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(b. Shrewsbury, England, ca. 1736; d. Plealey, near Shrewsbury, 15 August 1798), *mathematics*.

Little is known of Waring's early life. In 1753 he was admitted to Magdalene College, Cambridge, as a sizar, and his mathematical talent immediately attracted attention. He graduated B.A. as senior wrangler in 1757, was elected a fellow of the college, and in 1760 received the M.A. and resigned his fellowship to accept appointment, on the death of John Colson, as sixth Lucasian professor of mathematics. Although his Lucasian professorship was opposed in some quarters because of his age—he was still in his twenties—Waring soon effectively silenced his critics by publishing, in 1762, his *Miscellanea analytica de aequationibus algebraicis et curvarum proprietatibus*, which gave indisputable proof of his ability and at once established him as a mathematician of the first rank. He was elected a fellow of the [Royal Society](#) the following year.

The *Miscellanea* was described by Charles Hutton (in *Mathematical and Philosophical Dictionary*, II [1795], 584) as “one of the most abstruse books written in the abstrusest parts of Algebra.” It deals largely with the theory of numbers (some of its chapters are “De fluxionibus fluentium inveniendis,” “De methodo incrementorum,” and “De infinitis seriebus”), a branch of mathematics for which Waring had a special gift. It contains, with out proof, the theorem that every integer is the sum of four squares, nine cubes, nineteen biquadrates, “and so on” . In 1770 Waring published *Meditationes algebraicae*, a work that was highly praised by Lagrange; in 1772 he brought out *Proprietates algebraicarum curvarum*; and 1776 saw the publication of *Meditationes analyticae*. In addition to these important treatises, he also, during this period, published a number of learned papers in the *Philosophical Transactions of the [Royal Society](#)*. His last major work, *Essay on the Principles of Human Knowledge*, published in 1794, is notable for his application of abstract science to philosophy.

As a mathematician, Waring was unfortunate in working at a time in which English mathematics were in a state of decline. This was in part due to the clumsy notation in which Newton had expounded his calculus and to the geometrical exposition that gave the *Prittcipia* a somewhat archaic appearance and persuaded English readers that the great new mathematical tool forged by Newton and Leibniz (which was then being employed with great vigor and skill on the Continent, particularly by the Bernoullis) was, in fact, not really necessary. This melancholy state of affairs persisted for more than a century, despite the efforts of such distinguished mathematicians as [Brook Taylor](#), [Colin Maclaurin](#), and [John Wallis](#), and led Lalande to observe in a “Notice sur la vie de Condorcet” (*Mercure de France*, 20 Jan. 1796, p. 143) that there was not a single first-rate analyst in all England. (Waring, however, stoutly maintained that his *Miscellanea Analytica* disproved Lalande's charge, and cited its commendation by d'Alembert, Lagrange, and Euler.)

Despite the spectacular improvements in notation by which fundamental mathematical operations were expressed on the Continent, Waring, in his own works, used both the *deism* of Leibniz and the *dotage* of Newton—the two great rival systems—indifferently. And made no notable contribution to the establishment of a permanent notation in any branch of mathematics. His method of writing exponents (as, for example, on page 8 of the 1785 edition of his *Meditationes analyticae*) was clumsy in the extreme, and in general his presentation is unattractive and his books difficult to follow. He suffered from an apparent lack of intellectual order that rendered his mathematical compositions so confused that they are almost impossible to follow in manuscript, while his published works, perhaps because of his extreme myopia, are riddled with typographical errors. His language, at best, was obscure.

Waring received the Copley Medal of the Royal Society in 1784. He was also elected a member of a number of European scientific societies, notably those of Göttingen and Bologna. He served as Lucasian professor until his death; he was also a commissioner of the important Board of Longitude. Nor were his activities exclusively mathematical; simultaneously with his composition of his books he turned to medicine, and received the M.D. from Cambridge in 1770. He does not appear ever to have practiced medicine, but it is believed that he carried out dissections in the privacy of his Cambridge rooms.

## BIBLIOGRAPHY

I. Original Works. Waring's books include *Miscellanea analytica de aequationibus algebraicis et curvarum proprietatibus*... (Cambridge, 1762), his bestknown work: *Meditationes algebraicae* (Cambridge, 1770; 3rd ed., 1782); *Proprietates algebraicarum curvarum* (Cambridge, 1772); *Meditationes analyticae* (Cambridge, 1776; 2nd ed., enl., 1785); *On the Principles of Translating Algebraic Quantities Into Probable Relations and Annuities* (Cambridge, 1792); and *Essay on the Principles of Human Knowledge* (Cambridge 1794).

His papers in the *Philosophical Transactions of the Royal Society* are “Problems,” **53** (1793), 294 – 298; “Some New Properties in Conic Sections,” **54** (1764), 193 – 197; “Two Theorems,” **55** (1765), 143–145; “Problems Concerning Interpolations,” **69** (1779), 59–67; and “On the General Resolution of Algebraical Equations,” *ibid.*, 86–104.

II. Secondary Literature. British historians of mathematics have hardly done justice to Waring. *Gentleman’s Magazine*, **68**, pt. **2** (1798), 730, 807, contains a brief biography and a list of his principal contributions to mathematics; as does J. A. Venn, *Alumni Cantabrigien ses*, pt. 2, IV (Cambridge, 1954), 352. The most exhaustive account of his work is Moritz Cantor, *Vorlesungen über Geschichte der Mathematik*, IV (Leipzig, 1908), 92 – 95. See also Florian Cajori, *History of Mathematical Notations*, 2 vols. (Chicago, 1928 – 1929), see indexes and 1, 244, which reproduces p. 8 of the 1785 ed. of Waring’s *Meditationes analyticae*; and R. T. Gunther, *Early Science in Cambridge* (Oxford, 1937), 60.

J. F. Scott