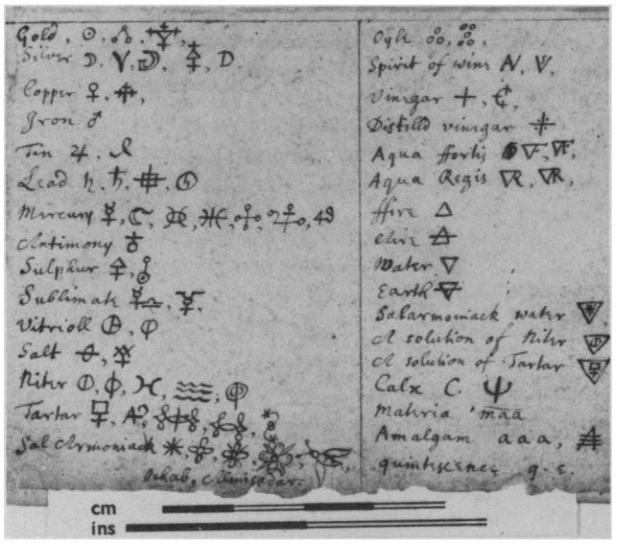

Alchemical symbols from one of Newton's earliest alchemical manuscripts, Keynes MS 31, Kings College Library, Cambridge. The table part of which is shown here is one "that Newton prepared for himself to explicate the symbols used in the recipes he had copied." [Reproduced in *The Foundations of Newton's Alchemy* with permission from the Provost and Fellows of Kings College, Cambridge]

contaminated with the metal, the "chymist" concluded that it was the mercury of the particular metal used. Newton's experiments were marked by a quantitative precision absent from traditional alchemy, and he used the same weight of sublimate and various metals (not being in possession of a concept of chemically equivalent weights). Though convinced of his success, he soon turned to the more ambitious alchemical end of making a "philosophick mercury" that would attract the powers of the alchemical "universal spirit." Dobbs ingeniously traces the path by which Newton arrived at the conclusion that "magnet," which would draw down that spirit, was made of the star-shaped regulus of antimony. After many trials, he believed he had converted ordinary mercury into "philosophick mercury," the proof being its power to dissolve all metals including gold.

Dobbs agrees with some earlier studies that alchemical notions deeply influenced Newton's early speculations on aether. R. S. Westfall has recently argued that as the philosophical difficulties of aetherial explanations and his accurate pendulum experiments led Newton to reject the existence of an aetherial medium, he reintroduced the attractions and repulsions that had so impressed him in his alchemical experiments. An attractive force analogous to that postulated by the "chymists" appeared in Newton's work on the dynamics of orbital motion in 1679–80. Dobbs points out that the apparent success of his attractive "magnet" in this same period may have been of crucial importance in any such development. That alchemical study and experiments occupied so much of Newton's time even during the period of feverish work on the *Principia* is a surprising fact. But as Dobbs points out, there are numerous indications that Newton had hoped to present in the *Principia* a system quantifying not only the gravitational force but also the short-range forces ruling "the properties and actions of all corporeal things."

By analyzing Newton's mature chemical thought, Dobbs pursues the fate of some of the earlier alchemical ideas. With a more complex hierarchical notion of matter, Newton perhaps could no longer believe in the power of his old "philosophick mercury" to penetrate and dissolve gold to its particles of "first composition." But he never seems to have given up the dream of transmutation. The continuing influence of alchemical ideas is evident in the "spirit" of the General Scholium to the *Principia*, in speculations on colors and particle size, and in much in the chemical Queries to the *Opticks*.

The most valuable results of Dobbs's study are presented in two chapters of the book (pp. 126–232). Other chapters review earlier studies and attempt to provide a historical and conceptual background to 17th-century alchemy. These more general chapters, for example one on chemistry and alchemy in Cambridge, may be vulnerable to the charge of sometimes oversimplifying complex intellectual patterns. But such criticisms do not detract from the solid achievement of Dobbs's general interpretation of Newton's alchemical studies, which all future assessments of Newton's thought must fully take into account.

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The International Scene

The Correspondence of Marcello Malpighi. HOWARD B. ADELMANN, Ed. Cornell University Press, Ithaca, N.Y., 1975. Five volumes, boxed. Vol. 1, 1658–1669; xxii pp. + pp. 1–436. Vol. 2, 1670–1683; xiv pp. + pp. 437–916. Vol. 3, 1684–1688; xvi pp. + pp. 917–1420. Vol. 4, 1689–1692; xvi pp. + pp. 1421–1850. Vol. 5, 1693–1694; xii pp. + pp. 1851–2228. $95. Cornell Publications in the History of Science.

The great tradition of study and research in the Italian universities continued well into the latter half of the 17th century. In anatomy and medicine no one better illustrates this continuity than Marcello Malpighi of Bologna. A master of dissection, he was among the earliest advocates and practitioners of comparative anatomy (from simple animals, he observed, we learn much which in higher forms, notably man, is hidden by complexity); sympathetic to the Galilean outlook, he sought to meld descriptive anatomy and functional interpretation, creating a mechanistic physiology; widely experienced in the demands of medical practice, he ended his days in Rome as personal physician to Innocent XII.

Malpighi's scientific career was pursued in Pisa, Messina, and Bologna. International travel was not his lot; international communication most definitely was. His correspondence was abundant, diverse in concern, and conducted on a European scale. This new *Correspondence* (numerous earlier and quite incomplete collections exist) includes letters written by and to Malpighi. One thousand seventy-nine letters are published (for the most part in the original Italian), brief summaries of the contents of each are given in English, and annotation is abundant. The work concludes with an enormous bibliography and a spendid index.

Through his correspondence (and his many scientific publications) Malpighi entered the nascent international scientific world. Most celebrated in this context is, of course, his contact with the Royal Society of London, beginning in 1667 and continuing until his death. Malpighi's correspondence with Henry Oldenburg of the Royal Society and with various English physicians and anatomists occupies a good portion of this edition. French correspondents are vanishingly few; there are more from the Germanies. Italy, then divided into a host of kingdoms, duchies, a republic, and the Papal States, itself presented an international scene, and it is within this smaller world that the vast bulk of Mal-

pighi's correspondence was exchanged. The exchanges with Giovanni Borelli, Malpighi's mentor in Pisa, and with Lorenzo Bellini are capital documents for the history of anatomy, physiology, and institutional developments in science in Italy. Bellini, passionate and ironic and Malpighi's lifelong friend, was an early and unrelenting advocate of the mathematicomechanical interpretation of vital processes in the manner of the Galileans.

The subjects discussed in the correspondence are prodigiously varied. Murder and civil disorder in Bologna, plant anatomy, publication arrangements, the battle between ancients and moderns, numerous details of animal structure, curricular reform, medical advice (Malpighi was a much-consulted authority), the unwelcome demands of one's scientific patrons, exchange of books across Europe—all find a place in these five volumes.

This *Correspondence* thus constitutes an archival resource of the first order. Viewing this work together with his magnificent study of Malpighi's scientific endeavors (*Marcello Malpighi and the Evolution of Embryology;* 5 volumes, Cornell University Press, 1966), we easily discern the magnitude of Adelmann's contribution to our access to and understanding of medicine and, above all, anatomy during an epoch of revolutionary intellectual change, the later 17th century. It is a major scholarly achievement.

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Struggles of Natural History

The Letters of Jan Swammerdam to Melchisedec Thévenot. With English translation and a biographical sketch by G. A. LINDEBOOM. Swets and Zeitlinger, Amsterdam, 1975. x, 190 pp. + plates. Dfl. 80.

Jan Swammerdam's correspondence with his French patron Melchisedec Thévenot was used by Boerhaave in his biographical introduction to the *Biblia Naturae* (1737–38); the letters then passed through the hands of Wouter van Doeveren to Göttingen University Library, where they remained unnoticed and forgotten for two centuries. For each of these letters G. A. Lindeboom has now provided a summary, a transcription of the Göttingen manuscript, and an English translation. Lindeboom has also written an introductory biographical