

Biographical Encyclopedia of Astronomers

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Morgan, Augustus de

Born Madura (Madurai, Tamil Nadu, India), 27 June 1806

Died London, England, 18 March 1871

Though not an astronomer, Augustus de Morgan, one of the most notable British mathematicians and logicians of the 19th century, served the Royal Astronomical Society in leadership positions for over three decades, including his service on the council, and as secretary and editor of the *Monthly Notices*. His influence on the organization and its members was substantial and positive

De Morgan's father, John, was a lieutenant colonel in the British Army in India. Born with only one eye, de Morgan was raised in England. Though he did poorly at school, at the age of 16 de Morgan entered Cambridge University where he studied under George Peacock, professor of astronomy and geometry, and William Whewell, with both of whom he remained friends. Peacock, along with John Herschel and Charles Babbage, formed the Analytical Society, famous for introducing to Cambridge advanced German and French methods of calculus and helping to develop a purely symbolic algebra. De Morgan took his BA in 1826, but because of his strong objections to the theological test required at Cambridge, he did not get a fellowship or proceed to the MA. He read for the bar in London but, in 1828, with no mathematical credentials, he was awarded the first professorship of mathematics at the new University College, London. De Morgan held the post until 1831 when he resigned on principle; he held the post a second time from 1836 to 1866, when he resigned, again on principle, once again on theological strictures, but now applied to others rather than himself.

The publication of de Morgan's *Elements of Arithmetic* (1831) was a significant advance in providing a mathematically rigorous yet philosophically sophisticated treatment of number and magnitude useful for scientific applications. De Morgan coined the term "mathematical induction" to differentiate once and for all the purely formal technique of advancing from number n to $n + 1$ (used in mathematical proofs) from the purely empirical method of hypothetical induction in science. He recognized the far-reaching applications of algebraic and numerical analysis to science and was himself fascinated by purely algebraic and numerical applications to purely empirical problems. He produced, for instance, the first almanac of Full Moons (from 2000 BCE to 2000) and demonstrated how probability theory can be used, for instance, to predict catastrophic events, a technique employed today by insurance companies worldwide. His *Trigonometry and Double Algebra*, first published in 1849, provided the first thoroughly geometric interpretation of complex numbers, further expanding their application in engineering and astronomical calculations.

De Morgan also made important contributions to symbolic logic; he saw, more than any other British luminary of the time (except, perhaps, George Boole), that logic as it had been passed down from Aristotle was severely handicapped in scope, due in large part to a paucity of

rigorous mathematical symbolism. He showed that many more valid inferences are possible than were envisioned by Aristotle, using formulas such as the ones now known as De Morgan's Law:

$$\sim(p \vee q) = \sim p \wedge \sim q, \text{ and } \sim(p \wedge q) = \sim p \vee \sim q$$

These laws of converses and contradictions state, in English, that the truth value of the negation, or contradictory, of the disjunction of two propositions is the same as the conjunction of the negation of each of the propositions; likewise, the truth value of the negation, or contradictory, of the conjunction of two propositions is the same as the disjunction of the negation, or contradictory, of each of the propositions. In his *Formal Logic*, de Morgan uses the important new concept of quantification of the predicate to solve problems that were simply unsolvable in classical Aristotelian logic; when Sir William Hamilton accused him of stealing the idea from him, de Morgan replied that it was Hamilton who was the plagiarist, a charge that seems to have been settled in de Morgan's favor. His *Budget of Paradoxes*, published in 1872 and reprinted in 1954 with a new introduction by the great philosopher of science, Ernest Nagel, is a paradigm-debunking book; in it, de Morgan shows step by step the fallacies by which fraudsters, cranks, and pseudoscientific tricksters continue to this day to titillate the public with extraordinary but ultimately false claims.

De Morgan became a fellow of the Royal Astronomical Society in 1828, joining the council in 1830. He was twice secretary of the society (1831–1838, 1848–1854). Though he was asked to become president of the society, he declined on the basis that, in his view, only practicing astronomers should assume that responsibility. In 1837, de Morgan married Sophia Elizabeth Frend, daughter of a mathematician/actuary.

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Selected Reference

Dubbey, John M. (1971). "De Morgan, Augustus." In *Dictionary of Scientific Biography*, edited by Charles Coulston Gillispie. Vol. 4, pp. 35-37. New York: Charles Scribner's Sons