

Circulation over the centuries: William Harvey (1578–1657)

“I profess to learn and teach anatomy not from books but from dissections, not from the tenets for Philosophers but from the fabric of Nature.”

Confusion over the nature of the heart and blood as well as its role in the body had existed for centuries. Pliny the Elder, a Roman writer of the 1st century, described arteries as not having sensation and being without blood [1]. Veins were considered too narrow and superficial to hold blood and only allowed moisture to pass in small drops of sweat. A century later Galen, a Greek physician, spent his lifetime studying the human body and believed that there were two types of blood with distinct pathways and functions [1]. According to Galen, nutritive blood was made by the liver and carried through veins to the organs where it was consumed. Vital blood however was made by the heart and pumped through arteries to carry the life giving spirits. Galen also believed that blood flowed through the heart via the interventricular septum through tiny pores and the heart itself did not pump blood but rather the arteries had innate pulsatility. Galen’s ideas persisted for fourteen centuries until William Harvey explained the true nature of circulation.

William Harvey was born in 1578 in Kent, England during the reign of Queen Elizabeth I. After earning his bachelor’s degree from Cambridge University, he carried on his studies at the University of Padua, the foremost medical school of the time, studying under the esteemed scientist and surgeon, Hieronymus Fabricius [2]. It was Fabricius who had observed one-way valves in veins; however Harvey was the one who later explained their true role. After returning to England Harvey set up practice and married Elizabeth Brown, daughter of the court physician to Queen Elizabeth I and King James I. Through this marriage Harvey quickly moved up the ladder of aristocracy and became the court physician to both King James I and King Charles I. His research, which was generously sponsored and encouraged by King Charles I, led to



a revolutionary view of cardiovascular physiology.

Harvey performed numerous dissections as well as physiological experiments on animals and quickly disproved many of Galen’s theories. His observations showed that the valves in the heart allowed blood to flow in only one direction and without a need for perforations in the interventricular septum [3]. Harvey

discovered that the heart in fact was a pump for blood and that ventricles contracted together rather than one after the other as Galen had stated. Previous theories declaring that the body consumed blood were also challenged by Harvey who mathematically concluded that the amount of blood circulating through the body far exceeded that which the body could make and thus vessels in essence were a closed circuit.

The discovery of the pulmonary circulation (as well as the coronary vessels) belongs to an eminent Muslim physician of the 13th century named Ibn Nafis. However it was William Harvey who proposed that blood flows through the heart in two separate closed loops, the pulmonary circulation and the systemic circulation [4]. In his famous experiment published in *De Motu Cordis* Harvey observed that blood in veins moved readily towards the heart but not in the opposite direction with the aid of valves previously described by his teacher. He tightly ligated a forearm so that no arterial blood could flow below the ligature down the arm. He then loosened it slightly allowing arterial blood to flow down the arm, but keeping the venous blood below the ligature. Harvey discovered that the veins were swollen after filling up with arterial blood thus proving that an unknown connection existed between arteries and veins. The presence of capillaries was discovered some years after Harvey’s death by Marcello Malpighi using the newly invented microscope (Fig. 1) [1].

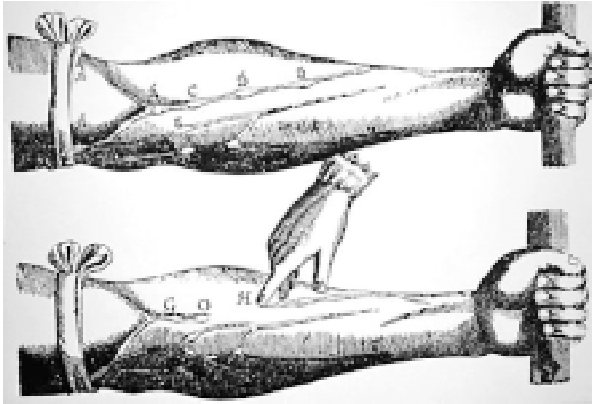


Figure 1. William Harvey's experiment of blood flow in veins and arteries.

In 1615 Harvey began to lecture about his discoveries of the cardiovascular system however it was not until 1628 that he published his work *Exercitatio Anatomica de Motu Cordis et Sanguinis in Animalibus* (An Anatomical Exercise on the Motion of the Heart and Blood in Animals) [3]. Despite

numerous critics and the continued clinical practice of blood letting, Harvey's work was accepted during his lifetime and it began a new era which encouraged investigation and questioning of previously taught theories. William Harvey felt very strong about the heart as many of Cardiology Journal's readers do; in his own words: "[the heart] is the household divinity which, discharging its function, nourishes, cherishes, quickens the whole body, and is indeed the foundation of life, the source of all action."

References

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