

Medicine in Stamps

William Harvey (1578-1657): Discoverer of the Circulation

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The 17th century witnessed a flurry of contributions by intellectuals as diverse as Descartes, Newton, Rembrandt and Shakespeare. There were giants in medicine too, and one towered above all others. He was a humble Englishman, short in stature, by the name of William Harvey, the discoverer of the circulation of the blood and the man who brought us the science of physiology.

The Lie in 1600: Since the days of Hippocrates (about 400 B.C.), physicians have generally understood that the human heart has four chambers, the lower chambers, the ventricles, being the “fountains of life” and the upper chambers, the auricles, the “receptacles of air”. The Greek philosopher-scientist Aristotle described the aorta, and other Greek physicians knew of arteries and veins. But it was Galen at the dawn of the first millennium who provided the most detailed – and misleading – description of the cardiovascular system. These Galenic errors included: 1) the septum separating the ventricles had invisible pores for blood to filter from right to left; 2) the heart was the source of body heat; and 3) there existed two different kinds of blood within two separate circulations: arterial and venous. The pulsatile arterial circulation carried the *vital spirit* called *pneuma* to provide the body with warmth and energy. The other type of blood, carried in the veins, was derived from ingested food and was continuously made in the liver.

Such was the state of the art at the turn of the 17th century. For an amazing two thousand years, no one had seriously doubted this proffered function of the heart.

History's First Physiologist: William Harvey was born in Folkstone, in the county of Kent in southern England, on 1 April 1578. At the age of 10, young Harvey attended King's Grammar School in Canterbury,

followed by a small college in Cambridge. He then enrolled at Europe's most famous medical school at that time, the University of Padua, Italy in 1599. Upon completing his medical studies in 1602, Harvey returned to England and began to practise medicine and conduct research at London's famed St. Bartholomew's Hospital, where he soon became its chief physician.

With careful experimentation, Harvey was able to correctly elucidate the pump function of the heart. At Padua, he met Fabricius, a teacher and friend, whose description of the valves of the veins helped Harvey to generate his hypothesis. Harvey was also influenced by the findings of two other great anatomists, Michael Servetus of Spain and Realdo Colombo of Italy, who described the flow of blood from the right heart to the lungs and back to the left ventricle. The Pope's personal physician, Caesalpinus, discovered how the valves of the heart worked: i.e. when the heart contracted, it sent blood to the arteries and when it relaxed, blood flowed in from the main veins. This also helped Harvey to shape his theory of the circulation of the blood.

Harvey began with simple observations of the flow of blood in fishes, amphibians, reptiles and small mammals and then extended them to man in health and disease. His most impressive yet simple experiments demonstrated the one-way flow of venous blood in the human forearm toward the heart. This led him to his central thesis: “The blood moves as in a circle. The arteries are the vessels carrying blood from the heart to the body and the veins returning blood from the body to the heart”.

De Motu Cordis (Motion of the Heart): Harvey chose to publicly deliver his novel theory on 16 April 1616 at the first Lumleian Lecture. This was a prestigious annual lecture he undertook as Professor of Anatomy at the College of Physicians. His presentation was well



received, but some of his colleagues remained sceptical. History tells us that Harvey kept meticulous notes, but his handwriting was quite illegible and his entries were a chaotic and incoherent mix of Latin and English. But they did culminate in his book, *De Motu Cordis*, a tiny treatise measuring all of 5½ by 7½ inches. Published in 1628, the book was described by British physiologist Thomas Huxley as “a little essay of 72 pages which no physiologist of the present day can read without wonder and delight”. *De Motu Cordis* makes the following points:

1. The auricles contract together first, followed by the contraction of the ventricles. Therefore the blood moves from the auricles to the ventricles.
2. The veins empty blood into the auricles and the semilunar valves prevent the blood from going back to the ventricles. Blood does not go from the right ventricle to the left through the septum of the heart, because there are no openings through the septum.
3. The heart makes more than a thousand beats in half an hour, forcing out more than 500 ounces, a greater amount of blood than is present in the whole body. Therefore the blood must return to the heart over and over; there is no other explanation.

In Chapter XIV, Harvey summarised the sum and substance of his findings:

“It has been shown by reason and experiment that blood by the beat of the ventricles flows through the lungs and heart and is pumped to the whole body. There it passes through pores in the flesh into the veins through which it returns from the periphery everywhere to the centre, from the smaller veins into the larger ones, finally coming to the vena cavae and right atrium. This occurs in such an amount, with such an outflow through the arteries and such a reflux through the veins, that it cannot be supplied by the food consumed. It is also much more than is needed for nutrition. It must therefore be concluded that the blood in the animal body moves around in a circle continuously and that the action or function of the heart is to accomplish this by pumping. This is the only reason for the motion and beat of the heart”.

Harvey's Humility: A private person described as one with an unusual capacity for slipping through the world unnoticed, Harvey had referred to Galen's *pneuma* and *vital spirit* as the common subterfuge of ignorance. Yet, he was humble and non-combative. Even as he rebutted his critics, he offered this apology: “...(L)et my thoughts perish if they are worthless, my experiments if they are erroneous, or if I have not properly understood them...it is not in my nature to upset the established order. If I am wrong

(for after all I am but a man), let what I have written turn sour with neglect, but if I am right sometime at least the human race will not disdain the truth”.

Harvey's Woes: Life was not always kind to William Harvey. His clinical practice reportedly fell off after publication of *De Motu Cordis*, although he lived to see his conclusions accepted by his peers. He was afflicted with a serious case of gout or more probably erythromelalgia (Weir Mitchell's disease), for which he sought relief by soaking his foot in ice-cold water. Although he did marry Elizabeth Browne, the woman he loved, Harvey's retreat to Oxford with King Charles I when London was under siege prevented him from being at her deathbed. Elizabeth died alone in London and left him with no heirs. His loyalty to the unpopular King led him to resign from his prestigious post at St. Bartholomew's and after the Army of Parliament overran Oxford in 1646, it nullified his honorary degree of Doctor of Physic. Allowed to return to London, Harvey could sense his increasing loneliness and the loss of will. His last intellectual output was a book on the growth and development of the young of animals (including the human foetus), *De Generatione Animalium*, published in 1651.

On 3 June 1657, at age 79, William Harvey suddenly lost his vision, then his speech as he succumbed to a massive stroke at home. His last act was to personally pass on his ring, watch and other mementos to his nieces and nephews. He bequeathed most of his wealth to the Royal College of Physicians. In his memory, the Harveian Oration is delivered each year on St. Luke's Day, 18 October to “exhort the Fellows of the College of Physicians to search out and study the secrets of nature by way of experiment”. Meanwhile, *De Motu Cordis*, Harvey's little book of 72 pages, is now a collector's item valued at over \$300,000.

REFERENCES

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