



Achilles and the maggots

... or how the *Iliad* inspired a Renaissance scholar to show how flies are made.

Paolo Mazzarello

Many artistic ideas have come directly from science. Scientific inspiration can be seen in the writings of Goethe, Robert Musil and Jorge Luis Borges, in J. S. Bach's mathematically precise music and in the use of anatomy and geometry in Leonardo da Vinci's paintings. Scientific discoveries form the basis of an entire genre, science fiction. But there are few examples of scientific research inspired by art, which owes more to science than vice versa.

Among the examples of science influenced by art, there are the geological investigations of Bernard Palissy (c. 1510–c. 90) on the origin of salts, precious stones, springs, rock formations and fossils, inspired by his work with ceramics. But I think the best case-history of a scientific discovery inspired by art — in this case literature — is the refutation of the doctrine that macroscopic life could arise by spontaneous generation.

The story took place in Florence, at the Medici court, in 1668. The head physician and superintendent of the ducal pharmacy and foundry was Francesco Redi (1626–98), whose scientific reputation was built on his studies of viper's venom (*Osservazioni Intorno alle Vipere*, 1664; a landmark in the history of experimental toxicology).

Redi was also a poet and aficionado of classical literature. One day, while reading the nineteenth book of the *Iliad*, he was puzzled by Achilles' request to his mother Thetis to take care of the corpse of his friend Patroclus: "I much fear that flies will settle upon the son

of Menoetius [Patroclus] and breed worms about his wounds, so that his body, now he is dead, will be disfigured and the flesh will rot." Thetis answered: "My son, be not disquieted about this matter. I will find means to protect him from the swarms of noisome flies that prey on the bodies of men who have been killed in battle." But, according to Aristotle, flies and lower animals such as worms could spring directly from decaying flesh. So why protect the body? Enlightened by this passage, Redi wrote, "I started to doubt whether the worms were generated directly from the putrefying flesh, rather than being the consequence of egg deposition by flies".

He launched a formidable attack on the doctrine of spontaneous generation. Redi exposed meat, cheese and other organic substances in jars, some covered with wire gauze, others uncovered. In due course, he observed the development of maggots on top of the gauze in the first cases and directly in the meat and cheese in the second.

With these and other experiments he established that flesh and plant "never become verminous if they are kept where flies and mosquitoes cannot enter". Thus animal and plant tissues "play no other part, nor have any other role in the generation of insects, than to prepare a suitable place or nest into

which, during the period of generation ... eggs and other seeds of worms are laid and hatched by the animals". When the worms were born, they found sufficient food in this "nest" to "nourish themselves very well". Thus Redi gave experimental support to the principle of *omne vivum ex ovo* (every living being from an egg). In 1668 Redi's masterpiece *Esperienze Intorno alla Generazione degli Insetti* (Experiences about the Generation of Insects) was published in Florence. It collected his experiments and results, and dealt a blow to the doctrine of spontaneous generation.

But the blow was not fatal. Phoenix-like, the idea was reborn after Anton van Leeuwenhoek's discovery of microorganisms. Microscopic beings were seen as a bridge between inanimate matter and organisms visible to the naked eye. Only after the discoveries of Lazzaro Spallanzani, Louis Pasteur and others was the dogma laid to rest.

So, the first serious blow to spontaneous generation came from the *Iliad*, a book which also inspired Heinrich Schliemann's discovery of Troy. Mathematicians and logicians know Achilles for his race with the tortoise, and anatomists for the Achilles' tendon. With his part in firing Redi's imagination, he is certainly the most influential mythological figure in the history of science. ■

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Epic idea: the death of Patroclus (top) set Redi (right) thinking.