Lund 1932. Johan Bureus, *Adul-Runici Clypei quinarius penetralis seu Adulruna Rediviva de quinque Alphabeti seeri dispositionibus.*

It may be claimed that the culture of natural philosophy that flourished at Bishop Rudbeckius' gymnasium in Västerås, and probably also at the gymnasium in Åbo, and academic culture as it was found in Uppsala, represented an alternative context of the study of nature based on Lutheran orthodoxy, Aristolenianism and a positive attitude to the religiously edifying role of the study of nature inherited from Philippism. However, while it is true that Rudbeckius and other bishops sometimes represented an opposition to government policy, both in matters of the organisation of the Swedish church and in their insistence on religious conformity vis-à-vis government attempts to create a limited religious tolerance dictated by reasons of state and with the support of powerful non-Lutherans like de Louis de Geer, Protestantism was also a part of Swedish propaganda. Moreover, when students from the school of Västerås, such as Rudbeckius' son whom we shall discuss in the next chapter, turned into natural philosophers, they would have to do so through patronage from court, and thereby became connected to the 'national project'. Also Johan Skytte would employ Gothic mythology on behalf of his patron,[929] Laurentius Paulinus Gothus drew on it in his account on the Northern countries,[930] Skytte's brother, the royal translator Erik Schroderus translated Johan Magnus' Gothicist history into Swedish in 1620, and Messenius would create a genealogy that traced the origins of Sweden's leading families back to the Gothic past.[931]

It has been pointed out how the utilitarian ideas of Skytte in many ways were in line with those of contemporaries like Francis Bacon and Jan Comenius, who were both influenced by Ramism.[932] There is, however, an important difference. The ideas of these two philosophers were concerned with the material and spiritual progress of Man (or at least Christian Man) in general; those of Skytte were closely connected to Sweden. While it is probable that Skytte knew Bacon, there is no evidence that he was influenced by him, and the initiative to Comenius' arrival in Sweden in 1642 did not come from Skytte, but from Louis de Geer,

[929] i.e. in the *Oratio Johannis Schroderi Skytte Sueci, de Suecorum Gothorumque vetustate et fortitudine militari.* Marburg 1599. The oration was translated into Swedish in 1599.
[930] *Historiæ arctoæ libri tres.* Strängnäs 1636.
[931] *Theatrum nobilitatis svecanae.* Stockholm 1616.
[932] Frängsmyr (1997), 22ff.

who as a Calvinist in a Lutheran country was in favour of irenic schemes, just as he supported the endeavours of John Dury, despite the marked lack of interest from Axel Oxenstierna and Johan Skytte.[933] While it is true that Skytte had some esteem for Comenius, there is little indication that this was not based on the reason of state: The Pan-Protestantism of the Czech reformer was useful to Swedish ambitions in Eastern Europe, just as his pedagogical gifts were useful to Swedish education.[934] In other words, while Skytte was influenced by currents that were also found in the utopian ideas of his age, his own view of learning was strongly connected to a specific locality, namely Sweden, and was not connected to general notions of mankind. That Skytte's son had more far-flung philosophical ideas is another matter, which we shall discuss later.[935]

In the 1630s, at the zenith of the Thirty Years' War, Swedish war propaganda in Germany - and probably also self-identity - was centred on two major lines of argument: divine support and political determination.[936] The first was based on Protestantism; the other on efficiency, technology and control over nature, while the Gothicist mythology elaborated by Bureus and others was a component in both arguments. The 'national project' was Sweden's 'national style' of science in this period and for the rest of the century. It left little place for autonomous or semi-autonomous cultures of natural philosophy, and here it differed considerably from the situation in Denmark.

There was, however, one thing in common between the developments in the two countries. In the last chapter we saw Worm attack the esoteric character of the Rosicrucian movement. What he wanted was an open scientific discourse, and this can also be said of Skytte. If learning is supposed to be useful to society in general, it must not be limited to an elect group of initiates, but must be "open" to use a modern terminology. Hence his program

[933] Blekastad (1969), 163f., 281f.

[934] On the Pan-Protestantism and Sweden see Åkerman (1991), 123-143.

[935] Chapter Nine below. That Skytte's son shared some of the cosmopolitan visions of Comenius' cannot lead us to assume that his father did the same, cf. Frängsmyr (1997), 29.

[936] G. Rystad, *Kriegsnachrichten und Propaganda während des dreissigjährigen Krieges.* Lund 1960, 189-204; it must be noted, however, that 'fortune' *(fortuna)* as a guiding principle of the cyclical conception of history also played a role, see Ankarloo (1983), 239.

of education conflicted not only with academic Scholasticism, but also with the esoteric traditions of the Renaissance. The national project in Sweden forced natural philosophy into the open, and also consolidated its dominance through patronage and censure. For much of their life, Bureus and Stiernhelm were concerned with theosophical speculations connected to more general ideas of mankind and nature, but what they published, or were allowed to publish, was all in line with the patriotic character of the Swedish national style in the 17th century.

Fig. 8. Thomas Bartholin as a young gentleman in Italy, member of a prestigious literary society and a famous academic dynasty.

Fig. 9. And as professor of anatomy in Copenhagen.

The Theatre of the Human Body

Despite the great interest in anatomy in much of Western Europe from the time of Vesalius and Melanchthon's appreciation of anatomy and the flourishing anatomical tradition in Wittenberg,[937] dissections did not enter the curriculum of the Scandinavian universities until the middle of 17th century. The re-established university of Uppsala did not have a professor of medicine until 1613, and although two more chairs in medicine were established in the 1620s, one of them with the specific obligation of conducting dissections, it took a generation before dissections were conducted at Uppsala.

In Copenhagen a medical faculty had existed since the Reformation, and its professors who had studied in anatomical centres such as Padua, Leiden, Basel, and Paris generally agreed on its importance. Various professors published anatomical treatises aiming more at teaching than originality, such as Hans Frandsen who in 1579 published a Latin translation of Galen's treatise on the bones, illustrated with pictures borrowed from Vesalius and the anatomical textbook of Caspar Bartholin discussed previously. Furthermore, in 1603 Chancellor Borreby ordered that an anatomy should be held once or twice a year.[938] Yet, no dissection came out of this. The faculty did not own a skeleton until 1628, and a century after the emergence of *Fabrica*, no thorough practical teaching in anatomy could be found in Scandinavia, and surgery was in the hands of barbers and field surgeons who were guild-organised craftsmen with no theoretical education.

The reason for this was partly intellectual, partly cultural. Especially in Sweden it seems that the first medical professors

[937] Vivian Nutton, 'Wittenberg Anatomy', Grell and Cunningham (1993), 11-32.
[938] AC, IV, 114: *"Ut semel avt bis quotannis in hyeme fieret anatomia cadaveris humani; id qvod etiam ex relatione Mag:ci Cancellarii retult"*

showed little interest in anatomy. In Uppsala physics was placed under the faculty of medicine, and the first medical professor, Johannes Chesnecopherus (1581-1635) was mostly occupied with scholastic medicine. Even in the 1620s when the medical faculty got a second chair particularly aimed at anatomy and botany, no dissection took place. Johannes Franck who occupied the chair was constantly reminded by Johan Skytte of his obligation to conduct anatomy, but showed more interest in chemistry. Like his colleague Johannes Raicus, he took great interest in Paracelsian medicine in general and iatrochemistry in particular, and for all its emphasis on observation, Paracelsian medicine did not show any great enthusiasm for anatomy. Petrus Severinus, for example, had rejected the terrestrial anatomy for the sake of what he called '*celestial* anatomy', i.e. the knowledge of signatures and semina.

There were at any given time only a handful of medical students in Uppsala, and the numbers for Copenhagen were only slightly higher. Medical students would always undertake an academic peregrination to intellectual centres in Europe where anatomies were frequent, so the need for public dissections at Uppsala and Copenhagen would not have seemed as urgent as one might believe.

Finally, there was the cultural dimension. Cutting up bodies could easily be viewed as a desecration of the dead, even if these were criminals who had received capital punishment, and in this age of religious orthodoxy, more occupied with sin, piety and penance, admiration for the human body as evidence of the ingenuity of the Creator, expressed by Melanchthon and Vesalius alike, was not at the forefront of official religion. Thus Johannes Franck defended himself to Johan Skytte that the crowd slandered those who cut up dead bodies. Likewise, in 1590, the medical professor Anders Christensen in Copenhagen had ventured to include dissections in the lectures on anatomy at his professor's residence in the lack of an anatomical theatre. However, according to Thomas Bartholin: "*If he had not withdrawn his hand, he had had to stay away from the social life of the patricians. So much was that time disgusted by this very useful discipline*".[939]

[939] Thomas Bartholin, *Cista medica hafniensis.* Cph. 1662, 147: *...nisi manum retraxisset, ut à conviviis honestiorum, hisce minus assvetorum, abstinere oportuerit, adeò nauseabant tum nostrorum hominum mores ab utilissima hac Medicinæ parte.*

Professor Christensen's attempt to introduce dissections was a private enterprise, and it was only when men better connected than he began to propagate the introduction of dissections that things changed. In this chapter we shall see how anatomy was introduced into Scandinavia, the strategies employed by physicians to overcome the obstacles, and the way dissections were presented. As usual patronage was instrumental to these efforts, and we shall therefore begin with an analysis of the situation on the patronage front in Denmark in the middle of the 17th century.

1. The German Hydra

Due to the efforts of Caspar Bartholin and Holger Rosenkrantz described in Chapter Five, Christian IV declared in 1601, that all future vicars should be knowledgeable of the human body. Two years later, it was further declared that one or two cadavers should be publicly dissected every year in order to further the study of anatomy. Little came of it, probably due to the fact that the King showed little concern with the high ideals of Rosenkrantz and Bartholin, but the two men continued their efforts, and in their sketch for the new constitutions of the University in 1621, which we have already mentioned, the importance of anatomy and dissections was emphasised.

Then Caspar Bartholin died in 1629. The previous year Holger Rosenkrantz had withdrawn from the Council of the Realm in order to pursue his theological studies. Like in the case of Tycho Brahe, a learned nobleman had turned his back on service to the state on behalf of learned pursuits, and echoing the case of Brahe, the central government did not take lightly on such an attitude. Rosenkrantz fell from grace. The King made an onslaught on his economy, and later his theology would be stamped as heterodox.[940] As we have seen, Cort Aslakssøn abandoned his attempt to create a synthesis between natural philosophy and theology around 1614, and with the fall of Rosenkrantz and the death of Caspar Bartholin, the strong religious emphasis on natural philosophy, Philippism transformed into the age of orthodoxy, declined as an active force in the reforms of schools and the University.

[940] J. Oskar Andersen (1896); cf. OWB II, 83: *"The proceedings* [i.e. against Rosenkrantz] *are being done so secretly that we have been allowed to see neither this nor that."*

At the same time Christian IV entered The Thirty Years' War as a defender of Protestantism against the victorious Imperial armies. The step was to have fateful consequences for Denmark. After the defeat at Lutter am Barenberge in 1626, Jutland was plundered, and a peace had to be concluded in 1629. The loss of prestige to the realm and its king was enormous, and to make things worse, the archrival Gustav Adolf soon led his Swedish armies to triumph in the very same theatre of war.

At this moment a new German dynasty of physicians began to establish itself in Denmark. The king's personal physician, Jacob Fabricius (1576-1652) persuaded the King to establish a chair in anatomy that also was to include surgery and botany. Not surprisingly, Fabricius felt that the best man for this job was his son-in-law, Simon Paulli (1603-1680),[941] and the King agreed. Paulli was not unknown to the Court. His father Henrik Paulli (1565-1652) was a professor of medicine in Rostock, who had become personal physician to the queen mother Sophie. As for Simon Paulli, his background was much like that of Caspar Bartholin and Ole Worm. After studies in Rostock, Leiden and Wittenberg, he became professor of medicine in Rostock, where both his father and grandfather had held chairs. Apart from being well connected and apparently an eminent physician, Paulli had one further advantage in being a skilled rhetorician and Latin poet. His verbal virtuosity was highly regarded by his contemporaries, and anyone who ventures to read his orations can assure himself that this admiration was not misplaced. They include the mandatory and ubiquitous citations from Virgil, Horace, Homer, Ovid and other classical poets, as well as a few from Scriptures, the language is not philosophically profound, but vivid, entertaining and (not to forget the foremost rhetorical virtue) persuasive.

It should hardly surprise us that the Bartholin clan was aghast at the trespassing of this new family into their domain. Once again the family's crisis coincided with the loss of a patron, namely Chancellor Kragerup who had died in 1639.[942] It was not that the new Chancellor, Christian Thomesen Sehested (1590-1657)[943]

[941] On Simon Paulli, see *Progr. fun. Uuniv. Hafn over Livlæge Simon Paulli.* Cph. 1680; *Danske Magazin* 5: II, 19; V. Ingerslev, I, (1873), 226f.
[942] OWB II, 163.
[943] Only an old and rather outdated biography exists on the chancellor: Thyra Sehested, *Cantsler Christen Thomesen Sehested.* Cph. 1894; see also Johan Dirich-

seemed hostile to the family. He had spent three years at Rosenholm, was the son-in-law of Holger Rosenkrantz and was a highly educated and widely travelled man who took a great interest in mathematics, history, constitutional law and religion. Worm had high hopes of him and promised friends on Iceland to try to secure the help of the new chancellor to solve some problems of theirs.[944]

The problem, however, was not so much the new chancellor himself, as the occurrence of one of the regular hazards of patronage. King Christian IV was in his sixties, an old man by the standards of this age, and ambitious men increasingly put their money on the crown prince. There was nothing unusual about this. It was an essential part of the dynamics of patronage in most European countries. The heir to the Throne would assert himself by establishing a court of his own and attract men of his own liking. It was exactly what Christian IV himself once had done, the only thing unusual being the length of his reign.

In the 1630s Prince Christian had established himself at Nykøbing on the island of Falster in the southern part of Denmark with his wife Magdalene Sibylle of Saxony. Close to Germany and ruled by a German queen, the court became a gateway for Germans who wanted to make a career in Denmark and escape the debacle of the war, and the fact that the Prince was ailing offered ample opportunities for a number German physicians. Furthermore, the Prince took a strong interest in learning, not least natural philosophy. When he established himself at Nykøbing, he immediately established a laboratory for the preparation of iatrochemical remedies and bought Paracelsus' *Chirurgia Magna*. The famous Daniel Sennert dedicated one of his books to the prince (the fifth book of his *Practinae Medicinae*), and a library of 400 volumes was also established in Nykøbing, about a third of which were concerned with natural philosophy, in particular that of Neoplatonism.[945]

søn Barsker, *Ligprædicken....som bleff holden i Vor Frue Kircke i Kiøbenhaffn den 27. Augusti 1657 etc.* Cph. 1658.

[944] OWB, II, 194f.

[945] Fink-Jensen (1997), 32; *Prins Christian (V).s breve, I,* 459.

Ole Worm, now effectively the leader of the Bartholin family, also put some of his money on the crown prince.[946] Generally, he does not seem to have been aggressive towards these new Germans, preferring cooperation to struggle, as in the case of Henrik Köster, a German physician in Nykøbing who provided Worm with information of developments there. The two men were greatly upset by an 'Empiricist' from Glückstadt, obviously some kind of Paracelsian, who received *"two hundred rigsdaler* (as much as the yearly wage of a professor of medicine) *and a large silver jug gilded on the inside"* for his harmful efforts to cure the Prince.[947] He soon evaporated, but other newcomers were more tenacious and seem to have been rather aggressive in their pursuit of patronage, such as the physician Helvig Dietrich, a iatrochemist and a former physician to the Elector of Brandenburg, who according to Köster intrigued against surgeons, apothecaries, and himself in order to monopolise the favour of the Prince.[948] Dietrich's brother tried to win a chair at the University, but was blocked by the professors.[949] Köster himself does not seem to have been particularly lucky at the court of Nykøbing and therefore with Worm as a broker, he consciously managed his relations with the Chancellor and academic circles in Copenhagen.[950] When the Prince died in 1647, one year before his father, he took with him the careers of many of those men who had gathered around his Court, and Helvig Dietrich himself lost favour.[951]

Another German who caused anxiety to Worm was the jurist Henrik Ernst, professor in Sorø and a friend of Holger Rosenkrantz, who attacked Worm's opinions of an ancient golden drinking horn that had been found in Jutland. The Prince had handed it over to Worm for examination, and Worm had written a treatise on it.[952] Now Ernst began to propagate another interpretation of

[946] e.g. Worm's commentary to the pseudo-Aristotelian DE MUNDO, *Liber Aureus Philosophorum aquilæ Aristotelis de mundi fabrica* (1625) was dedicated to the prince.

[947] OWB, II, 62ff; back in 1632 Köster had been involved in a conflict with the successful Empiricist Hartvig Lohmann in Odense, see Grell (1995), 88f.

[948] OWB, II, 63, 65, 115.

[949] OWB, II, 116, 117.

[950] OWB, II, 80, 117.

[951] OWB, III, 150.

[952] *De aureo Domini Christiani Quinti, Daniæ, Norvegiæ etc. electi principis, cornu dissertatio.* Cph. 1641.

the horn and indirectly criticised Worm. He did not publish his opinions, but since they were put forward in letters to Joachim Gersdorff, the Lord Chamberlain at the court in Nykøbing,[953] and were copied (Worm received his own copy from Köster), Worm regarded them as being public. What worried Worm was the opinion of the court, not the criticism as such. Angrily, he declared war on Ernst: "*If you were a friend of mine, you would have sent me the letter, before it was known to the entire court. Now I must reply, so that the world of learning can judge between us, and my letter shall reach further than yours.*"[954]

This incident exemplifies an important aspect of the relationship between power and learning in the early modern period. Since the various parts of intellectual life (academic disciplines as well as arts flourishing outside universities such as poetry, astrology, and history) were not separated by a Chinese wall, a well-connected man could cover and even monopolise a number of topics. We have already seen the example of the separation of astronomy and astrology in Denmark, which gave the professor of astronomy, Longomontanus, fewer means of asserting himself to Court than his teacher Tycho Brahe had had. In other words, the demarcation lines between intellectual disciplines (especially those outside the University syllabus) reflected the connections of individual men of learning.

Under the wings of late Chancellor Kragerup, Worm had established himself as the expert in Runes and ancient Danish inscriptions. It was a position that had cemented his favour with the old chancellor, and which also gave him a semi-official position as interpreter of the monuments of ancient Danish history, which was important to national propaganda vis-à-vis those of Sweden and other rivalling states. This position was now threatened by Ernst, and the fact that Ernst was only one head of the German hydra that also threatened the family's position in medicine, only made things worse. In Worm's anger at the criticism of Ernst, we thus notice 'national' undertones: "*He* (i.e. Ernst) *cannot think of anything else than devaluing our relics of the past; due to a*

[953] For the unpublished sources to the conflict between Worm and Ernst, Schepelern (1971), Ch. IV, note 32.
[954] OWB, II, 255.

hatred of anything Danish he employs any possible means to take this golden horn from us and give credit to the people of Rügen instead".[955]

The same irritation of Worm of German outsiders who outmanoeuvred the Bartholin family in the game of patronage is also evident in the matter of the establishment of the anatomical theatre. From late 1639 Worm got reports (from the indispensable Köster) that Simon Paulli had tried in vain to win a position as physician to the court in Nykøbing,[956] but in the following spring he managed to get appointed to an extraordinary chair in anatomy due to the influence of his father-in-law, Jacob Fabricius. Soon, Paulli convinced the government to build an anatomical theatre, and Worm could agree with his ward Bertel Bartholin: *"It is not plucked out of the air when you complain of strangers who grip the best bites from our countrymen. I do not know what Fate makes the mighty ones more favoured to them?"*[957] In 1643 Worm sourly remarked: "*We are now busy in establishing the anatomical theatre, and when it is finished Simon Paulli promises wonderful things. However, in the two years he has been here, he has not even dissected a dog*",[958] and Worm found himself quite impotent in the game of patronage.[959]

Essentially there was hardly any difference between the views on natural philosophy shared by Worm and Simon Paulli. It was a matter of family interests and prestige. When Paulli made his successful arrival in Denmark, received an extraordinary chair in anatomy and persuaded the government to establish an anatomical theatre under his direction, he was obviously jeopardizing the position of Worm and his young wards.

But the success of men like Simon Paulli was not only due to connections and the well-known and recurring phenomenon of a crown prince establishing his own network of patronage challenging existing structures of patronage. Changes in court culture were also at play. As mentioned, Paulli was an eminent rhetorician, and the rise of rhetoric also reflected the emergence of a new

[955] OWB, II, 254.
[956] OWB, II, 161; according to Köster, this attempt was not to the liking of Paulli's father-in-law, Fabricius, who regarded the move as being premature.
[957] OWB, II, 372.
[958] OWB, II, 428.
[959] OWB, II, 430.

type of courtier.[960] Scandinavian high noblemen like Borreby, Kragerup, Per Brahe the Elder and Axel Oxenstierna had had the education and outlook of the Reformation period with its grave emphasis on religion and deep reverence of learning. They were austere and highly religious men. Their way of living, dressing and thinking was simple and not conspicuously sophisticated. During the Thirty Years' War another type of high nobleman emerged in Scandinavia, it was an import from France and elsewhere in Europe and reflected the changing views on the state.

The main inspiration to this new attitude seems to have been the religious wars that harassed Europe, especially the civil wars in France and the Thirty Years' War (including the Dutch War). Such experiences discredited the idea of a close connection between state and religion, and international contacts that transgressed confessional borderlines created a secular culture of the elites. From the French court that increasingly asserted its cultural and political influence on Scandinavia, came a sceptical attitude like the one found in writers like Montaigne and Rabelais, but when embodied by courtiers often represented a superficial scepticism and cynicism masking their own ambitions. In Denmark a man like the King's son-in-law, the brilliant Corfitz Ulfeldt, represented it as expressed in his motto "The World is a farce and is ruled by prejudices" (*Tout le monde est une farce et se gouverne par opinions*).[961] This of course did not refrain Ulfeldt from entering a career at court and try to be a protagonist in the farce.

Corfitz Ulfeldt is quite paradigmatic of his age.[962] This was the great age of court favourites - Buckingham in England and Olivares in Spain, to name but two of the most well known. In general, such men would come from an aristocratic origin, but either from the lower ranks of the aristocracy or being younger sons of high noblemen. In both cases they would have to make their own way in this world, and they were nothing (at least in comparison with their ambitions) but for the court. Some of them were skilled administrators, diplomats or generals, but that did not necessarily matter. What mattered was their ability to catch the

[960] See Barner (1970); Fumaroli (1980).

[961] The motto was of course based on a well known sentence from Petronius, often used at the time. On Ulfeldt, see Steffen Heiberg, *Enhjørningen. Corfitz Ulfeldt.* Cph. 1993.

[962] The following is loosely based on Nobert Elias (1994 and 1997).

attention of the Prince (or those close to him) and in the long run to defend themselves against the inevitable intrigues of rivals.

In such an environment *appearance* was essential, the ability to follow the slightest decrees of an ever-changing fashion, to show elegance in manners and opinions, to conduct a polite conservation. The new ideal of the courtier, as not only embodied by Corfitz Ulfeldt but also by his contemporaries Hannibal Sehested in Denmark and Magnus Gabriel De la Gardie in Sweden, was one of easiness and stood in stark contrast to the gravity in dress, manners and opinions of the old generation of noblemen. Likewise, it stood in stark contrast to the culture of the University with its black-clad professors, brutal rites of initiation (the so-called *depositio*) and endless quibbles on subjects of little value in entertainment or practical life.

Under such circumstances, the ambitious natural philosopher would have to avoid being dull, to assume the role of courtier, or at least adopt some of the easiness and elegance valued at court. One of the means of doing so was to excel in eloquence. This was the way Simon Paulli succeeded in promoting himself at the Danish court, but it was not an easy water to navigate. Dependent on connections at Court, but being non-noble, he would have to combine the elegance valued by the Court culture with the religious orthodoxy dominating the rest of society.

2. The Domus Anatomica

The anatomical theatre established by Paulli was intended to improve the anatomical knowledge not only of future physicians, but also of the barbers around the city who took care of almost all surgery. These men were trained like craftsmen and organised in their own guild. Paulli claimed that most of them knew nothing more of anatomy than Empiricists, thereby being almost synonymous with quacks; "*Many barbers who practice surgery have butchered diseased people under great suffering, and often they have no more knowledge and skill in anatomy, than that which one can acquire like the Empiricists by treating deep wounds (with utter damage to the patients)*".[963]

What Paulli was propagating was a more systematic and theoretical approach to surgery for the benefit of the diseased. These

[963] Bartholin (1662), 9f; Bartholin (1982), 202f.

ethical motives that viewed medicine as practical piety were in line with the convictions of Caspar Bartholin described previously. They were underlined by Paulli's incessant emphasis that "*medicine does not judge men according to wealth or status, but promises indifferently to help everybody....the upper and the lower classes, as well as the middle class.*"[964] This medical ethics is, of course, not particularly Christian. It was very much in the tradition of Hippocrates, and not different from the official ethics of modern medicine. But the anatomical theatre was not only a place for teaching the construction of the human body for the improvement of medicine. The improved knowledge of the construct of the human body gained throughout the Renaissance had little effect on the practical curing of disease before the 18th century. The theatre was an icon as well, which is evident if we take a look of its arrangement.

On the ground floor there was an entrance hall leading to two small rooms, a stairway to the first floor, and the anatomical theatre itself. One of the small rooms was a so-called Præparatorium where cadavers were prepared for dissection; the other was a 'kitchen' (culina) where cadavers after the dissection were boiled so a skeleton could be constructed.[965]

The anatomical theatre itself was square with four rows of benches arranged like in an amphitheatre centred on the dissection table that could be turned so that all spectators would see the demonstration of even the smallest details of the body. The door to the theatre bore the inscription:

Wanderer, here you see, both bones and cut up bodies,
Art here dissolves and unites the works of Nature[966]

And a theatre it was, with the anatomist as the magician who revealed the secrets of Nature. Each row of benches was divided into separate seats, which could be drawn down so that tired or infirm members of the audience could rest, or they could be tilted back so that people could stand up and have a better view. The front seats were reserved for professors, medical doctors and notabilities from abroad, while the King and the court would be seated

[964] Bartholin (1662a), 10f; Bartholin (1982), 203.
[965] Thomas Bartholin, *Domus Anatomica Hafniensis brevissime descripta.* Cph. 1662, 4ff.
[966] Bartholin, *Domus Anatomica,* 5: *Hic aut ossa vides, aut corpora secta Viator,//Hic ars Naturæ solvit & unit opus.*

on the balcony above hidden behind a grating. And it was not anyone who was let into the theatre. People who were not professors, medical doctors or members of the court would have to spend 1 speciedaler or 6 Danish mark on a ticket,[967] and children and the vulgar crowd (profanum vulgus) were not allowed to witness the "sacred and solemn acts".[968] Furthermore, there was a barrier in the theatre separating the dissection table from the spectators to avoid the anatomist and his assistant being bothered by the pushing of the crowd of spectators.

In other words, despite Simon Paulli's claim that "Medicine does not judge people according to income or rank...but shall in war as well as peace take care of citizens of all estates, the highest and the lowest as well as those of the middle class",[969] the arrangement of seats was hierarchical and exclusive. But it is worth noting, that there was made no distinction between common laymen and noblemen who did not belong to the Court, so in this way the anatomical theatre reflected an absolutist (or at least centralist) concept of society. Or perhaps, since the theatre was generally modelled on that in Leiden, it should rather be said that it reflected a capitalist mentality, which in the Danish context was transformed into one of centralism.

At the top of the theatre there were closets with skeletons, and Simon Paulli had invented a method of producing particularly beautiful white skeletons.[970] There were skeletons of a man and a woman (called Adam and Eve, of course), as well as of ten different animals ranging from the skeleton of a baboon to that of a hen. Below the skeletons were sentences composed by Paulli's assistant, Michael Kirstein.[971] This tableau was similar to that of the famous anatomical theatre in Leiden where Paulli had studied.

Universities are, according to Paulli, "*herb gardens and markets of all the liberal arts, which many places in Europe are now destroyed by*

[967] This ticket price was a substantial amount, as it was more than the weekly wage of a craftman, see Jan Møller, *Borger i Christian 4.'s København.* Cph.1998, 115.
[968] Bartholin, *Domus Anatomica,* 26.
[969] Bartholin, *Domus Anatomica,* 10f.
[970] Thomas Batholin, *Acta Medica et Philosophica Hafniensia* I. Cph. 1673, 42.
[971] Bartholin (1662), 6.

war".[972] As a German, Paulli, had witnessed the debacle of the Thirty Years' War firsthand, and everybody had heard of losses inflicted by the war to the world of learning, such as the destruction of the Palatine library in Heidelberg. So, the anatomical theatre was not only a place of learning, it was also a temple to peace, and Paulli reminds his audience that in antiquity anatomy had been practised in the Temple of Peace with the Roman nobility as its audience.[973] There is hardly any evidence of this in the extant accounts of ancient Rome, but it suited Paulli's purposes. The longing for peace was of course a humble wish at a time when the war in central Europe had already lasted for more than twenty years. It may very well have been Paulli's sincere and personal hope, but at the same time it was also in line with the foreign policy conducted by Christian IV at this time. After the disastrous and humiliating defeat on the battlefield, he now tried to bury the hatchet and assert himself as a champion of European peace and reconciliation.[974]

This brings us to the third purpose of the theatre. Simon Paulli predicted that the theatre would help attracting Danish students to Copenhagen and prevent them from going abroad.[975] This was in line with government politics. In 1623 an academy had been established in Sorø to keep young noblemen from leaving Denmark until they had reached a certain age. The arguments for keeping students in Denmark were based on the physical danger to young men abroad as well as the devastating costs inflicted to families who wanted their sons to study.

But together with such arguments there was also the desire to keep control with the religious and political influences on students. Probably influenced by simultaneous developments in Sweden, students from Jesuit colleges were excluded from employment in the Danish Church in 1604, and in the university constitutions of 1621, it was even announced that no one should be employed in school or church, who had studied at non-Lutheran universi-

[972] Bartholin (1662a), 9; Bartholin (1982), 202.
[973] Bartholin (1662a), 11; Bartholin (1982), 203.
[974] See E. Ladewig Pedersen, "The Danish Intermezzo", *The Thirty Years War,* ed. Geoffrey Parker. London 1984, 71-81; P.D. Lockhart, *Denmark in the Thirty Years' War 1618-1648. King Christian IV and the Decline of the Oldenburg State.* Selinsgrove 1996
[975] Bartholin (1662a), 11f; Bartholin (1982), 203f.

ties.[976] As for the future administrators and members of government, the nobility, it was long ago argued by Knud Fabricius that centralist and absolutist propaganda flourished at the noble academy at Sorø, and although some of his findings have been contested, it is essentially true that the attempt to keep noblemen abroad was partly due to a wish to control the influences they received.[977]

Of course, early modern governments were not totalitarian in the 20th-century sense. Among other things they lacked the effective means both technical and in terms of organisation and ideology, but during the 17th century we can notice an increasing desire among European rulers and governments for *control.* This not only manifested itself in attempts to monopolise the exertion of violence, taxation, and trade (as in the institution of chartered trade companies), and the strong control of the national church, it also found more subtle expressions. One of these may be called 'symbolic control'. In the 16th and 17th centuries, governments began to require detailed maps and surveys of the lands under their rule. Surveys of land have, of course, been a part of asserting control at least since the days of the Domesday Book, but in the post-Reformation period, it was combined with the desire of the self-sufficiency of the State.[978]

The emerging and expanding Northern European state power of the 17th century tried to be self-sufficient and establish itself as a microcosmic entity. This was the thought structure behind the theory of mercantilism and the desire for monopolies. Surely, governments were not blind to the fact that the state was only one

[976] Helk (1966), chapter 23; Norvin (1937-40), vol. 2, 79.

[977] Knud Fabricius, *Kongeloven. Dens tilblivelse og plads i samtidens natur- og arveretlige udvikling.* Cph. 1920, 86-89; cf. Leon Jespersen, "Teokrati og kontraktlære", *Struktur og funktion. Festskrift til Erling Ladewig Petersen.* Odense 1994, 170f.

[978] The oldest printed map of Denmark of directly Danish origin, was the one published by Marcus Jordan in *Civitates orbis terrarum* IV (Cologne 1588) on the order of Heinrich Rantzau. Also Christian IV was occupied witht the mapping of his lands. In 1631 he ordered professor Hans Wilhelmsen Lauremberg in Sorø to *"produce a map of Denmark by means of the mathematical arts".* In 1647 the work was handed over to Johannes Mejer. Towards the end of his life, Christian IV ordered a general map of Denmark, which was finished in 1650 and hung in Copenhagen Castle; see N.E. Nørlund, *Danmarks Kortlægning.* Cph. 1942 and B. Bramsen, *Gamle Danmarkskort.* Cph. 1952.

among dozens of other competing states, but the aim was as far as possible to establish the ruler as the centre of a microcosm. Therefore it was important for the ruler that people as well as symbols of spiritual, economical or territorial power came to him. This was the logic between the endless discussions among diplomats of where to arrange peace conferences and meetings between rulers. In the case of Denmark and Sweden, meetings were often held at the border between the two countries.[979]

The relevance of this digression for the subject under our consideration is the fact that the idea of self-sufficiency and control also extended to natural philosophy. To control the land by mapping and surveying was similar to the mapping of the night sky and the human body. It all began as a symbolic control. There were, of course, practical applications of astronomy and anatomy, but on the whole it was a symbolic act with national overtones. The astronomical textbook published by Longomontanus in 1622 bore the title *Astronomia Danica*, Simon Paulli would later publish a botany called *Flora Danica,* and among Ole Worm and his circle we often find urges to use ones talents for the glory of the fatherland (*patria*).

Similarly, the establishment of the anatomical theatre propagated the territorial and social superiority of the monarch. In his opening speech Paulli expressed the wish that the theatre would be equipped with bird sloughs, animal skin and other rarities brought back from Greenland, Iceland, and Norway, "*regions ruled by our royal majesty and brought to him...*".[980]

In other words, the anatomical theatre in Copenhagen was established to improve the knowledge of anatomy, but also to serve as an icon of centralism, of the government's politics of conciliation and of its control over its widespread lands. As for religious motives for the study of anatomy we find them only in the closing

[979] As in the case of the peace treaties of Knäröd 1613, and Brömsebro 1645. Only when Sweden had almost conquered Denmark, could peace treatises be concluded on Danish soil as the treatises of Roskilde 1658 and Copenhagen 1660. That peace was concluded in Denmark, would normally imply that Denmark had the upper hand, but with Karl X at the head of a victorious army, symbolism was turned upside down.

[980] Bartholin (1662), 12; Bartholin (1982), 204: '*...exuviis avium, ferarum, aliisque rarioribus...ex Grönlandiâ, Islandiâ, Norvvagiâ, Regionibus S.R.M. Nostræ parentibus, huc transportatis, & in eundem illatis...*', see also 22f.

lines of the oration where Paulli refers to *"the wonderful creations of the Lord witnessed in anatomy"*.[981]

3. Thomas Bartholin: Between Gentleman and Client

The middle decades of the 17th century marked the breakthrough of a new culture of medically centred natural philosophy on the northern fringe of Europe. This was not only due to the introduction of anatomy *per se*. The activities around the anatomical theatre in Copenhagen, and the theatre established in Uppsala some decades later, meant more than improvements in the knowledge of the human body. First of all, the anatomical theatres, founded by royal support and including in its audience members of the government and the royal family, increased the prestige of natural philosophy by moving the culture of the University (or at least its medical faculty) closer to that of the court. And it is worth noting that the kind of natural philosophy gaining prestige was not one of philosophical subtleties concerned with pure intellectual abstraction, but a very visible and tangible one with ethical, religious, and thereby also political, implications. The natural philosopher had left his *museum* and lecture room, and moved into the public sphere (or *theatre* as Corfitz Ulfeldt perceived it), combining intellectual activities with the craft of cutting up cadavers and preserving skeletons, and disclosing the secrets of nature to his audience by means of his rhetorical skills.

Furthermore, the introduction of anatomy soon let two Scandinavian anatomists win international fame. Reacting on problems raised by recent developments in anatomy abroad, they not only introduced anatomical knowledge into Scandinavia but made their own contributions. In other words, the development of natural philosophy in Scandinavia, and its integration into the general European development had, at least as far as anatomy went, reached a point where a genuine interaction took place. Let us therefore take a look at these two anatomists.

In the autumn of 1646 THOMAS BARTHOLIN (1616-1680) returned to Copenhagen.[982] After nine years abroad he had reached

[981] Bartholin (1662), 14; Bartholin (1982), 205.

[982] On the biography of Thomas Bartholin, see Garboe, Axel, *Thomas Bartholin. Et bidrag til dansk natur- og lægevidenskabs historie i det 17. aarhundrede*, 2 vols. Cph. 1949-50; an edition of Bartholin's letters are currently in progress.

the age of thirty and was no longer a young man by the standards of the time. From an early age he had shown promise, and as the oldest son of Caspar Bartholin his family had destined him for an academic career. Previously, we saw that beneath obvious similarities between the natural philosophy of Caspar Bartholin and his brother-in-law Ole Worm, there were fundamental differences, the former being pervaded by a religious outlook, the latter by an outlook more in vein with the medical philosophy found in Padua and the culture of discovery and curiosity.

Both of these two aspects of medicine were contained in the career of Thomas Bartholin as they were in the careers of many of his contemporaries. With his father's early death Worm became his guardian and supported his decision to become a physician rather than a theologian, in spite of the express wishes of his mother. Thus, it was also Worm who planned the expensive peregrinations that took young Bartholin to much of Western and Southern Europe. They began in Leiden where he studied oriental languages, law, poetry, philosophy, and archaeology.[983] Urged by Worm he began to concentrate on medicine, and was taught anatomy by famous teachers like Vorstius Falkoburgus and Johannes Walæus. From Leiden he went to Paris and Montpellier on his way to Padua. He studied anatomy under Johann Vesling, and was a frequent guest at the house of Johan Rhode, a Danish physician who had settled in Padua. On his way home he followed the family tradition and took his doctor's degree in Basel.

While the older generation of the Bartholin clan had been sons of merchants and clergymen in the provincial towns of Denmark, Thomas Bartholin grew up in a family of well-off professors and physicians, in a culture of Latin language and international contacts. The German Poul Moth, the future royal physician, had taught him at home and introduced recent developments in anatomy. Thus, he had shown young Bartholin the lacteals (*venæ lacteæ*) discovered by the Italian anatomist Gaspare Aselli in 1622.[984] When he went abroad, Bartholin's studies were facilitated by the contacts already established by his relatives. Many of the men he met in the intellectual centres of Europe had been teachers or

[983] *De pereg. medica*, 17.
[984] Thomas Bartholin, *Medicus perfectus ex vita beati senis D.D. Pauli Moth..... informatus.* Cph. 1670.

fellow students of Thomas Fincke, Caspar Bartholin or Ole Worm, or were sons of such men.

It was also thanks to his family that the European Republic of Letters first learned to know his name. When he was in the Netherlands in 1640, Bartholin was urged to republish his father's popular anatomical textbook from 1622. This of course, was a great chance for making himself known, but it also caused certain problems. As already mentioned, Caspar Bartholin's anatomical textbook gained popularity, not because it contained anything original, but because it compiled most of what was known to European anatomists, and presented it in a clear and easily comprehendible way. Since its publication, however, the world of medicine had been shaken by William Harvey's theory on the circulation of the blood.[985] Worm, as we saw previously, did not embrace the theory, but many of Thomas Bartholin's teachers in Leiden, such as Johannes Walæus, did. Bartholin had followed most of the experiments Walæus conducted and which finally led him to embrace the theory, and Bartholin himself was inclined to agree.[986]

One would assume that Thomas Bartholin's family ties with Worm made him certain that the old man would act as his patron in terms of future employment. The source material, however, casts doubt on this. Once and again during his peregrinations, Bartholin did favours to Worm, mostly by sending him books and items to his collection.[987] And Worm would reply by ensuring Bartholin of his gratitude and patronage.[988] It was therefore imperative that he should not offend his guardian by including theories in the anatomy book that he did not sanction. As it turned out, a compromise was reached that Harvey's theory should not be included in the main text itself (which followed Galen's theory), but in an appendix written by Walæus. Finally, the textbook could be republished,[989] and it gained enormous popularity and reappeared in three editions, several reprints (especially in the Nether-

[985] William Harvey, *Excertatio anatomica de motu cordis et sanguinis in animalibus.* Frankfurt 1628.
[986] OWB, II, 173f., 177, 179.
[987] OWB II, 57-61, 70f, 101f, 119, 127f, 145, 202f, 225f.
[988] OWB II, 73f, 136f, 218f.
[989] *Casp. Bartholini Institutiones anatomicæ, novis recentiorum opinionibus et observantibus figurisque auctæ a Thoma Bartholini.* Leiden 1641.

lands) and was translated into French, German, Italian, Dutch, and English.[990]

For the rest of the century it was one of the most widely read textbooks on anatomy in Western Europe. When Henry Power in Cambridge in 1646 wanted to study medicine, Sir Thomas Browne referred him to Harvey's work and Bartholin's anatomy.[991] Later, a famous anatomist like Herman Boerhave claimed that he began by studying anatomy in the works of Vesalius and Bartholin.[992] Furthermore, the book played an important role in the circulation of new anatomical discoveries. It was the first anatomical textbook that included the theory on the circulation of the blood (albeit in an appendix). Another appendix included remarks by the Dutch physician Franciscus Sylvius on the anatomy of the brain. In the two further editions Bartholin not only included his (and Rudbeck's) discovery of the lymphatic vessels, but also incorporated the capillaries, as well as Richard Lower's observation of the transformation of the blood in the lungs. This was of course only made possible by Bartholin's close contacts with physicians all over Western Europe, contacts founded by his family as well as contacts he himself established. New books, treatises and items of natural history were circulated, generally by means of merchants or travelling students, and new theories and phenomena were discussed in letters. A European community of natural philosophy had been established, and Bartholin and his family were very much a part of it.

As for the acceptance of theories, it is interesting to notice how and why a man like Thomas Bartholin accepted a theory like that of the circulation of the blood. There is no doubt that it was in Leiden, probably due to Walæus' experiments, that he came to prefer Harvey's theory to that of Galen. Afterwards he became a self-confident propagator of it. In Montpellier he defended the theory publicly: *"When I with some sharpness had commenced a dis-*

[990] New and updated editions were Bartholin (1651) and (1673). The various editions of the book were translated into French (Paris 1647), German (Copenhagen 1648, Nürnberg 1677), Italian (Florence 1651), Dutch (Leiden 1653, Amsterdam 1688), Dordrecht 1656, Haag 1658, Amsterdam 1669), and English (London 1668).

[991] Charles Webster, *The Great Instauration.* New York 1975, 137.

[992] G.A. Lindeboom, *Herman Boerhave. The Man and his Works.* London 1968, 34, 381.

putation against the professor on behalf of the new opinions of the lacteals and the circulation of the blood, I was at first disliked by the stubborn champions of Galen. But afterwards they feared me, since the doors of the college stood open"[993] In Padua he defended Harvey's theory against Fortunio Liceto, who had constructed his own theory on the circulation of the blood (which Worm was enthusiastic about) that operated with two circulations and seeping of blood through the septum, thereby saving Galen's opinion.[994]

And yet, Bartholin could not accept the entire theory. On one essential point he disagreed, namely in the question of whether a porosity existed in the septum as Galen claimed. Harvey had vehemently rejected this: "*There are by Hercule no holes*".[995] Bartholin, however, claimed that he himself once had seen this porosity, and that blood seeped from right to left ventricle, an opinion he maintained for the rest of his life.[996] This begs the question why Bartholin nonetheless praised Harvey's theory and defended it against its opponents. In order to answer this we must turn to the objections against Liceto's theory that Bartholin gave to Worm.[997] The core of Bartholin's argumentation derives from his experience in anatomy and is centred on the structure of arteries and veins. For example, when we notice that arteries are stronger than veins, it must be because the blood they carry contains air and nutrition to the body. It is in other words an argument based on *function*, the argument of an anatomist. Bartholin did not regard Harvey's theory as perfect, but it was far better in explaining the structure of the human body than any competing theory, Galen's included. Another example of Bartholin's acceptance of an observation that could not be fully explained concerned the capillaries discovered by Marcello Malpighi.[998] He was prepared to accept the fact that a full comprehension of the workings of the human body was not yet possible.

But let us return to Bartholin's career. In the early 1640s he was a promising younger man, well-connected but without any guaran-

[993] OWB, II, 297f.
[994] OWB, II, 451, 459.
[995] Meisen, 20.
[996] Edv. Gotfredsen, *Harvey's lære og dens modtagelse i Danmark.* Cph. 1957, 26.
[997] OWB, II, 469f.
[998] Gotfredsen (1957), 29f.

tee of employment, and he was split between his desire to see things and places on the one hand, and his career prospects managed by Ole Worm on the other. In 1642 Worm mentioned the possibility (as a secret) that young Bartholin could enter the university as the assistant of his grandfather Thomas Fincke, who was ailing and therefore had difficulties in managing his teaching obligations.[999] But young Bartholin delayed his return, and Worm grew desperate: "*If you hesitate any longer, I fear that somebody else might snatch this choice bit (hunc bolum) from your mouth*"[1000]

Worm advised him to stick to the study of medicine: "*If you get tired of it, you can always return to the comfortable pastures of philosophy*"[1001] and promised that if he accepted the office, he would hardly have less time for private studies than now.[1002] When Bartholin was in Basel, Worm told him to hurry home, since there were two vacant chairs at the University,[1003] and assured him that Chancellor Thomesen Sehested was favourable. Bartholin dedicated the new edition of his father's anatomy to the Chancellor, but still tarried abroad. The hopes invested in the chancellor proved futile, and Worm insisted that he came home at once (*prima commoditate*).[1004]

Bartholin was sincerely fed up with the intrigues of patronage: "*I know that the love of you and other friends will attempt anything in order to bring me back home. But why, dear father, are you so eager for my return to a place where a bitter fate awaits me? Do I not suffer enough envy where I am now? Would it be better to meet more tight faces at home?", "I do not think, you back home are lacking certain great men who can make something up, and question that there are so many Bartholins at the University - as if it were unheard that relatives cooperate.", "I cannot see what good my presence would do, apart from making disappointment even more certain", 'Therefore, if You wish me the best, provide that I do not return to my fatherland yet.*"[1005] Then he went on to discuss books and items for Worm's collection to show that he was not ungrateful to his patron.

[999] OWB, II, 368.
[1000] OWB, II, 460.
[1001] OWB, II, 406.
[1002] OWB, II, 482.
[1003] OWB, III, 135.
[1004] OWB III, 163f. of March 16, 1646.
[1005] OWB III, 165, 170; see also Garboe (1949), 84f.

For now Worm let him alone, but secret negotiations took place in Copenhagen, unfortunately not preserved in the source material. In the autumn of 1646 Bartholin was back in Denmark, but still showed no great enthusiasm for being part of the game of patronage. The following year he thus rejected Worm's proposal that he should go to Nykøbing and accompany the crown prince to a spa in Germany (which may have proved wise since the prince died on this journey).[1006] Bartholin wanted to avoid being bogged down in service at court or medical practice: *"Writing prescriptions scatters my thoughts."*[1007] He wanted to concentrate on writing, and these years saw the first of his long list of publications. Fitting for his view on natural philosophy, he was mostly interested in monographies. And as fitting for the philological, literary and historical interests he combined with natural philosophy (to a degree that they could hardly be separated) the first book was on obstetric aid in Antiquity.[1008] Time did only allow him to publish a fragment of his original plan according to which the book should be well illustrated with pictures of antique and Italian sculptures.[1009] Another book was about bangles in Antiquity,[1010] a third about the wound in the side of Christ.[1011]

These are hardly subjects we would expect from a potential candidate for a chair in medicine. And the motive he gave: *"The mind sometimes takes pleasure in wandering beyond the familiar and travel to foreign regions"*,[1012] sounds more like a statement one would expect from a learned country gentleman or retired courtier. It contains an easiness, or playfulness, far removed from the austerity of most university teaching or the religious gravity permeating the works of Caspar Bartholin.

Thomas Bartholin had not severed the links to the pious Lutheranism of his father or the circle around Holger Rosenkrantz. Like other professors of natural philosophy such as Willum Worm

[1006] OWB, III, 20. Febr. 1647.
[1007] Thomas Bartholin, *Epist. medic. centuria*, 2 vols. Cph. 1663, 410.
[1008] Thomas Bartholin, *Antiqvitatum veteris puerperii synopsis, operi magno ad eruditos præmissa* (1646).
[1009] Letters to Johan Rhode, 29.6.1646 and 28.9.1646, KB NKS no. 1559, 2° (copy).
[1010] Thomas Bartholin, *De armillis veterum, præsertim Danorum schedion. Accessit Olai Wormii de aureo cornu ad F. Licetum responsio* (1647).
[1011] Thomas Bartholin, *De latere Christo aperto* (1646).
[1012] Preface to *De latere Christo aperto.*

and Ole Borch, he wrote several pious poems to the devotional books of Jørgen Rosenkrantz (the son of Holger),[1013] as well as a Danish book on religious edification and translated Hugo Grotius' apology of Christianity into the vernacular.[1014] Furthermore, Bartholin called on students to study both medicine and theology,[1015] and several future clergymen chose him as their *præceptor* upon entering the University.[1016]

In his treaty on *The Diseases of Christianity*,[1017] on the occasion of the University's celebration of the Reformation, Bartholin propagated peace and reconciliation. Like other European scholars (such as Hermann Conring in Helmstedt) he compared human society and Christendom with a body infected by religious conflicts and wars: *"Cities buried under ashes", "the lovely Rhine coloured red by the blood of innocents".* These signs of the disease of Christendom were, according to Bartholin, rooted in the sins and faults of the human mind. The only remedy was to change that mind, but only God was capable of doing this.

So, one side of Thomas Bartholin was very much in vein with his father in expressing a Lutheranism dominated by piety, a Christianity, which increasingly differed from the more and more dogmatic and systematic view expressed by the theologians. Thus, it was a humble and not predominantly intellectual religious view that propagated peace and reconciliation with little enthusiasm for controversies.[1018]

But Bartholin also dealt with religion in a more intellectual and (according to his own standards) scientific way, namely the so-

[1013] Jørgen Rosenkrantz, *Pii Vita Pia. Det er: It GVds Barns Gudelige lijf....Kierligen tilskrefvet alle som vente Jesu Rigis Komme* (1650); idem, *Davids salige eller Gud saa-lige Mand* (1651), and *Den welplagede Mand. Langfredags Minde eller Gudelige Tancker oc Erindringer om Jesu Christi.....Ljdelser* (1653).

[1014] Thomas Bartholin, *Gode Tancker udi onde oc verre Tider.* Cph. 1664; idem, *Om den Christen Tros Sandhed.* Cph. 1678

[1015] Bartholin, *Orationes varii argumenti.* Cph. 1668, 39f: *Oratio VIII De Theologiæ et Medicinæ affinitate.*

[1016] Among them were Thomas Kingo, the great Danish hymn writer and the vicar Oluf Rasmussen Pochstehn.

[1017] Bartholin, *De variis reipublicæ christianæ morbis et placidis eorum remediis dissertatio oratoria.* Cph. 1649; reprinted in idem, *Orationes.* Cph. 1668, 43f.

[1018] Thus Thomas Bartholin refused to engage in controversies with the Catholic theologian Barthold Nihus who attacked his opinion of the wound in the side of Christ: *"Receive everything with the best of intentions, let us refrain from public controversies"*, see Garboe (1949), 89f.

called 'biblical medicine' that investigated the diseases described in the Bible. Like Cort Aslakssøn and Laurentius Paulinus Gothus, Bartholin regarded the holy text as being incapable of erring and tried to deepen the understanding of it by means of his knowledge of natural philosophy. From the symptoms of various maladies described in the Bible, he thought it would be possible for the trained physician to determine what the disease in question corresponded with at the time.[1019]

Another side of Thomas Bartholin, however, showed far less humility and piety. It was as a matter of fact self-conscious and self-promoting and was rooted in his background. While the older generations of his family were *novi homines* in polite society, Thomas Bartholin was born and brought up in this self-conscious and well-off academic dynasty. The fact that he became the ward of Ole Worm, whose collection was visited by courtiers and foreign diplomats, also brought him in contact with circles of the nobility. Thus, when he went abroad, he acquainted not only professors of medicine and hospital doctors, but also gentlemen and nobles. While the former gave him a serious training in all kinds of medicine, including anatomy and practical work in a hospital (one might say practical piety), the latter gave him the ideal of diversity of learning and a dislike of academic pedantry. He wanted to embrace several branches of learning, and in Leiden he studied law, poetry, Plato, and archaeology, as well as Arabic, at that time a fashionable study taught by the celebrated Jacob Gollius.[1020]

Worm's collection had inspired him to see things and visit places, and much of the time his travels combined search of learning with sheer tourism. From Padua he went south, to Rome, and Naples, and further on to Sicily and Malta. He was able to enjoy the company of learned men of all religious orientations, and cultivate more sophisticated habits than his relatives of the earlier generation. In Venice he thus made friends with the Venetian friar Angelicus Vintimiglia together with whom he joined the fashionable literary society *Academia de' Signori Incogniti di Venetia.*[1021] To calm Worm's anxiety on Catholics like Vintimiglia, Bartholin assured his ward that their association was purely scientific. In other

[1019] Bartholin 1672/1994

[1020] Thomas Bartholin, *De pereg. medica*, 17.

[1021] *Le Glorie de gli Incogniti o vero gli huomini illustri dell' Accademia de' Signori Incogniti di Venetia* (1647), 408.

words, while The Thirty Years' War ravaged great parts of Europe in the name of religion (though still fewer educated men believed that), Thomas Bartholin was part of an international society of learning, where religious issues was a thing avoided by polite men. What mattered was Latin eloquence, learning and politeness, i.e. the ability not to offend anyone. Thus, to a certain degree he adopted the same culture of elegance and cosmopolitanism embodied in courtiers like Corfitz Ulfeldt and Magnus Gabriel De la Gardie.

His guardian at home did not oppose this sophistication of young Bartholin, since the success of the German physicians, Simon Paulli in particular, had jeopardised the family's career prospects for the next generation. Ole Worm might adhere to the same ideals of contempt of court life and praise the quiet and contemplative life of learning that were also expressed by Tycho Brahe and his circle,[1022] but he was pragmatic enough to recognise the importance of patronage, and he was acute enough to acknowledge the importance of rhetoric. In his advice to his sons on the study of medicine, Caspar Bartholin had dismissed the study of rhetoric as being almost useless to the future physician: "*The sick is not cured by words, but by herbs*".[1023] Worm now wrote to Thomas Bartholin in Leiden: "*I urge you, when you have spare time, to throw yourself into the study of philology, which you have already begun; a fine style is the best recommendation of a topic, and the World today has taste for nothing else but ornament*".[1024]

Portraits of Bartholin also reveal the fact that he very much looked like a gentlemen. Figures 7 and 8 not only illustrate that the prestige of Thomas Bartholin was closely connected to that of his family. They also show him wearing the long hair and pointed beard dictated by the latest fashion. Later he would be one of the first non-nobles in Denmark to wear a wig, he acquired himself a signet ring, and after 1660, when it became possible for members of the bourgeoisie to buy land, he bought himself a country estate with fifty farms a day's journey from Copenhagen. Likewise he would also allow himself the luxury of using eiderdowns in the

[1022] OWB, II, 185f.
[1023] Bartholin (1628), 3b; Bartholin (1662), 262: '*Inferior in usu est Rhetorica; non enim verbis sed herbis æger curatur*'.
[1024] OWB, II, 115.

duvets of his professor's residence.[1025] Thomas Bartholin was certainly not the only natural philosopher of his generation to wear the fashion and taste of a gentlemen. His brother Rasmus Bartholin did the same, as did the chemist Ole Borch and the physician Willum Worm.

There is no evidence that any of these natural philosophers felt a tension between the austere Lutheran piety of the Rosenkrantz circle, and the playful international culture of a gentleman. They seemed perfectly capable of lodging Golgotha and Parnassus under the same roof. What they might oppose was the tendency in contemporary theology (Protestant and Catholic alike) to make religion dogmatic and directed towards controversies with theologians of other religious camps. This is something to which we shall return below.

Part of the ideal of being a gentleman was freedom. Basically one had to be self-supporting and independent. One must not allow oneself to be bogged down in academic pedantry or social constrains, and this was the background for Thomas Bartholin's reluctance to be entangled in the game of patronage. The idea of being an independent and self-supporting gentleman was not foreign to the family Bartholin belonged to. His maternal cousins, the physicians Henrik and Thomas Fuiren, who were at his own age and with whom he had travelled abroad, had inherited a substantial fortune from their father, which enabled them to live comfortably and collect a vast library. Henrik established a cabinet of curiosities, and Thomas established a collection of items of natural history that allegedly even exceeded that of Ole Worm.[1026]

The fortune of Thomas Bartholin, however, did not allow him to follow the example of his cousins, and Worm put him under strong pressure. As planned he finally entered the University as a substitute for his ailing grandfather Thomas Fincke, and al-

[1025] Garboe (1949), 118f.

[1026] On the brothers Fuiren, see Willum Worm, *Progr. fun. Univ. Hafn. over Doct. med. Thomas Fuiren.* Cph. 1673; *Kirkehistoriske Samlinger* 3:V (1884-86), 292-295; Thomas Bartholin, *Oratio in obitum Henrik Fuiren.* Cph. 1659; See also the catalogues Thomas Fuiren published on his brother's library and collection, *Rariora Musæi Henrici Fuiren quæ Academiæ Regiæ Hafniensi legavit.* Cph. 1663 and *Bibliotheca medici Henrici Fuiren; quam patriæ Academiæ legavit.* Cph. 1659, and Petrus Andreæ, *In Luctuosissimum obitum, Viri Experientissimi, Henrici Fuirenii*....Cph. 1659

ready in 1647 he could take over the chair in mathematics that had become vacant by the death of Longomontanus, the last Danish assistant of Tycho Brahe. The chair was, of course, just a stepping-stone to the hoped for chair in anatomy, which Simon Paulli still held. Already the following year Bartholin was able to take over Paulli's chair. The extant source material does not indicate what actually took place (since it was probably secret and oral negotiations), but it was no doubt connected to the fact that the old Christian IV at long last died in 1648, and was succeeded by his son Frederik III. Worm had attended the King's deathbed where he competed with Jacob Fabricius (Paulli's father-in-law),[1027] and had ample opportunity for negotiating the cause of his ward.[1028]

Paulli did not lose favour, but was appointed as the king's personal physician. Perhaps Paulli was tired of the hard work of anatomy (no Scandinavian anatomist in the 17th dissected for more than a few years of his life), and wanted to spend more time on his passion for botany. Shortly afterwards, he published a great and beautifully illustrated book on the Danish flora.[1029] Probably he was also fed up with the resistance he met from the Bartholin family at the University, but afterwards there is no indication of antagonism between Paulli and the family. The very same year he published a German translation of Bartholin's anatomical textbook, and in an introductory poem (by a certain Friedrich Werner) Paulli and Caspar Bartholin are greeting each other:[1030]

Wie wird euch dann umbfangen
Mit Himmlischen verlangen/
Der Grosse Bartholin ?
Er wird mit Engelküssen
und mit gelahrten grüssen
Euch vor uns alln ziehn.

[1027] OWB, III, 297f.

[1028] That Worm acted as a broker for other men at this occasion is evident from his letters to Helvig Dietrich in Hamburg: OWB, III, 297, 302; among those who might have assisted Worm at court was Gabriel Akeleye, whom he regarded as his friend, see OWB, III, 362.

[1029] Simon Paulli, *Flora Danica.* Cph. 1648.

[1030] *Künstliche Zerlegung des Menschlichen Leibes des....Herrn D. Caspari Bartholini, itzo durch Anordnung D. Simonis Paullis...mit fleiss allen Wundarzten zu nütz ins Deutsche über gesetzet.* Cph. 1648.

Afterwards, Thomas Bartholin would always speak of Paulli with great respect, and after all, the German rival had expanded the territory of the family by establishing the *Domus anatomica* and thereby adding anatomy and its icons to the domain of medicine.[1031]

4. Bartholin's Bloody Pursuits

In early 1649 Thomas Bartholin could finally take over the anatomical theatre, and the winds of patronage were favourable. Chancellor Thomesen Sehested was a man of great learning who followed the king to the anatomical theatre. Bartholin had dedicated the first edition of his father's anatomy to the chancellor in 1645, in the 1651 edition he thanked Sehested because he *"never felt it being below his dignity to attend dissections"*, and later he would dedicate a number of his medical writings to this important supporter.[1032]

However, unlike the older generation of the family, who had been clients of the various royal chancellors, Thomas Bartholin won the patronage of the new king himself. Unlike his father and grandfather, Frederik III was a well-educated man. As the second son in the royal family he had been a pawn in the territorial ambitions of Christian IV. As it was planned that he should become archbishop of the strategically important see of Bremen, he had been sent to the noble academy of Sorø, and afterwards he governed Bremen and Verden for nine years with a court mainly consisting of Germans. Bremen and particularly neighbouring Hamburg were cities that attracted many learned refugees from The Thirty Years' War. Furthermore, he had spent a year in France and was deeply influenced by French culture. He was therefore interested in learning and was well versed in theology. He would often go to theological disputations, and sometimes he would even intervene. But Frederik III also shared the same interests as his peers in other European countries. At his castle he not only collected art, but also instruments, scientific preparations, curiosities and exotic animals.

[1031] In the anatomical theatre hung the portraits of both Caspar Bartholin and Simon Paulli's father-in-law Jacon Fabricius, see Wilhelm Maar, 'Et Blad af *Domus Anatomicas* Historie', *Thomas Bartholin Mindeskrift.* Cph. 1916, 18.
[1032] Such as *Controversiarum medicarum decas etc.* Cph. 1653.

The new king was therefore sympathetic to the *Domus anatomica* and witnessed several of Bartholin's dissections together with the chancellor and other members of court.[1033] This, of course, was to have an enormous importance to the legitimisation of anatomy. On a journey in the countryside, Bartholin even felt so assure of the new prestige gained by anatomy in his homeland, that he opened the grave of a deceased nobleman in order to investigate the mummified body, and even dared to publish his findings.[1034] Furthermore, he was widely used as a medical authority in trials,[1035] and called to Court when strange phenomena occurred, such as the egg in the royal hen run that had allegedly been laid by a cock.[1036]

But Bartholin also knew how to tickle the King's curiosity. In the National Museum in Copenhagen one can still see a one-meter tall ivory model of a human skeleton that originally stood in *Kunstkammeret*, the royal cabinet of curiosities (Fig. 9).[1037] Originally the skeleton had a scythe in the one hand and an hourglass in the other, symbolising that life is transitory, and death certain. A mechanic device ensured that the model could be turned and seen from all sides. Niels Gyntelberg who had studied mathematics and law in Germany, Italy, and the Netherlands and was connected to the Kunstkammer probably constructed the model. But it is likely that it was Bartholin who assured its anatomical accuracy, and it was certainly he who composed the ivory inscription on the ebony-box above the skeleton concerning the relationship between the corruption of nature and the loftiness of art: "*While this* [i.e. nature] *transforms the body to ashes, yonder shows how it is constructed. If the work of art had life and breath as well as the gift of sensation from God, there would be nothing more splendid on the entire earth. If, in our grave, we had so great splendour* [like these

[1033] Bartholin (1662); *Kjøbenhavns Universitets Matrikel* I (1890), 216; Bartholin (1654), 192f.
[1034] Bartholin, *Hist. anat. rarior. centuris* I-II. Cph. 1654, 96f.
[1035] See *Retsmedicinske Erklæringer afgivet af Københavns Universitets medicinske Fakultet i Aarene 1630-1668,* ed. by G. Tryde. Cph. 1939.
[1036] Garboe (1949), 110ff.
[1037] Thomas Bartholin et al, *Kunstkammer-Inventar* (1674), now in Rigsarkivet in Copenhagen; se also H.C. Bering Liisberg, *Kunstkammeret* (1897), 163.

ivory bones], *each and everyone must wish, that he had not any flesh on his bones*".[1038]

Apart from the prestige invested with anatomy by the support of the court, it also had the very tangible benefit that the King provided Bartholin with cadavers - executed perpetrators, a child murdered by its (probably desperately poor) *"mother, more wicked than Medea"*, and so on. Also animals were dissected, occasionally strange and exotic species. Some of them were animal bodies sent to Worm's Museum from around the realms and Europe, such as a Norwegian lemming,[1039] others such as a swordfish and a porpoise were provided by local fishermen.[1040]

It was not Lutheran piety that fuelled Bartholin's enthusiasm for anatomy, but rather the idea of gaining prestige within the European community of learning. While Simon Paulli had shown great interest for applying anatomy to the curing of the sick, namely in teaching anatomy to barbers and field surgeons and translating Caspar Bartholin's anatomical textbook into German, Thomas Bartholin directed his anatomical writings at a highly educated Latin-reading audience. He wanted to assert himself within the Republic of Medicine and was very much aware of the prestige of himself and his family. So while he did not want to engage in theological controversies, he felt obliged to defend himself against opponents within medicine. Therefore some of his first disputations in Copenhagen were directed against the attacks made on the anatomical textbook by the awe-inspiring Kaspar Hofmann in Altdorf and the famous Jean Riolan in Paris.[1041]

Both of these men had criticised the new anatomical theories included in the book, but Bartholin was aware that the world of natural philosophy was changing and felt confident. In his defence against Hofmann he branded him as an old man (*senex*), who hated the new generation and the new age, a geriatric who stag-

[1038] Nationalmuseet, Room 126; On the front is the following inscription:*De sceleto eburneo serenissimi et potentissimi Danorum Regis Dn. Friderici III Domino nostri clementissimi merito inter rarissima numeranda epigrammata;* see also Bartholin, *Carmina* (1669), 95.

[1039] Bartholin (1654), 96f.

[1040] Bartholin (1654), 178f., 192f.

[1041] Bartholin, *Vindiciarum anatomicarum pro parente* I-V *Casp. Hofmanno... publice opposita.* Cph. 1648. His introductions to these dispuations are found in *Orationes* (1668), Oratio III-VII; see also Gosch II (1873), 61f.

gered about in the dark.[1042] Bartholin wanted to make his own contributions to the development of medicine, and he was not a man who hid his own discoveries. As a matter of fact, he was extremely conscious of publishing his findings as soon as possible, and his anatomical work was intended to solve problems that occupied physicians around Europe.

During Bartholin's studies abroad two problems dominated anatomic discussions, the one was William Harvey's revolutionary theory on the circulation of the blood, the other was the Italian anatomist Gaspare Aselli's discovery of the lacteals (*venæ lacteæ*) in a dog, published 1627. The following year a French judge interested in anatomy discovered them in the body of an executed criminal. In Denmark Ole Worm took great interest in the lacteals,[1043] and in his home Bartholin's German teacher, Poul Moth, had showed them to his pupil.[1044] When he was in Leiden, Bartholin had unsuccessfully tried to find their origins in the cadavers of dogs and men.[1045]

The problem of tracing the lacteals was due to the fact that they usually vanished soon after a cadaver was opened. Nonetheless, Worm and Bartholin were convinced of their existence. As Worm told Bartholin in 1639: *"Even if their origin could never be demonstrated, would that allow us to deny their existence? They are there, visible to the eyes of everyone! One might put doubt on the purpose ascribed to them until their source and path is demonstrated, but only the blind can doubt the matter itself. Asellius' Chap. 19 has satisfied the mind desiring to learn until time brings better and more certain knowledge."*[1046]

In 1647 Bartholin's acquaintance from Padua, the German Johann Vesling brought the first illustration of the lacteals in the second editions of his anatomy book.[1047] When Bartholin became professor of anatomy in Copenhagen, he began to investigate the phenomenon, and in February 1650 he and Henrik Fuiren finally observed them in a human body, namely in a servant who had

[1042] Bartholin, *Orationes* (1668), 23; idem, *Anatom. vindiciæ* (1648), 103.
[1043] OWB, I, 242, 307.
[1044] Garboe (1949), 20.
[1045] OWB, II, 119.
[1046] OWB, II, 135f.
[1047] Johann Vesling, *Syntagma anatomicum* (1647).

been choked by a piece of meat.[1048] Bartholin's point of view was still that of Galen, as far as he concluded that the function of these vessels was to lead so-called *chylus* (nutritious juices) to the liver (which according to Galen was the organ that produced the blood).

In 1651 a medical student from Montpellier, Jean Pecquet, came up with a sensational observation.[1049] According to Pecquet, Aselli's lacteals did not lead the chylus to the liver where it was transformed to blood, but into a chylus-bladder (*receptaculum chyli*) and from there through a *ductus* situated in the thoracic cave to the left *vena subclavia* where it joined the circulating blood. Thus Pecquet rejected Galen's theory that blood was produced in the liver, and argued that it is produced in the heart. Unfortunately, Pecquet had only observed the chylus-bladder in animals, since he was convinced that it could only be found through vivisection.

From Thomas Bartholin's brother, Rasmus, who was studying in Paris, news of Pecquet's discoveries were brought to Copenhagen. Here Thomas Bartholin had acquired a very able assistant in the young German anatomist Michael Lyser (1629-1659), who belonged to a learned family in Leipzig and probably came to Copenhagen due to the connections established between his family and Ole Worm.[1050] Lyser studied at the University and earned his living as teacher in the household of leading patricians, before being employed by Bartholin. In the winter of 1651 and 1652, as soon as he had received Pecquet's book, Bartholin and Lyser conducted dissections on animals, which confirmed Pecquet's observations,[1051] and which Bartholin demonstrated in the anatomical theatre under the presence of Worm, Henrik Fuiren, and students as well as the French physician Pierre Bourdelot who was en route to Queen Christina's court in Stockholm.[1052]

Bartholin was keen on being the first anatomist to discover the chylus-bladder and thoracic duct in a human body. Despite suffering from a calculus, he spent long hours in ice-cold rooms

[1048] Garboe (1949), 128f.
[1049] Jean Pecquet, *Experimenta nova anatomica, quibus incognitum hactenus chyli receptaculum etc.* Paris 1651; another edition is from Harderwijk 1651.
[1050] Garboe (1949), 134f.
[1051] Bartholin, *De lacteis thoracicis in homine brutisque nuperrimè observatis etc.* Cph. 1652, 13.
[1052] Bartholin (1654), 225f.

bent over cadavers of men and beasts. In the winter of 1652 he and Lyser finally succeeded. King Frederik III agreed that two perpetrators, who were condemned to the wheel, should be well fed and filled with wine before they were hanged. Immediately afterwards they were handed over to Bartholin, who dissected them at the anatomical theatre and at home.[1053] At other occasions he also paid paupers for permission to dissect deceased family members, and it seems that his bloody pursuits aroused protests in town.[1054] Normally, Bartholin had religious scruples about making people drunk before they were executed, since a man should meet his end with a clear mind,[1055] but in this case the end seems to have justified the means. And Bartholin was lucky. One of the cadavers that of an infanticide, was so lean that the thoracic duct (which Bartholin called *lacteæ thoracicæ*) could be observed. He was aware that other anatomists around Europe were conducting similar investigations,[1056] so he hurried to publish his findings in order to be the first, and thereby win fame.[1057] Despite his haste, he took time to have the treatise illustrated, for as he wrote: "*No honest man can question our sincerity and truthfulness. We have never tried to deceive the public, or put it off with a lot of talk. Yet, I know that there shall be no lack of people, who will oppose us through either envy or disdain.....If these should accuse me of talking falsely, I put forward to my defence my drawings as well as witnesses, great and small, and the most respected spectators from all estates.*"[1058]

During dissections of dogs, Bartholin and Lyser had found around the veins of the liver and later in other parts of the body some new vessels, containing a clear liquid. The question now arose whether these vessels were *chylus*-vessels or something quite

[1053] Bartholin (1654), 79f.; already in 1645 it had been ordered that anyone condemned to hanging during winter, should be sent to Copenhagen for execution so that the body could be handed over to Simon Paulli, see F.V. Mansa, *Bidrag til Folkesygdommenes og Sundhedspleiens Historie i Danmark.* Cph. 1873, 331 note.
[1054] Cf. Thomas Bartholin, *De anatome practica.* Cph. 1674, 11f.
[1055] Bartholin, *De anatomica practica.* Cph. 1674.
[1056] See Nils von Hofsten, 'Upptäckten av bröstgången', *Lychnos* (1939), 273 for Jan van Horne; also the british physician George Joyliffe was later promoted as to have made the discovery of the lymph ducts independently, see Webster (1975), 318.
[1057] Bartholin, *De lacteis thoracicis in homine brutisque nuperrimè observatis, historia anatomica.* Cph. 1652.
[1058] Bartholin (1652).

new? For the time being, Bartholin and Lyser postponed the problem, until they had found Pecquet's *chylus*-bladder and the thoracic duct in man, but as soon as this discovery had been made, they began to investigate these new vessels. As far as Bartholin knew, no one else had observed these vessels, and he was cautious about drawing conclusions: *"It almost seemed to us like a miracle, and I did not quite trust my own eyes and one single observation however clear it may be. One should vary the material, little by little elicit Nature its secrets, and not rashly accept what has been seen only once when the general opinion through century speaks against it".*[1059] After the observation had been confirmed by several dissections of dogs, Bartholin could finally conclude that the phenomenon was not a monstrous exception: *"With a calmer mind we began to admire the constant law in this arrangement of Nature".*[1060]

Today we know that the vessels he had found (and called the lymphatic vessels) belong to the same system of vessels as the chylus-vessels discovered by Aselli, but this was not evident to Bartholin. What he did know, however, was that these vessels just like the chylus-vessels led clear fluid away from the liver and into the blood circulation.[1061] Thereby he must follow Pecquet in rejecting Galen's idea that blood is produced in the liver, and self-confidently he turned the last chapter of his treatise on the lymphatic vessels into a melodramatic burial of the liver, whose courage he had long upheld, but which now must see itself reduced to a more humble role in the body: *"I bade it to be in good spirits, told it, that Fate plays the same game with even the most outstanding heroes, that raising and debasement, birth and interment interchange".*

The analogy of the theatre and the stoic view on Fate were typical of the polite culture in Bartholin's age, as we have seen in the example of Corfitz Ulfeldt above. His hard work and bloody pursuits were turned into play. So were also his controversies with other anatomists. Self-confident and glowing with sarcasm he dedicated the treatise to his old opponent, Jean Riolan: *"The greatest anatomist in the world and in the city of Paris".*

[1059] Bartholin, *Vasa lymphatica...in animantibus inventa.* Cph. 1653, Ch. II.
[1060] Bartholin (1653), 11.
[1061] Bartholin (1653), Ch. III.

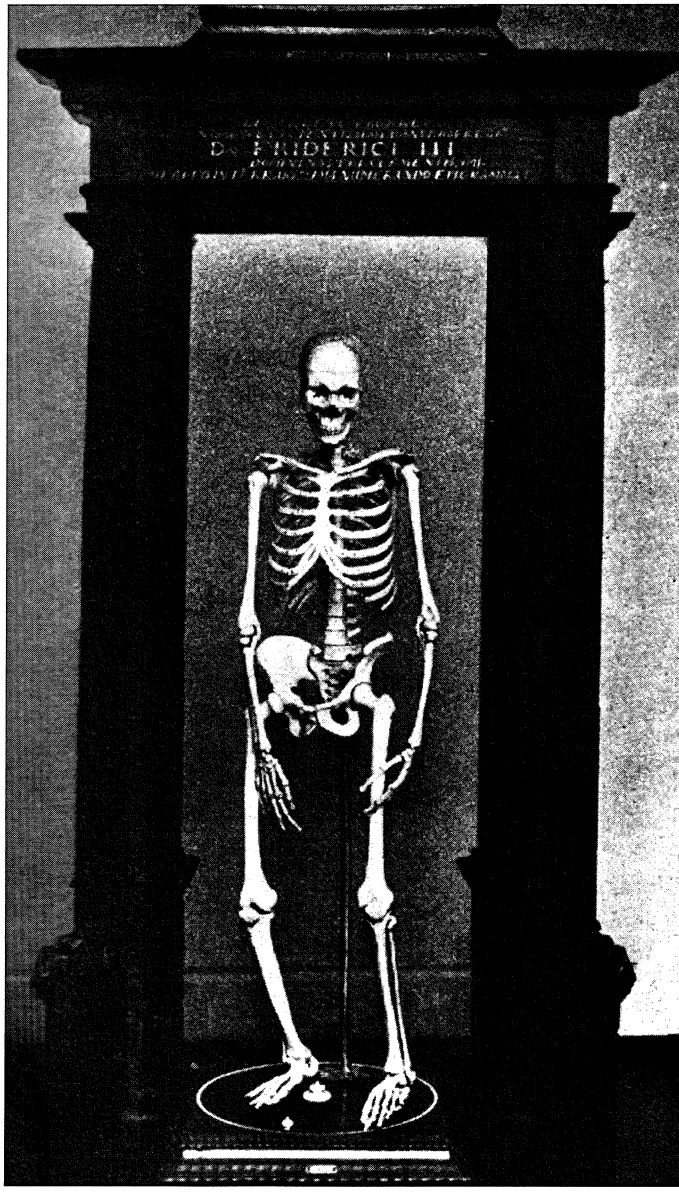

Fig. 9. Nature surpassed by art. The ivory skeleton from the Royal Kunstkammer, now in the National Museum in Copenhagen.

5. Olof Rudbeck

There are many similarities between Thomas Bartholin and his Swedish colleague OLOF RUDBECK (1630-1702).[1062] Being the son of Bishop Johannes Rudbeckius young Olof, just like his Danish rival, came from a deeply religious background dominated by piety, prayer and reading of the Bible, but which also contained humanist learning. Just like the gymnasiums set up by Holger Rosenkrantz and Caspar Bartholin in Denmark included anatomy in their teaching, Bishop Rudbeckius introduced anatomy in his gymnasium in Västerås and donated a copy of Vesalius' *Fabrica* to the cathedral library. In 1648 Olof Rubeck matriculated in Uppsala (he had already been there on a visit with his brothers in 1640), and was taught medicine and anatomy by Johannes Franck and Olaus Stenius.

We have already mentioned that despite urgings from Johan Skytte, Franck did not conduct public dissections, but was generally concerned with botany and traditional scholastic medicine. And yet, already at the end of 1650 young Olof Rudbeck had acquired sufficient knowledge of anatomy to contribute to the latest anatomical discussions. During the slaughtering of a calf, he observed the thoracic duct and the *cisterna chyli* and further dissections led him to conclude that the lacteals do not lead chylus to the liver, which could therefore be dismissed as the blood-producing organ.[1063] The dating of this discovery is based on Rudbeck's own statement (though he gives Stenius as a witness) and must therefore be taken with a caveat. However, the illustrations in his treatise of the discoveries (1653) show no influence from those of Pecquet.[1064] So if we are to believe Rudbeck, he not only made his discoveries prior to Bartholin, but also several months before Pecquet had published his book on the discovery.[1065]

[1062] For Rudbeck see Gunnar Eriksson, *Rudbeck 1630-1702. Liv, lärdom, dröm i barockens Sverige.* Stockholm 2002. For an introduction to Rudbeck in English see idem, *The Atlantic Vision. Olaus Rudbeck and Baroque Science.* Canton, Mass. 1994.

[1063] Rudbeck, *Epistola ad Thomam Bartholinum.* Uppsala 1657.

[1064] Hofsten (1939), 272.

[1065] A third anatomist also made claim to the discovery, namely the Leiden professor Jan van Horne, see Hofsten (1939), 273.

This begs the question, how a young Swedish student, however brilliant he may be, was able to acquire such knowledge of anatomy and skills in dissection techniques before he went abroad? One answer could point to his background in Västerås. Old Bishop Rudbeckius was familiar with recent developments in anatomy, which he had witnessed in Wittenberg and tried to introduce in the local gymnasium.[1066] He was, however, far from being a professional anatomist, and the anatomical knowledge of him or other teachers in Västerås was hardly up-to-date. Another answer could be that Swedish historians of medicine have generally underestimated his teacher in Uppsala, Johannes Franck. After all, Rudbeck was not the only one of Franck's students who turned into a brilliant anatomist; the same did Petrus Hoffvenius, who would later become professor of medicine in Uppsala. However, while Franck was an enthusiastic botanist and Paracelsian alchemist, there is no indication whatsoever that he was a skilled anatomist. Neither was Olaus Stenius, the professor who Rudbeck mentions as a witness of his discovery of the thoracic duct and who was important as a mediator between Rudbeck and Queen Kristina. It seems more plausible that the source of Rudbeck's anatomical knowledge was Sven Bröms, who occupied a chair *ad hominem* in medicine. He had studied at Leiden and Padua, and had therefore every opportunity to be up-to-date with developments in anatomy. In the sources, however, there is no indication that Rudbeck was taught by Bröms.[1067]

Since Uppsala had as yet no anatomical theatre, Rudbeck's dissections must have taken place outside the university premises, and it seems that they were conducted in a cellar, probably in connection with private seminars held by the poor student.[1068] In all cases they were not part of official university education, which also may explain while Rudbeck only dissected animal corpses.

While it remains a mystery as from whom Rudbeck learned the practical skill of dissecting a cadaver,[1069] his knowledge of anatomy was probably founded already during his years in Västerås. One enormously important aspect of the rise of anatomy in early

[1066] Eriksson (2002), 28f.
[1067] Eriksson (2002), 47-49; on Franck see also Lindroth (1943).
[1068] Eriksson (2002), 50.
[1069] Later in Leiden the Danish student Willum Worm would be deeply impressed with Rudbeck's techniques in dissecting, see Bartholin (1663), 514f.

modern Europe was the development of accurate illustrations of the human body and its parts. This was a tradition founded by Vesalius, who had fought hard to make the illustrators of *Fabrica* depict the body naturalistically rather than allegorically.[1070] Few anatomical works were as richly illustrated as *Fabrica*, but especially in connection with new discoveries, anatomists took great pains to have their treatises properly illustrated, and illustrations constituted a part of the evidence of their discoveries. Thus, Pecquet had his small but revolutionary treatise on the lacteals and the chylus-bladder thoroughly illustrated. Bartholin's search of the thoracic duct was conducted according to Pecquet's illustrations and directions, and as we have seen, he took great care to have his own findings depicted.

The aspect of illustrations reminds us that intellectual developments were only part of the development and spread of natural philosophy in 17th century Europe. An important component was the developments of new techniques by craftsmen and artists, such as improved techniques of engraving and etching. Furthermore, skilled printers were required, and the best of these were found in Basel and later in the Netherlands. It is therefore no coincidence that so many early modern philosophers send their books abroad for printing.

The development of anatomical illustrations enabled a talented and self-confident student like Olof Rudbeck, who had as yet hardly witnessed the dissection of a human body, to acquire a detailed knowledge of anatomy, make his own discoveries, and draw his own conclusions. This, of course, required that he could get his hands on new anatomical treatises, but this does not seem to have been a problem. Apart from the treatises provided by his father and the professors in Uppsala, the Swedish Empire in general and Queen Kristina's court in particular at this time attracted scholars from all over Europe, among them physicians. Furthermore, due to Sweden's important role in European politics, numerous embassies arrived in Sweden and brought with them books and new developments in fashion and learning. On their route to Sweden most of these men through Denmark, and therefore established indirect connections between intellectuals in the two rival-

[1070] See Harald Moe, *Den anatomiske billedkunst i renæssancen og barokken.* Cph. 1993, whish is richly illustrated.

ling Scandinavians countries. Pierre Chanut, for example, corresponded with Ole Worm, and another Frenchman, the physician Pierre Bourdelot, was employed by Queen Kristina. On his way to Stockholm he witnessed Bartholin's dissections in Copenhagen and the two discussed the lacteals.[1071] Later he would also inform Bartholin of Rudbeck's discoveries.[1072]

So, even though Rudbeck had not yet been abroad, he had ample opportunity to be up-to-date with the latest developments in anatomy and to find an audience interested in anatomy. In April 1652 he demonstrated the lacteals and thoracic duct for Queen Kristina, Bourdelot and a number of anatomists.[1073] Kristina was a highly intelligent and well-educated ruler, but from Rudbeck's description it is evident that the theatrical and artistic presentation of anatomy played an important role. Thus, the Queen's interest was particularly sparkled when Rudbeck showed her his real-size illustrations of the local flora and *"a construction I had made of the veins and arteries to full human length and width including the anastomosises, which to her Royal Majesty and the others was a delightful theatre, which nobody had ever seen, not even abroad".*[1074] So like in Copenhagen the presentation and entertaining qualities of the anatomist were important to winning support for anatomical studies.

If we are to believe Rudbeck, which is problematic since his account of his findings was published in connection with his controversy with Bartholin, he had never heard of the lacteals before, and was sincerely disappointed when one among the audience (probably Bourdelot) told him that these vessels had already been described by Pecquet. One month later he was further disappointed when he went to the Stockholm book market and found Bartholin's treatise of his discovery of the thoracic duct in a human body. Bartholin was not unaware of Rudbeck's pursuits, even though he did not know his name. Already in May he asked Bourdelot what was known in Uppsala of the thoracic duct, and in his reply Bourdelot mentioned Rudbeck's investigations.[1075]

[1071] René Jean Denichou, *Un médecin du grand siècle, l'Abbé Bourdelot.* Paris 1928.
[1072] Hofsten (1939), 279.
[1073] Eriksson (2002), 50ff.
[1074] Hemsterhuis, *Messis aurea* (1654), 21f.
[1075] Bartholin, *Epist. medic. centuria* I-II. Cph. 1663, 468, 470f.

Afterwards the two Scandinavian anatomists continued to follow the same track. During his dissections in 1650 and 1651 Rudbeck had noticed what came to be known as the lymphatic vessels.[1076] He did not publish until he had conducted further investigations, but he produced two copper tablets, which depicted his view of the lymphatic system, and which he showed to Bourdelot. In the summer of 1653 he finally published his discovery of the lymphatic system.[1077] A short time before, Bartholin had published his discovery of the lymphatic vessels, but at this time no controversy arose. Rudbeck had won the patronage of Queen Kristina and Axel Oxenstierna,[1078] and with their support he travelled to the Netherlands. In Leiden he made friends with a young Danish student, Willum Worm (the son of Ole Worm), who reported back to Copenhagen of Rudbeck's work on the lymphatic system and also sent a copy of his tablets.[1079] At Christmas Bartholin acquired a copy of Rudbeck's treatise from his bookseller,[1080] but still no controversy broke out, and Bartholin was more concerned with a forthcoming attack from Riolan.[1081]

Troubles began when a Dutch physician published a book called 'The Golden Harvest' (*Messis aurea*), which he dedicated to Bartholin.[1082] It contained the treatises by Pecquet, Bartholin and Rudbeck on the thoracic duct and the lymphatic vessels. In this book Bartholin dated his discovery of the lymphatic vessels to early 1652, almost a year before Rudbeck published his treatise on the subject. Rudbeck got angry and wrote a letter in which he accused Bartholin of manipulating the date, and the letter was adopted in the second edition of the book.

[1076] Rudbeck describes the progress of his findings in *Ad Thomam Batholinum Danum Epistola* (1657), 11f.; see also Nils von Hofsten, 'Upptäckten av bröstgången och lymfkärlssystemet. En kronologisk kommentar', *Lychnos* 1939, 262f.

[1077] Rudbeck, *Nova exercitatio anatomica, exhibens ductus hepaticos aquosos, & vasa glandularum serosa etc.* Västerås 1653.

[1078] See M.B. Swederus, 'Olof Rudbeck den äldre, hufvudsakligen betraktad i sin verksamhet som naturforskare', *Nordisk Tidskrift, Letterstedts* (1878), 451.

[1079] Bartholin, *Epist. medic. centuria* I-II. Cph. 1663, 505f.., 558f.

[1080] Bartholin, *Epist. medic. centuria* I-II. Cph. 1663, 558f.

[1081] Bartholin (1663), 514f.

[1082] Sibold Hemsterhuys, *Messis aurea triennalis, exhibens anatomica novissima et utilissima experimenta.* Leiden 1654. A second edition appeared in Heidelberg 1659.

Bartholin tried to keep aloof of the conflict and refused to defend himself against Rudbeck's accusations,[1083] but the fact that he claimed that it had no importance, who made this or that discovery as long as it would benefit the common good, does not sound sincere. After all, he had worked frantically to discover the thoracic duct and publish his findings before anybody else, and he did certainly not hold others back from defending him. A young German, Martin Bodgan, who worked as Bartholin's assistant, wrote a ferocious reply to Rudbeck,[1084] who was accused of stealing from Bartholin and acting out of envy.

There were probably two reasons why Bartholin refrained from entering the controversy himself. First of all, he could did not feel sure that he had actually detected the lymphatic vessels before Rudbeck (Swedish scholars have established that he did not), and secondly this kind of controversy would debase him. He was after all professor of medicine from a famous and well-established academic dynasty, while Rudbeck was still a student who had just begun his travels abroad. Men like Hoffman and Riolan were enemies that it would be prestigious to combat, Rudbeck was not.

Since Bartholin, despite his own claims, was very sensitive to his own prestige, he now began a frantic search for the lymphatic vessels in a human body: *"For the glory of a discovery is minor, if it is not extended to all species of living beings. It is immensely enhanced if it also includes human organs"*.[1085] However, despite several attempts, no one had yet succeeded in observing the lymphatic vessels in humans, but Bartholin did not give up. In the winter of 1653-1654 he dissected seven human cadavers, but still without any luck.[1086] Once again his good relations with the government and the city authorities (his father-in-law, Christoffer Hansen, was a mayor) made sure that cadavers were available, but despite his connections, Bartholin was in lack of cadavers and could sourly notice, *" an unusual lack of thieves"*.[1087]

[1083] Bartholin (1663), 514f.
[1084] Martin Bogdan, *Insidiæ structæ Cl. V. Thomæ Bartholini.....vasis lymphatica ab Olao Rudbekio Sueco, in suis Ductibus hepaticis, & vasis glandularum serosis Arosiæ editis, detectæ* (1654).
[1085] Bartholin (1653), 21.
[1086] Bartholin (1654b), 4,7.
[1087] Bartholin (1654b), 9f; idem, (1657), 5f.

Then the goddess of fortune smiled upon him. In March 1654, Ole Worm drew his attention to a neighbour of his, a poor, drunken and ailing Norwegian tailor. From dissections on dogs, Bartholin knew that it was easier to find the lymphatic vessels in meagre cadavers, but also that a dissection had to be conducted as soon as possible after death had occurred. Bartholin kept a close eye on the poor man, but shortly before he died, a ferocious plague epidemic began to ravage Copenhagen. This, however, did not hold Bartholin back. Four hours after the tailor had died, he sneaked into his house with two assistants and immediately began his dissection that led to the observation of two lymphatic vessels. He published his findings few weeks later.[1088]

6. Between Golgotha and Parnassus

Before we close this chapter on the emergence of anatomy in Scandinavia, it would be useful to draw some conclusions. Thomas Bartholin and Olof Rudbeck bears witness to the fact that in middle of the 17th century, natural philosophers on this northern fringe of Europe were able to contribute to the latest developments in natural philosophy. A prerequisite for this circumstance was the fact that circles of academics in both Sweden and Denmark had been culturally integrated into the general European development, visiting and corresponding with scholars and diplomats all over Europe and abroad.

Scholars have taken interest in the question whether Bartholin or Rudbeck were first in making their anatomical discoveries.[1089] It seems that Rudbeck generally arrived at his discoveries and drew conclusions from them before Bartholin, but this is not so important. What *is* important is the fact that the two anatomists made their discoveries independently,[1090] even though they were probably informed of each other's findings through Bourdelot and the international book trade.[1091] Furthermore, the case of Bartholin and Rudbeck shows the importance of being the first to

[1088] Bartholin (1654b), Ch. II.
[1089] Gosch (1873), II:1; Tigerstedt (1885, 1921); Fulton (1938); Hofsten (1939).
[1090] As cobcluded by Hofsten (1939), 282ff.
[1091] Hofsten (1939), 277.

publish one's findings. It was one of the first conflicts of priority in the history of science.[1092]

Bartholin and Rudbeck both came from a highly religious background, and throughout their lives, religion was important to them, but at the same time they also adopted a culture that had little to do with piety or penance as such. As already mentioned there is no indication in the source material that they experienced a tension between these two cultures, but differences there were. Take the way of presenting discoveries, the scientific discourse, for instance. To break into the house of a man who has just died might seem outrageous to many people in the 17th century as well as today, not to speak of dissecting the deceased immediately afterwards. Yet, we would never have heard about this incident if not for Bartholin's own account, which he proudly presented in his treatise of the lymphatic vessels in man.[1093]

Thus, the incident was part of the way Bartholin presented his discovery to the European public. As Bartholin himself admitted,[1094] the detailed account was intended to enhance the credibility of his discovery, but it was also presented as vivid and dramatic as possible. Bartholin gives a frightful description of the dreadful condition of the poor tailor who was suffering from consumption, showing no compassion whatsoever, but rather a grim humour as when the man is described as being *"as transparent as a Punic lamp"*.[1095] Or when he mentions that the man had lost his voice due to a physical defect: *"He was silent, while he was alive, so that we in his dead body could find, that of which we can speak with a loud voice. It is beyond description how much reputation our lymphatic vessels will gain from this. He lost his voice at the same time when we first discovered the lymphatic vessels in animals, and he was thus the one who first showed them in himself; and later he did not have to speak, since these had been observed by us in his body"*.[1096] The

[1092] A previous one being that between Tycho Brahe and Nicolaus Ursus see Owen Gingerich, 'The Wittich Connection: Conflict and Priority in Late Sixteenth-Century Cosmology', *Transactions of the Americal Philosophical Society* 78:7 (1988); Nicholas Jardine, *The Birth of History and Philosophy of Science.* Cambridge 1984.
[1093] Bartholin (1654b).
[1094] Bartholin (1940), 172.
[1095] Bartholin (1940), 172.
[1096] Bartholin (1940), 174.

cynicism that reveals itself in the distance, the so-called disinterest, between the scientific observer and the subject of study is also a distinction mark in much of modern science, and here Bartholin despite his Baroque rhetoric pointed towards a later period.

The Descent from Parnassus

*You must not allow that this science [anatomy], which here has grown forth with me also passes away with me (*Thomas Bartholin to the royal chancellor 1661*)*[1097]

1. The Golden Harvest of Natural Philosophy

With the energetic Thomas Bartholin at the centre, the two decades after 1650 witnessed the culmination of natural philosophy in Copenhagen in the 17th century. This flourishing of natural philosophy in the city was the result of two developments analysed in the previous chapters, one internal to natural philosophy the other connected to general political developments.

As for the former it was the result of the identity as natural philosophers adopted and developed by the physicians of the Bartholin family. After they entered the University in the wake of the fall of Tycho Brahe and his circle, they established a wide-ranging network of contacts all over Europe. They recruited new natural philosophers from within their own ranks, brilliant students (and some of them like Willum Worm and Jacob Fincke not so brilliant) who, as the example of Thomas Bartholin shows, from an early age were made familiar with general European developments in anatomy, chemistry and other areas. University professors they were, and their activities were therefore semi-official, but their international contacts, and the identity they adopted and which stimulated scientific discoveries were made on their own account.

Such discoveries, and the prestige they generated around Europe, were of course an important asset in the never-ceasing game of patronage, but although patronage was a fact-of-life so be reckoned with, these natural philosophers went further than what was needed to secure patronage. Thus, there is no indication that

[1097] Thomas Bartholin (1661), end of dedication to Chancellor Peder Reedtz.

the establishment of Ole Worm's collection of items of natural history was motivated by patronage, and the almost endless list of Thomas Bartholin's publications far exceeded the requirements for pleasing his patrons. Thomas Bartholin enjoyed publishing, of making his name known to the learned European public, and, as we saw in the previous chapter, the pursuit of fame and prestige within that community was one of the driving forces behind his frantic search for anatomical discoveries.

During the first half of the 17th century this development ran parallel to that of centralism and the emergence of the state. Political realities formed the framework in which the culture of natural philosophy developed. The importance of winning patronage has been illustrated several times in the previous chapters, and we have seen how new political and religious agendas also changed the conditions of patronage. Obedience to the chancellor and the government was demanded, issues with political implications must be avoided (unless asked for), and the rise of religious orthodoxy promoted by the government also made it urgent that physicians and other natural philosophers must be careful not to collide with official dogma. Within these limits, however, the natural philosophers could develop a culture of their own, with its own values and in connection with the international community of natural philosophers.

Religion might have formed a link between natural philosophy and the emergence of the state, since in the realms of the Danish king official religion and centralism could not be separated. However, when Philippism was replaced by orthodox Lutheranism at the turn of the 16th century, the close link between theology and natural philosophy was broken. While the emergence of Protestant Aristotelianism, philosophy (i.e. physics and metaphysics) was instrumental to theological training and thereby to the state, natural philosophy as such - medicine, chemistry, botany, astronomy - played no role in theology. In Chapter Five we saw how piety was instrumental to Caspar Bartholin's and Cort Aslakssøn's approach to natural philosophy, but for Ole Worm and for Thomas Bartholin and his generation (Niels Stensen excepted), religion was limited to pious treatises in the vernacular with no connection to their pursuits of natural philosophy.

Then, in the 1640s the government invested in icons of natural philosophy as part of its attempt to reclaim some of the prestige lost in The Thirty Years' War - the observatory of Rundetårn and

the anatomical theatre. This, of course, enhanced the prestige of natural philosophy outside the ranks of natural philosophers themselves, and when the learned Frederik III came to power in 1648 and led his chancellor and courtiers into the balcony of *Domus Anatomica* to witness Professor Thomas Bartholin's dissections, the study of nature moved into the public sphere and became an asset in the struggle for royal favour.

Initially, this was exclusively a gain to the culture of natural philosophy. Surely, the change of audience was bound to change the way natural philosophy was presented. The King shared the enthusiasm for curiosities and novelties so common to European court culture in this period, and the study of nature must be presented as a drama that evoked amazement in the spectators. Vividness and elegance was required, not only verbally but also in the visual presentation of natural philosophy as in the case of the miniature ivory skeleton mentioned in the previous chapter. But these requirements did not change the possibility of a serious study of nature *per se*, and proved no obstacle to the rhetorically skilled Thomas Bartholin.

Neither did the new official position of natural philosophy seem to have changed the attitude to Man's capabilities that Bartholin represented (although the Frederik III himself was theologically well-versed and enjoyed watching theological disputations). In a huge dogmatic work from 1633, the bishop of Sealand, Jesper Brochmand, had denied Man any freedom of will in all matters concerning salvation. The soul is blind, the senses awry (*perversus*) and the heart wrong and false, entire Man buried in sin.[1098] Twenty years later, this was still official religious dogma, also emphasised by the sentences on the walls of the anatomical theatre. It was an attitude that left little room for ideas of progress for mankind. And yet, in the orations held in connection with his dissections in the very same theatre, we find Thomas Bartholin express quite another attitude to Man:

> *No age has ever succeeded more in discovering the secrets of nature or shown more zeal in studying it than our. For this happiness we thank the Heavens and the investigators whose hands are like covered with eyes. We hardly retain anything of the Ancients, and when we follow them, this is not so*

[1098] Jesper Brochmand, *Universæ Theologiæ Systema I,* Cph. 1633, 332, 347.

much because they have discovered Nature's eternal laws, but because they are older than we are [...] They have far from finished the work, and were ignorant of many things since they knew less than these recent times have taught us. To avoid arousing disdain for the illustrious age of the Ancients, I shall not give the details [of these recent discoveries] or reel off my own six hundred observations; instead I shall describe the recently discovered ductus thoracius.[1099]

One could argue that bishop Brochmand is concerned with Man's salvation, while professor Bartholin concerns himself with natural philosophy, and if the discrepancy between these two views on Man was presented to Bartholin, he would undoubtedly defend himself (though probably far more eloquently), that as far back as Luther Protestantism had been very conscious of the dividing line between matters concerned with salvation and matters belonging to this World. Even Brochmand admitted that in matters of nature, as well as morale, there is a small reminiscence of free will and perceptive powers, dulled by sin, but yet there. But while the position was defendable, and while Bartholin and his circle hardly saw any incongruence between religion and the new natural philosophy, I think it is evident that the climate of this natural philosophy was very different from that of religion, and secular in so far as, unlike the natural philosophy of Philipp Melanchthon, it was not attached to promoting theological dogmas.

With Thomas Bartholin as the gathering point, a number of excellent natural philosophers emerged in Copenhagen from the mid-seventeenth century - his brother the physician Rasmus Bartholin, who took a particular interest in mathematics, the physician and Hermetic chemist Ole Borch, the versatile Niels Stensen (Nicolaus Steno), and the astronomer Ole Rømer. All of these men were one way or another connected to the Bartholin circle, either by friendship in the case of Borch, by patronage in the case of Steno, or by patronage and marriage in the case of Rømer. Furthermore, the fame of Thomas Bartholin began to attract foreign students of medicine to Copenhagen, in particular Germans like Martin Bogdan (who defended him against Rudbeck) and his dissector Mi-

[1099] Thomas Bartholin, *De lacteis thoracis in homine brutisque, nuperrime observantis historia anatomica.* Cph. 1652, 4.

chael Lyser. It was a self-conscious culture, which saw itself as part of a national humanist culture. This is evident from the encyclopaedia of Danish writers, the first of its kind in Denmark, published by Thomas Bartholin and his brother Albert.[1100] Here natural philosophers not only appear side by side with other kinds of authors, but their published poems etc. appear side by side with their writings of natural philosophy.

Natural philosophy in Copenhagen was stimulated by a number of facilities in the city. Ole Worm had bequeathed his collections to the King, but with the inheritance after Thomas Fincke, Thomas Bartholin in 1657 established an anatomical museum at the first floor of the Domus Anatomica. In the same year the University library moved into new locales at the attic of the church next to Rundetårn. It was arranged after the model of the university library of Leiden, and the Bartholin-circle made sure that also new works on natural philosophy were acquired. A well-connected student might also make use of the private libraries of Thomas Bartholin's cousins, Henrik and Thomas Fuiren, which included more than 12.000 volumes, among them numerous works on medicine and natural philosophy. When Thomas Fuiren died in 1673 these libraries were bequeathed to the University library.[1101]

Finally, there were men outside the Bartholin circle, who were important to natural philosophy. As court physician Simon Paulli was highly influential, and although he occasionally competed with the Bartholins in matters of patronage, he also collaborated with them. In the cathedral school of Copenhagen taught Jørgen Ejlersen (*Georgius Hilarius,* 1616-1686). He was an excellent mathematician who published several treatises on mathematical problems, and despite the fact that mathematics was not on the school's syllabus, it seems that at least Steno was introduced to mathematics by Ejlersen.[1102] In town lived also the Lord Steward Joachim Gersdorff, who took a strong interest in natural philosophy. A catalogue of authors in his library has been preserved and shows a great interest in various aspects of natural philosophy, particularly chemistry, wherefore his residence in Copenhagen

[1100] Albert Bartholin, *De scriptis danorum.* Cph. 1666.
[1101] See Lauritz Nielsen, *Danske privatbiblioteker gennem tiderne*, vol. 1. Cph. 1946.
[1102] Steno, *De glandulis oculorum*, dedication.

contained a well-equipped chemical laboratory. It was here Ole Borch, then employed as a teacher in the household, began to conduct his chemical experiments, and the Lord Steward's library also seems to have been an important source for Nicolaus Steno's readings in natural philosophy.[1103]

At its core this culture was centred on the University, in so far that most of its members were professors, and medical, in so far as most of them were physicians. The natural philosophy represented by Thomas Bartholin was a continuation of the eclecticism of the previous generation, Aristotelianism, Galenism and Ptolemaic (or Tychonic) cosmology piece-by-piece torn apart by new theories and discoveries, but not yet replaced by large-scale explanations within the various disciplines of natural philosophy. Harvey's theory of the circulation of the blood was accepted, but could not explain all the workings of the human (or animal) body, and many Galenic concepts and notions survived. Thus, it was also accepted that no clear and consistent theory of anatomy or medicine could yet be reached, though Bartholin seemed quite confident that it eventually would some day.

2. Hermes Reborn

From the late 1640s, the culture of natural philosophy in Copenhagen became more differentiated when Paracelsianism re-emerged and Cartesianism was introduced. As for Paracelsianism, it had never become extinct in Denmark and Norway. After its heyday within the circle of Severinus and Tycho Brahe in the late 16th century, it still constituted an important part of natural philosophy in the 17th century, especially in connection with chemistry. At the University it was largely confined to iatrochemistry. Caspar Bartholin and Ole Worm conducted chemical experiments at home, but these focused on mineral medicaments and were separated from the Neo-Platonic, Hermetic and magical aspects of the Paracelsian tradition. As described in Chapter Five, Worm had turned against the Rosicrucian movement and many of the notions these currents shared with other 'occult' (to use a broad term) philosophies of the age - the esoteric notion of secret knowledge restricted to groups of initiates, the inseparable connection between religion and natural philosophy, and the promise of a

[1103] As noted by A. Ziggelaar in Nicolaus Steno, *Chaos* (1997), 12f.

revelation that with one blow would uncover all secrets of nature. While employing iatrochemistry in his medical practice,[1104] Worm avoided public identification with Paracelsianism as evident in the examples of his connection with Ambrosius Rhodius and the attempt to publish the manuscripts of Severinus. Paracelsianism and Hermeticism and other animist traditions that operated with a connection between the macrocosm of the universe and the microcosm of man were thus banished from the culture of the Bartholin-circle, but were carried on outside the university - by Ambrosius Rhodius in Kristiania and at Court where the court alchemist, Peter Payngk adhered to the Hermetic tradition.[1105]

When Frederik III ascended the throne in 1648, alchemy, and the traditions connected to it, won new popularity and potential for patronage. Alchemy was one of the great interests of the new king; he greatly enhanced the salary of the new royal alchemist, the German Kaspar Herbach (1600-1664), he worked in the laboratory himself, and in 1655 a chemical laboratory was established at Copenhagen Castle. Furthermore, Herbach was sent to Amsterdam to acquire medical and alchemical prescriptions from the famous Johann Glauber.[1106]

Now, also a great Danish propagator of Paracelsianism emerged, namely Ole Borch (*Olaus Borrichius*, 1626-1690).[1107] He began his studies at the University of Copenhagen. His starting point was philological, but under the influence of Worm, Thomas Bartholin and Simon Paulli, he began to study medicine. What is most striking is the fact that Borch, already before he went abroad, became convinced of many ideas of Renaissance philosophy that were not part of the natural philosophy of his teachers (although they were undoubtedly known to them). It would be interesting to establish, whether Borch only developed these ideas from books or if there were someone in his environment in Copenhagen (perhaps

[1104] A number of Paracelsian remedies are also included in the Farmakopæ published by Thomas Bartholin.

[1105] Fjelstrup, *Payngk*, passim.

[1106] Fjelstrup, Guldmagere.

[1107] The best introduction to Borch in English is H.D. Schepelern's introduction to *Olai Borrichii Itinerarium*. Cph. 1983, although Schepelern follows the old tradition of neglecting the occult traditions of early modern natural philosophy. For those who read Danish, Fink-Jensen's unpublished dissertation (1997) remedies this.

even members of the Bartholin-circle) that inspired him.[1108] In the lack of such studies, we can only notice that Borch's first treatise from 1649 contained many ideas that were well known around Europe, but since the death of Severinus (apparently) had been neglected from the culture of the professors. In a treatise written while he was a student,[1109] Borch expresses the conviction that words, pictures and signs may contain certain hidden powers and also adheres to the idea of Ficino and others that music equally may contain hidden powers. On the other hand, Borch rejects Jewish Cabala and the idea that Man can manipulate the macrocosm. In this treatise, undoubtedly because of his awareness of the dangerous waters he was sailing, Borch is also very careful in not offending academic and religious authorities. Aristotle is praised, and the views of leading Danish theologians like Niels Hemmningsen and Jesper Brochmand are emphasized.[1110]

Borch's treatise was dedicated to the Lord Steward Joachim Gersdorff, and in 1655 he was employed as a teacher in Gersdorff's household and gained access to Gersdorff's library and laboratory. It was probably here Borch's interest in chemistry was stimulated. It was undoubtedly also Gersdorff's patronage that secured Borch the designation to a university chair in philology in 1660, but reflecting Borch's (as well as Gersdorff's and Frederik III's) interests, the appointment also included an extraordinary chair in chemistry and botany. Before he began to teach, however, Borch was sent on an academic peregrination that took him to the Netherlands, England, France, and Italy.

Borch's travel diary has been published (alas, not in translation) and gives a fascinating insight to the European community of learning in this period.[1111] In almost every town there was a man of learning whose museum or collection had to be visited, and with whom he could discuss matters of learning. The journey also included a good deal of sheer tourism, but one of the most striking aspects of Borch's diary is the fact that the observation of everyday phenomena often leads him to reflect on natural philosophy.

[1108] Unfortunately, Fink-Jensen (1997) does not treat this problem thoroughly, probably due to lack of extant sources.
[1109] *De Cabala Characterali* (1649).
[1110] E.F. Koch, 14f.
[1111] *Olai Borrichii Itinerarium 1660-1665. The Journal of the Danish Polyhistor Ole Borch*, 4 vols., ed. by H.D. Schepelern. Copenhagen-London 1983.

We have already seen how both Severinus and Caspar Bartholin were convinced that much could be learned from common man and everyday phenomena. This attitude was also shared by Ole Worm, and expressed by Thomas Bartholin in his treatise on medical travel.[1112] Likewise, Borch made useful observations en route to academic institutions, museums and libraries. Observations of everyday phenomena, such as the dyeing of stockings in Amsterdam or peasants spreading manure on his road to Oxford led to reflections on chemical processes.[1113]

As always, Borch's peregrination brought him in contact with religious opinions that differed considerably from Orthodox Lutheranism at home, and it has been claimed that he moved far from that religion.[1114] In all cases, the peregrination brought him into contact with the international European culture of alchemy, and during visits to the museums of physicians and learned gentlemen he got hands on many chemical recipes. In Amsterdam Borch met the Italian hermeticist, alchemist, and (according to many) charlatan Francesco Guiseppe Borri (1625-1695), who in 1661 had been burned *in effigie* by the Inquisition in Rome. Borch was greatly impressed by Borri, and through Borch and his connections with Gersdorff, Frederik III employed the Italian as a court alchemist in 1667.[1115] Anders Bording, the editor of the first Danish newspaper, *Danske Mercurius*, had earlier stamped Borri as a charlatan (January 1667),[1116] now, when Borri arrived in Copenhagen with royal support, he was warmly welcomed, and when he managed to cure one of the leading noblemen of the realm, Bording exclaimed:

What does Hippocrates or Galen matter now?
Borri with his art here rises far above.[1117]

With Borch and Borri, alchemy, Paracelsianism, and Hermeticism took a prominent role in the culture of natural philosophy in Copenhagen in the late 1660s. Its close connection to the

[1112] Bartholin (1961), 92.
[1113] Borch, III, 7.
[1114] J. Glebe-Møller, 'Lutheraneren Ole Borch, *Borchs Kolegium 1691-1991*
[1115] Fjelstrup, *Guldmagere*, 109.
[1116] The newspaper has been published by Paul Riess, *Anders Bording. Den Danske Mercurius 1666-1677*. Cph. 1973.
[1117] Bording (1973), 47 (February 1, 1668): "*Hvad vil Hippokrates, hvad vil Galen nu sige? Her Borri med sin Kunst langt høj're veed at stige*".

King himself, made it far more prominent than what took place within the Bartholin-circle, who was never mentioned by *Danske Mercurius.* As we shall see below, the two traditions co-existed peacefully, and now a third one emerged, namely Cartesianism and the mathematical and natural philosophical theories derived from it.

3. The Emergence of Cartesianism in Copenhagen

After the reign of Tycho Brahe that gave astronomy and mathematics an unheard of prestige in Denmark, astronomy had sunk back to its traditional position at the faculty of philosophy where also physics was found. No one denied that the subjects taught at the faculty of philosophy were fundamental to the learning of the higher faculties of theology, medicine and law, but in terms of prestige as well as salaries[1118] it was in the lower end of the academic hierarchy. Its applications in navigation and commerce attracted a number of students to mathematics such as Thomas Fincke and Dybvad, but as soon as they got the chance they changed to a more prestigious discipline, *in casu* medicine and theology respectively. Also Rasmus Bartholin, who was much more interested in mathematics than in medicine was persuaded by his family to take a degree in medicine, and later a chair.

But Rasmus Bartholin's enthusiasm for mathematics reflected the fact that in mid-seventeenth century Copenhagen mathematics increasingly gained popularity, and also began to influence other areas than astronomy. The main reason for both the increasing interest in mathematics and its application in various areas of natural philosophy was, of course, due to the rise of Cartesianism.[1119] In mid-seventeenth century the university of Leiden was a favourite stop for almost any kind of Danish student (including noblemen and theologians), but among students of mathematics and medicine, its importance was paramount.[1120] As René Descartes was connected to Leiden from 1630 and had his *Discours de la methode* published there (1637), it is not surprising that Carte-

[1118] A professor in medicine in Copenhagen received almost double the salary as a teacher in the Faculty of Arts.

[1119] A treatment of Cartesianism in Denmark included in chapter 5 of the new history of Danish philosophy (Ebbesen and Koch 2003), but from a different perspective that the account given in the present work.

[1120] Helk (1987), 42f; Helk (1991), 84f.

sianism caught the attention of Danish students and professors at a very early time. During his visit to Denmark in the summer of 1631, of which we know almost nothing, Descartes apparently did not come in contact with the Bartholin-circle, but already in the summer of 1638, Ole Worm was interested in the *Discours* (which had then only appeared in French) and had it sent from Thomas Bartholin in Leiden.[1121]

It has been claimed that students arriving at Leiden in the 1640s, no matter what faculty they belonged to, had to choose for or against Descartes.[1122] Thomas Bartholin studied in Leiden 1637-40, and a few years later he was followed by his brother Rasmus (1625-1698), who studied there 1644-51 at the same time as Christiaan Huygens. To both brothers, the choice for or against Descartes did not present itself as difficult. On the hand they saw hot-headed and cantankerous Calvinist theologians and sinister Jesuits, on the other courteous philosophers and physicians. Descartes, the moderate but open-minded gentleman was a character they could sympathise with, even before they had read the *Discours*. In their letters home they soberly described the conflicts raging around Descartes in Leiden and Utrecht, but their sympathy for Descartes is clear, and the positive reaction to Descartes by Ole Worm only strengthened this view.[1123] In 1647 Rasmus Bartholin described Descartes as a *"Phoenix among mathematicians"*, and when Descartes died he wrote a (rather bad) epitaph.[1124]

Apparently, Cartesianism was introduced in Copenhagen without any great controversy. In the light of the great opposition to Cartesianism in most European countries and the vehement contentions it aroused at several universities, among them Uppsala as we shall see in the next chapter, the problem seems not so much to explain that Cartesianism was adopted by Danish natural philosophers, but rather why it could be done without any apparent furore. In order so answer this question, it will be useful to take a brief look at the general, mainly theological, objections to Cartesianism.

[1121] OWB II, 75, 92, 102, 103.
[1122] C.L. Thijjsen-Schoute, 219f.
[1123] OWB III, 308; on Bartholin's general antipathy towards Jesuit fanaticism, see OWB III, 425. Courteous Jesuits, on the other hand, he often acquainted and discussed natural philosophical problems.
[1124] OWB III, 274, 436.

The main reason for Cartesian controversies in most Western European countries was an existing tension between different religious groups regarding dogmatic issues connected to metaphysics like the Eucharist, Predestination and the relationship between faith and reason. These tensions obviously also had social and political implications. In the Dutch Republic and in France the conflict was to a great extent provoked by the existence of a substantial heterodox minority. In the Netherlands the conflict stood between the liberal Remonstrant Church (Arminians), which had originated in Leiden, and the Anti-Remonstrants (Gomarists) who defended the Calvinist doctrine of predestination.[1125] The first group was supported by the Republican party (Oldenbarneveldt and later the Witt brothers), the latter by the house of Orange. In France the conflict was primarily between Jesuits and Jansenists, while the stimulus for the contentions in Uppsala, treated in the next chapter, was the theologians' fear of syncretism.

No such conflicts existed in Denmark due to the government's tight control of the church and the University ever since the Reformation. Common men and certain vicars might express heterodox views, and a surge of religious enthusiasm had struck Jutland during the 1620s, but no well-established or well-defined religious minority existed that might threaten the stability of the realm. Likewise, natural philosophy as well as philosophy in general was eclectic rather than dogmatic, as we have seen from Caspar Bartholin's manuals on metaphysics and other philosophical disciplines as well as the approach to natural philosophy expressed by the Bartholin family.

The good connections of this family also secured that Rasmus Bartholin could prepare the ground for Cartesianism. Before he published Schooten's introduction to Cartesian geometry, Bartholin conferred with Worm.[1126] With his usual cautiousness, Worm decided to take the matter to the Royal Chancellor, Christian Thomesen Sehested. When the Chancellor was delighted of the project, Bartholin carried on the work. The close relationship between University and government thus ensured that Cartesianism, at least Cartesian geometry, got government approval before it

[1125] For detailed accounts of Cartesianism in the Dutch Republic, see Louise Thijssen-Schoute, *Nederlands cartesianisme*. Amsterdam 1954 and Paul Dibon, *La philosophie néerlandaise au siècle d'or*, vol. 1. Amsterdam 1954.
[1126] OWB III, 412, 414, 424ff., 434ff.

was officially introduced. Rasmus Bartholin's collection of Cartesian treatises from 1659 was dedicated to Sehested, and ten years later the treatise on the Iceland crystal was dedicated to the King himself.

But what kind of Cartesianism did Danish natural philosophers actually embrace? Within the Bartholin circle it was certainly not the metaphysical foundations of Descartes' thinking that initially caught their interest. It was not the *Meditationes,* but the *Discours* and later the posthumously *Tractatus de homine*, which was published in 1662. Regarding the *Discours*, we must bear in mind that the way the work presented itself to Descartes' contemporaries differed considerably from the way it is presented to modern students of philosophy. For a long time Cartesianism has generally been presented to students as a coherent philosophical system centred on a new scientific method, which laid the foundations of modern science by sharply dividing spirit from physical matter. The *Discourse on Method* is on the reading list to any undergraduate course on the history of philosophy in the Western world and is provided by the university bookshop in a handy student edition. What have been left out of the student edition of the *Discourse* are the three scientific treatises (*La Dioptrique, Les Météores*, and *La Géométrie*) to which the *Discourse* itself was an introduction that only amounted to about one eighth of the volume.[1127] It was certainly these treatises that caught the attention of the Danish natural philosophers rather than the *Discourse* itself. In the first reference to Descartes by a Danish natural philosopher, it was the treatise on meteors that awoke the interest of Ole Worm,[1128] and afterwards it would be Descartes' geometrical and optical works that would be of main interest to Rasmus Bartholin, as we shall see below.

Bearing in mind that natural philosophy at the University of Copenhagen was centred on medicine and astronomy and represented an eclectic approach that accepted new theories without totally abandoning the general framework of Aristotelian physics and Galenic medicine, it is no great surprise that the Danish fol-

[1127] In the standard edition of Descartes' works, *Oeuvres de Descartes*, ed. Charles Adam and Paul Tannery. Paris 1897-1913, the *Discourse* itself thus amounts to 78 pages, while the so-called 'appendices' (the treatises) number 539 pages; later the treatise on geometry was published separately.
[1128] OWB II, 75., 92, 102.

lowers of Descartes took a special interest in Descartes as a geometrician and anatomist. Radical Cartesians like Henricus Regius, who attacked Aristotelian physics by abandoning the concept of substantial forms, were only despised as troublemakers or, even worse, as *"Socinians"*[1129] - a name given to all who emphasised rationality too strongly, often with radical religious and political implications. Danish students and professors did not embrace Cartesianism as a means to attack Aristotelianism, religious dogma or indeed social order, but rather sympathised with more moderate Dutch Cartesians like Jacob Gollius and Frants van Schooten the Younger,[1130] who concentrated on Cartesian geometry, as well as with Cartesian supporters like Adrian Heereboord and Johannes de Raei, who propagated the empirical and open-minded study of nature that, in their view, had characterised Aristotelianism before it was corrupted by Scholasticism.[1131]

Although men like Heereboord and de Raei belonged to the Cartesian camp, their critique of Scholasticism and particularly 'Aristotelian dogmatism' was connected to movements that preceded the emergence of Descartes and which - as we saw in Chapter Five - influenced Ole Worm as well. This is evident in Heereboord's attempt to separate theology and philosophy, and in his account of two natural philosophical traditions: One that studied nature itself, and one that clung to the authority of a single philosophical tradition. The first was represented by Aristotle, the other by the long tradition that had taken over his views and was more concerned with commenting on them and coupling them to theology than with the study of nature itself. Thus, Cartesians like Heereboord and de Raei did not picture themselves as anti-Aristotelian any more than did Jacopo Zabarella or Theodor Zwinger. What they protested against was a dogmatic and perverted Scholasticism that mixed the study of nature with theology, and Ole Worm shared this view.[1132]

[1129] Borch, 9 March 1661; see also OWB III, 308. For a discussion of Socianism, see Nordström (1924), XCIV-CIV and E.M. Wilbur, *A History of Unitarianism. Socianism and its Antecedents.* Cambridge, Mass. 1946. On 'Socianism' in relation to Cartesianism, Lindborg (1965), 48ff.

[1130] OWB #1582

[1131] Lindborg (1965), 34-42.

[1132] It is, however, hardly true that de Raei attempted to create a synthesis between Aristotelianism and Cartesianism, see Lindborg (1965), 42.

What made Descartes agreeable to a man like Ole Worm, probably unqualified to appreciate the Frenchman's brilliant mathematical talent, was his moderation. He was seen as a gentleman who did not intend to create religious or political upheaval, while at the same time accepting recent natural philosophic theories and making contributions of his own. This impression was reinforced by Rasmus Bartholin's personal experiences with Descartes, and in the correspondence between Worm and Bartholin, Descartes is always mentioned as *Monsieur.*[1133] So, the theories put forward in the treatises of the *Discours* and later in de *Traité de l'homme* were accepted as stimulating by Ole Worm and his circle. While his opponents were seen as the well-known bread of cantankerous and dogmatic theologians and philosophers, Descartes was considered a gentleman, he might be wrong on various issues, but he was regarded as being worth listening to and consulting. This was also important when he accepted controversial theories like heliocentrism or Harvey's theory of the circulation of the blood.[1134]

Living under the aegis of succesful patronage and with a clear *de facto* demarcation line between theology and natural philosophy, the members of the Bartholin family had little use of Cartesian metaphysics, which would not be applicable to the theologically orientated teaching at the Copenhagen Faculty of Philosophy. However, Cartesian theories on optics and other natural phenomena naturally implied a revaluation of the possibilities of mathematical description. As we have discussed previously, following the view of Aristotle that regarded natural philosophy as an investigation of (what would later be called) 'substantial forms', the traditional scholastic view on the status of mathematics held that it could only be an aid to physics (and inferior to it). It was useful in astronomy, in the discussion of the supposedly unchangeable superlunary world, where physics could not be applied, but it could only present hypotheses that would save the phenomena, not warrant true knowledge itself. Neoplatonists like Longomontanus had more faith in the truth-value of mathematical descrip-

[1133] OWB III, 308, 425, 439; Descartes' noble origin was also emphasised by the reply given to Dutch authorities by the University of Groningen, Lindborg (1965), 45.
[1134] OWB II, 181.

tion, as had Melanchthon, but these views were not reflected in the statutes of the University.

The most fundamental influence of Cartesianism on natural philosophy in Denmark was that it resulted in a revaluation of mathematics. Like many contemporaries, some Danish natural philosophers came to regard mathematics as a way to establish non-disputable truths rid of any confessional or social implications. Surely, the age could show a number of other natural philosophers, Galilei prominent among them, who proposed a study of nature based on mathematical description. Later on, both Rasmus Bartholin and Steno stood in contact with Vincenzo Viviani and the Academia del Cimento in Florence, and thus with the tradition from Galileo and Italian mathematics, but initially the influence from Descartes and his Dutch pupils was undoubtedly more important. In a disputation from 1644, i.e. before he became acquainted with Cartesianism abroad, Rasmus Bartholin discussed the status of mathematics. In this dissertation on *Five mathematical Problems,*[1135] Here Bartholin asks whether mathematics is a science (*scientia*) and preferable to physics.[1136] He is affirmative in both cases. While mathematical principles like those of Euclid are beyond dispute, physics is constantly suffering from controversy, and even the most erroneous opinion can find a defender and everybody will stick to his own opinion.[1137] Bartholin may or may not have written the treatise himself, but at least the questions discussed must have been accepted by his supervisor, Longomontanus. What matters is that in 1644, before he went to Leiden, Bartholin could propagate mathematics as a way to ensure indisputable scientific truths and these opinions were obviously sanctioned by leading natural philosophers at the university like Ole Worm and Christian Longomontanus.

Afterwards, Rasmus Bartholin turned into a prominent propagator of Cartesian mathematics, and was recognised, sometimes criticised, as such by his contemporaries. In 1651 he published his Leiden-teacher Frants van Schooten's introduction to Cartesian geometry,[1138] and when five years later he returned to Copenhagen

[1135] Rasmus Bartholin, *Problematum mathesos* ΠΕΝΤΑΣ. Cph. 1644.
[1136] Ibid. Problemata I and II.
[1137] ibid, Problema II.
[1138] *Principia matheseos universalis seu introductio ad geometriæ methodum Renati des Cartes.* Leiden 1651.

and took over the chair in mathematics, he introduced his students to Cartesian geometry.[1139] In 1659 he published a collection of treatises on Cartesian mathematics, which also included the posthumous works of the French Cartesian mathematician Florimond de Beaune.[1140] In 1669 followed his *Experiments with the double refracting Iceland Crystal*, which was clearly stimulated by Cartesian discussions on the nature of light,[1141] as well as his strong belief in the vital importance of carefully conducted experiments that he had expressed in a treatise the previous year.[1142] His small treatise contains a systematic and progressive geometrical observation of the phenomena of double refraction in a piece of 'Iceland crystal' (calcite spar), while his attempt to determine the nature of the mineral also leads him to chemical experiments. In his final hypothesis he leans himself to Descartes' theory of corpuscles, but Bartholin's experiments were to have great importance to future discussions of the nature of light. In the treatise itself, he describes how the shape of the piece of crystal can be reproduced by folding a piece of paper, and later pieces of Iceland crystal were sent to natural philosophers in Hamburg, London, and Paris.

Rasmus Bartholin's friend, the Dutchman Christiaan Huygens got hands on a piece of the crystal. He re-conducted and improved Bartholin's experiments, and the double refraction was an important step towards his theory that light moves in waves.[1143] Bartholin's observations on light were also important to his student Ole Rømer (1644-1710). When the French astronomer Jean Picard in 1671 returned from Denmark to the *Académie Royale des Sciences* in Paris, he not only brought with him Rømer, but also a piece of Iceland crystal. At that time French natural philosophers led by Jean-Dominique Cassini were engaged in systematic astronomic observations, among them observations of the moons of Jupiter. As a student of Rasmus Bartholin, Rømer not only took

[1139] As evident from *Dissertatio mathematica, qva proponitur analytica ratio inveniendi omnia problemata proportionalium, præsertim vero harmonice proportionalium.* Cph. 1657.

[1140] *Principia matheseos universalis, seu introductio ad geometriæ methodum Renati des Cartes.* Amsterdam 1659.

[1141] Rasmus Bartholin, *Experimenta crystalli islandici Disdiaclastici qvibus mira & insolita refracto detegitur.* Cph. 1669.

[1142] Rasmus Bartholin, *De Experimentis*, Cph 1668, and also *De hypothesis physicis.* Cph. 1669.

[1143] Christiaan Huygens, *Traité de la lumière.* Paris 1690.

interest in the motion of the celestial bodies themselves, but also in the nature of light. By observing the moons of Jupiter, and the irregularity between their entrance (immersions) into and exit (emmersions) from its shadow, he could finally conclude that the actual time of emergence of one of the moons from this shadow depended on the distance between the earth and Jupiter. Thus, Descartes could not be right, when he followed the traditional view, that light spreads instantaneously,[1144] but the background for Rømer's discovery was an interest in the phenomenon of light rooted in Cartesian geometry and taught to him by Rasmus Bartholin.

4. The Diversity of Natural Philosophy

So, from the middle of the 17th century, the culture of natural philosophy around the University of Copenhagen was very much alive and diverse. It was centred on three distinct traditions - the anatomical tradition of Thomas Bartholin and Simon Paulli, the chemical traditions containing numerous Paracelsian and Hermetic ideas presented by Ole Borch and Guiseppe Borri, and finally the great interest in a mathematical description of nature represented by Rasmus Bartholin and later by Ole Rømer, inspired by Cartesianism but increasingly questioning specific Cartesians theories. Sometimes, of course, these traditions would overlap, but one might expect that the essential incongruence between the underlying metaphysics of Cartesianism and Hermeticism would provoke animated discussions. This, however, was not the case, and part of the reason for this must undoubtedly be sought in the fact that both traditions were accepted and supported by patrons of court.

Furthermore, they were connected to distinct disciplines at the university - medicine, chemistry (now an independent discipline) and mathematics respectively. The general philosophical framework taught at the Faculty of Philosophy was still Scholastic (or rather eclectic Scholasticism), which left room for neither Cartesian metaphysics nor Chemical Hermeticism. Why should it? Despite the prestige of natural philosophy, the main purpose of

[1144] Rømer's discovery was presented to the French Academy on Novemer 21, 1676, and published in the December issue of the *Journal des Sçavans*, and a translation was brought in *Philosophical Transactions* in 1677. See also A. I. Sabra, *Theories of Light from Descartes to Newton*. London 1967.

the University was still to train future clergymen. Furthermore, as Roy Porter has warned us, we should take care not to be misled by formal curricula.[1145] Those whose family background or abilities enabled them to study nature beyond the teaching of the faculty of arts could do this at universities abroad or through their intercourse with professors like the Worms and the Bartholins, who had students lodging in their homes.

We have the privilege of being able to have a look into the subjects discussed by natural philosophers in Copenhagen outside the lecture room in the late 1650s. In the spring of 1659, the medical student Niels Stensen (Nicolaus Steno) began a manuscript of 'student notes', the so-called *Chaos-manuscript,* mostly excerpts from books he had read, but with his own commentaries.[1146] Apart from throwing light on Steno's individual development as a natural philosopher and deeply religious person, neither of which is our concern here, the manuscript reflects the discussions that took place within the circle of natural philosophers in Copenhagen outside the lecture room. When Steno began his manuscript, Copenhagen was besieged by the Swedish army, and the university had been closed for well over a year. So, instead of focusing on one discipline, Steno makes excerpts from authors within a wide range of topics. His natural focus is medicine and its various sub-disciplines - anatomy (Jean Pecquet) and chemistry, particularly iatrochemistry (Johann Glauber, Matthias Untzer). While Thomas Bartholin was his præceptor, he was not in town, and Steno's most important teacher in medicine was undoubtedly Ole Borch, who, as we have seen, took a strong interest in chemistry, Hermeticism and the more philosophical aspects of natural philosophy. Thus, we find Steno making an excerpt from Borch's transcription of Gassendi's philosophical atomism, and as long as

[1145] Ridder-Symons (1997), 533f.

[1146] The entire Chaos-manuscript with excerpts has been published with an English translation: *Chaos. Niels Stensen's Chaos-manuscript,* ed. August Ziggelaar. Cph. 1997. As Steno converted to the Catholic church and in the last part of his life departed natural philosophy for a life devoted to religion, he has either been studied as a religious person by Catholic scholars, or as a natural philosopher, mostly by Protestant historians of science, who generallt has regarded his conversion as a fall from grace. In my opionion, no biographer has as yet been qualified to comprehend both sides of Steno, though excellent scholarship has been done. The pionéer in Catholic scholarship on Steno was Gustav Scherz, see Scherz (1987-88). For a recent biography on Steno as a scientist see Kardel (1994).

Steno is in Copenhagen, Borch is an important interlocutor, whom he often cites.

However, reflecting the various views existing among natural philosophers in Copenhagen, we also find Steno taking interest in quite a different kind of natural philosophy. In my opinion, the Chaos-manuscript reflects a growing interest in Cartesianism that can hardly have come from Borch. Traditionally, Rasmus Bartholin was seen as the great mentor for Steno. This has been dismissed by modern historians, on good grounds since there is no evidence of any direct connection between them. But the growing interest in Cartesianism might very well have come from Rasmus Bartholin, who (at least according to the lecture lists) was the only teacher to continue his lectures in the academic year 1658-59. Another source that sparkled Steno's interest in Cartesianism may have been his reading of the medical treatises of Pierre Borel, who included a biography of Descartes in the 1656 edition of one of his books.[1147] Anyhow, the influence of Cartesianism on young Steno is evident.[1148]

The development is interesting. First we find Steno making excerpts from books on various physical problems, such as Athanasius Kircher's book on magnetism and Ismael Boulliau's book on light. Magnetism and light were of course some of the phenomena to which mathematics was applied in the 17th century, and already in the beginning of the manuscript, Steno makes a note that he must take a look at Descartes' philosophy.[1149] Further on, it is evident that Steno is familiar with many Cartesian concepts and theories. Thus, we find the theories on the elements by Descartes (as well as Regius) implicit in Steno's commentaries,[1150] and also his celebrated observations of the shapes of snowflakes are based on Regius.[1151] Later, we find Steno rejecting the criticism of Descartes' theory of vortices raised by Christian Nold.[1152]

Since we are concerned with natural philosophy in Denmark, Steno's attitude to Cartesianism and a geometrical description of physical phenomena after his departure shall not be elaborated

[1147] *Historiarum et observationum medico-physicarum Centuriæ IV.* Paris 1656.
[1148] Ziggelaar gives various examples of this, see *Chaos* (1997), 472.
[1149] *Chaos*, col. 3.
[1150] *Chaos*, col. 26.
[1151] *Chaos*, col. 27; cf. with Regius, *Philosophia Naturalis*, ch. 7.
[1152] *Chaos*, col. 97.

here. What can be noticed is that Steno as a student in Copenhagen in 1659 was influenced by two fundamentally different orientations within natural philosophy. On the one hand the Hermetic and Paracelsian tradition represented by Ole Borch and Borri with its essentially vitalistic view on nature, on the other by Cartesianism and the mechanical sciences, with their separation of spirit and latter, which was directly opposed to the kind of natural philosophy propagated by Borvh. To use a well-known, though somewhat simplistic, term, it was the meeting of 'occult and scientific mentalities'.

The difference between the two traditions was not as rigid as one might believe, since both were strong advocates of observation and experiment. In Steno's notes, however, there is one aspect that shows the essential difference between the 'new' natural philosophy and the traditions carried on by Borch. Rather than specific opinions on various natural phenomena it is the shape of scientific discourse. The works of Ole Worm, Thomas Bartholin and Ole Borch are filled with classical and Scriptural quotations and analogies that to the modern reader seem to be of little relevance to the subject matter. The discourse of younger men like Rasmus Bartholin, Steno and Ole Rømer appears radically more matter-of-factly. This change of style is partly connected to the rise of modernity. Worm and Thomas Bartholin were brought up with the notion that modern natural philosophers stood on the shoulders of giants. As seen above, Bartholin was eventually led to have little regard for the achievements of ancient natural philosophy compared with those of the moderns, but old habits are hard to get rid of, and Aristotelian physics and Galenic medicine still constituted an important point of reference. Furthermore, the elder generation adhered to a humanist ideal that put value in being well read and versatile both in the Bible and in the classics. In Rasmus Bartholin, Steno and Rømer almost every reference is to seventeenth-century scientists. In the Chaos-manuscript Steno refers to around one hundred authors.[1153] Of these only twenty belong to the period before 1600, the rest belong to his own century.

More important than the citation of such sources, however, is a new ideal of how to conduct a scientific discourse and what con-

[1153] H.D. Schepelern (ed.), *Niels Stensen. A Danish Student in his Chaos-Manuscript 1659.* Cph. 1987.

stitutes a scientific argument. There can be little doubt that the more systematic treatment of scientific problems by Rasmus Bartholin, Steno and Rømer was due to the analytical method of Cartesianism. It is striking that a natural philosopher only one year younger than Rasmus Bartholin, namely Ole Borch, who found little use for Cartesianism, did not adopt this new scientific discourse. Thus, Steno after a discussion with Borch criticises his teacher's lack of stringency: "*Another time when a conservation is made, one topic should be kept to and all grounds for and against what is propounded should be put forward and harmful leaping from one thing to another should be avoided, particularly in the case of Borch*". Later, he also criticises "*those who in regards to physical phenomena want to demonstrate by means of similarities*" as well as those who (like Nold in his critique of Descartes) "*argue from God's power*".[1154] Of course, this difference in the view on analogies also reflects the different metaphysical foundation between Cartesianism and Borch's chemical Hermeticism. Believing in a correspondence between various parts of nature, analogies *did* constitute valid scientific arguments to Borch, but as always discussions on natural philosophy in Copenhagen never got to the bottom of such metaphysical differences.

As it were, natural philosophy in Copenhagen focused on specific observations and experiments rather than general explanations. Thus, the outcome was a multitude of observations within all areas of natural philosophy without any attempt to establish comprehensive theories of explanation. Nowhere is this more evident than in the illustrated scientific journal, the *Acta Medica & Philosophica Hafniensia*, published by Thomas Bartholin from 1671 until his death in 1680. It was issued five times a year and contained, mostly short, articles by all members of the Danish culture of natural philosophy - his brother Rasmus Bartholin and his son Caspar Bartholin the Younger, Ole Borch, Simon Paulli, Holger Jacobæus, and Steno. Also foreigners such as the Englishman E. Tyson and the Germans Daniel Protter and J. Volckamer contributed.

Amazingly, no serious study has yet been undertaken of this journal. We know therefore nothing of how many copies were printed, how it was circulated and who were its intended readers.

[1154] *Chaos*, col. 23, 96 and 97.

Perhaps educated men at court and some clergymen and nobles were able to appreciate it, but its Latin articles can hardly have found many readers in the realms of the Danish king. Rather it was intended for the general European community of learning, whose appreciation always was so dear to Thomas Bartholin. In the previous years he had already published a number of collections of letters, observations and documents, not only his own but also those of other Danish natural philosophers, particularly members of his own family.[1155] At that time both the *Transactions of the Royal Society* as well as the *Journal des Sçavans* had appeared, and Bartholin probably saw the advantages of such periodicals. Tormented by ill health and by the fact that his numerous unpublished manuscripts had been destroyed by fire in 1670,[1156] Bartholin probably tried to assume the same role as co-ordinator and publisher as men like Marin Mersenne in Paris and Henry Oldenburg in London.

There is no hint that the publication was intended to play a part in the game of patronage. The first issue is not dedicated to the King or any other potential patron, but to the 'Curious reader' (*Lectori curioso*).[1157] Thus, there are good reasons for seeing the publication of the *Acta Medica* as another example of Bartholin's identification with the European community of learning at a time when connections between natural philosophers in Copenhagen and the most important centres of natural philosophy abroad were stronger than ever.

Traditionally, Danish natural philosophers had primarily corresponded with colleagues in Basel and the Netherlands. Dutch natural philosophy was still important, but in the second half of the 17th century regular contacts were also established with circles of natural philosophers in Paris, London and Florence. From 1655 Rasmus Bartholin corresponded regularly with Galileo's pupil Vincenzo Viviani in Florence, whom he had met on his peregrination

[1155] e.g. *Cista Medica* (1662), *Epistolarum Medicinalium* I-IV (1663-1667), and *Misciellenae curiosa medico-physica* (1671).

[1156] See Thomas Bartholin, *De bibliothecae incendio dissertatio ad filios.* Cph. 1670, where he described the calamity from the viewpoint of Stoic moral philosophy; English trans., *Thomas Bartholin on the burning of his library and on medical travel*, ed. C.D. O'Malley. Lawrence, Ka. 1961; Spanish trans., *El incendio de la biblioteca*, ed. by J.L. Toro. Valencia 1949.

[1157] *Acta Medica* (1671), dedication.

to Italy. They exchanged information and discussed natural phenomena.[1158] Regular contacts were also established with natural philosophers in Paris. Learned French envoys in Copenhagen established contacts between Ole Worm and French natural philosophers, and when Pierre Gassendi endeavoured to write a biography on Tycho Brahe these contacts increased. Later, Jean Picard visited Denmark and took with him Ole Rømer to Paris.

English natural philosophy had generally been known to Danes through French and Dutch intermediaries.[1159] Several Danish students had paid a visit to London and Oxford during their peregrination, but during the Protectorate close relations with an England ruled by regicides had been problematic.[1160] After 1660, this changed of course, and almost every Danish natural philosopher had been around London and Oxford.

Further contacts were established when Thomas Henshaw, one of the first members of Royal Society spent the years 1672 to 1675 on an embassy to Copenhagen - "*this unpleasant corner of ye world*", as he saw it. From Copenhagen he corresponded with The Royal Society and also established contacts between Rasmus Bartholin and the society.[1161] From The Royal Society, Rasmus Bartholin not only received the *Philosophical Transactions,* but also new English books on natural philosophy (Robert Boyle) as well as letters (or copies of letters) from natural philosophers on the Continent, such as the astronomers Giovanni Cassini in Paris and Johann Hevelius in Danzig.

Henshaw and Royal Society on their side acquired books by Danish natural philosophers - Ole Worm's book on the lemming (*De Mure Norvagico*), which discussed the popular opinions that hordes of lemmings would sometimes fall down from the sky,

[1158] A transcript of this correspondance has been made by the late Gustav Schertz and is now in the Royal Library of Copenhagen.

[1159] Thus, the hundred authors recommended by Caspar Bartholin in his *De studio medico.* Cph. 1628 only included two Englishmen, see Fink-Jensen (2002), 201; for relations between Denmark and England in this period see Glarbo (1935 and 1943) and particularly Seaton (1935).

[1160] see Seaton, E: *Literary Relations of England and Scandinavia in the 17th Century.* Oxford 1935.

[1161] These letters are now in the archive of The Royal Society, but are found in microfilm in The Royal Library of Copenhagen. They have been reprinted in *Danske Magazin* 7:R, VI, 82-106.

treatises by Ramus Bartholin and Ole Borch, pieces of the Iceland crystal, as well as copies of the *Acta Medica*.

5. Absolutism and the Revaluation of Learning

From the 1650s the culture of the new natural philosophy was in many areas becoming firmly established in Copenhagen, self-confident and largely self-recruiting, equipped with a scientific journal, an anatomical theatre, an observatory and excellent anatomists, astronomers, chemists and mathematicians. Contributions were made to international discussions on anatomy, optics, astronomy, and chemistry, and close connections were established with the leading European centres of natural philosophy. As a matter of fact, from 1650 to 1670 natural philosophy in Copenhagen made contributions to natural philosophy that was out of proportion with the smallness and general cultural level of the country.

Furthermore, inspired by Descartes, as well as by Dutch and English natural philosophers, some Danish natural philosophers had intentions of spreading natural philosophy outside their small ranks and connect it to practical life. In 1650, Rasmus Bartholin wrote to Ole Worm that he had made translations of the mathematical principles of Euclid, Archimedes and others into Danish, and hoped for an opportunity to publish them, as *"I find it intolerable that other peoples through such short cuts can learn these matters, which in war and peace are the foundations of human action, while our countrymen are either ignorant of them, or must learn them late and through many detours"*.[1162] Nothing came of it, but seven years later Bartholin delivered a speech at the University of Copenhagen, where he once more emphasised the importance of the vernacular, this time in all areas of life. What he propagated was to raise the general cultural level in the vernacular to the same rank as other European countries.[1163]

[1162] OWB, III, 435.

[1163] Rasmus Bartholin, *De naturæ mirabilibus*. Cph. 1674, N. 11; Danish trans. by Carl Behrend, *Rasmus Bartholins Tale om det danske Sprog*. Cph. 1914. This translation and the Latin text is reprinted in *Danske Grammatikere fra Midten af det syttende til Midten af det attende Aarhundrede*, ed. Henrik Bertelsen. Cph. 1979, I, 1-33; IV, 33-64.

Most of the phenomena, which we can connect with the concept of *The Scientific Revolution*[1164] could thus be found in Copenhagen in the second part of the 17th century. The old triad of Aristotelian physics, Galenic medicine and Ptolemaic cosmology still lingered on in the syllabus of the University, but those natural philosophers with whom we have been concerned in this study had in reality abandoned the major part of these systems. A new mathematically based physics had been introduced, and even those who, like Ole Borch, adhered to a view of nature with radically different metaphysical foundations were strong advocates of observation and experiment. Scientific facilities and icons such as well-equipped libraries, an astronomical observatory, an anatomical theatre, and a botanical garden had been established, and the commerce in books, letters, journals and items of natural philosophy flourished.

Furthermore, and this is perhaps one of the most important aspects of any idea of *'revolution'*, the developments also seemed to influence people who did not belong to the elect few. It would be worthwhile studying the interest in natural philosophy from people who were not natural philosophers by profession. We have already mentioned certain learned noblemen, and also some clergymen and administrators constituted an audience who followed developments in natural philosophy. But also people who did not master Latin may have been interested in developments in natural philosophy. In Chapter Five we discussed layman interest in the world in connection with the discussion of curiosity. There may very well have been others, but in lack of studies of the problem we must decline to investigate it further.[1165] What is certain, however, is that men like Rasmus Bartholin took an interest in publishing natural philosophy in the vernacular and connecting it with practical life. The example of the relationship between the mercantile politics of Colbert and the *Académie Royale des Sciences* shows that it was indeed possible to combine a serious study of nature with the commercial and military aspirations of the government.

[1164] For a recent summary and contribution to this concept see Margaret J. Osler (ed.), *Rethinking the Scientific Revolution.* Cambridge 2000.
[1165] Appel (2001) and Lassen (2002) are valuable prerequisites for such studies.

But in Denmark things turned out differently. One generation after Thomas Bartholin had made his anatomical discoveries in the newly established *Domus Anatomica,* the culture of natural philosophy in Copenhagen was already in rapid decline. It was not due to the nepotism and monopoly of the Bartholin family as Danish historians of science once used to think. Neither was it because members of the new generation of Danish natural philosophers were less talented than their predecessors or caught in some theoretical blind alley. The explanation for the decline has to be found outside the culture of natural philosophy, for, as always matters external to natural philosophy eventually decided the fate of natural philosophy in early modern Denmark.

The Thirty Years' War definitively turned the power balance in Scandinavia in favour of Sweden. From its earlier position as the leading power in that corner of Europe, the Danish monarchy now found itself on the defensive against its successful eastern neighbour. In the 1640s Denmark lost some of her provinces to Sweden, and the war of 1657-1660 brought the country on the edge of extinction as an independent country. The entire country (though not all Norway) was occupied by the Swedish armies, and only besieged Copenhagen resisted. It was only the intervention of the Dutch Republic and other great European powers that eventually secured a peace that allowed Denmark to continue as an independent kingdom. Nonetheless, the damage was substantial. A third of Denmark proper, the rich province of Scania, had to be ceded and the country was ruined and plundered.

Shortly after peace was restored, a radical change of system took place. Danish historians still disagree what exactly took place and who were the driving forces and master schemers behind the change, but anyhow, by means of a bloodless coup Frederik III introduced a constitutional revolution that eventually turned into absolutism. In the aftermath of the disasters of war, it was difficult for most people to grasp the implications of the new political system, but drastic constitutional changes were introduced. The throne became hereditary, the coronation charter (*håndfæstningen*) was discarded, the Council of the Realm dissolved, and all privileges of the various estates were evoked and replaced by new ones by which the special status of the old nobility was both formally

and effectively destroyed.[1166] All these developments implied that the rule of Denmark, Norway, and Iceland no longer consisted (not even theoretically) in co-operation between various estates. Men were no longer supposed to identify themselves with a certain estate whose privileges they sought to protect and whose values and specific culture formed an integral part of their identity. From now on, all privileges were bestowed from the all-mighty sovereign, and it was he who defined the value and function of a person through the privileges and honours he bestowed on him.

Surely, absolutism did not change society overnight despite the drastic changes it introduced. Especially in terms of mentality, it took a while before people accustomed to the old ways of doing things would fully accommodate to the demands of the new regime. Town patricians, noblemen and even the King himself still had mental roots in the old system, but with the coming of a new generation absolutism was firmly anchored as a mentality that pervaded all relations between people. Christian V, who succeeded his father in 1670, was not a man of learning; neither was he a warrior prince. He was brought up to become absolute sovereign, and it was under his rule that the values of absolutism came to pervade every area of Danish society, which became what an English observer would call *"as absolute a Monarchy as any is at present in the World"*.[1167]

Nothing was more telling of Danish absolutism or fundamental to social relations than the hierarchy of ranks that was introduced from the 1670s. The first protocol of regulations issued by the new regime on 25 May 1671 divided the administrative hierarchy into rigidly defined degrees of distinction - ranks - with the royal family at the top. In this system it was the function of a person's office in relation to the royal person, which was decisive, with the result that highly placed commoners were ranked above lower-placed noblemen.[1168] On 11 February 1679 the king promulgated a set of privileges for the royal officials of non-noble extraction. This provided that appointment to certain specified offices in the

[1166] See K.J.V.Jespersen (1995), 55ff.

[1167] Robert Molesworth, *An Account of Denmark in the Year 1692.* London 1694, 73.

[1168] For a closer analysis of the system, see Niels G. Bartholdy, 'Adelsbegrebet under den ældre enevælde. Sammenhængen med privilegier og rang i tiden 1660-1730', *Historisk Tidsskrift* (Dn.) 12:5 (1971), 577-650.

royal administration conferred personal nobility, which permitted the enjoyment of aristocratic privileges and advantages on the same footing as hereditary nobility. This system reached its logical conclusion with the promulgations on rank of 1693, which also graded the nobility itself into a series of ranks, and conferred hereditary peerages on commoners occupying the three highest classes of appointment within the royal administration, equivalent to those of the hereditary nobility. Ranking, a person's position in society, was thus connected to office. This hierarchy of ranks (and thereby the absolutist Monarchy) only recognised two kinds of offices - soldiers and administrators, *tertium non dabatur*, and this was to have fundamental influence on natural philosophy in Denmark.

At first, it seems, natural philosophy was little affected by the introduction of absolutism. Initially, the University was slow in grasping the change of power and in expressing support for absolutism, but through the rhetorical virtuosity and political flexibility of professors like Thomas Bartholin and Ole Borch, this mistake was soon made good.[1169] The revolutionary changes in Danish government might as a matter of fact have seemed as little more than one of the occasional disturbances in the system of patronage. As soon as the professors had found the right tune for the new song, that is finding a rhetoric that expressed panegyric support for royal sovereignty and divine right, business seemed to be going on as usual. As we have seen above, it actually did so in the first decade after the introduction of absolutism in 1660 when the culture of natural philosophy in Denmark reached its zenith.

This delusive sense of continuity was also furthered by the fact that most of the leaders of the absolutist regime in the 1660s and early 1670s were the same men, who had been patrons of natural philosophy before the constitutional revolution, such as Frederik III himself and the Lord Steward Joachim Gersdorff. These were men of learning who to a certain degree venerated learning for its own sake. So, apparently, did the rising star in Danish politics in these decades, Peder Schumacher, later ennobled as Griffenfeld, who had studied at the University of Copen-

[1169] See Olden-Jørgensen (1996) for a study of the occasional poetry by Bartholin, Borch and others concerning the introduction of absolutism in 1660.

hagen as well as at a number of academies in Western Europe, and who also took an interest in natural philosophy and had been the first librarian at the newly established Royal Library.[1170]

So, in a society increasingly pervaded by the mentality of absolutism, with its focusing on a person's usefulness to the King either in warfare or administration, the goodwill from the powers-to-be secured that the exploration of the ingenious construction of the human body, the nature of light and chemical substances, the mystery of the stars above and other natural phenomena could continue. In the preface to his *Experiment on birefringent Icelandic crystal* (1669) Rasmus Bartholin dared to distinguish between two uses of the crystal and left the reader in no doubt as to his own preference:

> *Since the glory of diamond is famous to all, and since so much pleasure is taken in the display of wealth's various ornaments, gems and pearls, that they may be worn around a finger or neck, I might hope that those whose faculty of curiosity is more powerful than their sensuality will be no less affected by the delightful novelty of a certain body in the form of a translucent crystal, which has recently been conveyed to us from Iceland..*[1171]

Here Bartholin skilfully played on Frederik III's interest in curiosities and the fad for novelties, which was a general trait of European court culture in that period, in order to defend the value of natural philosophy, and the treatise itself is a systematic and thorough observation of how light is refracted in that particular mineral. Bartholin's observations are thoroughly geometrical, devoid of any rhetorical ornament or reference to the practical application of the discovery.

However, this goodwill towards the exploration of nature for its own sake vanished in the years to come. First of all, the ascension to the throne of Christian V meant that the sovereign was no longer interested in natural philosophy himself. Furthermore, most of the rising stars in the Danish government were no longer men of any profound learning. In 1655 Frederik III had spent a substantial amount of money on acquiring Tycho Brahe's observa-

[1170] For Griffenfeld see Sebastian Olden-Jørgensen, *Kun navnet er tilbage. En biografi om Peter Griffenfeld.* Cph. 1999.
[1171] Bartholin (1669), 1.

tions from Kepler's son. By means of Schumacher, the observations were carried on to Rasmus Bartholin with the express order to transcribe and publish them. Paper for publication was ordered, money were found from the churches, and Bartholin received funds so he could employ students, among them Ole Rømer, to assist him. In a letter printed in the *Philosophical Transactions* (27 February 1670) Bartholin expressed the importance of the publication *"which all true Lovers of Astronomy cannot but have a great concern for"*. Alas, just as the observations were ready for printing, after corrections had been made by Bartholin and Rømer, the old king died and Christian V ordered Bartholin to abandon the scheme and hand the observations over to Jean Picard,[1172] who brought them to the academy in Paris.

Perhaps even more import to natural philosophy in Denmark than such evident lack of royal support, was the fact that the mentality of Danish absolutism in the 1670s, and its tangible expression in the hierarchy of ranks, was based on military and administrative functions,[1173] and did not have any category for practitioners of natural philosophy as such. It was not overtly hostile (though later on the 17th-century culture of learning would be dismissed as useless) - it was simply indifferent, and in the society of absolutism, indifference from the King meant that socially you would find yourself in a blind alley. In a Utopian world, the culture of natural philosophy might have continued despite the lack of encouragement from the surrounding society, fuelled by its practitioners' identification with the project of discovering the secrets of nature. That, however, would require that the practitioners of natural philosophy were immune to the mentality of society as a whole or their prestige in that society. Needless to say, they were not, especially since the hierarchy of ranks minutely regulated relations between people.

There exists an anecdote concerning the relationship between the self-esteem of natural philosophers and absolutist realities in this period. Apparently, the story was only recorded several generations after the incident it relates, so it has no value as a source to what actually took place. Yet, it is plausible and telling of the vac-

[1172] E.C. Werlauff, *Det store kgl. Bibliothek*, 2nd. edn. Cph. 1844, 56.

[1173] See N.G, Bartholdy, 'Adelsbegrebet under den ældre enevælde. Sammenhængen med privilegier og rang i tiden 1660-173 0', *HT* (da.) 12:5 (1971), 577-650; for a discussion in German see Sønderholm (1978).

uum in which natural philosophers found themselves after Absolutism had been firmly established. According to this anecdote, professors Thomas Bartholin and Willum Worm in 1673 participated in a celebration in the guild house of the Copenhagen brewers. Here the two learned gentlemen requested the honour to lead the dance. However, to their great consternation the request was turned down since such honours were regulated by the new hierarchy of ranks, which did not include professors. Instead the honour was given to two of their own former students, who had become secretaries in the Chancellery and thereby received a rank, however low it may be. After this humiliation, Bartholin and Worm, still according to the anecdote, turned to the grand chancellor Griffenfeld to ask for a rank, but got the reply:

> *You good men have already through your merits, in this country as well as abroad, won enough of the kind of honour that becomes you. Even the King himself cannot bestow any more of this kind of honour upon you. Also I will always honour you, also more than those with rank and title, who must stand outside, when I let you in. I desire no other kind of ranks for you, and will never help you achieve them. For I foresee that the University would thereby decline. If you become more than you are supposed to, you shall no longer be what you ought to be.*[1174]

This answer implies a distinction between the honours of the world of politics and the honours gained within the world of learning. It reflected the idea of the Republic of Letters that learning constituted a sphere of its own and was very much in vein with the self-identity of the Bartholin circle. It may have been the conviction of the university-trained Griffenfeld, but it is equally plausible that it was the attitude of Erik Pontoppidan, who recorded the anecdote in the 1740s. And while Griffenfeld was rooted in a

[1174] Erik Pontoppidan, *Annales Ecclesiæ Danicæ Diplomati.* Cph. 1747, IV, 592: *"Ihr guten Männer habt bereits durch eure Verdienste, ausser so wohl als innerhalb Landes, Ehre genug von der Art, womit euch gedienst ist. Selbst der König kan euch dieser Ehre nicht mehr geben. Ich will auch eure Personen allezeit ehren und zwar von vielen andern, die Rang and Titul haben, welche derraussen stehen sollen, wann ich euch hineinlasse. Allein, einen andern Rang gönne und wünsche euch nicht, will auch niemahls dazu behülfflich seyn. Dann ich sehe zum voraus, dass ein Verderb der Universität daraus entstehen würde. Werdet ihr mehr als ihr itzo seyd, so höret ihr bald auf das zu seyn, was ihr seyd und seyn sollet".*

mentality that still appreciated learning as an autonomous sphere, even though his own learning does not seem to have been particularly profound,[1175] those who succeeded Griffenfeld after his fall from grace in 1676 did not appreciate learning for its own sake, and prestige gained within the European community of scholars was no longer a valid currency in Danish society.

Whether the anecdote holds any truth or not, its central point is true, the loss of identity by natural philosophers in a society increasingly and minutely regulated by a rigid hierarchy of ranks. As mentioned, the government accepted two kinds of offices-military and administrative. To this may be added pleasure and entertainment. If a man could please and entertain the court, he may be regarded as valuable, even though he could not gain a place in the hierarchy of ranks unless he was provided with an office.

The devaluation of natural philosophers also weakened their power to further the careers of their clients, as illustrated by the example of Nicolaus Steno, undoubtedly the most innovative natural philosopher in early modern Denmark, perhaps ever. Danish historians of science once believed that this loss to the country was due to the nepotism of the Bartholin family. As has recently been pointed out, this is far from the truth.[1176] Steno had chosen Thomas Bartholin as his *præceptor* when he entered the University in 1656, and Bartholin made any possible effort to secure the chair in anatomy for his talented student. With letters of recommendation from Bartholin, Steno set out on his academic peregrination to the Netherlands in 1659 From Leiden he told Bartholin of the anatomical discoveries he made there and sent him the treatises he wrote.[1177] His doctoral thesis from 1661 was likewise dedicated to Bartholin,[1178] and their relationship much reminds us of that Bartholin himself had had with Ole Worm. Steno showed his talents and informed his teacher of new theories and discoveries, and Bartholin made efforts to secure patronage for his young protégé. Even before he had received any proof of Steno's work, he tried to recommend him to potential patrons. Due to illness, Bartholin

[1175] Olden-Jørgensen (1999).
[1176] Olden-Jørgensen (1992).
[1177] Steno (1987), E3, E5, E6, E8, E13 and E14.
[1178] *Disputatio anatomica de glandulis.*

had ceased to dissect in 1656, and he hoped that Steno would take up the scalpel after him. As he wrote to Ole Borch:

> *I cannot sufficiently praise the diligence and good luck of our Steensen, and even though I as yet have not seen anything from his pen, which has reached the public, I have recently recommended him from his best side to the great ones as a man, to whom one can eventually entrust our (anatomical) theatre, which still is bare and dusty.*[1179]

Also Borch had faith in Steno and praised his eyesight, indefatigability, good judgement and general learning. When Steno had sent him his *Observationes Anatomicæ* (Leiden 1662), Bartholin wrote back that he had not only recommended the book to his colleagues, but also shown it to Frederik III and recommended him to the anatomical theatre.[1180] Steno himself had asked Bartholin to recommend him to Chancellor Peder Reedtz. However, in May 1662 Jakob Henrik Paulli, a son of Simon Paulli, was appointed to professor of anatomy. Young Paulli had been Bartholin's assistant (*prosector*), but there is no doubt that Bartholin had thrown his lot in with Steno, and that Paulli's appointment went counter to his efforts.[1181]

Steno and Bartholin, however, did not give up the attempt to win patronage. In 1664 Steno was back in Copenhagen where he published his work on the muscles and glands, which he dedicated to Frederik III.[1182] He conducted anatomies at home, and demonstrated his anatomical discoveries to Bartholin, Simon Paulli, Willum Worm and other members of the culture of natural philosophy in town.[1183]

However, while several of Steno's former fellow students in Copenhagen won chairs and positions in the administration, and,

[1179] Bartholin (1667), III-IV.

[1180] Steno (1987), E5, E6.

[1181] Shortly afterwards, Bartholin in a letter to Steno expressed the wish that he could once be able publicly as well as privately to gratify his young protégé, see E8; likewise he also discreetly, but conceivably took the side of Steno in his conflict of priority (concerning the discovery of the ductus parotideus) with the Dutch physician Gerhard Blasius, see Bartholin (1667).

[1182] *De musculis & glandulis observationum specimen cum epistolis duabus anatomicis.*

[1183] Mentioned in Thomas Bartholin, *De Hepatis Exautorati Desperata Causa Cum præcipuis eruditæ Europæ Medicis Concertatio.* Cph. 1666, 81, 84.

ironically, Jakob Henrik Paulli was appointed to the teaching of history, Steno did not have any such luck. There was at that time no vacancy at the University, but for well-connected men, extraordinary offices could be created. Thus, a chair was found for young Matthias Jacobæus who was supported by men closely connected to Court, such as his brothers-in-law professors Peder Scavenius and Rasmus Vinding, as well as the royal physician Simon Paulli. Scavenius had in 1656 declined a chair in mathematics and chosen to enter one in law instead. After the introduction of absolutism he got the important (and highly paid) job of collecting money for the Crown and held an important position in the administration. Rasmus Vinding was likewise important to the crown as an administrator as well as a panegyrist. Already back in the late 1630s, when he studied at Descartes' old college of La Flèche, he had written a defence of the hereditary monarchy.[1184] After his return he became one of the leading and best-connected members of the Consistorium, a member of various commissions, the Chancellery and the Supreme Court. Such men could effectively further the career of a client - the Bartholin family could not.

Thomas Bartholin could only express his continued admiration of Steno in a pair of occasional poems in connection with Steno's great book on the muscles, *Myologiae Specimen seu Musculi* etc. (1667), in which he influenced by Descartes and Spinoza attempted to give a geometrical description of the muscles:

Behold, after experiments you move the strong muscles,
And the book shows the strength of talent

And playing on classical mythology and Steno's name (da. *sten*, stone):

Deucalion has returned. You owe your beginning to a stone.
He must be a stone, who denies you.....[1185]

With money inherited from his mother, Steno once again took the road and went abroad where he won fame and patrons, and converted to Catholicism in 1667. He was back for a brief sojourn in the 1670s when Griffenfeld managed to provide him with an extraordinary chair as Royal Anatomist, but left soon after.

[1184] *Oratio de regno hæreditario et electivo.*
[1185] *Carmina varii argumenti.* Cph. 1669, 233, 235; Olden-Jørgensen (1992), 289-290.

Perhaps the marginalisation of natural philosophy was furthered by the developments of natural philosophy itself. From a modern point of view, the change of scientific discourse to a more systematic and matter-of-factly approach to scientific problems, undoubtedly appears as a great step forward towards the emergence of science as we understand it. But in terms of patronage, this change was not necessarily a step forward. When scientific discourse became disconnected to allegory and rhetoric, when it refrained from including quotations from Scripture and classical authors, as well as allegory and other rhetorical techniques, it lost some of its ability to captivate, please and delight its audience of laymen. One of the main reasons for the successful introduction of dissections in Copenhagen by Simon Paulli and Thomas Bartholin was their ability to unite anatomy with edification and theatrical effects. When members of the Court witnessed Bartholin's skilled mapping of a cadaver, they not only learned about the construction of the human body, they were also entertained and edified. Mathematics and geometry can be fascinating - if one is equipped to grasp it. Preciously few of those who governed Denmark from the 1670s were so. In order to find a footing within the new social realities, natural philosophers were bound to turn into administrators, providers of solutions to practical problems or providers of pleasing demonstrations of optical illusions, mechanical devices and similar demonstrations of their mathematical skills.

From the 1670s Danish natural philosophers certainly turned into administrators, practical handymen and entertainers. Ole Borch, Willum Worm and Rasmus Bartholin all held offices in the administration as members of the supreme court or members of various commissions. The most telling example is that of Ole Rømer, who had discovered the hesitation of light when he was at the French academy and stood in contact with leading natural philosophers among in both France and England. However, after his return to Denmark, Rømer was given an almost endless list of offices in various commissions, and had little time for natural philosophy. When university professors finally were placed in the hierarchy of ranks in 1679, it was only those who had a seat in the University senate (the *Consistorium*), i.e. those who administered the academy.

This application of natural philosophers in all areas of administration and practical life was undoubtedly a benefit to the

absolutist government (though not to the taxpayers who were burdened by the higher efficiency of tax collection). Undoubtedly, however, it also meant a fatal blow to the flourishing of natural philosophy in Denmark. Most of the philosophers mentioned above still found time to study natural philosophy after they entered the administration, but most of them eventually had to abandon university teaching in order to take care of their other obligations. Throughout his life, Ole Rømer amazingly found spare time to continue to make astronomical observations and even established a private observatory in the countryside, where he tirelessly sought to observe a parallax of the fixed stars that would once and for all prove the theory of the heliocentric system. However, after his return to Denmark, Rømer never published a single word on natural philosophy, and to my knowledge, there never was a single occasion where he publicly (i.e. outside the lecture room) discussed natural philosophy. The standardisation of weights and measures, the water supply for Copenhagen, the measurement of the countryside, these were endeavours that made Rømer dear to the regime, his search for the parallax was not.

It would be easy to picture these new conditions of the natural philosophers as a tragedy. Brilliant scientific minds bogged down by trivial practical problems, suffering in their urge for delving into the secrets of nature. I am not so certain that this was generally the case. From the time of Francis Bacon many natural philosophers around Europe had advocated the connection between natural philosophy and the practical needs of the commonwealth. We have already seen that Rasmus Bartholin was influenced by such ideas as well, and he actually applied for the office of Royal Mathematician (*Mathematicus Regius),* which he received in 1667. In his application he emphasised the use his mathematical skills could provide for Danish navigation, particularly the navy.[1186]

We have previously discussed the attraction Thomas Bartholin felt at the life of a learned gentleman. When his health failed him, he was relieved from his obligations to teach and lived at his manor in the countryside. To men like Rasmus Bartholin and Ole Borch, who could use gentlemen like Descartes, Viviani and Robert Boyle as models for the role of a natural philosopher,

[1186] MS, Royal Library, NKS 376 8°.

traditional university culture based on disputations might seem outdated and unsuited for their natural philosophy. By being connected to Court as a royal mathematician, Rasmus Bartholin could hope not only for royal favour, but also for the opportunity to connect his interest in mathematics with practical problems without being bogged down by academic duties. As it turned out, Bartholin certainly got ample opportunity to deal with practical matters, not only as a royal mathematician, but later also as an administrator, so much that he found little time for scientific studies.

Elsewhere in Europe a *modus vivendi* had been found that combined studies of natural philosophy with the growing state power's need for solutions to practical problems. The solution turned out to be the royal (or Grand Ducal, in the case of Florence) academies of science with those in Paris, London, and Florence as the most prominent examples. Nothing illustrates perhaps more clearly the indifference shown towards natural philosophy by the Danish government after 1670 than the fact that it never attempted to imitate such illustrious institutions by establishing an academy in Copenhagen. After all, it would not have been that difficult. Able natural philosophers of European fame were at hand, facilities such as an astronomical observatory, an anatomical theatre, a well-equipped library, and a scientific journal were already in existence, and so was the ideal secretary for such an academy in the energetic Thomas Bartholin with his insatiable thirst for publishing and communicating his own discoveries as well as those of others. It would be an opportunity to enhance the prestige of the realm and its new absolutist king, but it was never seized or even considered.

The irony is that while natural philosophy in Copenhagen boomed with talents in the mid-seventeenth century, and even began to attract talents from abroad, the later part of the century witnessed problems of recruitment. In a given age specific careers attract a great part of the best innovative minds. In certain ages these entered theology and philology, in modern Europe careers in engineering or quantum mechanics attracted much talent, today it is perhaps computer science and biochemistry and their related disciplines. To attract innovative minds, a science or discipline generally has to offer a certain dynamics in terms of recent breakthroughs, but if these do not generate prestige and career possibilities from the surrounding society, this attraction may soon be lost. This was precisely what happened in Denmark. Tycho Brahe had

awoken the interest in astronomy in many students, who flocked to Hven to become his assistants, and likewise did the Bartholin-circle awake an interest in natural philosophy, e.g. in a student of theology like Peder Schumacher. This was of course connected to general European developments, but it is significant that both after the fall of Tycho Brahe, and in the 1670s when natural philosophers found themselves in a social nowhere-land, the general interest in natural philosophy rapidly declined. Those who might have considered entering natural philosophy or at least taken interest in it, now sought careers elsewhere, primarily in the administration.

It was not that natural philosophy was not practised in Copenhagen after the 1670s. Even new observations and discoveries were made. Thomas Bartholin's son and successor, Caspar Bartholin the Younger (1655-1738), made some minor anatomical discoveries, and Ole Rømer's pupil, Peder Horrebow (1679-1764), continued the work of his teacher, but generally natural philosophy in Copenhagen around 1700 found itself in a backwater. Part of its sorry state can also be explained by an increased sensibility on behalf of theologians of heretical opinions, even in Latin treatises. As previously emphasised, natural philosophy in Denmark had been eclectic rather than dogmatic. Galenic medicine or Aristotelianism or Ptolemaic cosmology did not amount to the same degree of authority as in many other places in Europe. Neither did the introduction of controversial thought currents like Paracelsianism, Ramism or Cartesianism provoke any significant furore, though surely these currents had opponents among conservative philosophers and theologians alike, and surely they were all accepted in a moderate form. Gradually iatrochemistry and Cartesian mathematics was accepted, gradually Galen was replaced by Harvey and other new anatomists, and gradually more and more Danish natural philosophers began to prefer heliocentric cosmology to the Tychonic world picture.

The most important condition for this situation was undoubtedly the successful patronage of the natural philosophers, which (together with the tight control of the Church) did not leave many chances to critical voices. However, this situation required not only the protection of powerful patrons, it also required that natural philosophers did not draw social, political or metaphysical conclusions from their philosophy, and that a demarcation line was established between theology and natural phi-

losophy. As long as patrons accepted the value of natural philosophy, not necessarily because they grasped its details but because they were steeped in the Philippist tradition, and as long as leading theologians were more concerned with piety and specific dogmas, natural philosophers had, within their own Latin-speaking community room for embracing and expressing changes in the view of nature.[1187]

However, from the 1630s Danish theology had begun to change towards a more systematic and dogmatic approach, not only to central dogmas like the Eucharist, but to a total description of the world as evident from the difference between the theology of bishops Hans Povlsen Resen and Jesper Brochmand.. Previously, heliocentrism had, among other reasons, not been an issue because it related to the *Genesis*, which was not a central point in the clash between Danish Lutheranism and its Calvinist and Jesuit antagonists. But when theology aimed at a full description of the divine, which of course also included Creation and the arrangement of the world, it became sensitive to opinions that differed from official dogma. So just as the rise of Orthodox Lutheranism had broken the Philippist symbiosis between theology and natural philosophy in Denmark (and thereby given natural philosophy an existence of its own), it was once more developments within theology that determined the relationship between matters of salvation and the study of nature. This needs to be emphasised, since the picture of modern science, as the dynamic side in the relationship with religion has been a part of Western tradition since the Enlightenment.

When the government of Christian V showed lack of support for natural philosophy on the one hand, and on the other a strong awareness of the Church as the provider of public order (and propagator of the regime), the theologians got the upper hand. In 1666 the professor of theology; Christian Nold, had published a manual on logic that happened to offend the government on two

[1187] I am quite certain, that, perhaps anatomy excepted, the Bartholin-circle did not communicate heliocentrism or other theories that might have upset religious and public order to common men. To my knowledge, no one has as yet studied the relationship between the natural philosophy of the learned and the common man in 17th century Denmark, but a study of the problem could include the various treatises on comets published in the vernacular by Jørgen Dybvad, Longomontanus, Rasmus Bartholin and other academic natural philosophers.

points. First of all, he had written that an elective monarchy was preferable to a hereditary. Nold defended himself that it was just given as an opinion to be treated logically. Furthermore, however, his claim that heliocentrism was generally accepted was condemned as a theological fallacy.[1188] Ole Rømer experienced the same hostility to heliocentrism. At the French Academy he had constructed a machine that showed the solar system based on the heliocentric world picture, at that time generally accepted at the academy. When he returned to Denmark he had to modify the machine so that it corresponded with the Tychonic world picture. Personally, of course, he was firmly convinced of the heliocentric world system, as proven by his life-long attempts to observe a parallax of the fixed stars, but in public he had to demonstrate of model universe with an immobile earth.

Caspar Bartholin the Younger and Peder Horrebow, both likewise convinced of heliocentrism, similarly had to move carefully. In a textbook from 1697 Bartholin still had to put Tychonic cosmology side by side with the Copernican, as did Horrebow in a dissertation from 1706.[1189] Later on, in 1727, Horrebow could finally re-modify Rømer's planet machine according to the Copernican world picture, and ten years later, when he was convinced that he had found a parallax, he dedicated his 'discovery' in a treatise dedicated to the crown prince. His long-held frustration can be read from the title of this treatise - *Copernicus Triumphans.* Horrebow, however, was a dinosaur, the last product of 17th-century Danish natural philosophy. In the 1730's no one in the surrounding society cared as to what his lone observations of the night sky might bring.

In such an icy intellectual climate, it is no wonder that those few who continued to be absorbed by problems of natural philosophy generally chose to emigrate. The brilliant mathematician Georg Mohr (1640-1697), who was highly valued by Leibnitz and frequently mentioned in his letters, never attempted to make a career in Denmark. Neither did the anatomist Jacob Winsløw (1669-1760).[1190] After studies in Copenhagen, he made an acade-

[1188] Nold, *Logica recognita.* Cph. 1666; Pontoppidan (1747), IV, 515; Worms Lex. II, 125; Helweg, *Den danske kirkes Historie* I, 421.
[1189] DLH, III, 90.
[1190] For a short introduction to Winsløw see Egill Snorrason, *Anatomen J.B. Winsløw 1669-1760.* Cph. 1969,

mic peregrination to the Netherlands in 1697, where he was shocked when he discovered how outdated the teaching in medicine was in his homeland in comparison with that in the Dutch Republic. He then decided to seek his fortunes abroad and ended his life as a highly valued leader of the new anatomical theatre in Paris and the *Jardin du Roi.*

So from its high peak in the second half of the 17th century, natural philosophy in Denmark had around 1700 sunk back to obscurity. From there it would only emergence again more than a century later, with Hans Christian Ørsted and the rise of Romanticism and a new self-confident bourgeois culture.

Fig. 10. Olof Rudbeck dissecting nature and history. Atlantica.

The Wings of Daedalus

A kingdom without Economy, Commerce and Manufactures is like a Man without body, feet and hands, and without Mechanics, Physics and Mathematics these are like the same Man without life, memory and reason. Christoph Polhem 1721[1191]

1. Sweden, Isle of the Gods

If Thomas and Rasmus Bartholin stood at the centre of the culture of natural philosophy in Copenhagen in the decades after 1650, their counterpart in Uppsala was Olof Rudbeck (1630-1702), the embodiment of Sweden's 'national style' of the 17th century if ever there was one. Previously we discussed his anatomical discoveries;[1192] here his natural philosophy shall be discussed as a whole.

According to Rudbeck, he inherited nothing from his father, the old bishop of Västerås. This was not exactly true, for although he may not have inherited money or land, his father had build up connections that would benefit young Olof. Most important of these was the connection to Queen Kristna, who shortly after ascending the throne visited old Rubeckius' deathbed and promised to protect his children. Afterwards Olof received a donation of 800 riksdaler,[1193] and when he later studied in Uppsala, the queen invited him to take part in a pastoral play at Uppsala Castle at Christmas 1651. While Kristina played a maid servant, the musical Olof appeared as a shepherd playing a shawm.[1194] So like in the case of Stiernhelm, it was initially entertainment at court that brought Rudbeck in contact with the country's supreme pa-

[1191] Christoph Polhelm, *Twenne betänkanden, Det förre angående oeconomien och commercen uti Sverige*...Stockholm 1721, 32.
[1192] See Chapter Seven.
[1193] Eriksson (2002), 20f.
[1194] Rudbeck (1679), I, 437.

troness. At the time as Rudbeck played a shepherd in front of the gathered court, he had also made dissections for some years, and in the spring of 1652 he changed the shawm with the scalpel and demonstrated the lymphatic vessels for the queen and other court members. Subsequently he visited the court several times, was granted a scholarship by Queen Kristina, and left for Leiden in 1653 with the promise of a chair at Uppsala at his return.

Rudbeck had been an extremely successful client and obtained the direct patronage of his queen. Therefore, her abdication the following year must have come as a shock, and though we are not well informed of his stay in the Netherlands, it is fair to assume that when he hurried back to Sweden in 1654, after but one year abroad, it was in order to rebuild his links of patronage.[1195] He immediately tried to win the favour of Axel Oxenstierna. In a letter he gave an account of his studies in Leiden, then moved on to the point: *»Though I may consider my progress and studies to be small, I might yet have greater faith in them, if they had a patron«.*[1196] It was in vain, however, as the old chancellor died the very same autumn.

When Rudbeck eventually managed to find new patrons, it was once again thanks to his late father. Old Rudbeckius had acted as patron and broker for several young men from Västerås, and one of these, Matthias Björenklou, had thanks to the bishop become praeceptor for the young Magnus Gabriel De la Gardie. As usual the patronage continued after the peregrination. De la Gardie had been the court favourite of Kristina, then fell from power, but regained his position when Karl X Gustaf ascended the throne and had his old praeceptor appointed secretary in the central administration.

When De la Gardie became chancellor for the University of Uppsala in 1654, Björenklou acted as a broker on behalf of Rudbeck.[1197] In 1655 Rudbeck could enter the faculty of medicine, five years later he advanced to professor, and for the rest of his long life he was a powerful and often controversial university administrator,

[1195] At this time Rudbeck was completely broke, and even tried to have the jewellery he had given to a young lady returned, see Eriksson (2002), 81.

[1196] *"...licet de profectibus et studiis meis exigua cogitem, majora tamen sperarem, si patronum haberent"*; Rudbeck's letter to Oxenstierna has been published by Nils von Hofsten, *Lychnos* 1940, 327-330.

[1197] Eriksson (2002), 83f.

among other things being a ferocious defender of Cartesianism as we shall see below. In Uppsala he created many of the same facilities for natural philosophy, which had been established in Copenhagen a decade before – a botanical garden and an anatomical theatre.

Apparently, Rudbeck was thus closely connected to the university and its culture, but in reality he constituted a counter-culture which was much closer to the court culture of his patron De la Gardie. This is already evident from the institutions he established in connection to the university. The well-stocked botanical garden was established shortly after his return to Uppsala, at his own initiative and partly at his own expense, with seeds and plants brought home from the Netherlands.[1198] The university was not prepared to pay for the project or to provide the land it required, so Rudbeck planted it in a field rented from his mother-in-law and began to publish catalogues of the collection.[1199]

With the support of De la Gardie he also in 1662 established the first anatomical theatre in Sweden in a tower of the university's main building. While the anatomical theatre in Copenhagen was modelled on that in Leiden, its Swedish counterpart was more of a theatre.[1200] Although he was familiar with anatomical theatres abroad, Rudbeck chose as his model the architecture of real theatres as well as Dutch mansions and churches and followed Vitruvius' architectural ideals. It was lavishly decorated and intended to glorify the kingdom and her rulers as evident from the polar star (a symbol of the Swedish monarchy, which we shall discuss below) inside the dome. While the theatre in Copenhagen had pious sentences on the wall, both the construction and decoration of that in Uppsala was dominated by an allegory, based on the Neoplatonic idea of the macrocosm and the microcosm: The dome stood high above the cadaver on the dissection table, a globe-shaped sundial crowned the roof. Thus, the philosophy behind the anatomical

[1198] See Eriksson (1969), 72f.

[1199] The culmination of these catalogues was the monumental *Campus Elysii*, 2 vols. Uppsala 1701-1702.

[1200] See Göran Lindahl, *Universitetsmiljö, byggnader och konstverk vid Uppsala Universitet.* Uppsala 1957, 54f; Rudbeck's own statements on the construction of the theatre can be found in Annerstedt (1893-1905).

theatre differed radically from official church dogma, as eloquently formulated by Professor Eriksson:

> *»It is hard not to imagine that Rudbeck with his anatomical tower wanted to establish a contrast to the twin towers of the neighbouring cathedral: While they point towards heaven from the assembly below and thus express a religious striving and a spiritual message pointing upwards, the sundial catches the material light from above and transforms it to a useful measurement of life on earth«*[1201]

Despite the differences between the theatres in Copenhagen and Uppsala, however, their emergence had much in common. Both were established on the initiative of individual physicians by means of the patronage they enjoyed from court. Both were not restricted to medical students, but intended for a larger audience, including the court, and both represented a radical breakthrough with the traditional, and almost exclusively theoretical, way of teaching natural philosophy. Finally, the men who headed the performance at the dissection table, Thomas Bartholin and Olof Rudbeck, presented themselves in a way that differed from that of traditional academics and clergymen like their fathers.[1202] While the latter still were sombre in dress and appearance, the two anatomists had long hair and had got rid of the traditional beard.

While Rudbeck and Bartholin had much in common, there was one side of Rudbeck's activities that was completely alien to his Danish counterparts (Rasmus Bartholin and Ole Rømer excepted), namely his obsession with technology, industry, and solutions to practical problems also in connection with entertainment. Rudbeck was a master-builder, musician, technologist and ship owner, surrounded by a staff of workers and successfully providing a regular line of mail-yacht traffic to Stockholm. At Uppsala he installed mechanical manufactures with the help of water power and demonstrated model manufactures of copper works, a paper mill, and a fullery for his disciples. He instructed noble students in fireworks, trained students in the construction of fountains, and taught them arts like house building and surveying. As we shall see below this connection between learning and technology was not

[1201] Eriksson (2002), 193.
[1202] The sombreness of dress and haircut was forced upon Rudbeck and his brothers, see Eriksson (2002), 19f.

unique to Rudbeck, but could also be found in later Swedish natural philosophers.

This was one of two essential differences between the culture of natural philosophy in Denmark and Sweden, the other was the Gothicist tradition, which we have already discussed. During the last thirty years of his life Rudbeck spent most of his time on a work that at a first glance seems astonishingly antithetical to his practical pursuits and natural philosophy, namely the *Atlantica*, whose four volumes were published 1679-1702.[1203] It was a momentous account in the Swedish vernacular with a parallel text in Latin of the history of Sweden. Within the Gothicist tradition, which witnessed a renaissance in the closing decades of the 17th century,[1204] its main thesis was that Sweden was one of the first countries inhabited after the Flood, the Atlantis of Plato, and the cradle of many peoples who after vast migrations had shaped world history. As such Sweden was also the cradle of fundamental intellectual achievements - the invention of astronomy, time reckoning, and writing, and thereby *Atlantica* stood in the same Gothicist traditions as similar works by Bureus and Stiernhelm.

To a modern reader, Olof Rudbeck thus appears to have had three faces - the innovative physician, the technical entrepreneur and the creator of national mythology, but as we have already seen, this was not unusual in the Swedish context. Furthermore, even the *Atlantica* with its mythological, philological and historical conjectures contained a good deal of natural philosophy. This is already evident in the frontispiece to the volume of illustrations (Fig. 10), which is composed on the model of the many contemporary depictions of real or imagined dissections from Vesalius and forth.[1205] In this picture, however, it is not a human body that Rudbeck – surrounded by great philosophers and mythical figures

[1203] While the original edition of *Atlantica* is very rare, the work has been republished as *Olf Rudbecks Atland eller Manheim. Olaus Rudbecks Atlantica, svenska originaltexten*, 4 vols., ed. A. Nelson. Uppsala and Stockholm 1937-1950. The volume of illustrations to *Atlantica* has been published in faxsimile, *Taflor till Olaus Rudbecks Atlantica.* Lychnos-bibliotek 2:1-5 (1938). For a summary and analysis of Atlantica see Eriksson (1994). For a critique of some of Professor Eriksson's interpretations see by Høyrup (1996).

[1204] Lindroth (1996), 298f.

[1205] For an analysis of the frontispiece, see Allan Ellenius, 'Olaus Rudbecks atlantiska anatomi', *Lychnos* 1959, 40-54 with an English summary.

of Antiquity - dissects, but the world globe, and the secret he draws forth from its interior is Sweden, situated between Asia and Europe and bearing the inscription "Sweden, the isle of the gods" (*SUECIA DEORUM INSULA*). Behind him we see the northern night sky with the Lesser Bear and the polar star, which in this period had become a national symbol in Swedish litterature;[1206] it was thought to reflect the independence and power of Sweden. As mentioned it also decorated the interior of the dome of Rudbeck's anatomical theatre, and in *Atlantica* it was employed to 'prove' that Sweden was identical to the Atlantis as described in Plato's *Timaeus* and *Critias*.[1207]

The imaginary stage of Rudbeck's symposium with the great philosophers of the past in the frontispiece is thus both an anatomical theatre and an astronomical observatory, the latter being emphasised by the fact that two of the spectators gaze through a telescope. Rudbeck also took an interest in astronomy. He observed two alleged comets in 1664 and 1666, reported his results in a letter to Hevelius in Danzig, and had them printed in the first volume of the famous *Theatrum cometicum* by Stanislaw Lubienietzki in 1668.

Thus, *Atlantica* was an endeavour that incorporated all aspects of Rudbeck's own studies of natural philosophy. This becomes all the more evident in the pages of *Atlantica* itself.[1208] According to Rudbeck, his inspiration to the work came when one of his friends asked him to draw a map of old Sweden,[1209] and the work is essentially about mapping. Just like anatomy mapped the human body, and astronomy mapped the heavens above, *Atlantica* was an attempt to map time – the history of culture and its chronology. Like his anatomical theatre, the work attempted to contain both the micro- and macrocosm, the secrets within man, the secrets of the universe above, together with a third dimension – time – as symbolised by the figure with the scythe that stands next to Rudbeck on the frontispiece, and is a counterpart to the sundial of the anatomical theatre.

[1206] See Kurt Johannesson, *I polstjärnans tecken. Studier i svensk barock.* Uppsala 1968, 123-125.
[1207] Rudbeck, *Atlantica*, I, 191f., 560.
[1208] For the natural philosophical content of *Atlantica* see Eriksson (1994), Ch. 4.
[1209] Rudbeck (1679), I, Preface, 3.

Rudbeck's thesis, that ancient Sweden was the cradle of civilisation, was thoroughly tested throughout the huge work. Bearing the Gothicist tradition in mind, it goes without saying that it was not a hypothesis that Rudbeck tested with an open mind; it was a conviction that he tried to prove. What is fascinating, however, is the scientific methodology he employs in his endeavour. Bureus' Gothic mythology had been based primarily on historical and linguistic conjectures, that of Stiernhelm on philology. Both of these endeavours seem rather crude compared with that of Rudbeck, who employed both land survey and archaeology in his argumentation.[1210] And these arguments were not only based on intellectual conjectures. Together with scores of students Rudbeck searched the area of Old Uppsala for similarities between its topography and the description of Atlantis given by Plato. An expedition was also mounted to the mountain range between Sweden and Norway in order to prove the same point, and in his archaeological argumentation Rudbeck was a pioneer of his time by being one of the first to pay attention to the humus layer and use it as a dating method.[1211]

As a historian of the development of the various peoples and cultures Rudbeck believed not only in the importance of climate and soil, as was not unusual in this age, but also in the importance of productive conditions. This led him to apply his botanical knowledge by giving observations on plant growth and speculate on the importance of various kinds of food, as well as measuring the height of men from various parts of Sweden.

With *Atlantica* Gothicism had moved into the age of the scientific revolution. Many of Rudbeck's conjectures are rather wild, but they are essentially not different from most pioneering archaeological studies in later centuries, such as the search for the origins of the Indo-European language that involved both linguistic and material arguments. Two premises are behind Rudbeck's argument:

1) That mankind and human civilisation originated in one place.

[1210] Eriksson (1994), 98-103 gives numerous examples of Rudbeck's use of observation and experiment in order to prove his point.
[1211] Eriksson (1994), 110f.

2) That Atlantis, Troy, The Temple of Solomon and other centres of supposed cultural greatness were more than the invention of ancient writers, and that the description they gave of these places was accurate.

The first of these premises was of course supported by the Bible, according to which all humankind derived from Adam and Eve and shared a common language until the destruction of the Tower of Babel. The second premise, the acceptance of the words of the ancients, may seem rather naïve to the modern reader, but although most modern scholars discard Plato's Atlantis as a myth, a utopia created for his particular purposes, there is nothing credulous in the account itself. Atlantis may have existed, in the same way as the existence of a historical Troy has been documented by archaeologists from Heinrich Schliemann and forth. To Rudbeck's acceptance of the accounts of ancient writers may be added the awareness that various peoples have migrated throughout history, carrying with them technology, skills and cultural traditions.

So while Rudbeck's *Atlantica* at a first glance appears to be the outcome of wild speculation in the tradition of Gothicist propaganda, it was in many ways an advanced and pioneering work in its own day and was taken seriously by most contemporaries.[1212] By combining Gothicism with material considerations and natural philosophical insights, it was the most monumental product of the particular Swedish national style of natural philosophy in the early modern period.

2. The Cartesian Contentions in Uppsala

While the almost exclusively national orientation was a hallmark of Sweden's national style in the 17th century, more internationally orientated cultures of learning also existed in the Swedish empire, namely traditional academic culture and Renaissance humanism. It is therefore necessary to say a few words about the relationship between these traditions and the national style.

Traditional academic culture at Uppsala, as well as at other universities in the Swedish empire and many places elsewhere in

[1212] One of these was the bibliographer Johannes Mollerus (1661-1725) from Flensburg in the Duchies. As a subject of the Danish king he argued that the Cimbrians did not origin from Sweden, as claimed by Rudbeck, but from Jutland. On contemporary reactions to *Atlantica* see Eriksson (2002), 341-356, 601-620.

Northern Europe, was dominated by orthodox Lutheran theology, based on Protestant Aristotelianism, and with lectures and disputations forming the backbone of teaching. In many ways this type of learning was antithetical to the national and practical orientation of the national style. First of all, it was theoretical and analytical and aimed at definitions. Secondly, it had little regard for other needs than those of theology. And finally, it upheld a strict distinction between various disciplines. Johan Skytte had attempted to counter this academic culture by forcing Ramism on the universities in Uppsala and Dorpat, and Rudbeck's views on the role of universities followed the same line:

> *»An academy should be neither a children's school only to teach reading, nor a lyceum, where most often only such matters are studied as seem to be most important for the preaching office in a diocese. Instead an academy is created for...all those intending to hold an office in the nation, whether secular or spiritual, civil or military, indeed, all kinds of services, as master masons, carpenters, builders of mills and fountains, hammersmiths, etc.«*[1213]

This position was also important in connection with the Cartesian contentions that raged at Uppsala from the 1660s.

The emergence of the new natural philosophy in Sweden has generally been connected to the introduction of Cartesianism at Uppsala and other Swedish universities, which included not only the physical and metaphysical views of the French philosopher, but also carried with it Copernican cosmology and Harvey's theory on the circulation of the blood.[1214] Unlike in Denmark, the introduction of Cartesianism in Sweden was met with fierce resistance from theologians and Aristotelians, and therefore makes a convenient landmark for the change in natural philosophy from Scholasticism to a modern worldview.[1215]

As the contentions surrounding the introduction of Cartesianism in Sweden have been thoroughly studied by several Swed-

[1213] C. Annerstedt (ed.), *Bref af Olof Rudbeck d.ä. rörande Uppsala universitetet*, III, 256ff.
[1214] e.g. Sven Widmalm, 'Instituting science in Sweden', Porter & Teich (1992), 240-262.
[1215] Lindroth (1997), 447.

ish and Finnish historians of learning,[1216] we shall here give only a brief account of the struggles, limit ourselves to Uppsala, and only put forward some remarks to the struggles, particularly in relation to the difference development and reception of Cartesianism in Sweden vis-à-vis Denmark.

In spite of the frequent contacts between Sweden and the Dutch Republic, and the fact that Descartes in the winter of 1649-50 spent the last five months of his life at Queen Kristina's court in Stockholm, it was not until the early 1660s that Cartesianism decisively entered Swedish intellectual life and provoked great contentions at Uppsala. When Swedish theologians were gathered in the summer of 1663, they discussed the dangers of a new and *"suspect philosophy"* that had come to Uppsala,[1217] and at the Diet (*Riksdag*) the following year the theologians explicitly besought Chancellor De la Gardie to banish Cartesianism from Uppsala. The Chancellor unsuccessfully tried to pour oil on the troubled waters, and the controversies escalated. Attacks were now explicitly directed towards Cartesianism with theologians gathering around a literal reading of the Bible, Aristotelian physics (particularly the idea of substantial forms) and geocentric cosmology, on the two last points assisted by Aristotelians at the Faculty of Arts.[1218] It was not until 1668 that this first Cartesian struggle in Uppsala ebbed away particularly due to the interference of the government.

Like in Denmark the men who introduced Cartesianism in Sweden were students who had visited the Dutch Republic.[1219] Prominent among them was Petrus Hoffwenius (1630-1682), who became professor of medicine in Uppsala in 1662 and immediately began to publish what eventually amounted to a series of four

[1216] For Cartesianism in Sweden, see Rolf Lindborg, *Descartes i Uppsala. Striderna om "nya filosofien" 1663-1689.* Uppsala 1965 as well as the review of this study by Gunnar Eriksson, *Lychnos* 1965-1966 and his further comments 'Framstegstanken i de cartesianska stridernas Uppsala', *Lychnos* 1967-1968, 137-185, which have been reprinted in Eriksson (1989), 60-116; for Cartesianism at Turku, see Maija Kallinen, *Change and Stability. Natural Philosophy at the Academy of Turku 1640-1713.* Helsinki 1995, 273-361 and references.

[1217] Lindborg (1965), 88.

[1218] Lindborg (1965), 91f., 94, 97-115, 120ff.

[1219] Also Cartesianism in Wittenberg was important to its introduction in Sweden, Lindborg (1965), 67f.

dissertations.[1220] As these dissertations emerged, they increasingly showed Cartesian influence and daring. While Hoffwenius in the first dissertation tried to appease Cartesian physiology with Galenic medicine through a subtle distinction between a medical and a physical (or philosophical) view of the body,[1221] he had almost turned wholeheartedly Cartesian in the third dissertation, as evident in his account of the sensual faculty and the passions and the terminology he applied.[1222]

The late arrival of Cartesianism in Sweden compared with its almost immediate adoption in Denmark had certain effects. As we saw in the last chapter, natural philosophers from the Bartholin family took an interest in Descartes shortly after the emergence of the *Discours*, and initially focused on its three treatises on geometry, optics, and meteorology. In Copenhagen Cartesianism was therefore regarded as a collection of theories on various natural phenomena rather than as a comprehensive natural philosophy. It was connected to a general hostility towards Scholastic dogmatism, to the idea of a distinction between theology and philosophy, and finally also to a revaluation of geometrical descriptions of natural phenomena.

When Cartesianism began to enter Swedish intellectual life more than twenty years later, Descartes had greatly elaborated his natural philosophy; particularly his views on physics and the human body, and his views had been modified, reworked and commented upon by several philosophers. Therefore, Cartesianism could emerge as a comprehensive natural philosophy, a system that accounted for both the functions of the human body as well as for the relationship between spirit and matter. In the 1660s the controversies surrounding Cartesianism in Western Europe were

[1220] *Artis medicinalis parvae exercitationes.* The first three dissertations were published 1662-1664, the fourth and last in 1680. The series is essentially an abridged version of Johannes Antonides van der Linden's *Meletemata medicinae hippocraticae*, which was published during Hoffwenius' studies in Leiden; see Lindborg (1965) 79f.

[1221] Lindborg (1965), 81. In the discussion of the various sprits of the body, for example (an important part of Galenic physiology), Hoffwenius claimed that if one regards the spirit (*spiritus*) from a physical point of view, there is only one (which was Descartes' view), but from a medical viewpoint it has different functions in various parts of the body and can therefore have different names (which corresponded with Galenic medicine that operated with four corporeal spirits).

[1222] Lindborg (1965), 82-84.

fiercer than ever. Few men adhered to all Descartes' theories - no one denied his great contribution to mathematics, while few supported his idea of the interaction of spirit and matter in the pineal gland - but the situation was polarised, and even men who tried to keep clear of the two camps would find themselves put there by opponents. Finally, the emergence of Descartes' later works where he dealt more specifically with the relationship between spirit and matter stiffened the resistance of theology, Protestant and Catholic alike, and governments like that of Louis XIV had prohibited Cartesian philosophy.

In Sweden the opposition against Cartesianism was mixed up in the already stiffened resistance of Swedish theologians against the Syncretistic efforts conducted by Matthiæ and Terserus under Queen Kristina's protection discussed in Chapter Six. The opponents of Cartesianism won a victory in 1664, when the two bishops were removed for Syncretism, and "pure" religion was more clearly defined under the auspices of the theologians at Uppsala. They employed this victory in their attack on Hoffwenius when they claimed, how Cartesianism would further Calvinist dogmas on e.g. the Eucharist, while Hoffwenius on his side claimed that theology and philosophy were separate and that the latter could never explain matters of Faith.[1223]

The first Cartesian contention in Uppsala involved a good deal more than Cartesianism. First of all, the only true Cartesian at Uppsala in the 1660s was Hoffwenius. Olof Rudbeck fiercely assisted his colleague at the Faculty of Medicine, but can hardly be called a Cartesian. It was a battle with the physicians on the one side and the theologians and the Aristotelians at the Faculty of Philosophy on the other. Matters were polarised so that even non-Cartesians took side against the theologians. In 1663 a dissertation was published under the professor of mathematics Petrus Fontelius.[1224] Despite references to Descartes, this dissertation was not Cartesian but rather based on the empiricism of Pierre Gassendi

[1223] Lindborg (1965), 118ff., 129f. Hoffwenius reply touched a self-contradiction in Lutheran orthodoxy, namely on the one hand its continuation of the original Lutheran emphasis on the all-important matter of Faith, on the other its attempt to produce a systematic Scholastic, and thereby rational, foundation of Lutheran dogmas. Orthodox theologians, of course, did not recognise this contradiction.
[1224] *Principia cognitioni*, see Lindborg (1965), 85f.

and denied that Man should have any innate knowledge (*notitiae innatae*) *of* God, since all knowledge derived from the senses.

Attempts by the theologians to censor Fontelius' dissertation greatly upset Olof Rudbeck, and to Fontelius' next dissertation he composed an unpublished preface in which he attacked the theologians. Rudbeck was also fired by the preparations for actions against the Cartesianism propagated by Hoffwenius.[1225] The consistent argument behind Rudbeck's onslaught on the theologians was the autonomy of the various academic disciplines, or more specifically the autonomy of philosophy vis-à-vis theology. Like Ole Worm he adhered to philosophical eclecticism and turned against any kind of dogmatism - be it theological or philosophical – and employed the old metaphor of Tertullian, also used by Francis Bacon, that the student should do like the bee that gathers honey from various flowers. A similar view was expressed by Fontelius in a disputation from 1664 in which he vindicated the freedom of philosophy and repeated the bee metaphor.[1226]

Secondly, like most academic contentions in this period the one that surrounded Cartesianism in Uppsala also involved the power relations between various groups. In matters of the university, its chancellor Magnus Gabriel De la Gardie was generally influenced by his client Olof Rudbeck. He was therefore disinclined to take proceedings against Hoffwenius, but as pointed out by Rolf Lindborg, as a chancellor he could hardly go directly against the clergy.[1227] He tried to reach a compromise, in which contested opinions were discussed individually, but this approach misfired. Controversies escalated, and De la Gardie admonished the clergy not to upset the stability of the country. Furthermore, he and Rudbeck tried to limit the influence of the theologians at the university. A triumvirate of curators was established; one of them of course being Rudbeck, but it never acquired any real power.[1228] Furthermore, De la Gardie and Rudbeck tried to change the university statutes so that controversial disputations were allowed, unless they were directed against religion, the government

[1225] Lindborg (1965), 86f.
[1226] Lindborg (1965), 92.
[1227] Lindborg (1965), 88f.
[1228] See Annerstedt, II, 69, 73-76.

or the mores, apart from that everyone was entitled to his own free opinion, but these constitutions were never carried through.[1229]

What was really at stake at the Cartesian controversies at Uppsala, and did their outcome matter much to the development of Swedish natural philosophy in general, and to the emergence of modern science in particular? Are these controversies - or similar doctrinal conflicts for that matter - anything but will-o'-the wisps that have lured historians through their sound and fury and easy tailoring to a view on the history of science we have inherited from the Enlightenment?[1230] After all, it was hardly Cartesianism that led Rudbeck to his anatomical discoveries, or led to the chemical observations of Polhem and Hiärne that we shall discuss below, or formed the foundation of Carl von Linné's botanical taxonomy. Surely, Hoffwenius' physiology was influenced by Cartesianism, but then again - did it matter much to the development of medicine whether it was based on a concept of substantial forms or followed Descartes' view on matter? Such objections are highly relevant and must be a caveat to historians of science, but may also lead to a simplistic view on historical developments even if one takes the viewpoint of social history.

Like all doctrinal conflicts the outcome of the Cartesian controversies at Uppsala reflected power structures. As long as Rudbeck had the ear of Chancellor De la Gardie,[1231] and as long as this patron himself enjoyed the favour of the sovereign, the anti-Cartesians could at best achieve a partial victory. Like in most controversies, it is hard to find men who allowed themselves to be convinced by the arguments of their opponents, but the controversies moved the position of the persons involved. They cemented the alliance between Aristotelianism and Lutheran orthodoxy in the one camp, while strengthening the claim for the autonomy of the various disciplines in the other. Thus, the most important aspect

[1229] Annerstedt, Bihang II, 92, 94f. The theologians suggested instead that Aristotelianism in reality should be the only philosophy allowed.

[1230] Also Jamison (1982), 229 n.52 has posed this question, and contrasts the plentiful Swedish historiography on doctrinal conflicts in Uppsala with the lack of studies on social history of Swedes and of those figures who - in his view – really mattered to the history of science, namely practical men like Polhem, Rudbeck and Hjärne.

[1231] It was Rudbeck who managed the relations between the Cartesians and the Chancellor, see Lindborg (1965), 126.

of the controversies is the relationship between various disciplines rather than discussions of specific physical theories in themselves (e.g. the discussions on substantial forms). Throughout the conflict Hoffwenius and Rudbeck insisted on the autonomy of medicine. It was already evident in Hoffwenius' first dissertation where he made a subtle distinction between a physical (i.e. Aristotelian) and a medical description. Also Rudbeck emphasised the autonomy of medicine, and the right of physicians not to include metaphysical, dogmatic or physical (i.e. Aristotelian) tenets in their treatment: *"No one who treats physics can be forced also to include metaphysics, in the same way as the one who treats anatomy cannot be forced to include physics"*.[1232]

This was essentially the position of the natural philosophers of the Bartholin family, who at least until 1660 succeeded in upholding a dividing line between theology and natural philosophy. When such a view was controversial at Uppsala, it was primarily due to the different position of the Swedish Lutheran church. If we take an unbiased view of the controversies, the theologians were only doing their job. In 1655 Catholicism, Anabaptism, and Calvinism had been expressly forbidden in Sweden, and in the university constitutions from the same year, it was imposed on the theologians at Uppsala to warn against impending dangers to established religion.[1233] Moreover, the Syncretistic movement had employed philosophical arguments, just as Cartesians abroad had used their philosophy to reject various tenets of dogma, such as the Lutheran view on the Eucharist and the way original sin was transmitted from one generation to the other.[1234]

Many of these radical Cartesians abroad had been physicians, so it is not surprising that the upholders of orthodoxy were aware of impending dangers from that direction. Neither theologians nor Aristotelians denied the methodical individuality of the various scientific disciplines, and no one objected to Cartesian mathematics or anatomical observation. When, however, Hoffwenius claimed that medical skills were better acquired without the traditional syllogistic form, and at the same time employed specific Cartesian terms (or used Aristotelian terms in a Cartesian sense),

[1232] Annerstedt, Bihang II, 87.
[1233] Annerstedt
[1234] Lindborg (1965).

they took offence. A new and confusing terminology should be avoided not least out of consideration for the simple folk (a somewhat odd statement since Hoffwenius' dissertations were written in Latin), which ultimately meant out of consideration for the stability of the realm.[1235]

The following years witnessed a cease-fire in the Cartesian contentions at Uppsala with Hoffwenius still teaching and discussing Cartesianism. Before new contentions broke out an intermezzo occurred in 1678 when Hoffwenius' student, Nils Celsius defended a disputation on the principles of astronomy, dedicated to De la Gardie.[1236] Celsius was clearly in favour of the Copernican world-picture, but what really upset the theologians, was young Celsius' claim that Holy Scripture was an authority only in matters of salvation. Their anger increased when Celsius in an *Apologia* emphasised that the Bible was not an astronomical textbook and in that connection cited the alleged words of Galilei before the Inquisition. Eventually, the disputation was censured, but it showed what was essentially at stake.

Before the second Cartesian contention broke out in Uppsala, drastic political changes had taken place in Sweden with the introduction of absolutism in 1680. Like in Denmark twenty years before, this development came in the wake of a devastating war, which in the case of Sweden did not turn into disaster due to French intervention. The Swedish government strengthened its control over the church, and like in Denmark the clergy came to play an important role in administration, propaganda, and ideology. Lutheran orthodoxy thereby came to play an increased role in Swedish society, as illustrated by the school reform of 1693 that was more Orthodox Lutheran than ever before. Like in Denmark the nobility lost many of its privileges as well as much of its land.[1237] There was however, one essential difference between absolutism in Denmark and Sweden. While in Denmark, the old rul-

[1235] Lindborg (1965), 129-131.

[1236] Nicolaus Celsius, *De principiis astronomicis propriis.* Uppsala 1679.

[1237] For an introduction in English see Michael Roberts, *Essays in Swedish History.* London 1967. Robert's view on the establishment of absolutism in Sweden was influenced by the debate of the general crisis of Europe. For a critique of some of Robert's conclusions see Stellan Dahlgren, '1600-talets ståndssamhälle', *Kultur och samhälle i stormaktstidens Sverige.* Stockholm 1967, 9-40.

ing elite of the nobility had to yield power to new men and was consciously kept out of office, the political elite in absolutist Sweden counted many members of old noble families, such as the new chancellor Bengt Oxenstierna.

The second Cartesian contention in Uppsala broke out, when the theologian Erik Ljung in a disputation in 1685 attacked the Cartesian idea of Man's innate knowledge of God, and was ferociously countered by Andreas Drossander, who had succeeded Hoffwenius as professor of medicine, and by the professor of mathematics Johan Bilberg, who in a disputation further advocated Cartesian dualism.[1238]

At the Diet of 1686 the clergy rallied in an attack against Cartesianism and demanded that it should be forbidden. It was suggested that natural philosophy, i.e. physics, should be moved from the infected medical faculty to the faculty of philosophy under strict Aristotelian surveillance. Aristotelianism was essential to theological polemics, it was claimed, and therefore the theologians should be allowed to stop damaging disputations, and grants should only be given to students who adhered to Aristotelianism.

The absolutist sovereign, Karl XI, however, demanded that the whole University of Uppsala, if necessary by faculty or individually, should give advice in the matter. Thereby ferocious controversies took place at the university between the theologians led by Heinrich Schütz and the Cartesians led by Drossander and Bilberg, assisted by the aging Rudbeck and by the famous Samuel von Pufendorf , who had recently been appointed to a chair in Lund. Several personal attacks were launched, particularly by Bilberg, who like the humanists in the pre-Reformation decades, depicted Schütz and other theologians as representing a sophistic, obsolete and useless kind of learning that was even a perversion of original Aristotelianism. In the *Catalogus praelectionum* of 1679, Rudbeck in the same vein had announced that he was going to lecture about the *"most noble, intricate, and subtle subject of Nothing"*, presumably a satire on philosophical sophistry.[1239]

[1238] *De reali distinctione mentis humanae et corporis.* Uppsala 1685.

[1239] The program is printed in Annerstedt (1899); for other interpretations on the lectures, which argues that they were partly serious, see Eriksson (1979-80).

The advice given by the various faculties illustrated how the frontiers had moved. In the first Cartesian contention in Uppsala, the physicians had stood alone, now they were supported by the faculties of law and philosophy. The advice of the philosophers was mainly written by Bilberg, who advocated the total separation of theology and philosophy, of revelation and reason. Furthermore, he advocated philosophical eclecticism and claimed that one could learn from everyone – Bacon, Descartes, Gassendi, and Boyle, although he regarded Cartesian mathematics as the key to the secrets of nature.

In 1689 a commission was appointed consisting of both theologians, Cartesians like Drossander and Bilberg, as well as civil servants like the secretary of state Samuel Åkerhielm and the powerful Erik Lindschöld, who was the handyman of Karl XI. The Cartesian contentions reflected the government's old dilemma regarding higher education, namely the need for educating both clergymen and administrators, and this again reflected the different, but equally important role of the Church and the administration, which now represented radically different cultures. Eventually Karl XI ordered that Cartesianism should be allowed, as long as it did not encourage thinking that went against the Christian religion. From a formal point of view the outcome of the contention was obscure, and has been interpreted differently by Swedish scholars.[1240] In practice the degree of freedom allowed to Cartesianism, or indeed to philosophical independence, depended on political considerations and the relationship between individuals at the university and those in power. As the man who was heading the government's cultural and educational policy, Erik Lindschiöld, was a great admirer of Bilberg, this meant in practice that Bilberg and Drossander could continue to teach Cartesianism, and he even managed to have Bilberg appointed to a chair in theology.

In the early 18th century, most Swedish philosophers would adhere to philosophical eclecticism. The analytical method and mechanism of Cartesianism was highly influential, but it was generally combined with Aristotelian, sometimes also Paracelsian, concepts, and it is telling that the physical textbook used in Swed-

[1240] Compare Lindborg (1965) with Erikssson (1965-1966).

ish gymnasiums in the 1730s referred to both Aristotelianism and Cartesianism.[1241]

3. Diversity and Unity

By 1660 Sweden had attained the greatest limits of her empire,[1242] which stretched from the highly urbanised Bremen in the West to the vast and nearly unpopulated forests of Ingria in the East, from the exotic and unexplored Lappia in the North to the old Hanseatic ports in Pomerania on the Baltic seaboard, her subjects speaking a Babel of tongues - Swedish, Finnish, Russian, Estonian, Lettish, German, and Danish.

In the last half of the 17th century, the Swedish empire was thus an international construction, and although it declined somewhat in the following decades, it would remain so throughout our period. Through education, diplomacy and campaigns in Central Europe, leading Swedish statesmen and generals had become acquainted with European elite culture and adopted many of its ideals. One would expect that the widening cultural outlook of the social elite – the patrons – would demolish the national orientation of learning in Sweden. That, however, was not the case, and we must take a closer look at the elite in order to explain why.

While the new power elite that emerged in Denmark after 1660 consisted mainly of *novi homines*, whose cultural outlook and identity was closer to that of a clerk or professional soldier than to a Renaissance patron of arts and sciences, the Swedish elite maintained its aristocratic character and connection to the past.

One part of the Swedish elite consisted of ancient noble families like the Oxentiernas and the Brahes. During the reign of Gustav Adolf these families had formed an alliance with the monarchy, took part in government, and held important administrative positions in the Swedish empire. Despite their close connection to the state and its needs, these families also adhered to an identity of high noblemen, as magnates and patrons. The other part of the Swedish power elite was made up by ennobled commoners like the Skyttes or immigrants, who had risen to power during the previ-

[1241] J.H. Svicerus, *Compendium physicae aristotelico-cartesianae.* Skara 1714.
[1242] The standard work on the Swedish empire in English is Michael Roberts, *The Swedish Imperial Experience 1560-1718.* Cambridge 1979.

ous generations like the De la Gardies and the Wrangels. These families owed their wealth and social position to their service as administrators and military commanders, but as they were assimilated and married into the ancient nobility, they adopted its culture rather than forming a counter-culture. Unlike their Danish counterparts they therefore represented and imitated the European culture of the social elites, and the iconography of the meeting hall of the Swedish nobility in Stockholm (*Riddarhuset*) depicted Mars and Minerva side by side.[1243]

Unlike in Denmark, where the University of Copenhagen and the noble academy of Sorø remained the only institutions of higher learning,[1244] the vastness of the Swedish empire and the relative independence of local magnates led to the establishment of several universities and thus several semi-autonomous patronage systems of learning. While the University of Uppsala was led by men connected to the court in Stockholm, like Magnus Gabriel De la Gardie, the University of Turku (Sw. Åbo) was established in 1640 by Per Brahe the Younger together with the bishops Isak Rothovius and Johannes Rudbeckius.[1245] It was an alliance between the high nobility and the church. As a member of a high noble family, Brahe had many reservations about Axel Oxenstierna's co-operation with the centralisation efforts of the monarchy, while the bishops on their hand wanted to counter-balance the Ramist influence of Johan Skytte on Uppsala, and strengthen the training of the Finnish clergy.

We have already mentioned the University of Dorpat (Tartu), founded on the initiative of Johan Skytte in 1632,[1246] and in 1668

[1243] see D. Lohmeier, (ed.), *Arte et Marte. Studien zur Adelskultur.* Neumünster: 1978, 235-240.

[1244] Around 1690 a noble academy, *Ridderhuset*, was also established in Copenhagen, but it soon evaporated.

[1245] On the University of Turku, see Maija Kallinen, *Change and Stability. Natural Philosophy at the Academy of Turku (1640-1713).* Helsinki 1995. On Brahe and his family see Arne Losman, *I grevarnas tid. En Brahe-historia genom 400 år.* Bålsta 1994.

[1246] For Dorpat see Bergman (1932); Sandblad (1975-76); Piirimäe (1985). Due to warfare it led a turbulent life throughout the century, and was relocated more than once, until it was finally closed down in 1710. Closely connected to the great commercial and predominantly German cities of the Eastern Baltic, it was open to new developments, and both pietism and ideas of natural right entered here, but its influence on Swedish culture at large declined steadily.

Lund University (or *Academia Carolina* as it was named) was founded in the province of Scania, which had recently been conquered from Denmark.[1247] Finally, the old Pomeranian University of Greifswald was conquered by the Swedes during the Thirty Years' War. It maintained its German character, but was under Swedish hegemony and was an important connection between Sweden and German cultural life.[1248]

While the emergence of regional universities resulted in diversity in learning and patronage, they did not present a challenge to the national orientation of Swedish intellectual life. We must keep in mind that states in early modern Europe were dynastical rather than national. They were generally multinational by nature, and a national orientation supported by the government and the social elite would therefore be concerned with Sweden as a dynastical rather than ethnical entity. Universities like Dorpat and Lund were founded in order to integrate the local elite into the Swedish empire, not as Swedes, but as loyal subjects. In the 18th century the same would be true of Åbo in face of the menace presented by Russia.

Furthermore, the patrons of the various Swedish universities were high noblemen, who even if they opposed the politics of government leaders like Axel Oxenstierna and Magnus Gabriel De la Gardie, identified themselves with the patriotism of the national project and its emphasis of the practical use of learning. Thus, Per Brahe the Younger worked on a translation of Justus Lipsius' *Politica*, propagated the use of the Swedish vernacular and was the patron of works in the Gothicist tradition.[1249]

The only notable exception was Bengt Skytte (1614-1683), the son of Johan, who was deeply inspired by the ideals of Comenius and the Rosicrucians. He cultivated relations with such groups during diplomatic missions abroad, and was also in contact

[1247] See Martin Weibull and Elof Tegnér, *Lunds universitets historia*, 2 vols. Lund 1868, which should be supplemented with Jerker Rosén, *Lunds universitets historia* 1. Lund 1968. The university suffered from the war with Denmark 1676-1682, and remained small throughout our period.

[1248] See Johann S. Kosegarten, *Geschichte der Universität Greifswald mit urkundlichen Beilagen.* Greifswald 1857. The importance of Greifswald to Swedish culture has been rejected by Lindroth (1975), 47-48: *"Men det lilla Greifswaldsuniversiter behöll sin tyska prägel och blev tills vidare inte av någon betydelse för vår nationella kultur".*

[1249] Lindberg (2001), 205-212; Nordin (2000), 191; Hansson (1984), 106.

with Royal Society, but eventually he lost favour in Sweden. With the support of the Elector of Brandenburg he tried to establish a city of wisdom, *Sophopolis*, which was to be a modern Athens, embodying the ideals of the Rosicrucians as well as Francis Bacon's utopian New Atlantis. It all came to naught, and he ended his life outside the leading circles of Swedish society.[1250]

In the second half of the 17th century, the connections between Sweden and Europe were closer than ever, also in intellectual life, while at the same time, the national orientation survived. Clearly, this national orientation can be exaggerated. After all, men like Olof Rudbeck stood in contact with Royal Society and other groups abroad, and most of their works were published abroad. Nonetheless, their point of origin was still the needs of Sweden rather than an international project of the advancement of learning. This project, so important to the culture of natural philosophy in Copenhagen, was essentially humanist in its origin. As the Swedish elite adopted European cultural ideals, an internationally orientated humanism began to find its way into Sweden, and celebrated humanists were imported particularly by Queen Kristina but also by other Swedish statesmen such as Magnus Gabriel De la Gardie and Karl Gustaf Wrangel. Several of these already had close connections to Sweden,[1251] and while we have already concluded that the culture of learning of Kristina's court had no profound impact on Sweden's general intellectual life, some of the foreign humanists stayed in Sweden after her fall as professors.

The best known is perhaps Samuel Pufendorf in Lund, another was the German philologist Johannes Schefferus (1621-1679), who had been imported to Sweden by Queen Kristina and given the chair Skytte had established in Uppsala.[1252] Here his lectures on rhetoric were highly popular among students and noble-

[1250] See Anders Grape, 'Comenius, Bengt Skytte och Royal Society', *Lychnos* 1936; Nils Runeby, 'Bengt Skytte, Comenius och abdikationskrisen 1651', *Scandia* 1963 as well as Åkerman (1991), 125-129.

[1251] Lindroth (1997), 200ff. While professor in Leiden Daniel Heinsius had corresponded with Axel Oxenstierna and been in contact with several Swedish students, the father of Isaac Vossius was closely connected to the Skytte family, while Hugo Grotius had been employed as Swedish diplomat.

[1252] For this controversy see Lindroth (1996), 311-320.

men, and his career survived the abdication of his patroness. Schefferus' published numerous books on his main interest, the Greek and Roman World, many of them illustrated with his own emblematic engravings, which expressed the greatness of Queen Kristina and Sweden. As such, Schefferus became involved in national glorification, but at the same time he was a humanist in the classical sense, and also identified himself with the Republic of Letters. It is thus significant that unlike most Swedish scholars, he maintained a vast international correspondence. Therefore, it is hardly a coincidence that to my knowledge Schefferus was the only professor in Uppsala, who stood in direct contact with a colleague in Copenhagen, namely with Thomas Bartholin, a fellow member of the Republic of Letters.[1253] Through Schefferus contact was etabslished between Bartholin and Rudbeck, and greetings were exchanged, but it never amounted to more than that.[1254]

As a student from Leiden Schefferus represented the flourishing Dutch philological tradition in the mid-17th century, which had textual criticism as one of its sign marks.[1255] He applied this method to a description of ancient Uppsala,[1256] and rejected that the town and its heathen temple had been founded shortly after the Flood. The antiquity and sacredness of old Uppsala was one of the central ideas in Gothicist mythology, and from 1672 Schefferus' interpretation was severely criticised by Rudbeck and Olof Verelius, who was the first and only professor of antiquities in Uppsala and thus professionally bound to Gothicism.[1257] Schefferus' arguments and conclusions were not always better than those of his opponents, but his critique of the philological speculation was modern compared to the method of the Gothicists. When Verelius thus found an ancient manuscript in Rudbeck's

[1253] Most of these letters was published by Bartholin (1667) and have been printed in *Danske Magazin* 6:II (1916), 27-60. The two men knew each other from Leiden, see Garboe (1949), I, 34f. The lack of correspondence between Swedish and Danish natural philosophers can be seen by conferring with Lauritz Nielsen, *Registrant over Breve fra og til Danske i udenlandske Biblioteker.* Cph. 1934.

[1254] Bartholin (1667), 217, 249.

[1255] For Dutch philology see Grafton (1983).

[1256] Johannes Schefferus, *Upsalia.* Uppsala 1666.

[1257] Verelius (1618-1682) had introduced the Icelandic sagas to Sweden, inspired and probably challenged by the so-called 'Icelandic Renaissance' in Denmark, which lasted from 1620s and had Ole Worm as one of its most prominent figures.

library that apparently confirmed some of the Gothicist arguments, Schefferus could dismiss it as a forgery by employing textual criticism. The controversy dragged on for ten years, and only ended after Schefferus had died.

The controversy is also interesting from the perspective of patronage, since both parties shared the same patron, namely the university chancellor De la Gardie. He let the controversy evolve; only stopping it when the hard-pressed Schefferus begged him to. It was in other words, the patron who defined the limits of dispute, and thus served as a mediator in the conflict. This phenomenon was of vital importance to scientific disputes in the 17th century and has recently attracted the attention of scholars.[1258] As such there was room for both Gothicism and humanist textual criticism under the wings of De la Gardie.

4. The Patriotic Scientist

In this study, we have used *natural philosophy* as a general term for the study of nature. This term is no longer useful if we deal with Sweden in the last half of the 17th century, and *science* is preferable. Philosophy is first of all concerned with understanding the world, while science can generally be defined as a culture, which combines theoretical insights with practical applications.

While Rudbeck and his generation was still concerned with studies that had no direct practical use, the following generation witnessed a greater emphasis on the immediate application of the study of nature. As evident from the quotation from Christoph Polhem at the beginning of this chapter, theoretical insight was seen as inevitable, but the raison d'être of the study of nature was its usefulness to practical life. Furthermore, Sweden's numerous wars in the closing decades of the century and beyond only stimulated the patriotic character of learning, which survived all political changes. It was as vital in absolutist Sweden after 1680 as it had been during the reign of Gustav Adolf, and even more so in the so-called Age of Liberty (*Frihetstiden*), when Sweden was turned into an aristocratic republic in 1719,[1259] and has been such

[1258] See M. Biagioli,'The Anthropology of Incommensurability', *Studies in History and Philosophy of Science* 21:2 (1990), 183-209.

[1259] For this period see Michael Roberts, *The Age of Liberty: Sweden 1719-1772.* Cambridge 1986.

a significant hallmark until modern times that it has provocatively been questioned whether Sweden belongs to Europe.[1260]

The two main figures in the development of the tradition of applied science in Sweden around 1700 were the chemist Urban Hiärne (1641-1724)[1261] and the master engineer Christopher Polhem (1661-1751).[1262] Both had studied at Uppsala, but as usual their success in obtaining patronage was due to their performance outside the academic framework, and it was not in Uppsala, but in Stockholm and the mining districts of Western and Northern Sweden that their science was carried out.

As a fugitive from the war ridden Finnish-Russian border, Hiärne was a man without means and was desperate in his attempt to find careers that could attract a patron. After attempting the traditional method of dedicating Latin poems to members of the social elite, as well as engaging in portrait painting, he turned to the study of medicine and finally found patronage and employment in Claes Thott, the governor of Riga and one of Sweden's leading diplomats. In the company of Thott, and on journeys sponsored by his patron, he visited most of Western and Central Europe.

Hiärne was essentially a Paracelsian chemist, and initially it was his iatrochemical treatments that won him favour. For a while he practised in Stockholm and also served as physician at Court. As a Paracelsist, Hiärne took a strong interest in the healing powers of spas, and encouraged by Thott and in cooperation with another Swedish nobleman, he travelled around Sweden and made chemical analyses of numerous water sources. Finally, he established the first Swedish spa in Medevi in 1679, and soon rivalling spas were established elsewhere in Sweden.[1263] The spas were commercial enterprises aimed at the social elite, and Hiärne earned a substantial amount of money and cleverly advertised for their

[1260] See Sörlin (1994), ch. 1; Jan Olsson and Olle Svenning, *Tilhör Sverige Europe?* Stockholm 1988, whose scope however goes far beyond the 17th century.
[1261] On Hiärne see Lindroth (1996), 511-529. His autobiography has been published by Henrik Schück in UUÅ.
[1262] On Polhem see Lindroth (1996), 545-555. His writings has been published in *Lychnos-bibliotek* 10:1-4 (1947-54), his letters in *Lychnos-bibliotek* 6 (1941-46).
[1263] Lindroth (1996), 410.

wonderful healing powers in two writings in the vernacular, the language of most of his publications.[1264]

Thus scientific theory and practice was united with commercial enterprise and the benefits to Swedish society, and this was to be a sign mark of the tradition Hiärne and Polhem belonged to. It was institutionalised when a *Laboratorium chymicum* was established in Stockholm in 1683, led by Hiärne but living on government funding and being organised under the Mining Corporation (*Bergskollegium*), where he was a member, just as he was a leading member of the corporation of physicians (*Collegium medicum)* that had been organised in 1663.[1265] Hiärne himself seems to have taken the initiative to the establishment of the laboratory, or at least propagated the cause, and the fact that national pride also played a role can be seem from one of his addresses to the government: *"Abroad there is no king, no magnate, no prince, yes not even a count, who has not a laboratory proportional with his rank".*[1266]

Supplied with sufficient funding and manpower Hiärne's laboratory was partly a chemical manufacture, and one of its main obligations was the large-scale production of medicine for the army, but he was also occupied with finding new solutions to practical problems such as the development of a rust preventive, a balsam what prevented wood from rot,[1267] and the construction of an oven that required less firewood. At the same time he served the mining industry by analysing minerals and was involved in reforms of mining techniques. These reform were obvious failures, but he was sure that radical improvements were possible.

The same applied for the younger Christoph Polhem, who was essentially a technical engineer and inventor. Though sceptical of many of the theories of the French philosopher, he was essentially a Cartesian. He had caught the attention of patrons due to his technical skills, primarily in the construction of clocks. In 1697 he was employed by the Bergskollegium, and his technical solutions to problems in the mining and arms industry soon made him an important figure in Swedish society in the early 18th cen-

[1264] Urban Hiärne, *Een kort berättelse om the nys upfundne suurbrunnar wid Medewij.* Stockholm 1679 and idem., *Een uthförlig berättelse om the nyss opfunde suurbrunnar widh Medewij.* Stockholm 1680.
[1265] Lindroth (1996), 378-386.
[1266] Quoted in Lindroth (1996), 516.
[1267] This was presented in *Xylobalsamus artificialis.* Stockholm 1718.

tury. Even more than Hiärne he propagated technological and economic reforms. In numerous writings he championed the connection between science and practice, as in the *"Discourse between Miss Theoria and Engineer Practicus"*.[1268] Science, which was not turned into practical results was useless, but geometry and mechanics were essential prerequisites for technological progress. It was therefore not surprising that he should follow Hiärne and establish a mechanical laboratory (*Laboratorium mechanicum*) in Stockholm in 1697, though it never amounted to the same importance as that of its role model.

While not all theories which we normally connect to the Scientific Revolution had been accepted in Sweden around 1700, it is clear that dramatic changes had taken place. The traditional Aristotelian framework had lost its importance outside the universities, where new scientific institutions had been established in Stockholm, which combined production, technology and research. Science was popularised due to the number of treatises in the vernacular, and in figureheads like Polhem and Hiärne. When the latter was ennobled and moved into a palace in Stockholm, where he also established a laboratory, natural philosophy had left the lecture room and the museum and taken a prestigious position in society.[1269]

Also among the social elite the interest in applied science was in vogue. Swedish noblemen were shareholders not only in the spa industry, but in most of the country's manufactures and mines. Thus, the elite not only supported men like Hiärne and Polhem due to their general usefulness to Sweden, but due to their direct usefulness to the patrons as well. This not only led to extensive patronage of science, but also increased its prestige as scientific experiments and instruments would find their way into polite society.

The most prominent example is Karl Gustaf Wrangel (1613-1676), governor of Swedish Pomerania and chancellor of Greifswald. As a soldier and administrator, his interest in natural philosophy was mainly connected to the mathematical sciences. He had studied at Skytte's Collegium Illustre in Stockholm in the

[1268] *Samtahl emällam fröken Theoria och byggmästar Practicus.*

[1269] Cf. Steven Shapin, 'The House of Experiment in Seventeenth-Century England', *Isis* 79 (1988), 373-404 and Tore Frängsmyr, *Vetenskapsmannen som hjälte. Aspekter på vetenskapshistorien.* Stockholm 1984.

1620s, and thereafter politics in Leiden. He had close connections to Dutch shipbuilders and instrument makers, and it was from the Netherlands that he acquired most of the books, artwork, curiosities and scientific instruments that he collected at his castle of Skokloster north-west of Stockholm.[1270] It has been estimated that he had a collection of 30 to 50 instruments at Skokloster - telescopes, microscopes, magnifying glasses and measuring instruments.[1271] Like many other Swedes he was also in contact with the Danzig-astronomer Hevelius, and acquired most of his works for his library.[1272] When Wrangel sent his son, Carl Philip on a peregrination to England, the acquisition of instruments was regarded as an important part of the young man's education,[1273] and like other Swedes young Wrangel joined the circle around Mercator who was one of the first members of Royal Society.[1274] Also Wrangel's successors at Skokloster, the Brahe family, continued to collect instruments.

With the prestige of science in mind, it is therefore no surprise that attempts were made to establish the supreme icon of the new science, the academy of science, in Sweden. Already in the 1680s Hiärne and others toiled with the idea of establishing a Swedish academy, as did the Swedish government in the second decade of the 18th century. At the end of 1710 a so-called *Collegium curiosorum* was established in Uppsala on the initiative of Polhem. Like its models abroad it was concerned with conducting experiments and making them known to the scientific community of Europe. In 1711 an expedition was mounted to Lapland, primarily in order to measure the refraction of sunbeams, but also physical observations were included, but its results were meagre, and the college seems to have ceased its activities the same year. The aspirations of organising and presenting Swedish science according to Western European standards were not abandoned, however. In the years 1716-18 Emanuel Swedenborg, a great admirer of Polhem, began to publish a scientific journal, which -

[1270] See E. Wrangel, *Sveriges litterära förbindelser med Holland under 1600-talet.* Lund 1897 and the various studies by A. Losman, cf. bibliography.
[1271] Losman and Sigurdsson (1973-74), 92.
[1272] For the contacts between Hevelius and Sweden, Losman and Sigurdsson (1973-74), 93 note 8.
[1273] Losman and Sigurdsson (1973-74), 94f.
[1274] Losman and Sigurdsson (1973-74), 95.

reflecting the ambitious technological character of Swedish science - was called *Daedalus* and was dedicated to the mathematically skilled Karl XII. A comparison between *Daedalus* and the journal of Thomas Bartholin in Copenhagen, clearly illustrates the different fabric of the cultures they were connected to. While the articles in Bartholin's *Acta* consisted mainly in observations and reflections on various phenomena of natural history and medicine, the main content of *Daedalus* was Polhelm's technical innovations as well as physical observations and experiments based on Cartesian theory.

If scientists like Hiärne and Polhem argued that theoretical knowledge should lead to technical and economic reform, it could however also go the other way around. In the 1690s Hiärne worked on a complete inventory of Sweden's natural resources for the benefit of the manufactures, the crafts and other areas of society.[1275] It was done by collecting reports from local authorities and clergymen. As it turned out, however, the economic motive became secondary to Hiärne's ambition of writing a vast geological and geographical description of Sweden. Like in the case of most of Hiärne's intended books, only the first two volumes were published.[1276] Here he reflects on the construction of the world within a Paracelsian framework, but the work is also regarded as establishing geology in Sweden. While adhering to the traditional view on the age of the world, he - like Steno whose views were not published in his lifetime - came to the conclusion that the earth had underwent dramatic changes since Creation caused by winds, water, fire and chemical processes, and also includes paleontological studies.

Around 1700, by the time Rudbeck the Younger began to concentrate on Gothic philology, Hiärne decided to devote his time and energy to a regular search for the 'anatomy' of beasts, plants and minerals and also attempted to establish a scientific

[1275] This scheme was presented in the anonymous *Een kort anledning til åtskillige malm- och bergarters, mineraliers, wäxters, och jordeslags...efterspörianda och angifwande.* s.l. 1694. It was sent to civil servants and clergymen in the Swedish provinces.

[1276] Urban Hiärne, *Den korta anledningen til åthskillige malm- och bergarters... efterspörjande och angifwande beswarad och förklarad.* Stockholm 1702 and 1706.

journal.[1277] It shows that while he was an innovative technician, in theoretical chemistry he was a highly conservative Paracelsian, who defended the old master against recent chemical reformers like Jean-Baptiste van Helmont and Robert Boyle. Against the emerging mechanical cosmology, he worked to establish his own chemical world system.[1278] Though original on several points not least due to recent developments in chemistry, it was essentially continuation of traditional Paracelsian metaphysics. It operated with a world soul (*spiritus mundi*) and a descent from the spiritual part of cosmos to the material world. Mechanical atomism was not rejected, but was regarded as insufficient to explain the inner nature of the world. It was, thus a chemical metaphysics Hiärne aimed at.

In the last years of his life he engaged himself in Neoplatonic light metaphysics, primarily in the tradition of Robert Fludd and the Hermetics. It was a return to the spiritual view of nature. As such Hiärne can be said to have returned to the Swedish tradition of systematic mysticism, but his development is not unlike other innovative scientists like Steno and Jan Swammerdam, who abandoned science and turned to religion. It does not mean that either of these men experienced an essential conflict between science and religion - Hiärne's spiritual search did not let him to abandon his laboratory work - but rather that they ended up finding scientific pursuits insufficient to the happiness of the soul. It was a matter of priority. Perhaps Augustine and the medieval theologians were right - curiosity is restlessness and can never bring Salvation or happiness to Man? It is therefore hardly a coincidence that Pietism won many disciples among the social and intellectual elites of the early 18th century.[1279]

[1277] *Actorum laboratorii Stockholmensis parasceve.* Stockholm 1706 was in the vernacular, while *Acta et tentamina chymica.* Stockholm 1712 was in Latin and dedicated to Royal Society. These were detailed descriptions of his laboratory and the methods and theories he employed there. They were, however, not followed up, and only long after his death were extant material published in Johann Gottschalk Wallerius, *Tentaminorum chemicorum tomus secundus.* Stockholm 1753.

[1278] *Physica generalis.* The work was never finished, but parts of it were included in the *Tentamina* of 1712. The manuscript is now in the university library in Uppsala.

[1279] For an interesting study of the connection between Paracelsianism and Piety in Norway in the late 17th century see Shackelford (1993).

5. The Eden of the North

While the scientific tradition represented by Hiärne and Polhem revolved around mechanics and chemistry, another Swedish tradition was equally important in the early modern period and illustrates the continuation as well as transformation of intellectual life.

Generally speaking, this tradition was concerned with mapping. In connection with the anatomical theatre in Copenhagen,[1280] we discussed the importance of symbolic control. The emerging power state presented itself as a microcosmic entity, which not only attempted to control violence, taxation and economic life, but also extended these attempts to include nature and history. Mapping the countryside, the ocean, the starry heaven, the human body and the human past, not only had practical applications, but were manifestations of Man's control over the world, and the ruler's control over his land. When a thing is given a name, when it is put on a map and connected to already well-known entities, it no longer belongs to the great unknown, but becomes a part of Man's domain. The control may be little but fiction, but chaos has been turned into order, and the entity has been given a place in human discourse.

The mentality of the previous period had been organic and reflected a society of estates. In political thinking each estate had its specific function, and the general metaphor for society had been the body. Likewise, the vitalist tradition of Renaissance philosophy regarded the world as a whole or, as it was often called, a body. As a body the world was coherent – matter and spirit, the macrocosm and the microcosm, the various parts interacted, and allegory was a legitimate element in scientific argument.

The mentality behind the power state of the late 17th century was order and control. Attempts were made to standardise weights and measures and control the taxation system and economic life, armies were increasingly uniformed and drilled, rigidly defined hierarchies of ranks were introduced, which in details described the privileges of each rank. This mentality was also extended to nature and history. Just like it manifested itself in society by separation and categories, it manifested itself in natural philosophy

[1280] Chapter Seven above.

through Descartes' analytical method and attempts for establishing taxonomy within the various disciplines.

We have already discussed Rudbeck's *Atlantica*, which was an attempt to map the cosmos as well as human history from a Swedish point of view. Thus, it combined what today is separated into scientific (astronomy, botany and anatomy) and humanist disciplines (history, archaeology and philology), and connected them to mining and manufacturing. This combination remained an important aspect of Swedish science in the early modern period, but in the early 18th century it was influenced by the analytical and taxonomic mentality as well.

Olof Rudbeck the Younger (1660-1740) succeeded his father and namesake as professor of medicine in Uppsala. In his youth Rudbeck's major interest was botany. He wrote a book on gardening in 1686[1281] that was both practical and emblematic, but first of all tried to analyse living nature by employing Cartesian, i.e. mechanical, theories. Rudbeck was also a pioneer in the taxonomy of plants as evident in a dissertation he published four years later.[1282] By creating a systematic terminology and classification of the flora and fauna, he aspired to turn chaos into order. He tirelessly studied the plant life of Sweden, and on behalf of his father, he went on an expedition to Lapland in 1695. It has rightly been claimed that this was the first purely scientific expedition in Sweden,[1283] but it was also an endeavour sponsored by the absolute monarch Karl XI *"for the glory of the kingdom"*, and professor Rudbeck was accompanied by three young noblemen. Thus, scientific motives went hand in hand with the mentality of absolutism. When Rudbeck described and depicted the wild life and plants of Sweden's northern lands, which were almost unexplored, sparsely populated and rarely visited by government officials, a symbolic control was established.[1284]

Rudbeck worked on a great and richly illustrated book on his expedition to Lapland, but only the introduction was pub-

[1281] Olof Rudbeck, *Propagatio plantarum.* Uppsala 1686.
[1282] Olof Rudbeck, De fundamentali plantarum notitia. Utrecht 1690.
[1283] Lindroth (1996), 434.
[1284] Already Olaus Magnus (exotic and dangerous). Schefferus had given a description of Lapland. Though outdated in many ways Hilden (1920) on the view of nature in 17th century Sweden is still valuable.

lished.[1285] Here Rudbeck reflects on the etymology of Swedish names and words, interpreted the native Lapps as the *sciopodes* of ancient authors, and regarded their language as related to Hebrew. From about 1700 he concentrated his energy on philological Gothicist studies particularly developed by Stiernhelm. Historians of science have sometimes complained that Rudbeck turned from a talented student of natural history into a speculative philologist,[1286] but to the son of the author of *Atlantica* the two things were connected, and in the 17th century such studies had been enormously popular among European scholars. Also Ole Worm and Thomas Bartholin in Denmark employed etymology in order to identify plants and understand the past and Biblical narrative. Though containing valuable insights such endeavours were mostly based on speculation, and at the close of the century scholars like Leibniz had become more sceptical of their use. Rudbeck, however, still employed philological speculation uncritically in order to prove his point that Swedish was the language closest to Hebrew.[1287] From 1721 he took leave from his medical professorship and worked for the rest of his life on a monumental comparative philology, which he left unfinished.[1288]

Rudbeck's philological speculations were obsolete already in his own time and were not well received by most of his contemporaries. As such he became the last prominent natural philosopher whose knowledge of nature was integrated with Gothicist mythology. Since the construction of the power state in Europe implied the construction of a national identity, one would assume that such mythologies were useful to governments in early 18th-century. Surely, a national sentiment can be seen in all areas of learning in Sweden in the Age of Liberty. Swedish language, history, jurisprudence, flora and wildlife were studied in numerous works, and the benefit of science to Sweden was prominent in legitimating scientific pursuits.

[1285] Olof Rudbeck, *Nora Samolad sive Laponia illustrata.* Uppsala 1701.

[1286] For Rudbeck the Younger see Lindroth (1996), esp. 432-437 and bibliography. Carl von Linné was a student of Rudbeck's.

[1287] Lindroth (1996), 302.

[1288] *Theasaurus linguarum Asiae et Europae harmonicus.* The manuscript is now in Uppsala, but has not yet been thoroughly studied. A preliminary treatise on his method was, however, published - *Specimen usus linguae gothicae.* Uppsala 1717.

However, between the age of Gustav Adolf and that of his successors in the late 17th and 18th centuries – whether it was the absolutist king or the leaders of the Swedish Republic – a cultural and mental change occurred. While power in the early 17th century was legitimated by reference to real or imagined ancient tradition, absolutist rule was legitimated by divine right. God had appointed the absolutist king directly, and there was no need to warrant his supremacy with examples from the past. Furthermore, the idea of progress had made its impact. The remote past was still useful in political arguments and in creating identities, but among the majority of the intellectual and social elite it was viewed as an age of innocence, rather than as a golden age of knowledge and wisdom. Governments and philosophers became possessed with the ideas of progress, of technological and administrative improvements, and here Gothicist mythology lost its attraction.

With the Gothicist element losing its grip on the culture of natural philosophy, Swedish scientists conformed more with the general identity of European scientists, This, however, not necessarily made them less national. The emergence of the national states around 1700 exiled the concept of the Republic of Letters into the realm of wishful thinking, a lost ideal according to some men of learning, but dismissed by others as reflecting a useless and pedantic culture of learning by the majority.[1289]

While Gothicism declined and Swedish historiography, the mapping of time, moved closer to the general European tradition, the other aspect of the works of the two Rudbecks, natural history flourished. Natural history became a focal point for many of the vital currents in Swedish intellectual life. Not only did the mapping of Sweden's flora, fauna and mineral wealth help to establish symbolic control, natural history also had more tangible applications. Plants, herbs and minerals were essential to medicine. Knowledge of plant life was important to societies still based on agriculture, and plant materials were furthermore important to the dyeing of the textile industry, and the silk production, which many European governments (including those in Scandinavia) tried to establish, just as mineralogy obviously was important to

[1289] For this development in Germany see W. Kühlmann, *Gelehrtenrepublik und Fürstenstaat. Gelehrtenrepublik und Fürstenstaat. Entwicklung und Kritik des deutschen Späthumanismus in der Literatur des Barokzeitalters.* Tübingen 1982.

the mining industry. Furthermore, the demand for order and system, which we have already connected to the mentality of the years around 1700 found its expression in philosophers like Christian Wolff, who was influential at Uppsala from about 1720.[1290]

Religious sentiment, the utilitarian aspect and the demand for order and system was the motivation for one of Rudbeck the Younger's students, the physician Carl von Linné (1707-1778),[1291] who reformed botanical taxonomy and established the flourishing Swedish tradition of natural history, which continued throughout the 18th century and has remained an important part of Swedish national identity until the present day. Later periods, and particularly Romanticism, has portrayed Linné, who came from humble origins, as a genius born on Swedish soil and preaching closeness to nature on a meadow in the Swedish summer.

That he was, but his work was also directed towards the mining industry and the manufactures, and the taxonomic project and his description of Lappia were also concerned with establishing symbolic control over nature. Thus, the natural history of Linné, for all its religious sentiment, resembled the work of men like Hiärne and Polhem. Man established his control over nature, if only by systemising and naming it, and this control would eventually turn out to the benefit of Swedish society. In Copenhagen the culture of natural philosophy came to an abrupt end, or at least decline, in the years after 1670, and would only remerge within a radically different framework. In Sweden there was much continuity throughout the early modern period. The transformation of philosophy and scientific method and the changing forms of government did not change the essential character of Sweden's national style, namely its ambitious patriotism and optimistic practical orientation.

While the culture of the Bartholin family in Copenhagen had been elitist, it was essential to the Swedish ideal that scientific and technical expertise should spread to large groups of the population; that the benefit to society should come by through scores of scientists and technicians. This ideal became particularly outspoken when Sweden changed from an absolutist monarchy to an

[1290] See T. Frängsmyr, *Wolffianismens genombrott i Uppsala.* Uppsala 1972.

[1291] See Sten Lindroth, 'Linné - legend och verklighet', *Löjtnant Åhls äventyr.* Stockholm 1967, 9-87; Gunnar Broberg, *Homo Sapiens L. Studier i Carl von Linnés naturuppfattning och människolära.* Uppsala 1975.

aristocratic republic after 1719, and science was seen as the vehicle for material progress. This, however, does not necessarily mean that Swedish science *was* particularly useful to Swedish society.[1292] While manufactures loomed large in the propaganda of scientists and their patrons, in reality they played a marginal role to the Swedish economy,[1293] and Swedish manufacturing declined after 1760.

This not only resulted in changes in government, and *eo ipso* also patronage. As the raison d'être for science had been manufactures, the economic crisis was immediately followed by a decline in the prestige of science. The cult of progress and manufacturing vanished, and 'national benefit' was increasingly regarded as a cloak for the self-interests of the elite. As in Denmark, the decline came rapidly, and in the closing years of the 18th century, foreign visitors who went to Uppsala were sadly impressed by the lack of enthusiasm among teachers and students, the grandiose visions of Rudbeck and Linné were gone.

In different ways, the study of nature in Denmark and Sweden was motivated by wishful thinking. Both the Republic of Letters and the Patriotic Science were visions, which only survived as long as they could find a place and prestige in contemporary society. Their success was thus intimately connected to the support and views of the social elite. When that changed and support was withdrawn, the visions proved to be nothing but ideals and evaporated in the thin air. Until that happened, however, these ideals nourished natural philosophy and science in Scandinavia for more than a century.

[1292] Johannisson, K: 'Naturvetenskap på reträtt. En diskussion om naturvetenskapens status under svensk 1700-tal', *Lychnos* 1979-1980, 109-154. With an English summary.

[1293] P. Nyström, *Stadsindustriens arbetara före 1800-talet.* Stockholm 1955. See also E. Heckscher, *Merkantilismen*, 3 vols. Stockholm 1953.

Conclusions and Perspectives

This comparative analysis of natural philosophy in 17th-century Denmark and Sweden has revolved on three major themes – motives and arguments for the study of nature, the institutional and social framework of natural philosophy, and the relationship between local conditions and general European developments. In all three areas we have seen significant differences between the two Scandinavian kingdoms, which resulted in radically different national styles, despite the fact that they received or had access to the same influences from the European continent and Britain.

The Purpose of Natural Philosophy

Anyone who advocated the study of nature claimed that natural philosophy was useful. But usefulness must essentially have an object – *useful for what?* Here a change of emphasis took place throughout our period. At the beginning of our analysis, the Reformation age in the middle decades of the 16th century, natural philosophy was ultimately connected to religion. The study of nature was the study of Creation, of God's arrangement of the world.

From the past, the 16th century had inherited the idea of the Book of Nature. Contemplation of the greatness and benevolence of God's arrangement of the world, supplemented the Bible in evoking awe and love for the Creator, and natural philosophy was thus useful for religious edification. In Northern Europe the idea was adopted by Philipp Melanchthon, who connected natural philosophy to moral philosophy and ultimately to Lutheran religion, particularly in response to the flood of religious enthusiasts that appeared in the decades after the Reformation. Through textbooks and students Melanchthon had a decisive influence on the structure and content of higher education in Scandinavia in the 16th century. His educational system intimately connected phi-

losophy to religion, at Lutheran universities like Wittenberg and Rostock natural philosophy flourished, and Scandinavian students would there be introduced to recent developments in medicine and the mathematical sciences.

At none of the two Scandinavian universities, Copenhagen and Uppsala, the study of nature reached the same high level. Both were more dominated by theological concerns than their German counterparts, and religious enthusiasm was not as widespread as in Germany. This was particularly so in Uppsala, which was never established as a fully equipped Philippist university, due to Sweden's turbulent political history in the 16th century. Nonetheless, the idea that natural philosophy was important to religion was a notion shared by many, and in both Denmark and Sweden clergymen were called upon to study natural philosophy, particularly anatomy.

The symbiosis between religion and natural philosophy was broken in the years around 1600, not because natural philosophy moved away from religion, but because of theological developments. The emergence of Lutheran orthodoxy, which was established in both Scandinavian countries through government support, turned theology more dogmatic, systematic and intellectual (though it also had its spiritual aspects). Furthermore, it also turned against many of the notions inherent in Philippist theology, such as the confidence in the intellectual powers of Man. It was not necessarily hostile to natural philosophy, but it was based on Scholastic philosophy centred upon metaphysics and logic, and the study of the human body or the stars above had little relevance to its main concern – the battle against Catholic and Calvinist theology.

While Lutherans and Philippists struggled in Wittenberg, it seems that things were not as polarised in Scandinavia, not least due to David Chrytraeus in Rostock, who in the closing decades of the 16th century was enormously influential on intellectual life in Scandinavia. Not only Philippist textbooks lingered on at Scandinavian schools and academies, but also the interest in the study of nature seems to have prevailed, even among some who theologically had parted with Melanchthon. This was important to the development of natural philosophy. It is significant that some of the most prominent Scandinavian natural philosophers in the 17th century, Olof Rudbeck in Sweden and the Bartholin brothers in Denmark, came from a highly religious background, and places

like Bishop Rudbeckius' household and gymnasium in Västerås and Holger Rosenkrantz' castle of Rosenholm were not only models of Lutheran piety and frugality, but also contained instruments and books of natural philosophy.

The separation of natural philosophy and religion did not turn natural philosophers into atheists, but natural philosophy and religion would become two different areas of their work. As theology had become monopolised by professional theologians, who, assisted by censure and the strong arm of secular power, were increasingly sensible to heterodoxy, natural philosophers expressed religious sentiment in pious devotional and conspicuously unphilosophical books in the vernacular.

If the study of nature was no longer directly connected to Lutheran theology, it could be useful otherwise. The period we have studied witnessed the emergence of the centralised state, which increasingly interfered with all areas of life. Accordingly, a new kind of usefulness emerged, often mentioned as usefulness to society or to the country, but in reality meaning usefulness to government politics. This usefulness was concerned with the needs of the growing administration, the need to utilize natural resources and establishing manufactures according to Mercantilist economic theory, and first of all the need to improve the government's military capacity.

In Sweden the emphasis on this kind of usefulness developed throughout the 17th century, reached momentous heights during its closing decades and continued far into the 18th century. Its main propagator in the first half of the 17th century was Johan Skytte, who was chancellor at Uppsala and also established the University of Dorpat in Livonia. At both academies he tried to direct teaching towards the needs of society, and based his ideas of useful learning on Ramism, particularly rhetoric and the mathematical sciences. He attacked scholastic speculation and stimulated the study of mathematics. This attitude to natural philosophy was carried on by Swedish statesmen and natural philosophers throughout the period, and the close connection between natural philosophy and technology was stimulated by the importance of the Swedish mining industry and the growth of manufactures. It played a dominant role in the views and work of men like Olof Rudbeck, Christoph Polhem and Urban Hiärne, who combined theoretical insights with solutions to practical problems.

From the perspective of usefulness, the Gothicist tradition, the attempt to establish the origins of Sweden and the Swedes was likewise connected to the development of the modern state. Regardless of the personal motivation of those who contributed to this tradition, the government's control of patronage and censure made sure that it was used to propagate its claims and legitimise its politics. The theosophical and prophetical speculations of Johannes Bureus, based on Paracelsianism, Hermeticism, Kabalism and various other currents of Renaissance philosophy, were employed by the Swedish propaganda in the years around The Thirty Years' War, while those parts of his thinking which did not suit the government's needs, particularly his millenarian ideas, were censured.

Not only was the Gothicist tradition carried on by men, who *also* contributed to the development of science as we understand it, such as the skilled mathematician Georg Stiernhelm, it was first of all integrated in the work of leading natural philosophers. The most prominent example is the momentous *Atlantica* by Olof Rudbeck, whose main thesis was the identification of Plato's Atlantis with ancient Sweden, and hence the claim that Sweden was the cradle of human civilisation. Here Rudbeck not only continued the philological argumentation of Bureus and Stiernhelm, but also employed advanced arguments from all areas of learning, not least natural philosophy.

In comparison, the motivation for Danish natural philosophers was more complex. Among those analysed in this book, the interest in the practical applications of natural philosophy was marginal. The lack of an important mining industry and abundant access to water power, which could stimulate the establishment of manufactures, may to a certain extent account for this difference between the two Scandinavian countries, but others factors were also at play.

In the first half of the 17th century natural philosophers in Copenhagen inherited two models of natural philosophy. The one was Tycho Brahe's astronomical, astrological and chemical pursuits at Uraniborg. Such activities could indeed be useful to everyday life, but essentially the study of nature was regarded as edifying. It was an elitist Neoplatonic ideal of a philosophical quest for divine secrets. After the fall of Brahe, some of his students such as Christian Longomontanus and Cort Aslakssøn contributed to natural

philosophy in Denmark, both continuing their master's combination of precise astronomical observation and Neoplatonic philosophy. In the case of Aslakssøn, he endeavoured to establish a cosmology based on concord between the Bible, the astronomical discoveries of Hven, and Neoplatonic metaphysics. Faced with hostility from orthodox theologians, he had to abandon his scheme in the second decade of the 17th century.

The second model was the Evangelical orientated natural philosophy of Philipp Melanchthon, supplemented with religious views, such as those of Holger Rosenkrantz and Johann Arndt, which emphasised pious deeds and living. This was distinct from the tradition of Uraniborg, but the two models were united under the patronage of leading noblemen such as Rosenkrantz. Furthermore, both models regarded Scholasticism, in theology as well as natural philosophy, as insufficient, and thus both traditions had other orientations than the traditional academic framework.

Both of these models were disturbed by the rise of Lutheran orthodoxy. As already mentioned, its development turned theology more dogmatic and professional. University philosophy was based on Protestant Aristotelianism, metaphysics was reintroduced, there was no longer room for Neoplatonic, Ramist or Paracelsian philosophy, and intellectual freedom was limited, as evident from the many allegations and controversies that dominated the Danish church and university in the first decades of the 17th century.

These developments made Danish natural philosophers outside the academic framework conspicuously unphilosophical. Focusing on observations of individual natural phenomena, they refrained from fitting them into a major philosophical framework, particularly metaphysical speculations that might provoke onslaughts from the theologians and the government. The professed ideal of men like Ole Worm and Thomas Bartholin was philosophical eclecticism (an ideal also shared by Olof Rudbeck and later Swedish natural philosophers), and as their natural philosophy was not carried out within a rigid metaphysical, or otherwise theoretical framework, they might combine concepts and theories from various philosophical traditions. Even when Cartesianism was introduced to Copenhagen in the 1640s, it was primarily Descartes' mathematics, analytical method and theories of specific phenomena, while his metaphysical ideas were largely left untouched.

In the second half of the 17th century a culture of natural philosophy flourished in Copenhagen, which was closely connected to neither religion nor the needs of society, but was essentially motivated by the identification with a general European project of the advancement of learning.

This motivation included some of the aspects already discussed. The application of natural philosophy, in particular medicine, to the benefit of society played a certain role as did national prestige and religious considerations. The latter, however, did not revolve exclusively around Lutheran religion, but was connected to the attempt to reconcile Western Christendom. Danish natural philosophers were generally hostile to the polemical character of contemporary theology. They were closely connected to colleagues of all religious orientations, and natural philosophy could therefore be seen as an area in which learned men all over Europe could find common ground.

The rise of the Rosicrucian movement immediately before the outbreak of The Thirty Years' War and its promises of a perfection of religion and the perfection of Man's knowledge of nature therefore attracted natural philosophers like Ole Worm. When he finally abandoned the Rosicrucians in an oration in 1619, Worm, like later Danish natural philosophers, also abandoned the attempt to establish a particularly Christian natural philosophy. He turned against the esoteric character of the movement and against the vision of a key that could unlock all the secrets of nature. He advocated the relative independence of philosophy from theology, and argued that philosophical progress was dialectical by nature and attained by philosophical dissent. He defended Aristotelian philosophy due to its terminological consistency, but adhered to philosophical eclecticism.

Worm's oration also contained other notions fundamental to Danish natural philosophy in the following decades, namely the belief in progress and the enthusiasm for intellectual curiosity. Much Renaissance philosophy contained the idea of a decline in philosophy since Antiquity, a view often connected to religious notions. While Adam, some argued, initially had had a perfect knowledge of nature, the fall of Man had perverted his intellectual capacity and thus made a thorough understanding of creation impossible. The incapacity of Man's intellectual faculty was also supported by Lutheran orthodoxy, so in both theology and phi-

losophy an attitude flourished which rejected progress in natural philosophy, unless it was esoteric or connected to religion.

From the 16th century, however, a radically different view of Man's general position in world, and the potential of natural philosophy in particular, began to emerge. Its most well-known and eloquent advocate was Francis Bacon, but as we have seen, he was only one of many contemporary voices. The background for this changing attitude is primarily to be found outside the intellectual framework itself. Inventions like the compass, the printing press, gunpowder, the telescope and the microscope challenged the idea of decline. So did the discovery of the New World and the exploration of the East, which brought to the light numerous plant and animal species, peoples and lands, unknown to the ancients. Also developments in astronomy and anatomy increasingly made the idea of decline untenable, and the increased knowledge of ancient philosophy and the development of textual criticism made it clear that the past contained numerous philosophical traditions and that a history of philosophy could be established, which showed the progress of ideas and sciences.

Reflecting this changing attitude, also the view on curiosity changed. The rejection of curiosity as a threat to the stability of the soul, as found in the Christian tradition from Augustine onwards, turned into a more positive view in the Renaissance. Most would agree that curiosity was restlessness and essentially unending, since it always found a new object once a problem had been solved, but to such thinkers and the mercantile culture to which many of them belonged, restlessness was a virtue. This connection between natural philosophy was stimulated by the fact that the main centres of natural philosophy in the first half of the 17th century were all situated in the proximity of bustling mercantile centres such as Venice, Basel, Amsterdam and London.

This new culture was thus connected to both mercantile and intellectual environments, and was enthusiastic about travels, literal as well as intellectual. A new literature of travel descriptions and cosmographies emerged, also in the vernacular, expressing a general positive view on Man's potential for mapping and mastering the world. This attitude was also found in the many collections established in this period, among them the famous *Museum Wormianum* and the collections of the Fuiren brothers in Copenhagen. Though such collections were potentially useful for im-

pressing patrons, as well as teaching students, this not was their original purpose.

With the anatomist Thomas Bartholin the identification with the European Republic of Letters reached its climax in Copenhagen. For the sake of this republic and his prestige in it, he frantically dissected in order to solve the burning questions of contemporary anatomy, and immediately published his findings. Throughout his life he published numerous books on various scientific problems, and established Scandinavia's first scientific journal in the 1670s. In his vast correspondence and his publications, he only rarely refers to the specific usefulness of his work. It was, so to speak, natural philosophy for its own sake, and while the closing decades of the century witnessed a more positive attitude to the practical application among some Danish natural philosophers, the culture we have analysed remained largely self-sufficient, and this would eventually lead to its decline.

The Social and Institutional Framework

Despite the fact that most of the natural philosophers discussed in this book were university professors, or at least had an academic background, the academic framework was, strictly speaking, not the forum for innovation in natural philosophy in neither Sweden nor Denmark. In our analysis we have therefore had to take a broader view than the institutional and connect the development of natural philosophy to the general development of society.

In an age with no formal criteria for evaluating scientific talent, the access to offices and funding depended on a man's success in what we have called the game of patronage. This success not only determined whether a natural philosopher could make a living, it was also reflected in the prestige of the various arts and sciences and the relationship between them. In Denmark the physician Ole Worm thus also managed to be the semi-official expert on ancient Danish history, while the lucrative monopoly on astrological almanacs were at times given to a client outside the university. While Tycho Brahe had given the mathematical sciences an unprecedented prestige in Denmark, and attracted many students, his fall made them decline until the successful patronage of Rasmus Bartholin allowed for the relatively unopposed introduction of Descartes in Copenhagen, which restored mathematics to its former glory.

The best illustration is perhaps the introduction of dissections. Although Melanchthon had held anatomy in high esteem, and various chancellors of both Uppsala and Copenhagen ordered that regular dissections should be held, nothing happened. A professor of medicine in Copenhagen began to dissect on his own initiative in the 1590s, but was allegedly stopped due to hostility from the surrounding society. It was only in the middle of the 17th century that Simon Paulli and Olof Rudbeck managed to introduce dissections at Copenhagen and Uppsala respectively. Both physicians had won the patronage of the court, initially not through their medical talent, but through other skills – rhetorical talent in the case of Paulli, musical talent in the case of Rudbeck, as well as family connections in the case of both.

The introduction of new disciplines and theories in natural philosophy were therefore highly dependent on patronage, and innovation generally found its expression outside the academic framework. Although the anatomical theatres in Copenhagen and Uppsala were connected to the university, they were much more than places of medical teaching and research. Both were stages which contributed to the glory of the kingdom and its ruler, as well as serving as entertainment for the court and people of more humble origin. While the *Domus anatomica* in Copenhagen had sentences which emphasised Lutheran piety, the orations of anatomists like Simon Paulli and Thomas Bartholin would express a radically different view on man and his possibilities, and the construction of Rudbeck's anatomical theatre in Uppsala expressed Neo-Platonic philosophy. At dissections in Uppsala and Copenhagen, the audience would thus be presented to concepts that were closer to the court culture of Queen Kristina and Frederik III than to the theologically dominated university.

The same applies for other areas of natural philosophy. Laboratories did not exist at the university, but were found at private households, as were astronomical observatories and instruments. Finally, also the collections of items of natural history were private property, and the botanical garden in Uppsala, was established on the initiative of Rudbeck, partly at his own expense, and at a field he had rented from his mother-in-law.

Therefore, while most of the men we have discussed were connected to the university, the innovative study of nature which they accomplished, took place elsewhere. This has led us to reflect on

the relationship between the institutional framework and the private enterprise.

We have already noted that the culture of natural philosophy in Copenhagen essentially identified itself with the Republic of Letters. This ideal community consisted of learned individuals from all parts of the Latin-speaking world, corresponding across all political and religious borders. The single cell in that body was the *museum.* Here the man, sometimes woman, of learning had his desk, his library, perhaps also his laboratory, and it was also here that collections were placed.

The culture of natural philosophy in Copenhagen was essentially a culture of the museum, and was generally situated in the professors' residences in the Latin Quarter. It was connected to both Court and University but belonged to neither. As most Danish natural philosophers were physicians, they visited the court as well as the households of noblemen and patricians, they depended on patronage from the social elite, but their study of nature and contact with colleagues abroad was conducted at home.

As for the university, its explicit function as keeper of political and social order, hence also the theological hegemony and orientation, put limits to philosophical freedom. Undoubtedly, physicians had greater liberty, a fact also reflected in their travels to countries banished to theologal students, but the number of medical students was small, and many of them were connected to the medical professors through blood, family contacts or patronage and often lodged in their residence.

It was therefore natural that the professor's residence should be the centre of an essentially medical culture of natural philosophy. Here subjects could be discussed, which were not part of the syllabus, chemical and other experiments conducted, and philosophical concepts employed, which deviated from Scholastic philosophy. We have mentioned the example of the Paracelsist Johannes Pratensis, who was professor of medicine at Copenhagen. While he had to fit his morning lectures into a Galenic and Aristotelian framework, the discussions with friends like Tycho Brahe that took place in his museum in the evening, could freely include Neoplatonic and Paracelsian concepts and theories.

This leads us to another difference between the museum and the lecture room. While university lectures were one-way commu-

nication, except the highly formalised disputations, the discourse of the museum was essentially, or at least ideally, dialogue. This, we have argued, may also account for the philosophical leanings of these two stages. While Aristotelianism, particularly in its Scholastic shape, was suited to lectures, the dialogue-form of the Platonic corpus and a good deal of the Neoplatonic tradition was suited to the museum.

The museum was not an institution, it had no official function, and it was not open to everybody. Yet, it was not an exclusively private enterprise. When natural philosophers published, i.e. when they made the discussions in the museum public to the Latin-speaking world, they were subject to censure like everybody else, and what they practised in their museum was made public.

Danish natural philosophers refrained from challenging religious authorities, and the close connection between natural philosophy and philosophical innovation which we find elsewhere in Europe, was almost nonexistent in Copenhagen. Nonetheless, the literary output of the museum contained much, which was incongruent with Lutheran dogma and culture, such as the humanist veneration for pagan culture and philosophy. Sometimes, conflict also broke out, as when Thomas Bartholin gave an account of the various diseases described in the Bible. Eventually, however, such conflicts were calmed, not by the participants, but by their common patrons at court. Through their travels abroad and their medical practice, physicians came in regular contact with the social elite, and while the Danish government throughout the 17th century supported religious orthodoxy in the church as well as at university and schools, it sanctioned the existence of the museum, although it had little immediate usefulness to government policy or society at large.

This changed when absolutism was established in Denmark from 1660. A new political culture emerged, and a rigid hierarchy of ranks was established, which evaluated men due to their usefulness to the King. The hierarchy of ranks was based on office, and only soldiers and administrators were included. Accordingly, the culture of the museum found itself in a social vacuum. We have argued that Thomas Bartholin and other natural philosophers hoped for the creation of an academy of science, which would give the study of nature a prestigious position in absolute society and connect the culture of the museum with the needs of society. Such

hopes were wasted, and natural philosophers, as well as other men of learning, could only find a place in society by turning into administrators. Most became wealthy, many were ennobled, but natural philosophy declined rapidly from around 1670, and at the end of the century Copenhagen was a scientific backwater.

In Sweden, things turned out radically differently. We have argued that Swedish natural philosophers showed a remarkable lack of identification with the Republic of Letters, and that they never established a distinct culture of their own, and generally, they were closer connected to their patrons than their Danish colleagues, physically as well as culturally.

This is also evident if we look at the institutional framework. In early modern Europe, higher education had two main functions. It must educate clergymen and it must educate administrators. In Denmark the government chose to separate the two, by creating a noble academy at Sorø, but despite various attempts to imitate this model in Sweden, they were abandoned, and both functions were contained at Uppsala and the various other academies, which were established in the Swedish empire throughout the 17th century.

The combination of the two functions and cultures, which also differed socially, was not unproblematic. While in Denmark, currents like Ramism and Cartesianism were introduced fairly peacefully, due to the fact that they were mostly confined to the culture of the museum or Sorø, both gave rise to vehement contentions at Uppsala. In most of these conflicts, the difference between the two functions of the university is evident. Johan Skyttes demand for useful learning in the shape of Ramism conflicted with the Scholastic philosophy, which was regarded essential to Lutheran theology. As for Cartesianism, theologians regarded it as an onslaught on religious dogma, while those who defended Cartesianism enjoyed government support. Among those at Uppsala who defended Cartesianism, few were particularly influenced by Cartesian philosophy. What men like Olof Rudbeck propagated was essentially a limitation of the theological hegemony at the university, the existence of philosophical autonomy

This endeavour was a continuation of the endeavours of Johan Skytte, a national orientated philosophy connected to practical life. Throughout his many years as professor in Uppsala, Rud-

beck constituted a counter-culture to traditional academic culture, and spent much of his time on solving practical problems concerning manufacturing, transport and entertainment. This model was followed by many of his contemporaries and was even strengthened in the following decades. In 1683 Urban Hiärne established a large and well-equipped chemical laboratory, and Christoph Polhem established a mechanical laboratory in 1697 and took initiative to the founding of a *Collegium coriosorum* concerned with conducting and publishing scientific experiments. All three institutions were located. not in the university town of Uppsala, but in Stockholm, closely connected to government circles and Swedish industry and manufacturing. This practical orientation, however, did not turn Swedish science into mere technology. Hiärne emphasised that although theoretical knowledge which was not turned into practical results was useless, theoretical insights were essential to technological progress, and in the following decades Swedish scientists, particularly chemists, made important contributions to theoretical science.

The International Perspective

If we compare the development of natural philosophy in Scandinavia in the 17th century with developments in France or Britain, both Sweden and Denmark were peculiar in different ways. As for Sweden, we have identified the predominant role of applied science as well as the national mythology. Neither of these traditions was unique to Sweden, what was remarkable was the way they combined in the very same philosophers, and first of all the almost exclusively national orientation of Swedish science. Few places in Europe do we find the demand for applied science as early and as forcefully as in Sweden. While Royal Society in the first decades of its existence focused on activities applicable to practical life, its focus became more elitist and theoretical in the early 18th century when it had secured its position in society.[1294] In Sweden the close connection between science and manufacture led to the opposite development. In the first half of the 18th century, science was cele-

[1294] R.K. Merton, *Science, technology and society in seventeenth-century England.* New York 1978 (1938), 205f; J. Ben-David, *The scientist's role in the society.* Englewood Cliffs 1971, 85ff.

brated as the essential prerequisite for material progress, and practical application was seen as the only raison d'être for science.

In Denmark the connection between advanced natural philosophy and applied science was almost non-existent in this period. Only almost, for it can undoubtedly be found among the alchemists employed by the court, and probably also at the noble academy of Sorø and the Norwegian mines. However, none of these environments were vital or extensive enough to count for a national style, and generally they consisted of foreigners. The sign marks of the culture of natural philosophy in Copenhagen in the last half of the 17th century was its international humanist orientation, its general indifference to practical life, and its lack of religious or philosophical agendas.

The great difference between the culture of natural philosophy Sweden and Denmark originated primarily in their different relationship to power - to the government and the increasingly centralised state. The process of political centralisation that escalated in both Denmark and Sweden from the end of the 16th century led to a centralisation of patronage, which again led to a centralisation of values. However, while this centralisation of values manifested itself in Sweden already from the first decades of the 17th century, revolving around the 'national project', it only made a forceful entrance in Denmark with absolutist government in the 1670s. Therefore, throughout the 17th century natural philosophy in Sweden developed in close connection to the emerging power state and its various needs, while in Denmark natural philosophy existed as an autonomous culture. It depended on the government, but the government did not depend on it, and for this reason the introduction of absolutism with its social and ideological implications lead to its decline.

The different cultural history of natural philosophy in Sweden and Denmark illustrates the importance of the national context. Scandinavian students visited the same European centres of learning, and apparently the two countries went through similar though not synchronic developments in the 17th century. In both countries the Reformation was firmly established, and there was no large oppositional and organised religious minority. Neither was innovation in natural philosophy connected to the outlook of a particular

religious group like it has been claimed was the case with the Puritans in England.[1295]

In both countries political centralisation turned into absolutism in the last half of the century. Scandinavian absolutism was generally constructed from German models rather than French or English. It is therefore not surprising that we find many of the same traits in Scandinavia as in Germany. In an important study Dr. Kühlmann has analysed the decline of humanist culture in late 17th-century Germany.[1296] The disrespect for traditional academic and humanist culture was closely connected to the rise of absolutism and the change of values it brought about. The man of learning was evaluated for his usefulness to the prince as advisor, and therefore traditional academic culture was rejected for being pedantic, while humanism with its cosmopolitan and individualist outlook was rejected for being obsolete and useless. It is exactly the same rejection we find in Denmark around 1700. In Sweden we find it in the onslaughts against Aristotelianism by the Cartesians, but the early adherence to the national project meant that this change of values did not have the same implications as in Denmark or Germany.

Essentially the success or failure of natural philosophy in the closing decades of the 17th century depended on its adaptation in the construction of the power state. As we have seen, the humanist character of natural philosophy in Copenhagen was its distinction mark and the cause of its decline. There were two sides of this development. Not only did Danish natural philosophers identify themselves with the ideal of the Republic of Letters. The ideal was also accepted by members of the high nobility as long as they paid their due to the fatherland. In Sweden the centralisation of values gave the ideal Republic of Letters much less appeal to both patrons and to natural philosophers.

[1295] See Robert K. Merton, *Science, Technology & Society in Seventeenth Century England.* New York 1970 (1938). For the discussion of the Merton-thesis see I. B. Cohen (ed.), *Puritanism and the Rise of Modern Science. The Merton Thesis.* New Brunswick & London 1990.

[1296] W. Kühlmann, *Gelehrtenrepublik und Fürstenstaat. Gelehrtenrepublik und Fürstenstaat. Entwicklung und Kritik des deutschen Späthumanismus in der Literatur des Barokzeitalters.* Tübingen 1982.

This study has endeavoured to combine what is generally known as the *internal* and the *external* perspective to the history of science. Only by connecting science to a local as well as social and cultural context can we improve our understanding of scientific development. Science is much more than theses, experiments and discoveries - it is also culture and cultural history. Instead of limiting discussions on The Scientific Revolution[1297] to the development and diffusion of various methods, theories and changing paradigms such as heliocentrism, the circulation of the blood, Newtonian physics and the breaking free of Aristotelianism, it is worthwhile to look more closely at the cultural and social aspect.

During the last decades several studies have increased our understanding of early modern science. Sociologists and historians of science have demonstrated the importance of patronage, of linguistic structures, general mentalities and so on. Other studies have emphasised the national context. Rarely, however, these various different approaches and insights have been combined.

As pointed out by Sverker Sörlin,[1298] there is an essential tension between the international character of science and the national character of patronage. As evident from our analysis of Denmark in the present study, this tension could be decisive. Too often the history of science has been studied from an almost exclusively national perspective or from the perspective of a modern scientific discipline, and we still need a better understanding of the international community of scientists in the early modern period. We need to transgress modern disciplinary borderlines and to analyse scientists not only as individuals, but as groups and social formations as well. The valuable sociological and anthropological approach needs to be closer connected to specific historical and local conditions, and a thorough study of the relationship between The Scientific Revolution and the emergence of the modern European state is yet to be seen.

This study has endeavoured to contribute to this project by analysing the national style of science in Denmark and Sweden and the various mechanisms that determined the development of Scandinavian science in the 17th century. Hopefully, its perspec-

[1297] For a summary the historiography and a reassertion on this concept see Margaret J. Osler (ed.), *Rethinking the Scientific Revolution.* Cambridge 2000.
[1298] S. Sörlin, De lärdas republik. Om vetenskapens internationella tendenser. Malmö 1994.

tives and conclusions shall puzzle and annoy readers so much that they take up the baton and continue the work.

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ticularly the Collection of Manuscripts. Since the major part of this book is concerned with natural philosophy in Denmark, my most ardent and tenacious critics have been Danish historians, who have taken the time and effort to scrutinise my work. Particularly Alex Wittendorff and Sebastian Olden-Jørgensen have provided useful advice as well as severe criticism.

The problem of having several supervisors and critics is that they tend to point in different directions. This book has been influenced both by Danish, German, English and Swedish historiography. It has covered a period of more than a century, and discussed problems, which normally belong to a range of academic disciplines. Although many mistakes and misconceptions of mine have been corrected by my critics, the conclusions, structure and frame of the work is entirely my own. For better or worse.

Jakob Danneskiold-Samsøe 2004,
In suo museo

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This book compares cultures of natural philosophy in Denmark and Sweden from the Reformation to around 1700. Rather than treating natural philosophers as individiuals, it analyses the rise of particular circles and cultures, which stimulated new approaches to the study of nature in talented individuals. As a study of culture, it does not treat natural philosophy as an autonomous phenomenon, but connects it to the political, social and religious framework of the surrounding society.

The book ventures to explain the highly different national style of natural philosophy in Denmark and Sweden, and why the flourishing scientific culture in Copenhagen in the mid-17th century had withered only few decades later, while science in Sweden attained momentous prestige and support in the decades around 1700.

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