like herrings in a barrel, thousands and thousands of them, one on top of the other, a solid mass of living and sleeping solehood, only waiting for the adventurous fisherman to pull them up and take them to market. Man, treacherous man, crept upon their peaceful slumber unawares, and proceeded, like Macbeth, to murder sleep wholesale in the most unjustifiable and relentless manner. He dropped his lines into the Silver Pits—the water there is too deep for dredging—and hauled up the hapless drowsy creatures literally by the thousand till he had half exhausted the accumulated progeny of ages. The Silver Pits are still excellent winter fishing-grounds, but never again will they yield such immense fortunes as they did at the moment of their first exploration.

In 1848, when the California gold-fever was at its very height, some other lucky smack-owners hit upon a second deposit of solid soles, lying in layers on a small tract of coarse bottom near Flamborough Head, where they retired to hibernate, perhaps, in consequence of the hard treatment they had received in the Silver Pits. This new El Dorado of the fishing industry was appropriately nicknamed California, because it proved for the time being a very mine of gold to its fortunate discoverers. But, like the prototypal California on the Pacific coast, its natural wealth was soon exhausted; and, though it still yields a fair proportion of fish, its golden days are now fairly over.

Driven from the banks and pits by their incessant enemy, the trawler, the poor soles have now taken to depositing their spawn on the rough, rocky ground where the fishermen dare not follow them for fear of breaking their nets against the jagged ledges. These rocky spots are known as sanctuaries, and if it were not for them it is highly probable that sole *au gratin* would soon become an extinct animal on our London dinner-tables. Even to the sanctuaries, however, they are rudely followed, as Professor Huxley has shown, by their hereditary fishy foes, who eat the spawn, and so deprive the world of myriads upon myriads of unborn soles, consigned before their time to dull oblivion. Formerly, fishermen used to throw away these useless fish when caught; in future, they have strict orders from the inspectors of fisheries to kill them all wherever found.

However, even the remnant left by all enemies put together is quite sufficient to repeople the waters with a pleuronectid population with extraordinary rapidity. The fecundity of fish is indeed something almost incredible. The eggs of soles are extremely small—not so big as a grain of mustard-seed—and the roe of a one-pound fish usually contains as many as one hundred and thirty-four thousand of them. Turbot are even more surprisingly prolific: Frank Buckland was acquainted with one whose roe weighed five pounds nine ounces, and contained no less than fourteen million and odd eggs. It is a sad reflection that not more than one of these, on an average, ever lives to reach maturity. For if only two survived in each case the number of turbot in the sea next year would be double what it is this; the year after that there would be four times as many; the next year eight times again; and so on in a regular arithmetical progression. In a very few decades the whole sea would become one living mass of solid turbot. As a matter of fact, since the number of individuals in any given species remains on the average exactly constant, we may lay it down as a general rule that only two young usually survive to maturity out of all those born or laid by a single pair of parents. All the rest are simply produced in order to provide for the necessary loss in infant mortality. The turbot lays fourteen million eggs, well knowing that thirteen million nine hundred and ninety-nine thousand nine hundred and ninety-nine will be eaten up in the state of spawn or devoured by enemies in helpless infancy, or drifted out to sea and hopelessly lost, or otherwise somehow unaccounted for. The fewer the casualties to which a race is exposed the smaller the number of eggs or young which it needs to produce in order to cover the necessary losses.

In fish generally it takes at least a hundred thousand eggs each year to keep up the average of the species. In frogs and other amphibians, a few hundred are amply sufficient. Reptiles often lay only a much smaller number. In birds, which hatch their own eggs and feed their young, from ten to two eggs per annum are quite sufficient to replenish the earth. Among mammals, three or four at a birth is a rare number, and many of the larger sorts produce one calf or foal at a time only. In the human race at large, a total of five or six children for each married couple during a whole lifetime makes up sufficiently for infant mortality and all other sources of loss, though among utter savages a far higher rate is usually necessary. In England, an average of four and a half children to each family suffices to keep the population stationary; above that number it begins to increase, and has to find an outlet in emigration. If every family had four children, and every child grew up to maturity and married, the population would exactly double in every generation. Even making allowances for necessary deaths and celibacy, however, I believe that as sanitation improves and needless infant mortality is done away with, the human race will finally come to a state of equilibrium with an average of three children to each household. But this is getting very far away indeed from the habits of flat-fishes.—*Cornhill Magazine.*

SKETCH OF FRANCIS GALTON.

A SKETCH of Francis Galton may appear with manifest fitness in the same number of the "Monthly" in which is published an abstract review of M. de Candolle's researches into heredity and the other conditions favorable to the production of men of science. Mr.

Galton is also a painstaking and intelligent investigator of the operations of heredity; he has made special studies of the family histories of English men of science; and presents in himself a bright example of the hereditary transmission of intellectual gifts.

Francis Galton is a grandson of Dr. Erasmus Darwin, the famous author of "Zoönomia," and a cousin of the illustrious author of the "Origin of Species." He is the third and youngest son of S. T. Galton, of Duddeston, near Birmingham, and was born in 1822. He received his preparatory education at King Edward's School near Birmingham; studied medicine at the Birmingham Hospital and King's College, London; and was graduated at Trinity College, Cambridge, in 1844. He afterward made two journeys in Africa, the first of which, begun in 1846, was in the northern part of the continent and on the White Nile, through regions which were then rarely visited; and the second in the western regions of South Africa, on which he started from Walfish Bay in 1850. Among the fruits of this journey was the book, "Narrative of an Explorer in Tropical South Africa." He also received, on account of it, the gold medal of the Royal Geographical Society, of which he has since been an active member and efficient officer. He published in 1855 a book on the "Art of Travel, or Shifts and Contrivances in Wild Countries," which has gone through numerous editions, and still holds its place in the markets. His "Meteorographica," published in 1863, was the first attempt to represent in charts on a large scale the progress of the elements of the weather. From his studies in connection with the preparation of this work was developed the theory of anti-cyclones, which was first propounded by him. A committee of the Board of Trade having been appointed, after the death of Admiral Fitzroy in 1865, to examine into the past and future duties and administration of the Meteorological Office, Mr. Galton was placed upon it at the instance of the Royal Society. He is now a member of the Council, to whose hands the parliamentary grant for the maintenance of the Meteorological Office is intrusted.

Mr. Galton is best known by his researches, which have been many, varied, and valuable. His journeys, and the books which he based upon them, stamp him a geographical explorer of no low or mediocre rank. His work in the Meteorological Office has been sufficient in itself to give him a high and extensive reputation. But all that he has done in these two branches has been surpassed, and we might say obscured, by his later researches in the laws of heredity and the growth of genius, and in anthropological measurements. Appertaining to Mr. Galton's studies on heredity are his paper on Pangenesis, read before the Royal Society in March, 1871, in which he drew, from his experiments on the transfusion of blood in rabbits and their after-breeding, conclusions adverse to Mr. Darwin's theory on that subject, and which became the topic of a correspondence between Mr. Darwin, himself, and Dr. Beale in the columns of "Nature"; his researches into the laws of blood-relationship, communicated in a paper to the Royal Society in June, 1872; and the inquiries which are represented in his books on "Hereditary Genius, its Laws and Consequences" (1869); "English Men of Science; their Nature and Nurture" (1874); and "Inquiries into Human Faculty and its Development" (1883).

In the lecture on "Blood-Relationship" he sought to analyze and describe the complicated relation that binds an individual, hereditarily, to his parents and to his brothers, and therefore, by an extension of similar links, to his more distant kinsfolk. By these means he hoped to set forth the doctrines of heredity in a more orderly and explicit manner than was otherwise practicable. "From the well-known circumstance," he said, "that an individual may transmit to his descendants ancestral qualities which he does not himself possess, we are assured that they could not have been altogether destroyed in him, but must have maintained their existence in a latent form. Therefore each individual may properly be conceived as consisting of two parts, one of which is latent and only known to us by its effects on his posterity, while the other is patent and constitutes the person manifest to our senses. The adjacent, and, in a broad sense, separate lines of growth in which the patent and latent elements are situated, diverge from a common group and converge to a common contribution, because they were both evolved out of elements contained in a structureless ovum, and they jointly contribute the elements which form the structureless ova of their offspring. . . . The observed facts of reversion enable us to prove that the latent elements must be greatly more varied than those that are personal or patent." An elaboration of this view, and a more detailed examination of the phenomena caused the author "to be impressed with the fallacy of reckoning inheritance in the usual way, from parents to offspring, using those words in their popular sense of visible personalities. The span of the true hereditary link connects, not the parent with the offspring, but the primary elements of the two, such as they existed in the newly impregnated ova whence they were respectively developed." In conclusion, he recorded as one result of the investigation, a very clear showing that "large variation in individuals from their parents is not incompatible with the strict doctrine of heredity, but is a consequence of it wherever the breed is impure. I am desirous of applying these considerations to the intellectual and moral gifts of the human race, which is more mongrelized than that of any other domesticated animal. It has been thought by some that the fact of children showing marked individual variation in ability from that of their parents is a proof that intellectual and moral gifts are not strictly transmitted by inheritance. My arguments lead to exactly the opposite result. I show that their great individual variation is a necessity under present conditions, and I maintain that results derived from large averages are all that can be required, and all we could expect to obtain, to prove that intellectual and moral gifts are as strictly matters of inheritance as any purely physical qualities."

In 1874 Mr. Galton published his "English Men of Science; their Nature and Nurture." It was a summary of the results which he had obtained from inquiries addressed to the most eminent scientific men of England, respecting the hereditary and other circumstances which might have been influential in directing them toward the careers in which they shone, and promoting their success in them. His criterion, in selecting men as typical for his purpose, was somewhat like that which M. de Candolle adopted. He took persons who had been elected to the Royal Society, and of them those who had been otherwise distinguished by receiving medals, or by holding official positions in scientific bodies or professorships in some important college or university. One hundred and eighty men were questioned for facts concerning their parentage and descent, the religious opinions, occupations, political party, health, stature, complexion, temperament, size of head, and a great many other particular facts concerning their parents and themselves; regarding their brothers and sisters, and their salient characteristics; the numbers and principal achievements of more distant relatives, grandparents, uncles and aunts, cousins, nephews and nieces; and the mode and duration of the education of the questioned scientific man himself, with an analysis of the causes of success of which he was conscious.

From the replies to these inquiries it appeared that the chief qualities in the order of their prevalence among scientific men were, energy, both of body and mind; good health; great independence of character; tenacity of purpose; practical business habits; and strong innate tastes for science generally, or for some branch of it.

The replies respecting the special experience in education of the men addressed exhibited a striking unanimity, notwithstanding the diversity of branches of science which they severally pursued. They commonly expressed a hatred of grammar and the classics, and an utter distaste for the old-fashioned system of education. "The following seems the programme they themselves would have most liked: 1. Mathematics, rigorously taught up to their capacity, and copiously illustrated and applied, so as to throw as much interest into its pursuit as possible; 2. Logic; 3. Some branch of science (observation, theory, and experiment), some boys taking one branch and some another, to insure variety of interests under the same roof; 4. Accurate drawing of objects connected with that branch of science; 5. Mechanical handiwork. All these to be rigorously taught. The following not to be taught rigorously: reading good books (not trashy ones) in literature, history, and art; a moderate knowledge of the more useful languages, taught in the easiest way, probably by going abroad in vacations. It is abundantly evident that the leading men of science have not been made by much or regular teaching. They craved variety. Those who had it, praised it; and those who had it not, concurred in regretting it. There were none who had the old-fashioned high-and-dry education who were satisfied with it. Those who came from the greater schools usually did nothing there, and have abused the system heartily."

In 1877, as Vice President of the Anthropological Department of the British Association, Mr. Galton described a method of accurately measuring mental processes, such as sensation, volition, the formation of elementary judgments, and the estimation of numbers; suggested means, by the aid of photography, of studying the physiognomy of the criminal and other special classes of men; and discussed the subject of heredity in crime. In the address in which these thoughts were conveyed he suggested that there were no worthier professors of the branch of anthropology that relates to types of character "than the writers of the higher works of fiction, who are ever on the watch to discriminate varieties of character, and who have the art of describing them. It would, I think, be a valuable service to anthropology if some person well versed in literature were to compile a volume of extracts from novels and plays that should illustrate the prevalent types of human character and temperament." Carrying out the ideas of this address to a further extent, he discussed, in a paper read before the Anthropological Institute in 1878, the system of taking composite portraits, by combining the portraits of several individuals distinguished by possessing some common quality into a single portrait which might be considered as typical of that quality personified. As among the possible practical applications of this system, he suggested that "it might be used to give typical pictures of different races of men; to construct a really good likeness of a living person by the combination of several likenesses of the ordinary sort; to produce, from many independent portraits of an historical personage, the most probable likeness of him; and, lastly, an application of great interest in inquiries into the hereditary transmission of features."

Among the later investigations of Mr. Galton is an interesting one on "Visualized Numerals," regarding a faculty which very many persons have been proved to possess, of forming, when any number is mentioned or thought of, vivid conceptions of the figures constituting the number as projected before them or standing plainly out in the air.

Since 1875 Mr. Galton has been engaged in active investigations, with the Anthropometric Committee of the British Association, of the heights, weights, etc., of human beings in the British Empire, and in obtaining photographic representations of the typical races.

Mr. Galton was General Secretary of the British Association from 1863 to 1868; was President of its Geographical Section in 1862 and 1872, of the Anthropological Sub-section in 1877, and of the Anthropological Section in 1885; and he has been Vice-President of the Royal Geographical and Anthropological Societies, and a member of the councils of many other bodies.