Profiles in Cardiology

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Claudius Galen of Pergamum: Authority of Medieval Medicine

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"If dissection differed from Galen, it was because nature had changed."
Jacobus Sylvus

Claudius Galen and his scholarly teachings defined the practice of medicine in Western Europe for 1500 years (Figure 1). His empiric approach, based on original animal experimentation, and his reputation for miraculous cures had an enormous influence on Western medicine during the Middle Ages and Renaissance until William Harvey's discovery of the circulation of blood in the early seventeenth century.[1–7]

Galen was born in 129 A.D. in Pergamum, a city with its great temple to Asclepius, God of healing and a library of 50,000 volumes. His father, Aelius Nicon, was a wealthy cultured architect and landowner who provided young Galen with an education in philosophy and politics.[1] He counseled his son to not compete for wealth and to pursue the truth regardless of the opinions of others.[2] Galen idealized his father's noble and level-headed nature, while condemning his mother for her short temper. By his teens, he was well-acquainted with Plato, Aristotle, the Stoics, and the Epicureans.[1,2]

Galen wrote that when he was 17, Asclepius appeared to his father in a dream, forecasting that his son's destiny was medicine. Though he ceased to study philosophy after his teens, Galen retained the background of his original academic pursuit. He marveled at elegantly simple biological systems and attributed nature's wonders to a creative force.[2] He often referenced Plato's Dialogues, and said that they had similar minds.[3] Galen also relied on the teachings of Hippocrates, whom he thought to be nearly divine.[3] He believed that a physician should be well-rounded and familiar with other arts and scientific fields, including music, rhetoric, geometry, and astronomy.[4]

When Galen was 20, his father died leaving him an inheritance which he used to travel throughout the Mediterranean and Near East to study medicine. He also searched for medicinal ingredients in foreign lands, not trusting the purity or freshness of the local drugs.[1] He returned to Pergamum from Alexandria in 157 A.D. and was appointed physician to the gladiators when only 28 years old, an honor given to him by the high priest of Asia.[1] Because the gladiators' performances were often dedicated to the Emperor, maintaining their ability to fight was critical. Thanks to his experience in dissection, which gave him extensive knowledge of the skeletal and muscular systems, he was proficient in caring for the injuries that the gladiators received in combat.[5]

Galen was 33 years old when he first came to Rome, where he held public lectures and dissections through which he became increasingly well known. Since dissection of humans was illegal in Rome, Galen performed diverse animal dissections from which he sometimes extrapolated inaccurate ideas about human anatomy.[2] His reputation also grew through his seemingly magical cures and skills as a diagnostician. Marcus Aurelius complimented his accurate diagnosis of a medical problem in the emperor that no other doctor had recognized. He was one of the few empiricist physicians of his times who sought to educate the public with his ideas, despite the trend that doctors did not disseminate their findings because of jealousy that others would profit from their work.[2]

Galen espoused moderation and poverty while observing much avarice in his contemporaries.[5] At that time, socialite physicians in Rome courted the friendship of the wealthy and were followed by entourages who bolstered their importance.[2] Galen offended these physicians by comparing them to brigands.[4] Tension grew when he discredited their theories by his demonstrations.[6]

Galen left Rome in the summer of 166 A.D., possibly to escape the plague.[1] Two years later Marcus Aurelius summoned him to travel to Germany with his army. Galen convinced the emperor to allow him to remain in Rome, where he was physician to Commodus, the heir to the throne. He stayed in the city until 192 A.D. when he was about 62 years old.[2,5] He never married. There are no extant statues or coins of his image. Few details are known about the final years of Galen's life, but he probably stayed in his native Pergamum, dying around 200 A.D. at age 70.[2]

The practice of medicine during medieval times and early Renaissance was based largely on Galen's methods. He was thoroughly conversant with the prior body of medical knowledge, including the doctrines of the Empiricists, Methodists, and Dogmatists, about which he wrote critical analytical works.[2] He sought past authority, primarily Hippocrates, Herophilus, and Erasistratus, and tried to combine his ideas with existing theories. He believed that Hippocrates was always right. Galen's high regard for these authors contributed to his failure to discover the circulation of blood, despite his stress on experimentation and his accurate identification of the function of valves in preventing "matter from flowing backwards."

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Figure 1. Claudius Galen (a commonly used depiction since no actual drawing or statue is available).

Galen believed that the body was regulated by the brain, heart, and liver. From Hippocratic medicine, he related health to the four humors: blood, black bile, yellow bile, and phlegm. Disease was caused by an imbalance between the four humors and, therefore, restoring their balance would cure the disease.[7] The liver converted chyle from the intestine into venous blood which was then endowed with natural spirit, imparting life and nourishment. It then flowed from the liver to the right side of the heart and from there to the other organs of the body. Impurities in the blood were carried from the right ventricle into the lungs to be removed upon expiration. Blood passed through invisible pores in the ventricular septum from the right to the left ventricle.[2] In the left ventricle blood combined with pneuma, the vital spirit inspired from the air that endowed life.[7,8] The critical concept of pneuma originated with earlier philosophers' writings on respiration, primarily those of Plato and Aristotle. Galen believed pneuma to be the source of the blood's heat and that the heart was responsible both for the infusion of blood with pneuma and its movement through the arteries and the rest of the body. Because Galen thought that blood was "used up" as it passed through organs and tissues, he overlooked the possibility that blood returned to the heart.[2]

Like Erasistratus, Galen believed that the atria were not true chambers by their own right, but were expanded features of the veins, connecting the vena cava to the right ventricle and the pulmonary vein to the left ventricle. He followed the convention of Herophilus, who classified the vessels attached to the heart on the left side as arteries, and those to the right side as veins. Therefore, the pulmonary vein became a "vein-like artery" and the pulmonary artery an "artery-like vein," and the coronary vein carried blood to the heart, not the coronary arteries.[7]

Galen was extraordinarily prolific, writing his first treatise at age 13 and over 2.5 million words by the end of his life. Some of his famous works include: On the Usefulness on the Parts of the Body, On the Natural Faculties, On Antecedent Causes, and On Hippocrates' On the Nature of Man. His doctrines of the pulse were especially enduring, lasting for 1600 years, reaching beyond even Harvey's time to our own. Eighteen works by Galen on the pulse alone have been discovered. He taught that arterial expansion was due to an active diastolic process of the vessel, while systole was due to its contraction. Diastolic expansion sucked blood into the arteries, not the force of ventricular contraction behind it. Galen's descriptions of various pulses included pulsus tardus, celer, myurus, caprisans, mollis, durus, rarus, and the formicant and vermicular pulse.[9,10] One of his more famous observations was that a woman's pulse sped up when she heard the name of her lover.[9,10] As late as the sixteenth century, a challenge to Galen's teachings could result in a fine from the Royal College of Physicians.[10] Individuals made public apologies to avoid criticism for their failures to obtain Galenic texts for updated and improved translations.[11]

Galen's teachings were considered infallible from his lifetime until Vesalius corrected some of his theories on anatomy and William Harvey, his physiology.[12] His theories were among the last contributions to Western medicine before the ancient world's intellectual spirit declined into the Dark and Middle Ages.

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