

Rome and Hellenism Before the Common Era: with a Focus on Early Hellenistic Science

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If one does a search on Amazon.com, one quickly finds that science and Rome do not really go together. One might ask why, but “Roman science” proves to be something of an oxymoron. Perhaps this is harsh, but it is certainly a legitimate first impression. Because of this, when we talk about science in the Roman period we are going to be talking largely about Greek Hellenistic science. My topic here will be a little broader than usual in that we will also be talking about Greek Hellenism in the Roman period, particularly until the time that Rome was able to consolidate their hold over the Hellenistic world. True Roman Hellenism does not really begin until this consolidation takes place. For that, we have to begin considering the period of Late Antiquity, and that lecture can be found linked at <http://www.betsymccall.net/edu/CLAM/greek>. When we talk about the Hellenistic world today, we’re going to be using science as our principal example of what’s going on.

The Hellenistic world begins officially with the death of Alexander the Great in 323 BCE, from a political standpoint, at least. From an intellectual perspective, we begin the Hellenistic period with the death of Aristotle in 322 BCE. Politically, while the conquests of Alexander did bring change and increase the rate of Hellenization, Alexander’s conquests did not *create* Hellenism. Greek colonies had existed abroad from Gaul to Asia minor for centuries already. The imposition of a Greek elite, and Greek ruling class did serve to accelerate the cultural contact. The exchange of ideas proved to be two-way, however. While most governmental institutions remained in place—the Persian satrapy system was maintained, Pharonic traditions were adopted by Alexander’s successors—the settlement of Greek governmental officials and Greek soldiers, and the intermarrying of the royal families created a bilingual society that was highly stratified. Hellenism was a two-way process. It was not just the introduction of Greek people and ideas into an eastern culture, but it was the outflow of eastern ideas, as well, that changed the character of Greek Hellenism, and eventually, Roman Hellenism.

Intellectually, we say that Hellenism begins upon the death of Aristotle, coincidentally, the year after the death of Alexander the Great, but in truth, enough stability remained in the Greek-speaking world that little changed intellectually. Unlike the political situation, there was not abrupt intellectual change, and an unbroken line was maintained between the Classical period of Greek thought and the “new” Hellenistic one. No one living at the time would even have noticed. Indeed, we see that the first scientist of the period is a man named Theophrastus. He was head of the Lyceum, and a former student of Aristotle’s. His studies of botany were the standard for the Hellenistic period, and he employed a faithful Aristotelian method of categorization. There is no great revolution. It would be another century before we see a real change in the character of intellectualism in the Hellenistic world, and more than anything else, we begin to see encroaching Romanism.

What did begin to change immediately was where intellectuals did their thinking. In the Classical period, science was “founded” in Asia Minor, and quickly moved to Athens, where philosophy reigned supreme. We still find in Athens during this period that the Academy and the Lyceum continue teaching philosophy, but other intellectual pursuits find a new home in Ptolemaic Egypt, in Alexandria.

Alexandria itself was a city envisioned by Alexander the Great when he conquered Egypt, but it was not until his successor there, one of his generals named Ptolemy, took over that this vision of a grand capital

could begin to take shape. Egypt had certain advantages coming out of the collapse of Alexander's empire, and in taking up the reigns as the intellectual center of the Mediterranean world. For one thing, it took relatively little time for Ptolemy to consolidate his power in Egypt. Other parts of Alexander's empire proved more volatile and required more time to regain control despite the conservatism of the political machines. Second, Egypt was also extremely wealthy. Thirdly, the second Ptolemy, Ptolemy Philadelphus, lived a very long time, and long-lived rulers naturally help bring stability to a dynasty. The Ptolemies, particularly these first two, were able to pour large sums of money into a particularly eastern idea: the Library of Alexandria. Before this, large public libraries did not exist in the Greek world, rather, Alexander and Ptolemy took this idea from great eastern libraries in Persia and Babylon. The Ptolemies embraced it with gusto, hoping to win themselves prestige and the advantages that come from monopolizing intellectual thought. Beside the Library was built a Museum in the royal quarter—and we do not mean a museum as we think of one today, but rather a temple dedicated to the Muses, the goddesses of history, philosophy, poetry, mathematics, astronomy, music, etc. The temple appears to have served a dual status: to highlight on the one hand the purpose of the Library to pursue these endeavours and to seek the Muses blessings, but also to establish in Greek law a legal status for the schools associated with the Library, as had been the case of the Academy and Lyceum in Athens. The Library became such a magnet for scientific and literary thought that nearly every great thinker of the period was in some way associated with the Library, either as a student or a teacher there, at least until the destruction of the last remnants of the Library in 391 CE by the Christians. It is said that at its peak, the Library contained between 400,000 and 700,000 volumes.

Let's consider some of the scientists associated with Alexandria:

Euclid, *The Elements*, c.300 BCE

His book became the standard text for geometry until well after the Renaissance. It survives in its entirety. Other books he wrote on astronomy, optics and music do not survive in tact. Some only survive by name. His *Elements* contained all the geometrical knowledge known to the mathematicians of his day. He organized it into a simple framework of beginning with simple suppositions and proving all other things from this few things.

Aristarchus of Samos, c. 281 BCE

He attempted to measure the distance of the Earth to the Sun, but measuring angle that the Sun made with the moon at the quarter moon. His method was innovative, but his estimate was off by a factor of 400. It was partly because of this gross underestimate of the size of the solar system, that his own idea of a heliocentric solar system (sun-centered) was shown be unprovable by the observational standards of the day. A heliocentric model predicts movement of the background stars, which is beyond the ability of naked-eye astronomy. His heliocentric model won him the accusation of impiety because it moved the Earth from the center of everything.

Archimedes of Syracuse, 272-212 BCE

He applied mechanical principles to practical uses, and war engines, but he believed that practical sciences were ignoble and vulgar. He preferred to be known for pure mathematical pursuits, and he employed a method of proof that foreshadowed the development of calculus. He was the first prominent casualty of Roman encroachment on the Greek world—he was killed at Syracuse by Romans as they battled with Carthage over control of Sicily.

Eratosthenes, c.273-192

He was a younger contemporary of Archimedes. Chosen as the Librarian of the Library at Alexandria because he was a polymath, and his skill at math was needed to help catalogue the growing number of scientific scrolls that the Library was collecting. His nickname was “Beta”, because his contemporaries felt he was the second best at everything—geography, astronomy, mathematics, poetry, history, and more.

Apollonius of Perga, “the great geometer”

He extended knowledge of conic sections—ellipses, parabolas, hyperbolas and circles—and showed how they were related. Along with Euclid, he dominated geometry for 2000 years. It was Apollonius that first devised a mathematical account of the motion of the planets using epicycles, which Ptolemy (the astronomer, no relation to Ptolemaic kings) eventually turned into his model of planetary motion that survived until Copernicus.

Hipparchus

He developed early spherical trigonometry. He catalogued over 850 stars, and discovered the precession of the equinoxes by comparing his observations with those of Aristarchus, made about 150 years apart.

Herophilus & Erasistratus

These men were physicians who worked at the Library under the direction of Ptolemy Philadelphus. The Ptolemies were the only rulers in the Mediterranean world that permitted dissections of human beings. They also permitted for a limited time, for these men, vivisections—live dissections—of human criminals. They became the founders of the dogmatist school of ancient medicine. Their opponents were the empiricists—they did not believe in experimental medicine (such as dissections), and they further did not believe in speculating or theorizing about the body.

The chief rival of Alexandria was Pergamon, in Asia Minor. The Seleucid Empire was only able to manage a distant second to Alexandria because they lacked the funds that Egypt had, and because politically they were more unstable than Egypt. Rome conquered Asia before they annexed Egypt. The presence of Pergamon gave the Ptolemies more incentive to be generous to the scholars gathered at Alexandria. But Alexandria’s dominance came at a price: when Egypt declined, so did intellectualism in all of the Hellenistic world. Because the Library received state funding, and because the scholars there had no need to lecture to make ends meet, they were far more a research institution than the Academy or Lyceum whose scholars very much needed to teach in order to live. But the Alexandrian scholars were very much subject to the will of the king, and when his sponsorship dried up, so did scholarship. In time, the Library became more a custodial function, merely preserving old works rather than creating new ones. This would become the ultimate legacy of the Library into the late antique period. It reflected Roman influence in merely imitating the past.

The Roman love of all things Greek is old. Rome rose up at a time when the Greeks were the dominant cultural influence, and they strove to create their legitimacy as a great culture by showing how they were really Greek themselves in the myths of the Aeneid. But while Greeks had a love for all things thoughtful and intellectual, Romans loved practicality. Where Archimedes distained mechanics, Romans, upon his death, honoured him for these things. Romans borrowed from the Greeks literature, philosophy, architecture... but it was not until long after the Roman conquest of the Mediterranean do we find Roman citizens doing science—and all of these were not Italian by birth—they were Greek and Egyptian and Asian. And though Romans praised science, in their words, above engineering, their words and their practices told different tales.

We talk about Hellenism as a process of spreading the Greek culture throughout Asia and the Mediterranean, but in truth, Hellenism was two-way, with eastern influences intruding on the Mediterranean world. One place where this process is very pronounced is in the changes we see in religion during this period. Mystery cults are introduced, though they become particularly strong during the Empire. Astrology was considered “scientific”, and this sense of acceptability, in the mantle of science, made Roman particularly fond of astrology. We see the rise of Stoicism in the later Hellenistic period become extremely popular with Romans, and the rise in popularity, along with astrology, of the appeal to goddesses like Fortuna/Tyche.

Hellenism, for all that it was a two-way exchange of information, the Hellenistic culture was not internally very stable. The Library of Alexandria was a particular sore point with the populous in Egypt since it was eating up their tax money for things they were not sharing in. This exacerbated the mistrust the Egyptian people felt for their Greek rulers, and while they hated the Romans, this breach between the Greeks and the Egyptian populous, and the rivalry between the Egyptians and the Seleucids, allowed Rome to get a handhold politically in the region. When Caesar arrived in Alexandria and part of the Library burned in 47 BCE, the populous cared little. And it would be another century-and-a-half before political stability was restored and the Library would once again approach its former glory. However, as the Christian cults grew in strength, the Library was already doomed.

You can also find this page linked at <http://www.betsymccall.net/edu/CLAM/greek>.

For the second half of Hellenistic science, see Late Antique Notes.

For general overview from founding of “science” to medieval period, see Pre-Renaissance notes.

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For primary sources, see bibliographies in back of these texts.