OBITUARY.

Sir Francis Galton, D.C.L., D.Sc., F.R.S.

SIR FRANCIS GALTON, who passed away on January 17 last, was born at Duddeston, in Warwickshire, on February 16, 1822. His father was a Birmingham banker who married a daughter of Erasmus Darwin, and Galton was therefore, on his mother's side, a cousin of Charles Darwin. He was educated at King Edward VI's School, Birmingham, entering the Birmingham General Hospital in 1838, and completing his medical education at King's College, London. In 1840 he entered Trinity College, Cambridge, and in 1843 he took a poll degree. He married, in 1853, a daughter of Dr. G. Butler, Dean of Peterborough, and was thus the brother-in-law of the Master of Trinity.

Two years after leaving Cambridge Galton undertook a journey to the Sudan, at that time unexplored, and this was followed in 1850 by an expedition, extending over two years, to Damaraland, Ovampoland, and Namaqualand. The fruit of this expedition was the publication in 1863 of his "Narrative of an explorer in tropical South "Africa." This received immediate recognition; Galton was awarded the Founder's gold medal of the Royal Geographical Society, and was elected a member of its council. In 1885 he published "The art "of travel; or shifts and contrivances available in wild countries."

In 1857 he became honorary secretary of the Royal Geographical Society, a position which he retained until 1863, when he became general secretary of the British Association. In this capacity he served the British Association for about five years. But he was, in addition, president of the geographical section in 1862 and 1872, president of the anthropological subsection of biology in 1877, and president of the section of anthropology in 1885. On the death of Admiral Fitzroy he was named a member of the Board of Trade committee appointed to consider the reorganisation of the Meteorological Office, and for nearly forty years he was associated with the Meteorological Committee, created in 1868 in accordance with its recommendations, and its successor, the Meteorological Council. He was also for many years a member, and for some years chairman, of the managing committee of Kew Observatory.

From 1885 to 1888 he was president of the Anthropological Institute, and in 1908 the Linnean Society awarded him the Darwin-Wallace celebration medal. In 1886 the Royal Society, of which he had been elected a Fellow in 1860, conferred on him a Royal medal, in recognition of his statistical inquiries into biological phenomena. This distinction was followed by the award of the Darwin medal in 1902 and the Copley medal in 1910. In 1894 he

received the degree of Honorary D.C.L. of Oxford University, and in 1895 his own University of Cambridge conferred on him the degree of Hon. D.Sc., while he was also made an honorary Fellow of Trinity. In 1909 he was knighted.

Sir Francis Galton's connection with this Society dates from 1860, when, on the proposal of Colonel E. H. Sykes, seconded by Mr. James Heywood, he was elected a Fellow. He served on the Council from 1869 to 1879, and was chosen to serve as a Vice-President in 1875. He contributed to the JOURNAL on several occasions, the first contribution being "The relative supplies from " town and country families to the population of future generations." (*Journal of the Statistical Society*, vol. xxxvi, 1873.) His other contributions were: "A common error in statistics" (*Statistical Society's Jubilee Volume*, 1885), and "Application of the method of percentiles " to Mr. Yule's data on the distribution of pauperism" (*Journal of the Royal Statistical Society*, vol. lix, 1896). In 1886 he was elected an honorary member of the International Statistical Institute.

This brief outline of his life will give some, but only a faint, idea of the variety of Galton's scientific activities; it is hardly possible for a worker in any one branch of science to realise how fundamentally the freshness of his outlook, the entire novelty of his methods, have affected the scope and character of research in many branches of knowledge. In meteorology, he was largely responsible for the introduction of graphical methods of mapping the weather; he took a considerable part in the early construction of the daily weather charts appearing in *The Times*, and he was the originator of that now familiar term an *anticyclone*. His various memoirs on points of psychology, dating from the seventies, and partially summarised in the "Inquiries into human faculty and its development" (1883) are of fundamental originality and importance. In biology, he was the originator of the use of statistical methods. In sociology, the adoption of the biological standpoint is largely the result of his researches; he was the inventor of the term eugenics and the science of eugenics, and the founder of the Eugenics Laboratory. As an incidental result of his statistical researches in biology, he was the parent of modern statistical methods.

In his statistical work Galton may fairly be said to have inherited the mantle of Quetelet, though his interest was first seriously drawn to the normal law of error owing to its use by William Spottiswoode in a geographical memoir. It seems clear, however, from the references in "Hereditary Genius" (1869), that it is to Quetelet's "Letters" in Downes' translation he is indebted for his knowledge of the properties of the curve, and like Quetelet, he always regards the normal curve as derived from the binomial series.

His first contribution to the methods of statistics, foreshadowed in "Hereditary Genius," was the method of grades or percentiles ("Statistics by intercomparison, with remarks on the law of frequency "of error." *Phil. Mag.*, 4th series, vol. xlix, 1875). It deserves perhaps to be emphasised that in this memoir Galton lays stress principally, indeed almost wholly, on the application of the method to unmeasured characters. His object is to describe a method "which has the merit of being applicable to a multitude of objects "lying outside the present limits of statistical inquiry"; the objects need only to be ranked in order as regards the character considered; the middlemost (median) then indicates the average, those one-quarter distant from either end (quartiles) the divergency of the series. These particular objects need not, perhaps cannot, be measured as regards the character concerned, but if they can be pictured or described we have a summary picture or description of the series. The method is, of course, freely used in "Natural "Inheritance" (1889) and the memoirs that preceded it, and Galton's continued interest in it is evidenced by papers published from time to time during the remainder of his life. Reference has already been made to one contribution in this JOURNAL, in 1896; mention may also be made of notes "on the median estimate," in the B.A. Report for 1899, on a geometrical method of determining the median of a normal distribution from two centiles (*Nature*, 1900), on the application of the median in voting, *e.g.*, for damages to be awarded by a jury or in guessing (*Nature*, 1907), and of the explanatory introduction to a table of Grades and Deviates of the Normal Curve, calculated by Mr. Sheppard, in vol. v of *Biometrika* (1907). A remarkable memoir "On the most suitable proportion "between the values of first and second prizes," published in *Biometrika*, vol. i, 1902, is also related to the same train of ideas. In more general terms the problem is this: if the objects or individuals with which we are concerned are ranked in order, as for the determination of percentiles, what is the average difference between the nth and the $(n + 1)$th? The originality is characteristic: the whole problem is new to statistical theory—and the author of the memoir was aged 80.

The method of percentiles, while in many respects novel, may be regarded rather as a new application of a much older idea—the idea at the root of the determination of the median and of the "probable error." By his invention of the method of correlation Galton opened an entirely fresh field of work. Certain memoirs by earlier writers deal with problems which present some mathematical similarity to those with which he was concerned—the distribution of shots on a target or of stars in space—but to no one had it occurred

to apply such methods to the serious study of statistical relations, nor to employ a single coefficient as a measure of the closeness of the relation between two varying quantities. Just as the method of percentiles arose from Galton's work on the inheritance of genius, the method of correlation arose from his studies on the inheritance of stature and in anthropometry; the fundamental memoirs are the Address to Section H (Anthropology) of the British Association (1885), "Regression towards mediocrity in hereditary stature" (Presidential Address) (*Journ. Anthrop. Inst.*, vol. xv, 1886, p. 246), "Family likeness in stature" (*Proc. Roy. Soc.*, vol. xl, 1886, p. 42), and "Correlations and their measurement" (*ibid.* vol. xlv, 1888, p. 135). The first three of these memoirs form a single group, dealing with the same data, the third being provided with an appendix by Mr. J. Hamilton Dickson on the theoretical expression for the normal correlation surface; in the fourth the theory is dealt with from a somewhat more general point of view, the correlation being considered between two different measurements on the same individual, instead of between the same measures on parent and offspring, and coefficients of correlation are given for stature with cubit (0·8), head-length (0·35), middle finger (0·7) and height of knee (0·9); for height of knee and cubit (0·8); for cubit and middle finger (0·85), and for head-length and breadth (0·45). The concluding passage of the memoir is worth citing for its historical interest:—"The prominent "characteristics of any two correlated variables, so far at least as "I have as yet tested them, are four in number. It is supposed "that their respective measures have been first transmuted into "others of which the unit is in each case equal to the probable "error of a single measure in its own series. Let y = the deviation "of the subject, whichever of the two variables may be taken in "that capacity; and let x_1, x_2, x_3, &c., be the corresponding "deviations of the relative, and let the mean of these be X. Then "we find (1) that $y = r\mathrm{X}$ for all values of y, (2) that r is the same "whichever of the two variables is taken for the subject, (3) that r "is always less than 1, (4) that r measures the closeness of the "co-relation." Galton determined r by a simple graphic method, which has since been replaced by the product-sum formula due to Professor Pearson and suggested by a memoir of Bravais; but to Galton is due the idea of such a coefficient (termed "Galton's "function" by Professor Weldon in his earlier papers); he introduced the symbol by which it is now generally represented and determined all its principal properties—the values of the regressions (r is the initial letter of regression) and the standard deviations of arrays.

Mention was made above of the theoretical paper by

Mr. Hamilton Dickson on the form of the normal correlation surface; in his "Memories of my Life," Galton tells us how he came to ask for Dickson's assistance. He had formed the correlation table for stature of parent and child, and had determined its principal properties, but could not see his way to express the results of the complete table in a single formula. Poring over the diagram in his notebook while waiting at a roadside station near Ramsgate for a train, it struck him at length that the lines of equal frequency ran in concentric ellipses, and more careful drawing corroborated the first impression —a skilled guess of a most remarkable kind when the roughness of the data is considered. "All the formulæ of conic sections having "long since gone out of my head, I went on my return to London "to the Royal Institution to read them up. Professor, now "Sir James, Dewar came in, and probably noticing signs of despair "in my face, asked me what I was about; then said, 'Why do you "'bother over this? My brother-in-law, J. Hamilton Dickson, of "'Peterhouse, loves problems and wants new ones. Send it to "'him.'" Galton did so, and all his empirical conclusions were fully confirmed. The assistance sought in this case, when Galton's abilities did not suffice to solve the mathematics of his problem, is paralleled in other instances. Dr., now Sir, Donald Macalister contributed a mathematical sequel to his paper on "The geometric "mean in vital and social statistics" (*Proc. Roy. Soc.*, vol. xxix, 1879, p. 365), and the Rev. H. W. Watson was associated with him in an earlier memoir on the probability of the extinction of families (*Journal Anthrop. Inst.*, 1875).

Of recent years Galton's main interest lay in the propagation of the ideas of eugenics, but it must not be forgotten that this was a subject which had always lain near his heart since the days when he had been working at "Hereditary Genius" forty years before; the word itself first occurs in "Human Faculty" (1883, p. 24). Many passages of "Hereditary Genius" reflect the eugenic idea; the gist of the matter is given at once on p. 1. "I propose to show in this book that a "man's natural abilities are derived by inheritance, under exactly "the same limitations as are the form and physical features of the "whole organic world. Consequently, as it is easy, notwithstanding "these limitations, to obtain by careful selection a permanent breed "of dogs or horses gifted with peculiar powers of running, or of "doing anything else, so it would be quite practicable to produce a "highly gifted race of men by judicious marriages during several "consecutive generations." The views are emphasised again towards the end of the book, and are essentially the same as those that were advanced in the magazine article that was written some four years before the publication of "Hereditary Genius." His more recent views on the subject will be found illustrated by a series of

papers read before the Sociological Society, republished in volume form in 1905, and by the Herbert Spencer lecture of 1907. In 1904 Galton founded a Research Fellowship in National Eugenics under the University of London, providing sufficient endowment for the tenure of the Fellowship for three years, for the publication of memoirs, and for office expenses. Mr. Edgar Schuster was appointed to the Fellowship, and on his resignation, in 1907, was succeeded by the present holder, Dr. David Heron. At the same time the office was reorganised on a more permanent footing, under the title of the Francis Galton Eugenic Laboratory, with a Scholar and Computer in addition to the Fellow, under the general direction of Professor Pearson and Sir Francis Galton himself.

It has only been possible to mention incidentally Galton's direct contributions to psychology in his "Inquiries into human faculty and "its development" (1883), and the related memoirs on whistles for determining the upper limits of audible sound, on generic images, on visualised numerals, on apparatus for testing the delicacy of the muscular senses and allied matters. His statistical methods are an indirect contribution of equal or greater importance. As regards his work on finger prints also, we can only cite the titles of his contributions—"Patterns in thumb and finger marks" and "Methods of indexing finger marks" (*Proc. Roy. Soc.*, 1891), "Finger prints" and "Blurred finger prints" (1893), and "Finger "print directory" (1895). No account of his work would, however, be complete without some reference to his remarkable mechanical ability. The first scientific paper which he published was a most ingenious scheme for a printing telegraph, and we have in subsequent years designs for a hand heliostat, for anthropometric instruments, for apparatus for measuring the rate of movement of various limbs, for apparatus for reducing horizontal and vertical scales of diagrams in different proportions, and for computing vapour tension. His mechanism for giving the average statures of children in terms of the statures of the parents, and his apparatus for reproducing the normal curve by allowing a stream of shot to trickle through a forest of nails will be familiar to all readers of "Natural "Inheritance." Readers who wish to supplement this all too incomplete account of his work must be referred to the bibliography at the end of his "Memories of my Life," and to his works themselves.

Of Galton's personal character it is impossible to speak too highly. His papers, and above all his "Memories," are in themselves a revelation of the simplicity and innocence of his spirit, and his innate goodness and modesty. His intense and childlike delight in the mathematical verification of an empirical result, in the successful overcoming of a difficulty, in some unexpected appreciation of his work, appears continually. It is characteristic that he was never

engaged in controversy. No younger man who came into personal contact with him is likely to forget his cheery welcome, his friendly and utterly unassuming discussion—as between equals—of any points that might arise. He was one of those rare characters that inspire at once a respect that is not unmingled with a strong affection.

Sir Francis Galton's own bent for statistics seems to have been to some extent inherited from his ancestors. His paternal grandfather, Samuel John Galton (1753-1832), he speaks of as "a scientific " and statistical man of business; he had a decidedly statistical bent, " loving to arrange all kinds of data in parallel lines of corresponding " lengths, and frequently using colour for distinction." S. J. Galton was a contemporary of Playfair (1759-1823), and the use of graphic methods may perhaps have been suggested by his works. Francis Galton's father, Samuel Tertius Galton, was also "eminently statistical " by disposition," and published a chart, with explanatory text, on currency questions ("A chart exhibiting the relation between the " amount of Bank of England notes in circulation, the rate of foreign " exchanges, and the prices of gold and silver bullion and of wheat, " with explanatory observations." London, 1813.)

The Right Hon. Sir C. W. Dilke, Bart., M.P.

SIR CHARLES DILKE, whose death in his 68th year occurred on January 26th, had been a Fellow of the Royal Statistical Society since 1866, when he was elected on the nomination of Dr. Newmarch. He served as a member of the Council in 1869-71, and was President in 1907-09. He contributed papers to the Society's Proceedings in 1874 on "Local government among different nations" (JOURNAL, vol. xxxvii), in 1876 on "The municipal government of Paris" (JOURNAL, vol. xxxix), in 1891 on "Statistics of defence expendi- " ture of the chief military and naval powers" (JOURNAL, vol. lxiv), and in 1900 on "The defence expenditure of the Empire" (JOURNAL, vol. lxiii). For his presidential address, delivered in November, 1907, he took the subject of "Official statistics," and throughout his term of office he recurred frequently to the same subject, to which when chairman of the Select Committee on the Income Tax, in 1906, his attention seems to have been specially directed. His denunciation of the imperfections of certain statistical returns was vigorous, and he averred more than once that he hoped to signalise his presidency of the Society by promoting an improvement in the system by which official statistics are now compiled and issued. He induced the Select Committee on Publications to hear evidence on behalf of the Society on this subject, but the Committee did not think themselves entitled, by the terms of their reference,