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(*b*. Arbuthnot, Kinkardineshire, Scotland, 29 April 1667; *d*. London, 27 February 1735)

mathematical statistics.

The son of a Scottish Episcopal clergyman, Arbuthnot studied at Aberdeen, took his doctor's degree in medicine at St. Andrews in 1696, and settled in London in 1697. He was elected a fellow of the Royal Society in 1704 and was appointed a physician extraordinary to Queen Anne in 1705 (he became ordinary physician in 1709). The Royal College of Physicians elected him a fellow in 1710.

Arbuthnot wrote a few scientific and medical essays, but he became especially famous for his political satires. He was a close friend of the wits and literary men of his day: with Swift, Pope, John Gay, and Thomas Parnell he was a member of the Scriblerus Club. Of the characters in his political novels, the one that has survived is John Bull.

Arbuthnot was well acquainted with the theory of probability. It is certain that he published an English translation of Christian Huygens' *De ratiociniis in ludo aleae* (probably to be identified with a work said to have appeared in 1692, and with the first edition of part of an anonymous work that appeared in a fourth edition in 1738 in London under the title *Of the Laws of Chance*...). His scientific importance, however, resides in a short paper in the *Philosophical Transactions of the Royal Society*, which has been taken as the very origin of mathematical statistics. Entitled "An Argument for Divine Providence, Taken From the Constant Regularity Observ'd in the Birth of Both Sexes," it begins:

Among innumerable footsteps of divine providence to be found in the works of nature, there is a very remarkable one to be observed in the exact balance that is maintained, between the numbers of men and women; for by this means it is provided, that the species never may fail, nor perish, since every male may have its female, and of proportionable age. This equality of males and females is not the effect of chance but divine providence, working for a good end, which I thus demonstrate.

He first shows by numerical examples that if sex is determined by a die with two sides, *M* and *F*, it is quite improbable that in a large number of tosses there will be as many *M* as *F*. However, it is also quite improbable that the number of *M* will greatly exceed that of *F*. Nevertheless, there are more male infants born than female infants—clearly through divine providence—to make good the greater losses of males in external accidents. In every year from 1629 to 1710, there were more males christened in London than females—as if 82 tosses of the die would all show *M*. Such an event has a very poor probability: 2^{-82}. Therefore it cannot have been produced by chance; it must have been produced by providence.

Arbuthnot's argument is the first known example of a mathematical statistical inference and, in fact, is the ancestor of modern statistical reasoning. It immediately drew the attention of Continental scientists, particularly the Dutch physicist's Gravesande, as is shown by contemporary correspondence. Daniel Bernoulli used it in 1732 to show that it could not be by chance that the planetary orbits are only slightly inclined to the ecliptic. In 1757 John Michell proved the existence of double stars by showing that stars are found close to each other more often than mere chance would allow.

Condorcet applied the argument to test the veracity of the tradition of Roman history that seven kings had reigned for a total of 257 years. Laplace, in his classic work, reconsidered such applications and added many new ones. This crude argument, although now greatly refined, is still the basis of statistical inference.

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Hans Freudenthal