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(*b*. Largo, Scotland, 16 April 1766; *d*. Coates, near Cupar, Fife, Scotland, 3 November 1832),

natural philosophy.

Leslie was one of three sons born to a poor cabinetmaker, Robert Leslie, and his wife, Anne Carstairs. At the age of thirteen he entered the University of St. Andrews, where he studied mathematics under Nicholas Vilant, who also taught John Playfair and James Ivory. In 1785, Leslie went to Edinburgh to continue his studies with Joseph Black, John Robison, and the moral philosopher Dugald Stewart, from whom he derived a continuing interest in the philosophy and history of science. From 1790 to 1804, when his major work, *An Experimental Inquiry Into the Nature and Propagation of Heat,* appeared, Leslie supported himself by working as a science tutor to Thomas Wedgwood, son of the Etruria potter, Josiah, and by writing for the *Monthly Review*. Leslie became professor of mathematics at the University of Edinburgh in 1805, over the protests of the local clergymen that his acceptance of Hume's notions of causality made him an atheist; and in 1819 he was promoted to the chair of natural philosophy. Throughout his life Leslie refused membership in all British scientific society of London refused his first communication in 1791, but he was made a corresponding member of the Paris Académie Royale des Sciences in 1820 and was knighted in 1832 for his scientific work.

Leslie's *Experimental Inquiry* (1804) established several fundamental laws of heat radiation: that the emissivity and absorptivity for any surface are equal, that the emissivity of a surface increases with the decrease of reflectivity, and that the intensity of heat radiated from a surface is proportional to the sine of the angle of the rays to the surface. The book also played a major role in the early nineteenth-century argument about whether heat was a form of matter or a mode of motion. Leslie's experiments showed that heat, unlike light, was not directly transmitted through transparent solids. Since Leslie embraced a corpuscular theory, he incorrectly interpreted the apparent blockage of heat radiation as evidence that heat was composed of particles much larger than those of light. He borrowed from James Hutton the basic notion that heat was a compound formed by the union of light particles with ordinary particles of matter. François Delaroche later showed that Leslie's failure to detect direct transmission of heat through solids was a result of using only low-temperature heat sources whose radiation was absorbed by the solid screens. In the meantime, Leslie's puzzling experimental results had stimulated further investigations of diathermancy and the nature of radiant heat.

Although Leslie is best known for his heat studies, his interests were wide-ranging. In 1791, for example, he wrote a paper which analyzed the leakage of static electricity from charged bodies through different conducting paths. First he theorized that the quantity of electricity conducted to ground per unit time I would be proportional to the instantaneous intensity of the source—that is, the quantity of electricity per unit volume at any moment v—where it joined the conductor. In addition, he argued that the amount communicated per unit time would be a function of the composition of the conductor ϱ, that it would be proportional to the cross-sectional area of the conductor α, and that it would be inversely proportional to the length L of the conductor. In modern symbols, $I = V\varrho(\alpha/L)$. Next he provided a limited confirmation of his theory by varying the length, composition, and cross sections of conductors discharging a bank of Leyden jars. Finally, he showed geometrically that one could replace a series of conducting segments of varying compositions, lengths, and cross sections with a single equivalent conductor, and he suggested that similar geometrical methods could be used to simplify "more intricate cases" such as those in which parallel conductors were used simultaneously to produce the discharge. Thus he prefigured many of Georg Ohm's considerations of voltaic electricity.

His systematic study, begun in 1793, of temperaturedensity relations in gases allowed him to propose a widely discussed formula for the decrease of temperature with increasing height in the atmosphere. In 1800, he announced the discovery of the wet- and dry-bulb hygrometer and provided an essentially correct theory of how the instrument operates. In 1802 he presented the first correct interpretation of capillary action, thus stimulating the work of Thomas Young and James Ivory. Finally, in 1810, Leslie showed that it was possible to attain very low temperatures by evaporating water in the presence of a desiccant in an evacuated receiver, thus providing the principle exploited by Ferdinand Carré in creating the first laboratory ice machines.

In his theoretical work Leslie emphasized the need for systematic explanations; he had little patience with the English love of what he called "dull empiricism." In conformity with this deep interest in theoretical schemes, Leslie was a principal proponent of the point atomist theory of Bošković.

BIBLIOGRAPHY

I. Original Works. Leslie wrote ten book-length works, twenty-one journal articles, at least thirty-seven reviews, and sixteen encyclopedia articles. His most important books are *An Experimental Inquiry Into the Nature and Propagation of Heat*(London, 1804); *A Short Account of Experiments and Instruments Depending on the Relations of Air to Heat and Moisture*(Edinburgh, 1813); and *The Philosophy of Arithmetic*(Edinburgh, 1817). Leslie's important historical sketch of the exact sciences in the eighteenth century is most widely available in Dugald Stewart, Sir James Mackintosh, John Playfair, and John Leslie, Dissertations on the History of Metaphysical and Ethical, and of *Mathematical and Physical Science* (Edinburgh, 1835).

His more important articles include "Description of a Hygrometer and Photometer," in Nicholson's *Journal of Natural Philosophy*,**3** (1800), 461-467; "On Capillary Action," in *Philosophical Magazine*,**14** (1802), 193-205; "Méthode nouvelle de produire et d'entretenir la congelation," in *Annales de chimie et de physique*,**78** (1811), 177-182; "On Heat and Climate," in *Annals of Philosophy*, **14** (1819), 5-27, first read to the Royal Society of London in 1793; and "Observations on Electrical Theories," in *Edinburgh Philosophical Journal*,**11** (1824), 1-39, read to the Royal Society of Edinburgh in 1792.

II. Secondaray Literature. The only significant published biographical sketch is Macvey Napier, "Leslie, Sir John,' in *Encyclopaedia Britannica,* 7th ed. (1842), VIII, 242-252. For more detailed information and bibliography see Richard Olson's thesis, "Sir John Leslie: 1766-1832; A Study of the Pursuit of the Exact Sciences in the Scottish Enlightenment" (Harvard, 1967).

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