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WILLIAM HARVEY

1578 - 1657

William Harvey, the great English physician who discovered the circulation of the blood and the function of the heart, was born in 1578, in the town of Folkestone, England. Harvey's great book, *An Anatomical Treatise on the Movement of the Heart and Blood in Animals*, published in 1628, has rightly been called the most important book in the entire history of physiology. It is, in fact, the starting point of the modern science of physiology. Its primary importance lies not in its direct applications, but rather in the basic understanding it provides of how the human body works.

For us today, who have been brought up with the knowledge that the blood circulates, and therefore take that fact for granted, Harvey's theory seems completely obvious. But what now appears so simple and evident was not obvious at all to

earlier biologists. Leading writers on biology had expounded views such as: (a) food is turned into blood in the heart; (b) the heart heats up the blood; (c) the arteries are filled with air; (d) the heart manufactures "vital spirits"; (e) blood in both the veins and the arteries ebbs and flows, sometimes going toward the heart and sometimes away.

Galen, the greatest physician of the ancient world, a man who personally performed many dissections and thought carefully about the heart and blood vessels, never suspected that the blood circulates. Nor for that matter did Aristotle, though biology was one of his major interests. Even after the publication of Harvey's book, many physicians were unwilling to accept his idea that the blood in the human body is constantly being recirculated through a closed system of blood vessels, with the heart supplying the force to move the blood.

Harvey first formed the notion that the blood circulates by making a simple arithmetic calculation. He estimated that the quantity of blood that was ejected by the heart every time it beat was about two ounces. Since the heart beats about 72 times per minute, simple multiplication led to the conclusion that about 540 pounds of blood were ejected each hour from the heart into the aorta. But 540 pounds far exceeds the total body weight of a normal human being, and even more greatly exceeds the weight of the blood alone. It therefore seemed obvious to Harvey that the same blood was constantly recycled through the heart. Having formulated this hypothesis, he spent nine years performing experiments and making careful observations to determine the details of the circulation of the blood.

In his book, Harvey clearly stated that the arteries carry blood away from the heart, while the veins return the blood to the heart. Lacking a microscope, Harvey was unable to see the capillaries, the minute blood vessels that transport the blood from the smallest arteries to the veins, but he correctly inferred their existence. (The capillaries were discovered by the Italian biologist, Malpighi, a few years after Harvey died.)

Harvey also stated that the function of the heart was to

pump the blood into the arteries. On this, as on every other major point, Harvey's theory was essentially correct. Furthermore, he presented a wealth of experimental evidence, with careful arguments to support his theory. Though his theory at first encountered strong opposition, by the end of his life it had been generally accepted.

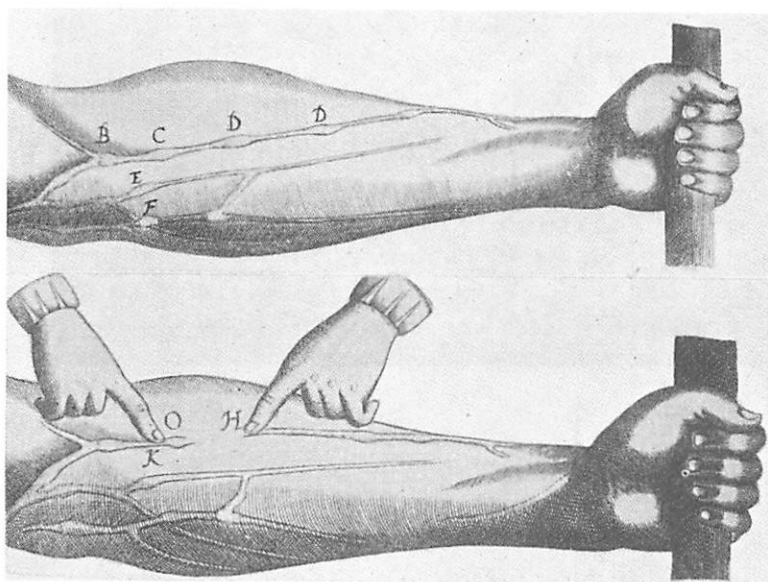
Harvey also did work on embryology, which, though less important than his research on blood circulation, was not insignificant. He was a careful observer, and his book, *On the Generation of Animals*, published in 1651, marks the real begin-

Harvey explains his ideas to Charles I.



ning of the modern study of embryology. Like Aristotle, by whom he was strongly influenced, Harvey opposed the theory of preformation—the hypothesis that an embryo, even in its earliest stages, had the same overall structure as the adult animal, though on a much smaller scale. Harvey correctly asserted that the final structure of an embryo developed gradually.

Harvey had a long, interesting, and successful life. In his teens, he attended Caius College at the University of Cambridge. In 1600, he went to Italy to study medicine at the University of Padua, at that time perhaps the best medical school in the world. (It might be noted that Galileo was a professor at Padua while Harvey was there, although it is not known whether the two ever met.) Harvey received his medical degree from Padua in 1602. He then returned to England, where he had a long and very successful career as a physician. Among his patients were two kings of England (James I and Charles I), as well as the eminent philosopher Francis Bacon. Harvey lectured on anatomy at the College of Physicians in London, and in fact was once elected president of the College. (He declined the post.) In addition to his private practice, he was for many years the chief physician at St. Bartholomew's Hospital in London. When his book on the circulation of the blood was published, in 1628, it made him famous throughout Europe. Harvey was married, but had no children. He died in 1657, in London, at the age of seventy-nine.



*Illustration from
William Harvey's
book On the
Movement of the
Heart and Blood in
Animals.*