` *determinism. However, Charles (1815–1903) and Charles Peirce presented arguments for indeter- psychological and methodological spectively, and William James thought it remained plausible. ivent of *quantum physics in the century, Max Born (1882–1970) physics now showed that indeter- rue. Others, including Albert Ein- 1955), did not accept this, and some ivocated theories postulating *hid- s to avoid quantum indeterminism. isality.

RAH

emy. *See* alchemy.

ice. *See* Hindu science.

See reagent.

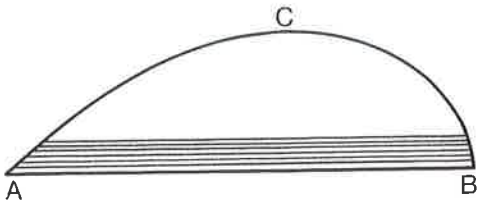
lity of identicals. *See* Leibniz law.

lifferences. The object of a branch logy developed by Francis Galton) that studies the differences of men- ristics in individual human beings. tially by *associationist psychology, hat *intelligence was a simple func- ate at which sensory tasks were per- lton investigated the differences be- ons in respect of various sensory e.g. reaction time [*reflex]. irches in this led to no established ween intellectual ability and sensory and his disciples preferred the in- IQ) tests introduced by Alfred Binet). In Britain, Cyril Burt (1883–1971) Q scores typically followed a normal l distribution. In the USA study of differences was boosted in World nscript-testing. Recently the science l personality variables, using the method of factor analysis.

l the study of individual differences psychological discipline, the term it- from Charles Darwin's (1809–82) *pecies* (1859), where it referred to differences that make different mem- same species physically distinguish- dity and variation]. Darwin insisted lual differences were the material ch *natural selection operated. ians sought *probability laws which best described the distribution of these differences – e.g. differences in stature – in a population. In the case of stature, differences followed a normal or Gaussian distribution. Such studies provided statistical methods for psychologists. From this context emerged interest in the inheritance of individual differences. In particular, in 1918 R. A. Fisher (1890–1962) showed that normally distributed characters and their inheritance could be explained by *Mendelian genetics, indicating the proportion of observable variance due to *heredity and to *environment [*environmental–heredity controversy].

BJN

indivisibles. In Antiquity and the Middle Ages the concept of indivisibles was closely related to the hypothesis that the *continuum is composed of indivisible parts – in contrast to the Aristotelian hypothesis that the constituent parts of the continuum are divisible to *infinity. Inspired by G. Galilei (1564–1642), Bonaventura Cavalieri (1598–1647) introduced indivisibles in the infinitesimal *analysis. To determine an area of a figure, like ABC, he introduced an auxiliary magnitude, which he called 'all the lines' (*omnes lineae*) of the figure. It is the totality of parallel line segments obtained by letting a line, starting along AB, be uniformly displaced parallel to AB and taking all the sections between the figure and the moving lines. Cavalieri called these lines the indivisibles of the figure (and similarly he conceived the indivisibles of a solid as parallel planes); however, in his calculations he avoided speculating whether the lines really made up the figure. The work of Cavalieri and others on indivisibles gave rise to the development of the concepts of infinitesimal and differential [*calculus] in the 17th century.



KMA

induction (biology). Experiments performed on lower-order vertebrates from about 1900 showed that the pattern of *development is not completely determined in the *fertilized *egg *cell. Rather, embryonic development depends on a complex series of feedback systems, so that in one embryonic stage, *organizer material will begin to induce the next stage, and so on. The organizer thus induces embryonic material to develop into particular types of tissue. Detailed studies have shown that specific areas of the embryo induce specific body structures; e.g. head inductors and trunk inductors. The exact way in which the inductor material works remains unknown, although F. R. Lillie's (1870–1947) experiments on *regenerating feathers and their consistent *morphogenetic responses to different concentrations of *hormones have been significant.

JM

induction (electricity). *See* lightning; lines of force.

induction (philosophy). Though Aristotle (384–322 BC) recognized induction as a process of reasoning establishing general truths from particular instances, Francis Bacon (1561–1626) was the first to attempt a detailed account of its operation in science. He despised reliance on mere numbers of instances and advocated that scientists interrogate *Nature to tabulate both the circumstances under which a phenomenon is present and also those under which it is absent. In discovering a circumstance uniquely correlating with the phenomenon, scientists have discovered its proximate explanation and know how to reproduce it at will [*replication]. Features of these explanatory circumstances can then form the topic of further inquiry, and as more and more comprehensively explanatory generalizations become available, in a pyramid of causal *laws, the generalizations themselves enjoy greater certainty.

Robert Boyle (1627–91), Robert Hooke (1635–1702), and many other 17th-century *experimentalists applauded Bacon's seminal ideas, though no-one fully adhered to them; and interest in the concrete details of scientific progress soon drew attention away from abstract issues of *methodology. William Whewell (1794–1866) saw himself as reviving Bacon's doctrine, but stressed the role of conceptual innovation in the process by which a pair of natural laws could come to corroborate one another when subsumed under a more comprehensive theory [*consilience]. J. F. W. Herschel (1792–1871) found Bacon's methodology to be exemplified in the experimental science of his own day. He emphasized