Jesuits and Science

Introduction

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Abstract

Jesuit scholars have pursued studies in mathematics and science since the founding of the order. Authors in this issue discuss the work on magnetic declination by the Jesuit polymath Athanasius Kircher, the reform of Spanish naval education using the treatise on naval warfare by the Jesuit Paul Hoste, the Jesuit contributions to the Japanese clock-making industry, the dissemination of scientific knowledge through the Jesuit journal *Brotéria*, the Jesuit Erich Wasmann's attempts to grapple with Darwinian evolution, Jesuit contributions to understanding the natural environment of India, and the many accomplishments of the Jesuit-run Vatican Observatory.

Keywords

Christopher Clavius – Athanasius Kircher – magnetic declination – Juan José Navarro – Paul Hoste – naval warfare – Japanese clock-making – *Brotéria* – Charles Darwin – evolution – Erich Wasmann – botany – Blatter Herbarium – Vatican Observatory

The common view of the history of science has been colored by what historians for many generations had labeled “the Scientific Revolution.” This narrative concentrated on the great changes in astronomy and physics that started in the mid-sixteenth century and continued through the following century. It proclaimed straightforward progress as Copernicus (1473–1543) replaced Ptolemy (c.100–c.170), Galileo (1571–1642) replaced Aristotle (384 BCE–322 BCE), and science replaced the occult. The Catholic Church did not accept Copernican astronomy, continued to embrace Aristotelian natural philosophy, and condemned Galileo for his defense of the Copernican system; the scientific work of the church’s adherents was not always viewed favorably.

But history is rarely so straightforward, and Jesuits in particular contributed to the growth of science in that period. Their Aristotelian philosophy encouraged experiments, and so they experimented with nature and observed the heavens. Why the Jesuits? Christopher Clavius (1538–1612), professor of mathematics at the Roman College from the latter part of the sixteenth century, added the mathematical sciences, which, in addition to arithmetic, geometry, and algebra, included the study of astronomy, mechanics, geography, various mathematically based technologies, and related subjects, to the curriculum of all Jesuit colleges, the *Ratio studiorum* (1599). He wrote important textbooks on geometry and astronomy, and as an educator for almost fifty years, he was a powerful influence on Jesuit education. His students filled chairs of mathematics in Jesuit universities throughout Europe, and they carried their learning with them on their missions abroad. Jesuit scientists were at the forefront of scientific activity until the work of Isaac Newton (1642–1727) at the end of the seventeenth century made the continued acceptance of the geocentric universe and Aristotelian natural philosophy untenable. After a hiatus of several decades, eighteenth-century Jesuits were instrumental in overturning the prohibition against the heliocentric system, and Jesuits, fostering Newtonian science, were once again at the forefront, until the suppression of 1773. With the restoration in 1814, Jesuits resumed their active involvement with science.¹

1 For fuller treatments of the historiography of Jesuit science, see Sheila J. Rabin, “Jesuit Science before 1773: A Historiographical Essay,” in *Jesuit Historiography Online*, ed. Robert A. Maryks (Leiden: Brill, 2017), https://referenceworks.brillonline.com/entries/jesuit-historiography-online/jesuit-science-before-1773-a-historiographical-essay-COM_196375; and Agustín Udías, S.J., “Jesuit Contribution to Science 1814–2000: A Historiographical Essay,” in *Jesuit Historiography Online*, ed. Maryks (Leiden: Brill, 2016), https://referenceworks.brillonline.com/entries/jesuit-historiography-online/jesuit-contribution-to-science-18142000-a-historiographical-essay-COM_192552.

The three papers in this issue that deal with the pre-suppression period illustrate various aspects of Jesuit contributions to science. Agustín Udías has written about studies on magnetic declination by a seventeenth-century successor to Clavius's chair in mathematics, Athanasius Kircher (1602–80). Magnetism was a subject that attracted studies by various Jesuits, and Kircher was particularly interested in it. He collected observations of magnetic declination from many sources, including Jesuits, and suggested that a map could be made, which would be useful in navigation. He never drew the map, but Udías shows that he could have indeed drawn one from the data he collected. Thus, even though Kircher did not accept the idea of a moving Earth, he developed tools to enable the drawing of such a map.

Marcelo Aranda discusses the reform of Spanish naval education by Juan José Navarro (1687–1772) in the eighteenth century. He identifies two crucial contributions by the Jesuits that led to the success of that reform. First was Navarro's use of the French Jesuit Paul Hoste's (1658–1700) treatise on naval warfare Navarro had translated; the second was Jesuit mathematical education, which enabled the absorption of the theoretical side of his reforms. Both Aranda's and Udías's articles illustrate one of the reasons why a Jesuit education was so attractive to European aristocracy: its emphasis on the mathematical sciences gave their students a solid basis for the careers in the military and government.

The Jesuit missionary experience in Japan is not as widely studied as that in China, in part because the Japanese expelled the Christians in the seventeenth century, whereas the Jesuits in China set up a mission that lasted until the suppression in the late eighteenth century. Ryuji Hiraoka shows how the Jesuits used their knowledge of the mathematical sciences to impress the Japanese. Jesuit missionaries brought Western objects as gifts to ingratiate themselves with the ruling classes in the East. Mechanical clocks were a favorite, and starting with Francis Xavier (1506–52), the first Jesuit to reach Japan, Jesuit missionaries presented these clocks to the rulers. Hiraoka further shows the role of these Jesuit missionaries in the development of the Japanese clock-making industry. After about 1600, domestic production of mechanical clocks began in the workshop affiliated with the Jesuit seminary in the Kyushu district. The Japanese followers of the Jesuits continued the clock-making after the expulsion of the Jesuits, and it expanded into a major industry. Though the Chinese mission was ultimately more successful than the Japanese mission, the use of clocks as gifts to the rulers set an example to the former of how to ingratiate themselves into the ruling class.

After their restoration in 1814, the Jesuits resumed their scientific work. In this period, the Jesuits' scientific work changed with respect to the earlier

period; science in general had progressed and was already firmly established and institutionalized. In this period, Jesuits established some seventy new observatories, especially in the mission countries of Asia, Africa, and South America, fostering in those places the development of science in the fields of astronomy, meteorology, and geophysics. Biology, which was just developing, was another field of interest for Jesuit scientists, especially as they confronted Darwin's (1809–82) theory of evolution. To this period the last four articles belong.

Francisco Malta Romeiras presents the contributions of Portuguese Jesuits to biology through the publication of the journal *Brotéria*, which began as a purely scientific journal, especially in the specific field of taxonomy, the only Jesuit journal of its kind. Later, *Brotéria* added the publication of a separate journal for the popularization of science, *Brotéria: Vulgarização científica*, which had a wider distribution. Romeiras's article shows the Jesuits' contributions to the many fields included in the journal, especially in those of agriculture, commerce and industry, geography, chemistry and physics, medicine and hygiene, and science and religion. *Brotéria* continues being published today as a cultural journal.

Darwin's theory of evolution was a controversial subject in Catholic ecclesiastical institutions in the early twentieth century. James R. Hofmann presents the efforts of the German Jesuit Erich Wasmann (1859–1931) to accommodate evolutionary biology within the neo-Scholastic theology of the age. Although Vatican authorities issued no doctrinal pronouncements on evolution as such, it discouraged the introduction of evolutionary perspectives, especially human evolution. Wasmann, who trained in biology and specialized in myrmecophile beetles, developed broad interests in evolutionary theory and its implications for taxonomy and published a book on the subject in 1904. Hofmann gives a detailed presentation of Wasmann's position regarding evolution of natural species and divine intervention and the problems it created with the Jesuit authorities, especially Superior General Franz Xavier Wernz (in office, 1906–14), which precluded further editions of his book. After this point Wasmann restricted his writing either to purely scientific or devotional genres. As Hofmann concludes, Wasmann faithfully remained silent about possible theological implications of human evolution.

Jesuit science flourished also in mission countries. Leo D'Souza presents the Jesuit contributions to biological sciences in India. Beginning in the middle years of the nineteenth century, Jesuits in India dedicated themselves to work on botany with collections of herbaria and taxonomic studies. One example is the Blatter Herbarium with more than three million specimens. Jesuits published a large number of detailed studies of the flora of different regions and

applications to agriculture. Recently Jesuit scientists in India have moved to other fields such as biotechnology and environmental studies.

Astronomy has been a favorite science for Jesuits since the early days of the order, as shown by the names of Clavius, Christoph Scheiner (1573?–1650), and Giovanni Battista Riccioli (1598–1671). In 1906, the Austrian Johann G. Hagen (1847–1930) was named the first Jesuit director of the Vatican Observatory, and in 1935 the management of the observatory was entrusted to the Jesuits. Guy Consolmagno, the present director, presents an overview of the work done today at the observatory in the fields of meteoritics, meteors, NEO observations, trans-neptunian objects, exoplanets, stellar astronomy, extragalactic astronomy, cosmology, and telescopic instrumentation. He summarizes the mission of the observatory with the words of Gabriel Funes, a former director: “Our only goal is to do good science; our only commitment is to pursue truth, wherever it is to be found.” The Vatican Observatory is today the most important scientific institution managed by Jesuits.

This issue gives an idea of some of the Jesuit scientific pursuits. Though it contains a small selection of articles, they suggest that from the founding of the order to the suppression and then from the restoration to the present time, Jesuit scholars have engaged in a wide range of scientific studies and have made important contributions in science, mathematics, and technology.