

Renaissance Biology ^[1]

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Part II - The Rise of Observational Science

Perhaps the greatest advance of the Renaissance biologists was the study of anatomy, a period where humanity first began to understand the human body and the structure of animals. This was initially fuelled by the needs of the Renaissance artists and sculptors for greater accuracy in their work, with men such as Da Vinci (1452-1519), Antonio Pollaiuolo (1431/32-1498), Michelangelo (1475-1564) and Baccio Bandinelli (1488-1560) studying human and animal physiology, allowing them to create greater detail in their models.

Renaissance Biology - The Rise of Observational Science Part I ^[3]

Renaissance Anatomy – the Artistic Revolution

Andreas Vesalius by Tintoretto

Andreas Vesalius, by painter Tintoretto about 1540
(Public Domain)

This trend grew into another science, aided by the easing of restrictions on the dissection of cadavers, something that held back the work of the Muslims, and the Church felt that there was no problem in using the bodies of criminals and other sinners for research. As with most areas of Renaissance science, the advent of printing allowed diagrams of anatomy to spread far and wide, giving a greater number of scholars access to the latest studies. Possibly the greatest of the early anatomists was the Belgian, Andreas Vesalius ^[4] (1514-1564), who studied the work of the Islamic scholar, Galen and, after moving to Padua, began to dissect cadavers in front of students, also recording their anatomy in meticulous detail. His 1543 book, *De humani corporis fabrica libri septem* (Seven Books on the Structure of the Human Body), was an important publication in the history of anatomy, and he brought an element of discipline and academic thoroughness to the field. Crucially, Vesalius instructed his students that they should always strive to verify findings for themselves rather than blindly accept the words of others.

The Birth of Human Physiology

For the first time, the Renaissance saw scholars begin to study the underlying process of the human body, using a mixture of dissecting cadavers and living animals to study circulation,

breathing, and other functions. Michael Servetus (1509/1511-1553), a Spanish physician, studied the heart and found that blood traveling to the lungs flowed from the right chamber of the heart. He also discovered that blood did not flow between the two halves of the heart via pores in the septum.

William Harvey

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William Harvey ([Creative Commons](#) [5])

William Harvey (1578-1657), an Englishman studying in Padua, took the work of Servetus a step further and worked out how the blood circulated around the body. Previously, physicians believed that blood flow was tidal, that the heart pumped blood as it contracted but then sucked it back up as it expanded, also suggesting that pores between the two sides of the heart allowed blood to flow between the two. Harvey blew this idea apart and showed that the heart certainly pumped blood, but he proved that the expansion was passive and did not have the power to suck up the blood. He proposed that blood left the heart through the arteries and returned via the veins, tentatively suggesting that smaller vessels bridged the gap between the two, although he had no way of proving this and that particular discovery would not be verified until the discovery of the microscope. In his astonishingly concise text, *Exercitatio anatomica de motu cordis et sanguinis in animalibus* (The Anatomical Function of the Movement of the Heart and the Blood in Animals). William Harvey also proposed that all organisms originated from an egg, where they are undifferentiated forms that would develop into the larger animals.

William Harvey Veins Image

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Image of veins from William Harvey's *exercitatio* (Public Domain)

Another area that saw advancement during the Renaissance was in the study of embryology, where scholars studied exactly how animal and human embryos developed during the period of gestation. Volcher Coiter (1534-c.1576) studied the development of chickens, and Giaralomo Fabricius charted the development of humans, domestic beasts, fish, and snakes throughout embryonic development. His work, *De formato foetu* (1600), was the first treatise on this subject.

Renaissance Zoology – Gesner, the Father of Zoology

There is little doubt that the Renaissance was the formative era for botany, as the period where the discipline really took off as a genuine science and scholars shifted towards observational science rather than recycling the work of the ancients. By contrast, Renaissance zoology was slower to develop, partly because the study of animals was largely disassociated from medicine, and partly because the Renaissance zoologists tended to include creatures of myth and legend in their bestiaries. Of course, it would be unfair to

criticize them overly for this; in an age where we can see rhinoceroses and anacondas on National Geographic, we forget how fantastic some animals must have seemed to European observers. If the earth contains such strange beasts, why not the creatures of mythology – does a giraffe make any more sense than a dragon or giant serpent? Because of the difficulty of observing animals when compared to static plants, which are easy to sample and preserve, the Renaissance zoologists had to rely upon legends and hearsay. Even when such animals were seen, artists often had to rely upon a fleeting glance that lent itself to interpretation and embellishment rather than the intricate details possible with botany and anatomy. Despite this, there were some excellent zoologists during the Renaissance and, while they may not have been able to document species with the accuracy of the botanists, their work was still important, especially where it overlapped with paleontology. The man regarded as the Father of Zoology is Conrad Gesner (1516-1565), a scholar who produced a monumental work of five volumes, documenting animal species and including vivid drawings and etchings by such luminaries as Gustav Durer.

Sketch of bird anatomy by Volcher Coiter

Image not found or type unknown

Sketch of bird anatomy by
Volcher Coiter (Public Domain)

Born in Zurich, the son of a furrier, he lost his father during the Battle of Kappel, but was encouraged to enter university by the scholars Heinrich Bullinger and Oswald Myconius. He showed an aptitude for linguistics and nature, initially studying Greek and moving on to become a physician. Gesner compiled a dictionary of classic authors writing in Hebrew, Latin and Greek, and his *Bibliotheca universalis* earned him renown, ensuring that he found sponsorship for future projects. Eventually employed as a physician in Zurich, he began to compile his compendium of animals in 1551, and his *Historia animalum* documented pretty much every known species in the animal kingdom, although he also included many beasts that we now know to be mythical. Previously, any such compendiums had concentrated upon the fantastic creatures or incorporated moral tales into their descriptions, such as describing foxes and ravens as the work of the devil or stating that men should strive to be as brave as lions or as loyal as dogs. Gesner cut out much of this and, probably due to his interest in botany and the direction taken by that subject, attempted to stick to a more realistic view. However, he did not attempt to classify animal species other than following the crude divisions used by Aristotle and Pliny. The book contained more than simple descriptions of animals: Gesner used a variety of resources for his information, including the observations of classic authors, especially for some of the mythical beasts, but also included information from observation and dissection. He did not just describe the physical appearance of the animal, but also documented their habits and nutrition, as well as any uses in medicine. Gesner also documented the importance of the animal in art, heraldry, history, and literature. His work was divided into five volumes:

1. Volume I: Viviparous four-footed animals
2. Volume II: Oviparous quadrupeds
3. Volume III: Birds
4. Volume IV: Fish and other aquatic animals
5. Volume V (Published posthumously): Snakes and scorpions

These volumes certainly marked the beginning of zoology as a separate discipline, although it would be nearly two-hundred years before scholars began to challenge the commonly accepted creation stories of the Bible.

Later Renaissance Zoologists

Ulisse Aldrovandi (1522–1605) was another great naturalist, born in Bologna, eventually studying both botany and zoology and contributing greatly to both. Originally versed in medicine and philosophy, this Italian pursued his passion for the natural world and he became the first professor of natural sciences at the University of Bologna, in 1561.

Aldrovandi Owl

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Owl by Aldrovandi (Public Domain)

His legacy was developing collections of specimens containing preserved plants and animals, a method that allows scholars to understand the structure of both. Like many Renaissance scholars, he was placed under house arrest for holding non-conformist views and it was during this period that he developed his interest in natural science. Aldrovandi became obsessive about collecting specimens and continued this work after the lifting of his sentence, eventually gathering a collection at the museum that contained over 18 000 specimens and was open to scholars and the aristocracy for study. After his death, his collection passed into the hands of another naturalist, Ferdinando Cospi (1606-1686), some 50 years after Aldrovandi's death, and he greatly added to its contents. The Bologna Natural History museum is still one of the world's greatest resources for the development of natural history through the ages and the animals, stuffed and preserved in formaldehyde, are still viewable today at the museum. Aldrovandi wrote many books on natural history, including his famous *Monstrum Historia*, a collection of what he perceived as animal and human 'monstrosities.' He also left behind a great legacy of pictures of various species, commissioning professional artists, such as Jacopo Ligozzi (1547–1627), to create detailed sketches of specimens. He always made sure that an artist accompanied him on his many field trips and went on to write 400 other books, although only a few were printed during his lifetime. While his work often lacked accuracy and the pictures contained large amounts of artistic interpretation and license, there is little doubt that they were landmark texts and widely read by later scholars. Aldrovandi contributed greatly to zoology, influencing later luminaries such as Ole Worm and Linnaeus who recognized the debt they owed to this man. Ultimately, many of the scholars studying zoology also specialized in botany, but they did not attempt to answer any theoretical questions or classify animals in the same detail as they did with plants. However, they did lay down the groundwork for a later expansion of the discipline, which would become one of the most important subdivisions throughout the Enlightenment, culminating in the works of Linnaeus, Wallace, and Darwin, as they attempted to uncover the why behind the diversity of animal species and why certain species were adapted to particular habitats.

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