

Maarten Franssen

Archimedes in his bath. Myths and legends from the history of science.

Introduction

The common denominator for the book's fifteen chapters is the interplay between two meanings of 'myth': one the modern meaning, i.e. a story which is often told and believed to be true, but is in fact false; and the other the classical myth, part of a general mythology of, in this case, the heroes of science. This is illustrated by the story of Copernicus receiving the first copy of his momentous *De Revolutionibus* on his deathbed. The facts are that he was already unconscious or at least out of his wits when the book arrived, but in the 17th century this was already slightly but significantly improved into a version where Copernicus gave a final nod of approval as his last move.

Eureka - The life and death of Archimedes

The details of the life and death of Archimedes are often cited directly from Greek sources in books on the subject, but as one looks more closely on the exact words of the ancient historians, and takes into account the changing versions as one gets further away from the life and times of the real Archimedes, one comes to suspect most of these well-known stories. It turns out that according to ancient history Archimedes shouted 'Eureka' for a discovery that was so simple that Galileo discredited the story just for that reason, and it was Galileo who connected Eureka with the Law of Archimedes. His death by a Roman soldier, while shouting 'Please don't disturb my circles!', seems to have been used by its first concocter to teach a moral lesson; earlier accounts of Archimedes' death, by people who were much closer, do not have this part.

Finite but boundless - The round earth from Aristotle to Columbus

Many people still think that the earth was believed to be flat during the greater part of the Middle Ages, and that before Columbus the navigators never set sail to the West because they were afraid to fall off the earth. It turns out, however, that the fact that the earth is round has been known continuously from the time of the ancient Greeks and Romans throughout the Middle Ages. People even had a fairly correct notion of how large the earth was, so that no one would think of trying to get to India the other way around. But Columbus chose to believe a different and in fact wrong estimation of the circumference of the earth, making it a sensible move to look for a shorter route to India by sailing to the West, and in that way he blundered into America.

Dancing on a needle - The science of angelology in the Middle Ages

The well-known depreciatory characterization of medieval intellectual discussion, that the scholars seriously discussed the question how many angels can dance on the tip of a needle, is shown to be a later invention, originating from 17th-century religious controversy. When one compares the way angels were actually discussed by the scholastics, one can see it makes sense if you take the Bible literary.

Better than God - Alfonso of Castile between Ptolemaeus and Copernicus

King Alfonso of Castile is famous for his statement that, if God had asked his advice while creating the world, the result would have turned out a lot better. This is always taken to be, e.g. by Thomas Kuhn, as a prime example of the 'feeling of crisis' towards the heliocentric planetary theory of Ptolemaeus, making the time ripe for the theory of Copernicus. The story is indeed very old – it is mentioned already in the 14th century – but the interpretation of Alfonso's complaint as dissatisfaction with the structure of the heavens dates only from the late 17th century, long after Copernicus and even Kepler and Galileo. The then recent revolution in astronomy was projected back on this statement which before this time had had a religious even a political use and had never been interpreted as directed against the planetary motions.

Orlando Furioso - Giordano Bruno as a martyr for science

The myth that the Italian philosopher Giordano Bruno was burnt at the stake in the year 1600 because he was an advocate of Copernicanism is compared with the historical facts and shown to be completely false. Copernicanism played no part at all in Bruno's trial for the Inquisition; the inquisitors were hardly interested in these matters. Bruno was tried for denying almost all of the basic dogmas of the Catholic faith. Bruno didn't even understand Copernicanism, at least not as a scientific doctrine. He seems simply to have used it, along with other theories, for its opposition to medieval (and ipse facto catholic) learning.

Maarten Franssen

Free fall - Galileo on the leaning tower of Pisa

Did Galileo actually perform his famous experiment of dropping two objects of unequal weight from the leaning tower of Pisa to show that they struck the ground at the same time? All things considered, one must conclude that he probably did not, at least not in public. He hardly can have done so, given what we know that he *did* perform, which is interesting enough by itself. The story has to be credited to Galileo's first biographer, his secretary Viviani, but his way of history writing, although not in accord with modern standards, was totally excusable by the standards of the 17th century. And apart from that, a Dutch scientist, Simon Stevin, did perform a similar experiment, and in fact earlier than Galileo ever could have done.

Eppur si muove - Galileo before the Roman Inquisition

Not only the words that Galileo is supposed to have spoken after his trial before the Roman Inquisition, namely 'And still it moves!', are a myth; the whole conception of Galileo's trial has drifted into plain mythology. He was never tried because the Church was set on repressing Copernicanism. Quite the reverse, many of the higher prelates in the Church admired Galileo deeply and protected him against the popular call for measures against all this 'modernism'. But Galileo made the stupid mistake of bringing the anger of his mightiest protector, the Pope, upon himself by insulting him in his famous book, the *Dialogo*.

In which the moon falls down - Newton and the apple of gravity

The famous story of how Newton came to his theory by the fall of an apple was told by Newton himself to some of his biographers to be. Because their biographies were never published, and the only one left who did publish the story was Voltaire, this famous episode was long believed to be a piece of fiction. But now that we know that it is authentic, can we also believe that it is true? Here we must conclude that Newton misleadingly associated a development which took twenty years with a single moment in his youth. We can reconstruct the calculations that Newton did when the apple fell reasonably well, and there was no place for an attractive force of gravity in his physics at that time, let alone for universal gravitation. It took the intervention of Robert Hooke some thirteen years later to get him thinking along this line, and the better part of his physics was developed only while writing the *Principia*, twenty years after the event.

Ex aequo - Scheele, Priestley, Lavoisier and the discovery of oxygen

The case who first discovered oxygen is one of the most famous priority disputes in the history of science. Joseph Priestley has come out victorious, especially in the Anglo-Saxon world. But can we really say any one of these three was the real discoverer of oxygen? It is argued that we cannot, by looking more closely at what each of the three contestants *thought* he had discovered. Moreover, the choice for Priestley or Lavoisier has been influenced by the completely different characters of these two scientists and by the general antagonism between Britain and France.

Redundant - Laplace and God as a hypothesis

The famous conversation between Bonaparte and Laplace, where Bonaparte asked Laplace why there was no talk of God in his cosmological books and Laplace answered that he "had felt no need for that hypothesis", is often cited. It is ideally suited to illustrate the contributions of Laplace to the perfection of Newtonian mechanics. The story is maybe literally too good to be true. The first complete version dates from almost forty years after Laplace's death, and one has found only fragments of it in earlier books, none reaching back to Laplace's own time. We know, however, that Bonaparte often engaged in this kind of conversation. William Herschel witnessed one such occasion, for instance.

One out of two - Oersted and the discovery of electromagnetism

The way the Danish physicist Oersted discovered the influence of an electric current on the orientation of a magnetic needle is often cited as a prime example of an accidental discovery. Oersted himself, however, denied this vehemently. Indeed he more or less derived the existence of the phenomenon from Immanuel Kant's philosophical ideas about physical forces.

Maarten Franssen

Ureka - Wöhler and the synthesis of urea

Every textbook on organic chemistry still starts with the knockout blow that the laboratory synthesis of urea, hitherto a substance found only in the urine of animals and people, struck to the doctrine of vitalism, which learned that there was an impenetrable wall between the organic and the anorganic world. This is a perfect example of a story made up long after the event. In fact the synthesis of urea was not so very important for the fate of vitalism: it was not the first synthetic organic compound and not the one that made the greatest impression in this regard. To be sure, Wöhler's synthesis did make a great impression, but for a completely different reason: it was the first clear indication of the phenomenon of isomerism, pointing out the way to the insight that the structure of organic molecules is all-important to their chemical properties.

Ouroboros - Kekulé and the structure of benzene

One of the most charming legends from the history of science is the story how August Kekulé, while searching for the structure of the organic compound benzene, saw in a dream a snake biting its own tail and then knew that he had to give benzene a cyclic structure. Kekulé himself told it only at the end of his career, being a bit ashamed for it. He has been challenged of making the dream up to mask the fact that he took the benzene ring from a French book, but the evidence for this is extremely thin. There even is a traumatic incident in his youth that might explain the occurrence of the tail-biting snake.

Exemplary accidents - Röntgen, Becquerel and the discovery of two new rays

The discoveries of the X ray by Röntgen and of radioactivity by Becquerel are often cited as two famous incidences of chance discoveries, or of the phenomenon of serendipity. But if one looks more closely to what actually happened, it turns out that the element of sagacity, one part of serendipitous discoveries, is commonly downgraded in favour of the element of accidentality. This is especially clear if one compares their work with that of the scientists who did not discover anything, although they observed the same strange things.

Bending light - Einstein and the Solar Eclipse Expedition of 1919

The fame of Einstein as the first pop hero of science originated in the way the press picked up the confirmation of his general theory of relativity by the British solar eclipse expedition of 1919. The leaders of the expedition reported that their experimental results were completely in accord with Einstein's prediction that starlight that passed through the gravitational field of the sun was bended slightly away from its course. The real results, however, were rather ambiguous, but the astronomer Eddington presented them favourably because he believed Einstein's theory to be true anyway. Apart from public fame, this had the result that other inconclusive attempts to test the theory profited from a kind of 'bandwagon effect': they were suddenly looked upon as much less inconclusive.

*Mythen en sagen uit de geschiedenis
van de wetenschap*