Dibner Library
NEWS

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A Newsletter from the Dibner Library of the History of Science and Technology

Anthony Grafton to Give the 2002 Dibner Library Lecture

The Smithsonian Libraries is pleased to announce that Dr. Anthony Grafton will deliver the 2002 Dibner Library Lecture on Tuesday, October 15th. The lecture will be: "Technica Curiosa: Engineering and Magic in Early Modern Europe." It will be held at 5:00 PM in the Leonard Carmichael Auditorium of the National Museum of American History, Behring Center at 12th Street and Constitution Avenue, NW, Washington, DC. A reception will follow the lecture, at which attendees will have the opportunity to meet Dr. Grafton and the staff of the Dibner Library. The lecture is free and open to the public.

Dr. Grafton is the Henry Putnam University Professor of History and Director of the Shelby Cullom Davis Center for Historical Studies at Princeton University. He works on European intellectual history with special focus on the history of the classical tradition, chiefly during the Renaissance, in the history of science and scholarship, and in the history of books and readers, thus making him a particularly appropriate speaker for the Dibner Library. His most recent book, *Leon Battista Alberti*, was published in fall 2000. Grafton's recent books are *Joseph Scaliger: A Study in the History of Classical Scholarship, vol. 2: Historical Chronology* (Clarendon, 1993), *Commerce with the Classics* (Michigan, 1997), *The Footnote: A Curious History* (Harvard, 1997), and *Cardano's Cosmos* (Harvard, 1999). He has been curator of two library-based exhibitions, "New Worlds, Ancient Texts," at the New York Public Library, Fall 1992-Winter 1993, and "Rome Reborn: The Vatican Library and Renaissance Culture," at the Library of Congress, Winter 1993. He has given a number of named lectures during his career, and Smithsonian Libraries is extremely happy to have him as the 2002 Dibner Library lecturer.

We, at the Dibner Library, look forward to the lecture and hope that you will be able to join us on the evening of October 15th.

Dibner Library Acquires Its Final "Herald of Science"

The Dibner Library is, at long last, happy to announce that it has now collected all of the works listed in Bern Dibner's *Heralds of Science*. The last piece of the puzzle was Herald 109, Leibniz's 1684 article in the journal *Acta eruditorum* on the invention of the differential calculus. The Spring 2001 issue of *Dibner Library News* noted that we had managed to obtain three of the four missing Heralds, but that the Leibniz article still eluded us. Fortunately, the opportunity arose for us to not only purchase the Leibniz article, but also a complete run of the *Acta eruditorum* from the first volume of 1682 through 1731.

Gottfried Wilhelm Leibniz (1646-1716), a German philosopher and mathematician, although largely self-trained, was adept at working on some of the most sophisticated mathematical problems of the time, including infinite series and infinitesimals. Between 1675 to 1676, Leibniz made his breakthrough on the development of calculus, a mathematical method used to determine the rates of change of quantities. Such problems were not solvable through algebra or geometry alone, and their solution occupied mathematicians throughout the seventeenth century. Isaac Newton (1642-1727) had developed calculus independently back in 1665 and 1666, but shared his discovery with only a few colleagues. His early treatises on the matter went unpublished. It was not until 1687 that Newton revealed his discovery in his monumental work, *Philosophiae naturalis principia mathematica* [Mathematical principles of natural philosophy]. Like Newton, Leibniz did not publish anything on his discovery and only hinted at it in his correspondence. It was

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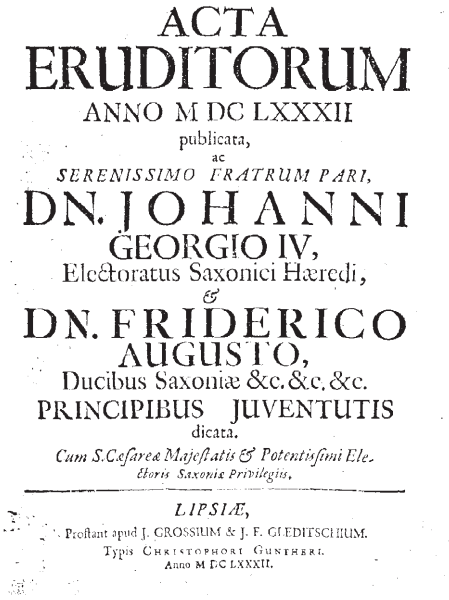
The Final "Herald of Science," continued...

not until 1684 that Leibniz shared his method of finding tangents to curves, the "calculus differentialis," in an article titled "Nova methodus pro maximis et minimis, itemque tangentibus, qua nec irrationals quantitates moratur [A new method for maxima and minima, and also for tangents, which is not obstructed by irrational qualities]." This article is the famous Herald of Science 109 and was published in the *Acta eruditorum*. In 1686, he followed this work with a second article on his method of finding the areas under curves, the "calculus integralis," and demonstrated that it was an inverse method of differential calculus.



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ERUDITORUM
ANNO M DC LXXXII
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DN. JOHANNI
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LIPSIÆ,
Prostant apud J. GROSSIUM & J. F. GLEDITSCHIUM.
Typis CHRISTOPHORI GUNTHERI.
Anno M DC LXXXII.

Title page to the first volume of *Acta eruditorum* (Leipzig, 1682)

Leibniz published his discovery first, thus sparking a battle with Newton and his allies. They countered that Newton deserved credit for the invention of calculus, since he had developed it before Leibniz, even though the Englishman had neglected to publish his work. The priority dispute between Leibniz and Newton raged on for some time and was often quite bitter. Suspicious of the brief correspondence exchanged between Leibniz and Newton in 1676, the English felt that Leibniz had then stolen seminal ideas from their hero. John Wallis (1616-1703) implied Leibniz had lifted Newton's work, while Nicholas Fatio de Duillier boldly and directly accused Leibniz of plagiarism. The Royal Society of London established a rather biased commission to rule on the matter and, not surprisingly, came out in favor of Newton in 1712. Leibniz prepared a response, but this remained unpublished until the nineteenth century. Today, historical scholarship indicates that the two men did indeed come up with calculus quite independently. And it was Leibniz's more useful methods and notation that ended up becoming the standard for use in differential and integral calculus. Publication of new discoveries usually ensures establishment of priority in science and mathematics, but should too much time pass before findings are published, criticism and disputes such as that between Newton and Leibniz are certain to ensue. Newton's earlier disputes with Robert Hooke had left him in an uncommunicative mood and with an unwillingness to share new ideas with the scientific community at large. This particular state of mind only made things worse for the calculus affair. Leibniz waited much too long as well, which similarly exacerbated matters. Part of the problem was due to the fact that Leibniz did not have an effective journal in which to publish brief papers. The only satisfactory places available to him at the time of his discovery of the calculus were the *Philosophical transactions* of the Royal Society of London (Leibniz was a member), and the French *Journal des sçavans*. His problem was solved in 1682 with the appearance of a new scholarly journal from Leipzig , titled *Acta eruditorum* [Records of the learned], edited by Otto Mencke (1644-1707). Mencke sought to elevate German learning in the eyes of the international community of scholars by providing a forum for German savants to publish reviews of books and occasional topical articles. In its first twenty-five years of existence, *Acta* consisted primarily of book reviews, which amounted to about eighty-nine per cent of its contents. Mencke did include mathematical and scientific articles (seven per cent of the contents) in order to increase the journal's prestige. Leibniz wasted no time in taking advantage of the forum provided by *Acta*, and published articles in the journal almost every year until his death. Other notable figures published important articles in *Acta* including the Bernoullis, Johann (1667-1748) and Jakob (1654-1705), and Christiaan Huygens (1629-1695). After Otto Mencke's death, the editorship of the journal stayed in the family through his son and grandson, but its quality began to decline in the mid-1700s. The year 1776 marked the journal's final issue, one that did not appear until 1782, due to scheduling problems.

The Dibner Library has been on the lookout for the 1684 Leibniz calculus article for the last few years in our effort to complete the "Heralds of Science" collection, and we were dismayed to see the Haskell Norman seven-page extract from *Acta* sell at Christie's for $15,000 in 1998. Fortunately, the opportunity to acquire the article presented itself in 2002 with the sudden availablility of Verne Roberts' famous Bibliotheca Mechanica collection. The completion of the Heralds collection will enable the Dibner Library to properly celebrate the 50th anniversary of the publication of Bern Dibner's *Heralds of Science* in 2005.

Spotlighting the Dibner Library's Collections

History of Astronomy. Part II.

After the fall of Rome, the study of astronomy concentrated on practical matters designed to help maintain the accuracy of the various calendars and religious events. This continuing interest in astronomy helped preserve the ancient knowledge, allowing it to be available to scholars with the coming of the Renaissance. Thanks to the efforts of leaders such as Harun ar-Rashid (766?-809), Islamic astronomers gained access to Greek manuscripts and translations were made into Arabic. Islamic astronomy was primarily concerned with predicting the visibility of the new moon (marking the new months of their lunar calendar), the times of prayer during the day, and the orientation of mosques and other religious acts toward the direction of Mecca. These concerns also resulted in advances in planetary astronomy and the development of observatories. The Dibner Library does not have Islamic astronomical works in their original Arabic, but it does have a number of later Latin translations produced after the development of printing. Some astronomers represented in the collection include: al-Farghani (fl. 861) and his *Compilatio astronomica* in editions of 1493 (Ferrara) and 1537 (Nuremberg) and his *Elementa astronomica* (Amsterdam, 1667); Abu-Ma`shar (or Albumazar, 787-886), the leading astrologer of the Muslim world, with his *Flores astrologiae* edition of 1488 (Augsburg), his *Introductorium in astronomiam* of 1489 (Augsburg), and two editions of his *De magnis coniunctionibus* (Augsburg, 1489 and Venice, 1515); Abu al-Saqr `Abd al-`Aziz ibn `Uthman al-Qabisi (or Alchabitius, fl. 980) and his great astrological work, *Libellus isagogicus* in editions from 1485, 1491, 1502, 1503, and 1521 (all from Venice); Averroës (or Ibn Rushd, 1126-1198), the major Islamic philosopher, and his commentaries on Aristotle's *Libri quatuor de coelo et mundo* (Leiden, 1542); and several others.

Frontispiece from Abu-Ma'shar's *De magnis coniunctionibus* (Venice, 1515)

In the West, a key astronomical concern was finding the date of the Paschal Full Moon in order to determine when Easter will occur. Although this did not require the complexities of Greek astronomy, it did ensure that astronomy would survive as an important discipline during medieval times, even though the writings of the ancient astronomers were not available in either their original Greek or in Latin translations. Many original works of the early Middle Ages were not of great use to astronomers, although they did contain some interesting ideas. Martianus Capella's (fl. 400) allegorical work about a heavenly marriage, *De nuptiis Philologiae et Mercurii*, mentioned the possibility that Mercury and Venus orbited the Sun, which in turn orbited the Earth. Copernicus noted this theory in his great work to help lend credence to his idea that the Earth revolved around the Sun. The Dibner Library has two editions of the Capellan work from 1499 (Vicenza) and 1500 (Modena). It also boasts a copy of Ambrosius Aurelius Theodosius Macrobius's (fl. 400) *In Somnium Scipionis* (The Dream of Scipio) from 1550 (Leiden), wherein a reader can find a cosmology based upon Plato and the Pythagoreans. In the Dibner Library one can also find a copy of *De natura rerum et temporum ratione* by Saint Bede, the Venerable (673-735) from 1529 (Basel). This work provided a guide to finding the date of Easter and understanding the Christian calendar.

The introduction of the astrolabe and the growing popular interest in astrology during the tenth century helped promote observational and planetary astronomy in the Latin west. Then, with the receding Islamic power in Spain, a large number of Greek and Arabic texts became available to Western scholars. The translation of key texts into Latin provided a better understanding of astronomical theory, an important factor in allowing astronomers to be more than calculators of Easter dates. The aforementioned works of al-Farghani and Ptolemy were translated in the twelfth century and were crucial to demonstrating the poor data and methods that had been used by medieval Western astronomers. With the development of the medieval university, astronomy was introduced as one of the seven Liberal arts. The medieval texts were not adequate for education in astronomy, and the first to introduce a new work was John Holywood, better known to us as Joannes de Sacro Bosco (fl. 1230), who taught in Paris. Sacro Bosco's work is known as *De sphaera* (The Sphere) and is a short treatise that was hailed for its clarity in explaining complex mathematical concepts. Written around 1220, *De sphaera* has only four chapters, or books. Book One describes a sphere and discusses the natures of the celestial sphere, the earth as a sphere, and the centrality of the earth. Book Two continues by discussing the celestial equator, ecliptic, poles, meridian, and horizon, and the regions of the earth defined by the equatorial, tropical, and arctic circles. Book Three follows with material on the risings and settings of celestial bodies, the variation in the length of days at different places on the earth, and the seven terrestrial "climates." Book Four concludes the work with a brief treatment of the motions of the Sun, Moon, and planets, and the causes of eclipses. *De sphaera* gained rapid acceptance and was used widely in Europe well into the sixteenth century. It was probably the first astronomy book printed, with two editions published in 1472 in Ferrara and Venice. The Dibner Library has a number of editions of Sacro Bosco's work that allows for scholars to do some valuable comparisons of

Heavily annotated copy of Sacro Bosco's *De Sphaera* (Leipzig, 1489)

the text and its presentation. The collection contains editions, recensions, and commentaries in Latin from 1478, 1485, 1488 (all Venice), 1489 (Leipzig), 1490 (Venice), 1495 (Paris), 1499, 1500, 1508, 1519, 1531, 1534 (all Venice), 1551, 1552 (both Paris), 1554 (Venice), 1563, 1578 (both Wittenberg), 1586 (Venice), 1607 (Rome), 1608 (?), and 1647 (Leiden). A researcher can also find Italian versions from 1537 (Venice), 1550, 1571 (both Florence), and 1582 (Lyon?), as well as a Spanish edition from 1599 (Madrid). And as an added bonus, the Library has a circa 1430 manuscript produced in England. Definitely a treasure trove for scholars of *De sphaera*!

The appearance of planetary tables also stimulated the development of astronomy. Since the twelfth century, the West had gained access to Latin translations of the *Toledan tables* of al-Zarqali. With these tables, astronomers could calculate where a planet would be at any time in the past or future. A much improved set of tables appeared in the thirteenth century in Castile, under the name of King Alfonso X, *el sabio* (the Wise). These *Alfonsine tables* seem to have been lost, but around 1320 a Latin set of tables appeared in France and kept the name of the earlier Castilian tables. Based on Ptolemy's theory of planetary motion, the *Alfonsine tables* were the primary means of computing planetary positions until the development of the Copernican theory in the sixteenth century. The Dibner Library has three editions of the *Alfonsine tables*, from 1483, 1492, and 1518 (all Venice).

The next part of this article will look at the astronomical works in the Dibner Library that relate to the printing and the Copernican revolutions.

To be continued...

-Ronald Brashear

Be sure to visit the Dibner Library's website:
www.sil.si.edu/Branches/dibner.htm

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Smithsonian Institution Libraries
Special Collections Department
P.O. Box 37012
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