

Heavenly phenomena

How an astronomer's words were transformed into a citation classic.

Euan Nisbet

The life of a scientific work proceeds by stages. First is an age of mouth and rumour, then it grows to abstract or preprint. Next it blossoms under critical review, then reaches the adulthood of formal publication. For most of our offspring, this brief springtime in the current printed issue lasts a week or a month, and is then followed by a high summer of a few citations within the next year or so. Next comes a lingering old age, surviving only in our own c.v. submitted annually to the dean. Eventually, the seventh age of the paper is in landfill.

But for some works (never our own), the last three ages of scientific life are different. They find fame, sooner or later, and are carried on in general knowledge by the citations of many, and in 1,000 student term papers. Then, as time passes, great works enter the texts as anonymous knowledge, important threads in the very fabric of science. And for the greatest knowledge, the fates do not cut off the threads — it becomes immortal, part of the received wisdom shared by us all, though its chronicler is long forgotten.

One of the finest works of Greek science is *Phaenomena*. This work was written by Aratus the Cilician, probably in the years following 276 BC. It summarizes the astronomical knowledge of its age. It has recently been edited, with a scholarly and erudite commentary, by the classicist Douglas Kidd. For many centuries, *Phaenomena* was one of the best known texts of science. Cicero translated it into Latin, as did Germanicus, the adopted son of Tiberius Caesar.

Most of *Phaenomena* is observational natural science as we know it today, not greatly different in purpose from modern textbooks. Much of the work is a map of the sky. The axis of rotation and pole are specified (north was then not quite where it is now), the constellations are carefully listed, and we are taught how to use them to measure time. Finally, we are given a lesson on the weather: words about clouds and wind. This is recognizably modern science: we are told to look for ourselves and “do not just keep up the observation carelessly”. Apart from a few wondrous introductory lines it is a detailed observational record, testable and useful.

Through Aratus we inherit the names of the north (*arctoi*, or Great and Little Bears), of the tropics of Cancer and Capricorn, and of the constellations. Aratus transmitted to us the knowledge of the great circle of stars that made the wheel of milk (*gala*), which the

poet John Milton later popularized as “the galaxy, that milky way”.

Unlike the sages of modern newsprint, Aratus did not dabble in myth, for he was an astronomer, not an astrologer. He saw and described, and invited the reader to test his observation. To Aratus, the 12 signs of the Zodiac and the five visible planets were features in the starry globe, to be used to define space and to measure time but not for divining the future. Milton, who was a member of Galileo's academy and associated with the founders of the Royal Society, is a true inheritor of Aratus.

The normal destiny of great texts is that the topics they discuss become invisibly written into the fabric of science. Aratus had a wider skill. He was not only a great text-writer, but a great poet. *Phaenomena* is written in poetry. Aratus takes technical material and puts it into lovely verse — imagine Keats rewriting Newton. Perhaps modern biochemistry texts should try poetry too, to make them easier to remember. Most of us start our papers with a couple of introductory lines, what the Greeks called a proem. Nowadays, our purple prose is usually a claim for the importance of our topic. Being a poet, and writing about the heavens, Aratus too allowed himself the luxury of a few brief lines before getting down to his catalogue of the stars: “With Dios let us begin.” This Dios (or Zeus) did not represent the planet Jupiter, nor even the misbehaving Greek god, but a wider universal God.

As poetry, *Phaenomena* was so admired that Virgil took Aratus as the direct inspiration for his *Georgics*, nature poems that are among the most fragrant of all Latin writings, and which, together with the direct influence of Aratus, helped inspire modern meteorology. Another who studied Aratus was a fellow Cilician, Sa'oul the Tarsean. Sa'oul was a thinker and poet. His poem on love, written to guide friends who lived in a raunchy boomtown, stands at the pinnacle of Greek literature.

Sa'oul was asked to address the Council of Athens, the embodiment of democracy. The council took its name from its original seat,

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Celestial view: Aratus gave us the ‘circle of stars’.

the Areopagos (the hill of Mars). The members enjoyed listening to new ideas. They thought Sa'oul was a *spermologos* (this spunky, typically Athenian insult self-translates into English), but they heard him out and even asked him back. Milton's essay *Areopagitica*, which sets out the logic that led to the First Amendment, honours the tolerance they showed.

In the speech, Sa'oul fused Hebrew insight with Greek philosophy: the speech marks the birth of Judeo-Christian culture. But which Greeks did he take? Not Plato or Aristotle. Instead, he picked two authors we would today welcome into the maths/science community. One is the shadowy figure of Epimenides, who, it is thought, had said of the deity: “In him we live and move and have our being”. Some propositions may be true but unprovable: Epimenides, the Cretan, gave us the paradox “All Cretans are liars”. Epimenides, with Solon, had helped create Athenian democracy, and, according to legend, had insisted on a statue to the unknown God.

After Epimenides, Sa'oul chose to add a line from Aratus's introduction to *Phaenomena*, a line also quoted by the Stoic Cleanthes. Roughly translated, it says “For we also are God's children”. And so, thanks to Sa'oul, *Phaenomena* contains probably the most printed citation in all scientific history. Perhaps it may dismay racists and creationists, but the message of support for observational, empirical science is clear. Sa'oul, also known as Paul, admired this textbook of natural science so much that, cited in the Christian bible, *Acts 17:28* — “For in him we live, and move, and have our being; as certain also of your own poets have said, ‘For we are also his offspring’” — are the words of the scientist Aratus. ■

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FURTHER READING

Aratus, *Phaenomena* (ed. Kidd, D.) (Cambridge Univ. Press, Cambridge, 1997).