

## Marcello Malpighi (1646-1694)

Marcello Malpighi studied chick embryos with microscopes in Italy during the seventeenth century. Trained as a medical doctor, he was among the first scientists to use the microscope to examine embryos at very early stages. Malpighi described early structures in chick embryos, and later scientists used his descriptions to help develop the theory of preformationism.

Malpighi was born in 1628 in Crevalcore, Bologna, Italy, and he was baptized 10 March of that year. His parents were Maria Cremonini and Marcantonio Malpighi. He entered the University of Bologna in Bologna in 1646, and his tutor Francesco Natali encouraged him to study medicine, which he began in 1649. While in medical school he was one of only a few students permitted to attend vivisections and dissections in the home of Bartolomeo Massari. He graduated in 1653 as a doctor of medicine and philosophy, and three years later he became the lecturer in logic at the University of Bologna.

In 1656, Malpighi moved to The University of Pisa in Pisa, Italy, to assume the Chair of Theoretical Medicine. While in Pisa, he continued to attend dissections, now at the home of Giovanni Alfonso Borelli, a mathematics professor who introduced Malpighi to members of Galileo's school. It was in Pisa that Malpighi adopted a mechanistic view of anatomy and physiology. This mindset would inform his future work, particularly his interest in finding a physical mechanism for the nervous system and brain. In 1659 he returned to the University of Bologna where he lectured in theoretical and practical medicine. He took the principal chair of medicine at the University of Messina in 1662, but returned to lecture in Bologna four years later.

Malpighi used the microscope to study fine structures in organs and tissues, and he used varied methods of preparation for his samples as well as different intensities of light. His work constituted the foundation of histology, the study of the structure of tissues. Malpighi was the first to observe capillaries, thus solving the issue of how blood circulates from the arteries to the veins, which he wrote about in his first work *De pulmonibus* in 1661. Many other structures that he was the first to document now bear his name, such as the Malpighian tubules of arthropods and the Malpighian layer of the skin.

Because of his interest in comparative anatomy, specifically in minute structure, Malpighi spent a great deal of time studying chicken embryos at various stages of maturity. By studying with his microscope the embryos, some as young as twelve hours old, Malpighi was able to observe the formation of the structures that become the chicks' hearts and blood vessels. This work he documented in *De Formatione de pulli in ovo* in 1673. In this work, Malpighi described seeing structures become visible as though they were pre-formed and simply too small or transparent to see earlier in development. He also described the massive changes that these structures underwent as development proceeds. Eighteenth century scientists such as Albrecht von Haller and Charles Bonnet, both in Switzerland, used Malpighi's descriptions to support the theory of development called preformationism. According to this theory, embryos were pre-formed in either the maternal egg or the paternal sperm and needed only to grow. Along with this contribution to embryology, the illustrations and diagrams Malpighi produced of these developing chick embryos are highly regarded to this day.

In 1667, the Royal Society of London in England invited Malpighi to send his scientific correspondence to them, and the Society took charge of publishing all of Malpighi's works from then on. He later became the chief physician to Pope Innocent XII. Malpighi died in Rome on 29 November 1694 in his apartments at the Quirinal Palace.

## Sources

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