INTRODUCTION

Intersections of Science, Theology, Philology, and Political and Religious Education

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The present volume is a follow-up project of *Early Modern Zoology. The Construction of Animals in Science, Literature and the Visual Arts*, published some seven years ago in the same series.[1] In the present volume, it is our aim to further explore the fascinating alterity of early modern zoology by focusing on *theology* and *philology*, and their interplay with other methods of early modern knowledge production. Theology and philology certainly belong to the most important alterity aspects of early modern zoology. If one looks at the basic principles, methods, tools, and research practices of the modern science of zoology (in the 20th and 21st centuries), it is clear that there is in fact no place for religion or theology, and hardly any for philology; and there is only a very limited amount of attention devoted to what may be called literary tradition. The very foundation of modern zoology—evolutionary theory—excludes all religious worldviews that are based on the assumption of a single *creatio ex nihilo* of the species by a godly creator. Evolutionary theory demonstrates that the species presently living have evolved during an evolutionary process of hundreds of millions of years, which has caused all kinds of adaptations; life once started from amoebas, and it has slowly developed into the most complex organisms, the mammals, with man as the highest developed species at the top of the pyramid of evolution. According to *Genesis*, however, man, plants, and animals (i.e. *all* known species) were created by God at approximately the same time in Paradise.

Moreover, in Christian theology man was completely set apart from the animals: he was not part of animal life, and nobody regarded him as the offspring of animal ancestors. In the modern zoological system of species, as a matter of course man (*Homo sapiens*) partakes in evolution: he is regarded as belonging to the category of the *Primates*, and he has the same early pedigree as chimpanzees, orangutans, gorillas, and gibbons, but also the *Lemures*, makis and bushbabies (*Galagonidae*). The more direct ancestors of *Homo sapiens*, the family

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Hominidae or great apes (consisting of seven surviving species), diverged from the family of the *Cercopithecidae* (guenons) some 24 million to 30 million years ago, and from that of the gibbons or *Hylobatidae* some 12 million to 18 million years ago; *Homo* (not yet *Homo sapiens*) diverged from other *Homidae* or great ape species, such as chimpanzees, orangutans, and gorillas, some 3 million to 4 million years ago. In comparison, according to the Bible the creation of both man and all animal species took place only some 6,000 years ago. Modern zoology does not attribute to man (*Homo sapiens*), the only surviving subspecies of *Homo*, an ontological status that would differ from that of other *mammalia* species. Ethological research and behavioural biology treat man and other animal species along the same lines, and the same goes for comparative morphology and physiology. The academic discipline of theology is in fact irrelevant to the science of zoology, at least if one talks about the methods and practices of zoological research. The understanding of nature is no longer intertwined with theological knowledge. The modern understanding of the science of zoology is characterised by sharp chronological distinctions: zoology before and after Linnaeus, before and after Darwin.

While modern zoology hardly leaves any room for theology, there are a number of intersections with political ideology. These pertain to the status of animals in the 20th and 21st centuries, animal rights, regulations of professional and commercial animal keeping, food politics, environmental questions in the broadest sense, and the preservation of wild living species. With respect to the use of animals and their status in the modern world, a consensus seems to have developed that some kind of preservation of wild living species is necessary in order to prevent the extinction of species. Nowadays, animals can be regarded as endangered beings. Many political parties in the Western world include some sort of environmental issues in their ideological programme, while some countries even have political parties in defence of animals.

In the early modern period, however, almost nobody felt the need to preserve wild living species. Especially the European *Homo sapiens* was about to conquer and "civilise" more and more of the areas of "wild" nature. Animals were predominantly seen either as useful, as harmful, or as a mirror of God's wisdom, and they were treated accordingly. On the one hand, Christian belief legitimised the use of animals through the authority of the Bible; on the other hand, animals were regarded as an important part of God's creation, and therefore as a manifestation of his unlimited prudence, wisdom, goodness, and beauty. It is exactly this fact that made them an excellent object of study. The understanding of nature was somehow equated with the understanding of God. God was the author of the "Book of Nature", and it was man's task to read

and interpret it, and to contemplate on it. And it is clear this could be done in many different ways.

The contributions of the present volume try to map out the different ways in which the reading of the "Book of Nature" by early modern naturalists took shape. The "Book of Nature" comprises, among other things, the careful description of animal species, using certain literary, scholarly, or pictorial traditions, as well as empirical observations, vivisection, and eyewitness accounts (contributions by Enenkel on "The Species and Beyond", Hendrikx, Jorink, and Ogilvie); furthermore, it also involves the production of zoological illustrations in woodcuts and engravings (Hendrikx, Enenkel on "The Species and Beyond", Jorink, and Herrin), and the "translation" of zoological species into visual art for different purposes, such as religious devotion and prayer, scientific and philosophical contemplation, or scholarly curiosity (contributions by Jorink, Smith, Herrin, and Rikken). It includes theoretical, philosophical, and theological thinking regarding God's creation, the Flood, and the generation and procreation of animals (contributions by Enenkel on "The Species and Beyond", Roling on Bartholin, Roling on palingenesis, Jorink, and Ogilvie); new attempts with respect to animal nomenclature and taxonomy (contributions by Hendrikx, Enenkel on the "Species and Beyond", and Ogilvie); biblical exegesis in word and image (contributions by Smith, Herrin, and Enenkel); philological comment upon classical authors (contributions by Enenkel on "The Species and Beyond" and Smith); the application of etymology, proverbial wisdom, and Erasmus's *Adagia* (contributions by Smith, Loose, and Kalff); translations, either of Greek sources into Latin or classical sources into vernacular languages; impressive collections of either literary or pictorial sources (contributions by Hendrikx and Herrin), of natural objects in early modern *Wunderkammern* (contributions by Roling on Bartholin, Rikken, and Herrin), or of animals in (princely) menageries (Rikken and Herrin). It also includes engagement in practical issues and questions, e.g. the problems and methods of animal breeding (contribution by Enenkel on "The Species and Beyond") and maintenance; cooking; medicinal recipes with regard to animal substances (contribution by Roling on Bartholin); and analysis of the anatomy and physiology of animals by vivisection and experiments (contributions by Jorink and Roling on Bartholin). At the same time it also includes—even on a large scale—the production and discussion of symbolic meanings ascribed to animals, with respect to ethics, religion, politics, and social hierarchy; and, in more general terms, the use of animals as transmitters of various kinds of applicable knowledge in different literary and scholarly contexts, such as emblematics, fable literature, books of memory, satire, political and religious

pamphlets, etc. (contributions by Kalff, Loose, Herrin, and Smith). In many cases, these different approaches were interconnected and were applied in various combinations: in early modern zoology rationalisation, analysis, and empirical observation were always intertwined with religious devotion and the search for admirable or miraculous aspects.

Indeed, most of the above-mentioned approaches, fields of interest, and methods of research were in one way or another connected with a distinct search for the admirable or wondrous (*mirabile*). This goes back to the major classical sources of early modern zoology—Aristotle, Pliny, and the Bible—and to medieval zoology as well, for example Albertus Magnus. As is demonstrated in the contribution by Karl Enenkel on "Die antike Vorgeschichte der Verankerung der Naturgeschichte in Politik und Religion", Pliny preferred not to present his animal descriptions in the framework of a clear and plausible system that would explain the common morphological and physiological features of certain families or classes, but he always deliberately stressed the *uniqueness* of the various species. In his zoology, Pliny generally emphasised the miraculous character of God's creation, and nature's inherent intelligence, wisdom, and creative power. As Enenkel shows, Pliny constructed his zoology as a lemmatical collection of *mirabilia naturae*. Aristotle, although his zoological works were of a different kind, nevertheless did not refrain from including strange and astonishing aspects.

Early modern zoology proceeded to work along those lines, albeit in part approaching the topics from different perspectives and using different means. Its different perspectives were, of course, formed by the mainstream features of Christian theology, including scholastic debates; from the middle of the 16th century on, the theological framework of zoology was shaped by Protestantism and the Counter-Reformation, and especially Jesuit scholarship and science. Early modern zoology's different means and methods refer to a new and distinct interest in animal anatomy based on vivisection, and furthermore to the invention of the microscope; the increase in travelling; the discovery of the New World; the invention of the printed book, especially animal illustration in woodcuts and engravings; and the new role scientific exchange played, for example in terms of scholarly correspondence.

The present volume aims to present in-depth case studies that shed light on the fascinating amalgam of intellectual pursuits that shaped early modern zoology. In fact, all of the contributions are dedicated to the various intersections and combinations of the above-mentioned approaches, interests, and methods: the intersections of new "scientific" methods and refined theological argumentation (contributions by Ogilvie, Jorink, Enenkel, Roling on Bartholin, and Roling on palingenesis); of empirical observations and literary traditions

(the majority of the contributions); of attempts to construct an integrative systematic taxonomy and of the belief in wondrous and "phantastic" animals, or singular "monsters" (contribution by Enenkel on "The Species and Beyond"); of empirical observation and the rise of a new "teratology" (contributions by Enenkel on "The Species and Beyond" and Roling on Bartholin); of various constructions of nomenclature, both new and traditional (contribution by Hendrikx); the intersections of religious or mythological animal painting and of 16th-century zoology (contribution by Rikken); of graphical representations of animals (woodcuts, copper etchings, drawings) and philology, including etymology and proverbial wisdom (contribution by Smith); of animal painting as a virtuoso piece of art and *Wunderkammer* collector's item, and microscopic zoological research (contribution by Jorink); of representations of animals in the visual arts and of biblical exegesis (contributions by Smith, Herrin, and Rikken); and of printed representations of animals (woodcuts and engravings) as scientific illustrations (contributions by Hendrikx, and Enenkel on "The Species and Beyond") and as emblematic, symbolic images (contributions by Herrin and Kalff).

The second section ("The Order of Nature") is especially dedicated to early modern views on animal classification and generation. Enenkel's contribution on "The Species and Beyond" focuses on one of the most striking paradigms of early modern zoology: hybridisation (cross-breeding) and hybrids. He discusses the methods and patterns of argumentation of animal classification and description in zoological treatises and manuals of the 16th and 17th centuries, especially those by Edward Wotton, Conrad Gessner, Wolfgang Franzius, Giovanni Battista della Porta, Juan Eusebio Nieremberg, John Jonston, Athanasius Kircher, and Caspar Schott. Enenkel elaborates on the intersections of philology, theology, and empirical observation. He shows that it would be misleading to assume that there was a linear "progress" in zoology from the middle of the 16th century to the end of the 17th century, in terms of either method or results. The belief in hybrids is evident in the 16th century, and it still flourished in the second half of the 17th century. The various arguments developed by the above-mentioned zoologists are determined and influenced by their different interests, purposes, intellectual contexts, and theological affiliations.

The contributions by Sophia Hendrikx and Karl Enenkel on "The Species and Beyond" demonstrate that a single zoologist (Gessner) was able to work with different methods and principles. Whereas in the first edition of his work on the quadrupeds (*mammalia* and part of the *reptilia*) Gessner deliberately refrained from presenting the species in an (integrative) taxonomical system, he used such a system in the *Icones* and, in an even more refined and elaborate

way, in his works on fish species. Hendrikx shows in her case study on the herring species (*Clupeidae*) that Gessner made a systematic attempt to construct a taxonomical family of species based on empirical study, eyewitness accounts, and scientific exchange; and that the methods he applied led to results which come surprisingly close to the later ichthyological classifications based on the Linnaean binary nomenclature.

Bernd Roling in his contribution on Bartholin describes the breath-taking, but complex and ambiguous career of the *unicorn* in the zoology of the 17th century, from a quadruped to a fish, the narwhal (*Monodon monoceros*, a sea mammal); he especially sheds light on the pivotal role the Danish naturalist, medical doctor, and university professor Thomas Bartholin and his family (his father, Caspar, and his brother-in-law Ole Worm) played in this process. Although at a certain point it became clear that the spectacular horns of unicorns that were shown in collections and *Wunderkammern* all over Europe did not belong to the famous but mysterious even-toed quadruped (the existence of which, however, was legitimised by an immeasurable amount of literary *auctoritates*), but to a whale species, the narwhal, Bartholin and other scholars, such as the Dutch medical doctor Albert Kyper and the German scholar Paul Ludwig Sachse, still insisted on the (supposed) medicinal value of the so-called "horn"—which was in fact the tooth of the narwhal—as an antidote to poisons. Interestingly, the medieval belief in the almost magical power of the unicorn goes closely together with a "modern" interest in the animal for medical experiments. A number of cats and dogs were the poor victims of these experiments.

Erik Jorink elaborates on the intriguing intersections of advanced empirical zoology (based on systematic microscopic observations) and technically brilliant *Wunderkammer* painting or virtuoso artistry in the 17th-century Dutch Republic, against the background of contemporary physico-theological debates. Jorink focuses on the intellectual and artistic exchange between the remarkable, but thus far little-known animal painter Otto Marseus van Schrieck (born ca. 1620) and the pharmacist, naturalist, and pioneer in entomology and microscopic research Johannes Swammerdam (who authored the ground-breaking *Historia generalis insectorum*, 1669), in the Amsterdam circle of learned *curiosi*. Both Marseus and Swammerdam engaged in comparative anatomy, and both were fascinated by the problem of the mysterious "spontaneous generation". Through his advanced microscopic research Swammerdam was able to observe and describe the genitals of insects, which of course made spontaneous generation superfluous, at least with respect to the species researched by the Dutch naturalist. Swammerdam's advanced

empirical research, however, did not exclude theological thinking. Through microscopic research, God's creation turned out to be even more ingenious and perfect.

The same is true for John Ray's zoological studies on insects, to which Brian Ogilvie dedicates an in-depth study. Ogilvie tackles the question of how seriously physico-theologians took the discoveries of natural history, and to what degree they included them in their devotional and apologetic argumentations. With respect to John Ray's works, Ogilvie presents a positive answer: the enormous number of insect species testified to the 'magnitude of God's creative power', and their remarkable anatomy to the 'immense subtlety of divine craftsmanship'. Ogilvie elaborates on the precision and scientific devotion with which Ray described and classified insect species, and demonstrates that in the succeeding editions of his works, Ray was eager to improve, correct, or complete his findings. In this way God manifests himself in the smallest details of zoological research. Each little step toward more precision is an important one toward the knowledge of God.

In his second contribution Bernd Roling deals with another important theory of generation, *palingenesis*. He shows that 'already in the 17th century, scholars such as Caspar Posner had recognised that the Scotist hypothesis of a *resurrectio naturalis* could open a clear path to accepting palingenesis. If the connection of form and matter could operate by natural means at the moment of resurrection, then they were both perhaps continuously together even after death. Why should the form of the body not simply be re-activated as the life-principle in its remains after death? For Paracelsus, the form stayed in the remains of a creature and merely waited for its revivification'. Roling demonstrates that many naturalists at the end of the 16th and the early 17th century adopted Paracelsus' view and attempted to prove it by experiments.

The third section ("Images of *Genesis*"), containing three contributions, is dedicated to the representations of animals in the early modern visual arts (painting, woodcut, engraving/copper etching, and drawing), and their intersections with theology, philology, and the 'modern' zoological knowledge displayed in the important manuals of the 16th century. All three contributions deal with biblical topics or scenes from *Genesis*: *The Fall of Man* (Smith); *The Creation of the Animals in Paradise*; *Adam Naming the Animals*; *The Animals Boarding the Ark of Noah*, and *The Animals Leaving the Ark* (all Herrin and Rikken). The second, fourth and fifth topic also played an important part with respect to the problem of hybridisation and hybrid speciation, especially in zoological discussions of the 17th century—such as those by Wolfgang Franzius, Juan Eusebio Nieremberg, Athansius Kircher, and Caspar Schott (contribution

by Enenkel, on "The Species and Beyond")—and to the question of spontaneous generation treated by Jan Swammerdam and Otto Marseus (contribution by Jorink).

Paul Smith analyses Albrecht Dürer's copper etching of *The Fall of Man* (1504), and his woodcut (1510) and drawing (again from 1510) on the same topic. In each of these three pieces of art Adam and Eve are accompanied by different animals: on the 1504 print by the serpent, elk, cat, mouse, hare, ox (or cow), parrot, and ibex (or he-goat); on the 1510 woodcut by badger and bison; and on the 1510 drawing by serpent, lion, and stag. In these devotional pieces of art, Dürer's animal representations are on the one hand very realistic, but on the other highly symbolic. Dürer's inventions are based on a profound interest in philology, etymology, and proverbial expressions, inspired by the advanced humanism of the early 16th century, especially Erasmus's *Adagia*. Paul Smith convincingly elaborates on these intersections of painting and humanist philology. Dürer has constructed the representation of the animals as intellectual enigmas, and he expects the viewer to solve them in a process of intellectual discovery. Probably only highly educated viewers were able to fully understand Dürer's symbolic inventions.

Amanda Herrin deals with the intersections of the visual arts at the end of the 16th century and important zoological works that appeared in the second half of the 16th century, especially Gessner's *Historia animalium* (1st edition, 1551–1558). She focuses on a series of engravings invented by the Antwerp artist Maarten de Vos, *Imago Bonitatis* (ca. 1587), and executed by Jan de Sadeler, which she convincingly explains in the context of the zoological interest and knowledge of the circles of artists in Antwerp, and later in Prague. Among the artists inspired by Gessner's animal illustrations were Marcus Gheeraerts, Jan Collaert, and Joris Hoefnagel.

Marrigje Rikken further explores this specific interest of artists in the Low Countries and in Prague, by focusing on Jan Brueghel the Elder and Roeland Savery. Rikken demonstrates that the inventions of Breughel and Saverij are to a spectacular degree dominated by their fascination with exotic or rare species. Both try to depict as many exotic species as possible, and often they hide other elements of the biblical narrative (e.g. the Ark of Noah) in the background or do not depict them at all. It looks as if painting scenes from *Genesis* has developed in a genre of animal painting *pur sang*.

The fourth section focuses on the symbolic use of animals in political education. Sabine Kalff discusses the political meaning of the crane as an emblematic animal. Alexander Loose explains in what ways the Bohemian humanist Johannes Dubravius used animal allegory as a mirror of princes. The last section deals with physiology and early modern political ideology.

Tamás Demeter shows that in the first half of the eighteenth century, the representation of human functioning in physiology and moral philosophy went through a significant transformation. The ideal of a mechanical description give way to a vitalistic approach more sensitive to qualitative differences than mathematical formulae. This theoretical transformation coincided with a large-scale social and political change in Scotland after the Glorious Revolution and the Union of 1707. Demeter argues that the mechanical image of human functioning served the purposes of Scottish Jacobite political apology. In contrast, the vitalistic image of man, developed in physiology and moral philosophy at the same time, could be put to ideological use serving the social and political aims of the post-Union political and intellectual elites.

The editors hope that the contributions in this volume may inspire others to further research the intriguing and complex field of early modern zoology.

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