

# William Harvey

Renowned physician and scientist William Harvey is best known for his accurate description of how blood circulates through the body. While his published work on the circulation of blood is considered the most important of his academic life, Harvey also made significant contributions to embryology with the publication of his book *Exercitationes de Generatione Animalium* in 1651. In this book he established several theories that would set the stage for modern embryology and addressed many embryological issues including conception, embryogenesis, and spontaneous generation.

The second oldest of nine children, Harvey was born in Folkestone, England, on 1 April 1578 to Joan Halke and Thomas Harvey, a yeoman-farmer. At age ten, Harvey's parents sent him to King's Grammar School in Canterbury. In May 1593, he was admitted to Gonville and Caius College, Cambridge. Harvey's inspiration to pursue a degree in medicine was rooted in the prominent work of Caius, one of the founders of the college. He obtained his BA degree in 1597 and in 1600 entered the University at Padua in pursuit of a medical degree. While attending Padua, he became associated with the famous professor of anatomy and surgeon, Hieronymus Fabricius. Fabricius held a strong interest in Aristotelian views on the formation of the fetus and the function of valves in the veins. It is said that Fabricius had the single most influence on Harvey's way of thought, influence that would later be observed in his research. Harvey received his degree on 25 April 1602.

Harvey then sought to become a fellow of the Royal College of Physicians. However, a long-held tradition required fellows to have earned an MD degree from Oxford or Cambridge before admittance. Not to be deterred, Harvey obtained a license to practice from the University of Cambridge, and on 5 June 1607 was officially admitted as a fellow of the College of Physicians. During his wait for admittance, he married Elizabeth Browne, the daughter of physician Lancelot Browne, on 24 November 1604; they had no children. On 14 October 1609, he succeeded Ralph Wilkinson as physician at St. Bartholomew's Hospital. He became Physician Extraordinary to James I in 1618 and retained the title through the reign of Charles I.

In addition to his hospital duties and private practice, Harvey was highly involved in teaching and research. In August 1615, he was appointed Lumleian Lecturer, a post that allowed him to teach anatomy at the College of Physicians. This position helped initiate his research on circulation of the blood. Most of his evidence came from the observations made during his dissection and vivisection of various animals. His close relationship with Charles I served him well as the king supported his research, even providing deer from his royal parks for Harvey's investigations. In 1628 he published his work on the circulatory system under the title *De Motu Cordis et Sanguinis*. This publication brought Harvey both fame and criticism.

Harvey also took great interest in the science of reproduction, most likely from his master Fabricius. During his lectures on anatomy, Harvey made comments on animal genitalia, on different kinds of fetuses, and on the development of the chick. He collected notes over several years on his observations on reproduction and embryology, resulting in the publication of his final work, which explored the generation of animals. However, George Ent, Harvey's fellow physician and long-time friend, was the most responsible for publishing this work. Ent visited Harvey in the winter of 1648 because he believed that Harvey had other work worthy of publication, hidden in secret. After long conversation, Harvey presented Ent with his draft, *De Generatione Animalium*. Although Harvey's perfectionist attitude made him reluctant to reveal his work until his discussion on the "Generation of Insects" was complete, he granted Ent control of the book's future. The book, titled *Exercitationes de Generatione Animalium*, was published in London in March 1651.

*Exercitationes* was divided into seventy-two chapters on topics in development, and three additional

chapters covering parturition, the structure of the uterus, and conception. The first thirteen chapters describe the comparative anatomy of the reproductive organs of various animals. Chapters 12 to 25 demonstrate the day-by-day development of a chick in the egg. In his observations, Harvey discovered the cicatricula, the area of the embryo that contains all the embryonic cells and from where generation proceeds. In chapters 26 to 62 he discusses at length theories and errors of generation, criticizing some of Aristotle's and Galen's conclusions as erroneous and hasty.

Harvey also established several of his own conclusions about theories of generation. First, he denounced spontaneous generation by claiming that even maggots and worms have some origin in eggs. This example is also associated with the establishment of the doctrine *ex ovo omnia*, meaning that all life originates from an egg, a doctrine that Harvey helped advance. Moreover, in chapter 51, Harvey expressed support for the theory of epigenesis, rather than preformation, through his description of the formation of limbs. Last, he rejected the Aristotelian and Galenic theories about early embryogenesis. Aristotle believed that embryos form from the combination of menstrual blood and semen, while Galen believed it was female semen and male semen. In addition to providing new information about conception and early human development Harvey also criticized many of his predecessors, particularly his old master Fabricius.

Harvey died in London on 3 June 1657. Though his work in embryology was overshadowed by his work on the circulatory system, Harvey did provide a basis for the development of modern embryology. Joseph Needham, author of *A History of Embryology*, summarized Harvey's view from *De Generatione*, emphasizing Harvey's advancement of the doctrine *ex ovo omnia*, the discovery of the cicatricula as the origin of the embryo, denial of spontaneous generation, and the dismissal of Aristotelian and Epicurean theories of embryogeny.

## Sources

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