

History of Blood Circulation (Galen through Harvey)

Subject Matter:

- The discovery of blood circulation in the human body and the development of the theory.

Thesis/Theme of Approach:

- The true history behind the development of the blood circulation theory, from the classical views of Galen, through the Islamic Golden Age, and up to William Harvey with his groundbreaking and accurate description about how the heart pumped blood throughout the body.

Background:

- For almost 1500 years most of society followed Galenic teachings involving the circulation of the blood throughout the body, which were a logical evolution from the teachings of Aristotle and other Greeks. Galen (wrongly) believed there were two independent types of blood that ebbed and flowed to the upper and lower extremities and eventually “evaporated.” The venous blood was filled with nutrients, while the arterial blood was infused with the “vital spirit” by a mixture of air from lungs, chemicals, and heat from the heart. The former was formed within the liver and the latter in the left ventricle. He also thought the two ventricles were perforated and blood flowed through it and did not act as a pump. This blood was not recycled but was either evaporated or consumed by the organs.

Points of Interest:

- People were skeptical about any new theory’s challenging the teachings of Galen. Descartes, for example, agreed with these views and claimed that if Galen was wrong about blood circulation none of his own work was worth anything. William Harvey’s contemporaries, as late as the 1600’s, claimed they would rather “err with Galen” than support Harvey’s new conclusions. Galen’s work incorporated popular mythology.
- Michael Servetus is commonly credited with being the first to conclude that the blood had to pass through a pulmonary circuit and could not move directly from the right to the left ventricle, but this is true only in terms of European scholars. Ibn al-Nafis, an Arab scholar, had 300 years earlier hypothesized the same thing during the underappreciated Islamic Golden Age. While the two hypotheses are admittedly similar, there are minor but notable differences that have convinced historians that Servetus most likely had no access to Nafis’s earlier writings.
- Andreas Vesalius is also notable because of his discoveries and illustrations concerning human anatomy. He found that the blood vessels came from the heart and not the liver as Galen had earlier believed, and he agreed (with Servetus and al-Nafis) that the left and right ventricles were not connected and perforated.
- William Harvey thought that the heart pumped blood around the body, determined that the blood was circulated and conserved within the body, being the first to correctly describe this phenomenon despite a majority opinion from his contemporaries that disagreed with his challenges to Galen. He published his major work, “De Motu Cordis” (“On the Motion of the Heart and Blood”), in 1628. This work detailed the structure and inner workings of the heart, incorporating, refining, and expanding on many of the ideas of Galen, al-Nafis, Vesalius, and Servetus. His many experiments pointed to systemic circulation and the possible existence of capillaries (which proved to be a correct assumption) despite not being able to see them due to technological limitations. He was influential for his efforts to remove theology from physiology. Harvey’s views finally started to receive their due diligence during the 1800’s.

Experiment Concept:

- Physician ties a tight ligature around the upper arm to cut off the blood flow from the arteries to the veins. Arm is fully extended and hand tightly grasps some kind of cylinder. The purpose was to show that the upper arm was warm and the lower arm was cool and pale. When one releases the ligature, the opposite of this is true, with the lower arm being swollen and warm and the upper arm being cool. Bumps in the veins would form when one tries to push the blood back against the flow of blood in the veins, and you will be unable to do so because of vein valves. This proves that veins brought blood back to the heart, with the valves maintaining the direction of the blood flow. This also suggests the existence of capillaries connecting the arteries to the veins in the arm (but you cannot physically observe them in this experiment and neither could Harvey prove their existence, he only theorized the possibility of capillaries).
- Calculate the volume of blood in the left ventricle over a 30-minute span and calculate the volume of blood in the body at any given time. The amount passing through the heart in 30 minutes should be greater than the amount of blood present in the entire body. It is unlikely for the body to produce such a huge volume of blood in such a short period of time according to Galen’s model. This proves the blood is conserved and circulated throughout the body in what is now known as systemic circulation.

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