*CHARLES DARWIN**.

"This man decided not to live but know."

BROWNING.

The telegram which announced the death of Charles Darwin said, in effect, to every naturalist who read it, "Thy master is taken from thy head this day." There are few more striking instances of the acknowledged supremacy of one man in his own branch of knowledge, than that which is furnished to us by the subject of this paper. In an age of distinguished naturalists, it occurs to very few to question the right of Darwin to a position above them all, as the father of modern biology. He has been described by one well able to judge as "the greatest man of science, save one, since Aristotle." In what may be called the scientific period of knowledge from the Revival of Learning to the present day, Newton and he stand out as the mightiest of those who have given their lives to the tracing of that "perpetual chain of causes and effects whose first link is riveted to the throne of God."

To understand Darwin's influence in modern science it becomes necessary to know something of the history of biology. Like so many of our most precious intellectual possessions we derive the first conception of the science of living things from the Greeks. It is in the works of Aristotle, written three hundred years before the commencement of our era, that the foundation of Zoology, as a science, is laid. In spite of errors, both of interpretation and of observation—the latter, however, often apparent rather than real—the books on "The History of Animals" and "The parts of Animals" remain to this day a monument to the genius of their author: considering the time at which they were written, and the difficulty attending the unassisted study of the subject, one is amazed at the extent of knowledge and the breadth of view they display. We find in them, indeed, the foundation at once of systematic zoology, of comparative anatomy, physiology, and of embryology, as well as

* A Lecture delivered before the All Saints' Literary and Debating Society, Dunedin.

of that minute study of the habits of animals which is seen in its latest development in the works of Darwin.

Pliny's Natural History, written during the first century after Christ, is very pleasant reading, but adds little or nothing to the development of science, and, in spite of the voluminous works of Aldrovandus and others in the middle ages, the most important advances in biology for many centuries after Aristotle were made by the long line of human anatomists, beginning with Galen, and culminating at the Renascence in Vesalius, who, seeking merely to elucidate the structure of the human body, laid up a store of accurate anatomical knowledge which was of the greatest importance to the furtherance of a scientific zoology.

The next real advances, also, were made on side issues: Harvey's discovery of the circulation of the blood, in the 17th century, laid the foundation of experimental physiology, and the discovery of the microscope at about the same time made possible the discoveries of Leeuwenhoek, Swammerdam, Malpighi and others as to the minute structure of the bodies of animals, and the existence of both animals and plants invisible to the naked eye. In the same century great advances were made in botany by Grew, Millington, and Ray, the latter of whom was also the chief geologist of his day, and the precursor of Linnæus. It is also noteworthy that in this 17th century appeared the first dawning of a belief that the world and its inhabitants have come into existence through the operation of natural laws.

During the 18th century great advances were made in biology, the four men who chiefly contributed to the growth of science being Buffon, Linnæus, Erasmus Darwin, and Caspar Friedreich Wolff. Of these Wolff was the founder of the modern sciences of histology and embryology, Linnæus put systematic zoology and botany upon a satisfactory footing, while Buffon and Erasmus Darwin were pioneers in the region of philosophical biology, both of them having conceived and worked out the great idea that species are not immutable, but are capable of arising by the modification of other species.

The first sketch of a theory of evolution seems to have been made by De Maillet in 1735, but the absurdities of some of his applications of the principle—for instance that birds are directly descended from flying fishes—ensured the rejection of his views, and Buffon has the honour of being the first to treat the origin of species in a scientific spirit. According to him "the temperature of

the climate, the quality of nutriment, and the ills of slavery, these are the three causes* of change, of alteration, and of degeneration in animals,"—that is, in domesticated animals, for in the wild state he admits that the first two causes can have little influence, and the last none at all. He notices that in the wild state, polygamous are more variable than monogamous animals, and attributes considerable influence to the accumulated effect of use in modifying organs, as, for instance, in producing the thickened skin on the soles of the feet.

But for the blighting influence of the theological faculty of the Sorbonne, Buffon would, in all probability, have given the world a far more consistent theory of evolution than that we now find scattered up and down the numerous volumes of his "Histoire Naturelle."† Erasmus Darwin, fortunately, had no Sorbonne to contend with; like other pioneers of science he was accused of atheism, but he had the courage of his opinions, and published speculations so advanced that their essential truth is only now beginning to be recognised. His views on education, sanitation, the treatment of the insane, slavery, and temperance, were all far ahead of his time, and, in science, as Dr. Krause says, "it is only now, after the lapse of a hundred years, that by the labours of one of his descendants we are in a position to estimate, at its true value, the

* Not "the three *main* causes," as Mr. Butler translates this passage: no naturalist can fail to see that the causes of transmutation assigned by Buffon are totally inadequate.

† When I first read Mr. Butler's "Evolution Old and New," I was greatly taken with his theory that the passages in the earlier volumes of the "Histoire Naturelle" which avow a belief in immutability are ironical. But in reading Buffon himself I find the theory rather more difficult of acceptance. Buffon had undoubtedly conceived the idea that species might arise by degeneration, and he discusses the question admirably, but on the whole seems to think that there is no actual evidence of transmutation. I quite acknowledge that irony is to be seen in such passages as "Mais non, il est certain par la révélation, que tous les animaux ont également participé à la grâce de la création," said by a free-thinker like Buffon, but the following passage stating a difficulty in the way of transmutation which was unsurmountable before the days of natural selection, appears to me serious enough :— "Quoiqu' on ne puisse donc pas démontrer que la production d' une espèce par la dégénération, soit une chose impossible à la Nature, le nombre de probabilités contraires est si énorme, que philosophiquement même on n'en peut guère douter; car si quelque espèce a été produite par la dégénération d' une autre, si l' espèce de l' âne vient de l' espèce du cheval cela ne peut se faire que successivement et par nuances, il y auroit en entre le cheval et l' âne un grand nombre d' animaux intermédiares, dont les premiers ne se servient peu à peu éloignés de la nature du cheval, et les derniers se servient approchés peu à peu de celle de l' âne: et pourquoi ne verrions nous pas aujourd' hui les réprésentans, les descendans de ces espèces intermédiares? pourquoi n' en est il demeuré que les deux extrêmes?"

wonderful perceptivity, amounting almost to divination, that he displayed in the domain of biology."

He advances in the clearest manner the theory that all organized beings are descended from a single particle of living matter. The changes which resulted in the formation of new species he conceives to have been brought about by the endeavours of the creatures themselves to supply their own necessities, the resultant changes being intensified by the repeated efforts of successive generations.

Linnæus, although less of a philosopher than either of his great contemporaries, was a better practical naturalist—I mean that he had a wider knowledge of the whole range of botany and zoology—and, as a natural consequence, his immediate influence upon the progress of science was far greater than Buffon's, and very much greater than Erasmus Darwin's. The only theory he has left upon record as to the origin of species is a very crude one—namely, that a few species were originally created, and that the infinite variety of forms we find at the present day is due to the crossing of those few. But he did what was more urgently wanted at that time than any theorising—he systematised botany and zoology: he invented the binomial nomenclature—that is, the custom of giving each species two Latin names, a generic and a specific, corresponding roughly to surname and christian name—and he produced a detailed classification of animals and plants. It is true that his classification was artificial, and is now in great measure superseded, but it was simple and logical, and served the very important purpose of supplying naturalists with so many very convenient and accessible pigeon-holes in which to place their facts.

Among the many eminent naturalists who laboured during the first half of the present century, the first place is due to Cuvier and Lamarck,* and of these two it happened—unfortunately in some respects, fortunately in others—that the best man was on the wrong side. Cuvier was a steady supporter of the doctrine that species are immutable, and his authority had an immense effect in retarding or stifling the growth of the opposite opinion. From one point of view, therefore, Cuvier's very genius was a hindrance to the advance of the science of which he was the most distinguished ornament, but the attitude he took is not wholly regretable. Believing as he did that all theorising on the most vital of biological problems was useless, he devoted himself to facts; he developed and perfected the

* Goethe, Geoffrey Saint Hilaire, and Treviranus were all evolutionists, but their influence appears to have been far less than Lamarck's.

study of comparative anatomy, and, I suppose, did more than any one man, either before or since, to make known the structure of the lower animals—John Hunter, from his invincible repugnance to publishing his results, having had far less influence in this field than his genius and labours warranted.

Besides his work in comparative anatomy, Cuvier may be said to have created the science of paleontology: it is from his researches that the scientific study of fossils dates.

At the same time Von Baer, Johannes Müller and several other biologists of the German school were continuing the work of Wolff by studying the stages through which the germs of animals pass to attain the adult condition. Although none of them evolutionists, these men were laying up a store of facts destined to become one of the chief bulwarks of the doctrine of descent. The same may be said of the botanical work of Hofmeister and Robert Brown.

Lamarck, whose chief biological work was done during the first twenty years of this century, has left less mark upon science than Cuvier, but went altogether beyond his great contemporary in one respect, namely, in that he saw the necessity for a central idea around which the facts of biology might group themselves, and saw, also, that this central idea was supplied by the theory of organic evolution. He appears to have been converted from his early belief in immutability by the writings of Erasmus Darwin, following whom he taught that the changes which resulted in new species were induced by the desires of the animals themselves to accommodate themselves to altered surroundings. His vast zoological knowledge allowed him to work out the theory in far greater detail than had been possible to Erasmus Darwin, so that for convenience sake we may speak of the doctrine of descent, as elaborated by him, as Lamarckian evolution. But the world was not ready for any such theory, besides which the proofs of transmutation brought forward were felt to be insufficient, and the causes assigned in great measure fanciful, and unsupported by evidence. These circumstances, together with the great influence of Cuvier, caused the theory of evolution as propounded by Lamarck to meet with ridicule and obloquy instead of with the careful consideration and calm criticism which were clearly its due.

After promulgating his views for nearly 30 years, Lamarck died in 1829, leaving hardly a follower behind him. The philosophical biology of Buffon, Erasmus Darwin, and Lamarck was now almost

wholly neglected, and the matter-of-fact biology of Linnæus and Cuvier had it all its own way. Even the greatest naturalists of the time were content to accumulate facts, and to classify and compare their results, satisfied if they could establish some subsidiary principle such as correlation of parts, or serial homology, or the physiological division of labour, and apparently acquiescing in the view that no single guiding principle was to be found which should bring their results into harmony, and give their classifications a real, and not a mere arbitrary or empirical, value.

Such was the state of biological science when Charles Darwin was appointed to the post of Naturalist on board H.M.S. "Beagle," which was about to start on a scientific cruise under the command of Captain Fitzroy. The sailing of this expedition, on the 27th of December, 1831, was the starting point of Darwin's career: he was at the time 22 years of age, having been born in 1809, the year in which Lamarck published his "Philosophie Zoologique."

The Beagle was away from England for nearly five years: during her voyage she visited many of the most interesting and least known parts of the world, including New Zealand, with which, by the way, Darwin was by no means prepossessed. We may, however, comfort ourselves by the fact that his experience was confined to the Bay of Islands and its immediate neighbourhood.

After his return to England, Darwin published an account of the results of his cruise in the delightful "Naturalist's Voyage" or "Journal of Researches," a book of travel which has never been surpassed for combined charm of style, extent and accuracy of observation, and breadth of view. Alike in the zoological, the botanical, and the geological researches, the hand of a master is evident from the very outset. It must not be forgotten that this book is founded upon researches begun at the early age of 22, that much of the work must have been done on board ship, and by one who was an eminently bad sailor, and that the author had apparently received but little strict scientific training: he studied medicine at Edinburgh in 1825-6, where he also worked at marine zoology, while, at Cambridge, the Rev. Professor Henslow was largely instrumental in strengthening his taste for natural history studies.

It was during, or shortly after, this same cruise that Darwin conceived the first idea of the theory which has since made his name famous. His own account of the origin of Darwinian evolution—the only personal statement, as far as I recollect, in any of

his strictly scientific writings—forms the first paragraph of the "Origin of Species." He begins by saying, "When on board H.M.S. 'Beagle' as naturalist, I was much struck with certain facts in the distribution of the organic beings inhabiting South America, and in the geological relations of the present to the past inhabitants of that continent. These facts, as will be seen in the latter chapters of this volume, seemed to throw some light on the origin of species —that mystery of mysteries, as it has been called by one of our greatest philosophers."

The majority of men, having conceived an idea like this, would have lost no time in giving it to the world, and no one could have blamed them for doing so: but such was not Darwin's way; to return to his own words, "it occurred to me, in 1837, that something might perhaps be made out on this question, by patiently accumulating and reflecting on all sorts of facts which could possibly have any bearing on it. After five years' work I allowed myself to speculate on the subject, and drew up some short notes; these I enlarged in 1844 into a sketch of the conclusions which then seemed to me probable: from that period to the present day I have steadily pursued the same object."

After five years' work he allowed himself to speculate, and in two more drew up a sketch of his conclusions! This statement, made with the simplicity and directness so characteristic of the man, speaks volumes for his eminent fitness for the work he had undertaken. "He that believeth shall not make haste."

This sketch of conclusions, on the question of the origin of species, was shown to one or two scientific friends, but not published: its writer continued to accumulate facts and make experiments, occasionally publishing a paper, mostly on some botanical or geological subject, in the transactions of a learned society. At the same time he undertook what for any other man would be a *magnum opus*, his monograph on the *cirripedia*, which still remains the standard work on the subject, and which, besides its value to the systematic zoologist, contains many important discoveries in comparative anatomy and embryology. It is somewhat rare to find a philosophical biologist undertake a laborious systematic work of this sort; I am disposed to think it must have been taken up as a discipline—for the sake of learning, personally and practically, all that was to be learned about one large and varied group.

The accumulation of material went on until 1858, when Darwin considered his great work nearly done. In that year Mr. A. R. Wallace, who was exploring the Malayan archipelago, wrote a paper "On the Tendency of Varieties to depart indefinitely from the Original Type," and sent it to Darwin with the request that he would forward it to Sir Charles Lyell for publication. This paper enunciated the theory of Natural Selection, the very hypothesis at which Darwin had arrived, and to which he had given expression in the sketch of conclusions written in 1844, but which he had hitherto allowed to lie unpublished.

As Darwin considered that it would still take two or three years to elaborate his views, he wished to send Mr. Wallace's paper for publication without a word of his having himself arrived at similar conclusions at least fourteen years before,* but, fortunately, two of his most intimate scientific friends, Sir Charles Lyell and Dr. (now Sir Joseph) Hooker, intervened, and persuaded him to send to the Linnean Society, along with Wallace's paper, extracts from his own MSS. The selected extract was called "On the Variation of Organic Beings in a State of Nature: on the Natural Means of Selection: on the Comparison of Domestic Races and true Species." Along with a letter from Darwin to Professor Asa Gray, and Mr. Wallace's paper, it was read at the Linnean Society on July 1st, 1858.

On the 1st of October in the following year—1859—Darwin published the work by which he is most widely known—"On the Origin of Species by means of Natural Selection; or, the Preservation of Favoured Races in the Struggle for Life,"—an abstract of the work of nearly 30 years, giving, in something under 500 pages, a concentrated essence of the principles of biology. The storm which followed the publication showed that something remarkable had been done. Lamarck had been laughed at, but I don't suppose anyone ever really laughed at the "Origin of Species": the thing was too serious: here was a man reviving the heresy of the transmutation of species, who, instead of indulging in metaphysical speculations, actually brought facts to prove that in the ordinary course of the struggle for existence in which every organism is to take part, a selection of favoured individuals must happen at the expense of those less adapted to their surroundings, and that such favoured individuals, transmitting to their descendants the charac-

* See the statements by Sir C. Lyell and Dr. Hooker prefacing the papers by Darwin and Wallace. Proc. Linn. Soc. (3001.) vol. III., p. 45.

ters by virtue of which they have the advantage, must tend to form, first a new race, and finally a new species.

There was one point about the book from which the enemy derived great comfort, namely, the way in which Darwin brought forward and even emphasized the weak points in his theory. It saved so much trouble to have to do with a man who frankly acknowledged that he could never reflect on some of the difficulties without being staggered. Such statements were eagerly seized hold of, and much capital was made out of them.

The opposition to any new scientific theory has been said to pass through three stages: people first say that it is against religion, then that it is against reason, and, finally, that they knew it all along. The first phase of the contest is usually a long and bitter one, but by-and-by it is discovered that some of the upholders of the theory are very good Christians, and that it is actually spreading among the more intelligent classes, quite independently of their religious views. The cry is then changed, and the theory is said to be against reason; numberless books and sermons are produced, full of much apparent learning, in which it is supposed to be clearly proved that the whole balance of evidence is against the theory; the critics themselves have, they tell us, no personal objection to it, but the facts are against it. This stage of the controversy may, as Dr. White observes, be taken to be at its last gasp, when it is boldly announced that the theory is completely exploded, and that all the leading men of science have ceased to believe in it. Of course to make such a statement as this requires more impudence than usually falls to the lot of man, but still, if it can but be made with a good face, it is often very effective—for a time. Finally, when the consensus of educated opinion has decided for the theory, the former opponents discover that it is in absolute harmony with the views they teach, and that some of their greatest authorities have expressed themselves more or less definitely in favour of it.

The evolution controversy may now be considered to be hovering between the second and third of these stages. The opinion has already been advanced that St. Augustin, St. Thomas Aquinas, and the Jesuit Father Suarez, were evolutionists,* and I should not be in the least surprised if, before long, the same discovery were made with regard to Knox, Calvin, and Wesley. Certainly a very good

* That is, believers in "derivative creation," which is much the same thing as evolution from the purely biological aspect, however different it may be theologically.

case could be made out for Dr. Watts; a line in one of his hymns—"From change to change the creatures run"—is simply evolution in a nutshell.

The rapidity with which these stages of opposition have been and are being run through in the case we are now considering, is one of the most striking proofs of the hold which science has taken upon men's minds. It took centuries to establish the true theory of the Solar system: the views of Copernicus were bitterly opposed by Luther and Melancthon, Galileo was imprisoned and tortured by the Inquisition, Newton's "Principia" was placed on the "Index," and the same honour—as Mr. Darwin puts it—was accorded to Erasmus Darwin's "Zoonomia." To-day all is altered; some fifteen years after the publication of the "Origin of Species," a pronounced evolutionist—Mr. St. George Mivart*—was appointed to the chair of biology in the Catholic University College, established in London under the direction of Mgr. Capel, and with the approval of the Cardinal Archbishop of Westminster; while I see that, within the past few months, the post of Governor and Chaplain of Wesley College, Sheffield, has been filled up by the appointment of a distinguished biologist of evolutionary views, the Rev. W. H. Dallinger. "And so the whirligig of time brings in his revenges."

I am far from saying that the evolution controversy has everywhere reached this desirable phase. In some outlying parts of the field the battle still rages, and the Partington-broom of second-hand criticism, ignorantly applied, is wielded with much force and enthusiasm. But each skirmish is less fierce than the last, and excites less interest in the spectators, so that the contest is becoming hardly worth the powder and shot.

The majority of cultured people, then, have ceased to look with any horror on the doctrine of descent, and a very fair proportion have already been brought to see its truth. With men of science the change of opinion was, naturally, still more rapid: before 1859, all but the more advanced among them were content to believe that each species had been miraculously created; and, although men like Owen, Spencer, Hooker, and Huxley felt the absurdity of limiting the action of second causes to inorganic nature, and were convinced that evolution in some form was certain, yet they were

* Some exception may be taken to my application of the term "pronounced evolutionist" to Mr. Mivart: what I mean is that he is an upholder of the doctrine of descent as opposed to that of special creation. His refusal to admit as wide an application of the doctrine as some thinkers claim for it, is quite beside the present question.

prepared with no theory of evolution which should stand the test of facts: with one exception, they felt the total insufficiency of Lamarckian evolution, and, therefore, welcomed the "Origin of Species" as the one thing they wanted to convince them—not only that the doctrine of descent *must be* true, but that it *was* true.

Others were convinced by Darwin's arguments, and one by one joined the ranks of his adherents, the most famous conversion being that of the veteran geologist, Lyell, whose excessive caution kept him from becoming an evolutionist until his clear intellect refused to remain longer unconvinced. A small number of the older naturalists still hold out, but of the younger men I can safely say that I have neither met with, nor heard of, a single one who believes in the immutability of species.

Let us briefly consider the cause of this extraordinary change of opinion. Why did this one book accomplish in a few years what all the writings of Buffon, Goethe, Erasmus Darwin, Treviranus, and Lamarck had failed to do? At the time of its publication, as I have just said, there were many scientific men who were perfectly prepared to accept evolution, and had long felt the untenability of the rival hypothesis, and who yet remained totally unconvinced by Lamarck's arguments.

The reason lay in the essential difference between Lamarckian and Darwinian evolution. Lamarck, following Erasmus Darwin, considered that the endeavours of animals to accommodate themselves to altered surroundings—often resulting in the increased use of some, and the diminished use of other, organs—gave rise to the modifications of structure by which new species were, in course of time, produced. Charles Darwin started from the fact, known to everyone, that the offspring, although resembling the parent in essential particulars, never resembles it perfectly: in other words, that individual variations are universal. He then argued that if a variation should arise in a certain proportion of the individuals of a species, which should render them more perfectly adapted than before to their conditions, these favoured individuals would have a better chance of surviving and of leaving descendants than the others. The favoured race would thus be "naturally selected," and, the process continuing, the characters in virtue of which the new race had obtained its advantage would be strengthened; the differences between it and the original stock eventually becoming of specific value, and the original stock itself, in most cases, being gradually exterminated.

An illustration may serve to make this clearer. Suppose that rabbits were introduced from a country in which there were no birds of prey, into one in which hawks abounded. It is certain that the rabbits would use every means in their power to escape the hawks, and would acquire considerable skill and agility in evading them. Now, according to Lamarck, the efforts of the rabbits to become more agile, called forth by the need of escaping their enemies, would result in changes of structure which, accumulating in successive generations, would ultimately result in the formation of a new species. There can, I think, be no doubt that some modifications of structure—such as increased size of certain muscles—would be brought about in this way; but from all we know of similar cases, it would certainly be a very long time indeed before the efforts of the race to accommodate itself to its altered surroundings would have any appreciable effect in forming a new variety, to say nothing of a new species.

Now let us take a case in which Darwinian principles would come into play. Suppose that the country into which the rabbits were introduced was one in which the prevailing colour of the herbage was a dull yellowish-green; and suppose that the rabbits, like so many wild animals, exhibited certain variations in colour, of such a nature that, while the majority had the usual brownish-grey hue, there was a certain proportion in which the colour was lighter, and a few in which it was distinctly tawny. Under these circumstances, the tawny rabbits would be less conspicuous than the ordinary brown individuals, and, as a natural consequence, a larger proportion of the brown than of the tawny kind would fall a prey to the hawks. In accordance with the law of inheritance, the tawny rabbits would tend to produce tawny offspring; and the brown, brown offspring. Under the circumstances, however, a smaller proportion of the brown than of the tawny individuals would live to produce young; and of these young a smaller proportion of brown than of tawny would survive. From these premises it follows, as a mathematical certainty, that, in a certain number of generations, the brown variety would be completely weeded out, the race consisting finally of tawny individuals only. Thus a distinct breed of rabbits would be produced by natural selection or the preservation of a favoured race in the struggle for life. That such a race would, in course of time, come to differ so much from the original stock as to be what any zoologist would call a distinct

species, there can be little doubt, from the analogy of the well-known Porto Santo rabbits.

Another illustration may be taken from the analogy of the growth of ideas. A new idea—religious, social, or scientific—does not make its way because its conceiver earnestly desires its success, and transmits the desire in a strengthened form to his intellectual descendants; but because it is in harmony with the intellectual environment; and being thus favoured in the struggle with old and obsolescent ideas, its adherents increase slowly, but surely, until the old idea is simply stamped out. Take, for instance, the theory of the spherical form of the earth, and the consequent existence of antipodes. This idea was conceived in very early times—by Plato, for instance—and I cannot doubt that those who conceived it were very anxious that it should spread, and did their best to transmit it to others. But the surrounding conditions were unfavourable; the general ignorance of science was simply abysmal—for centuries some of the greatest thinkers fought earnestly against such abominable heresy*; and as late as the fourteenth century one Cecco d'Ascoli was burnt alive for maintaining it. It was not until the voyages of Columbus and Magellan had prepared men's minds for it—in other words, had brought about a change in the intellectual environment—that the idea began to be favoured in the struggle for existence; but when once this state of things was brought about, it spread with absolute certainty, completely exterminating the old theory of the earth's flatness, which now only survives as a "persistent type"—a sort of mental ornithorhynchus—in the mind of an occasional fanatic.

It was thus, in great measure, the theory of natural selection which so completely altered the position of the evolution question; for the rest, the change was due to Darwin's eminent fitness for the work, in virtue of his great and varied attainments. These are displayed in the thorough manner in which the whole question was worked out, the immense array of facts brought to bear upon it, and the consummate skill with which these were arranged and focussed, as it were, upon the one point.

It is this combination of scientific qualifications which gives

* One argument against the existence of our hemisphere is so delicious that no excuse is needed for quoting it. It is a syllogism invented by Tostatus, just before the time of Columbus. "The apostles were commanded to go into all the world and to preach the gospel to every creature; they did not go to any such part of the world as the antipodes; they did not preach to any creatures there: *ergo*, no antipodes exist."—(White, "Warfare of Science.")

Darwin the pre-eminence over other apostles of evolution. He did not originate the doctrine of descent, and he was only one among many who conceived that of natural selection. As far as their two papers in the Linnean Society's proceedings are concerned, Mr. Wallace would seem to be quite on an equality with him: it is only by studying their fuller works that the difference of calibre becomes manifest—a difference which is nowhere better expressed than in Mr. Wallace's admirably modest and manly preface to his essays on natural selection.

Attempts have been made—notably by our brilliant fellow-colonist, Mr. Samuel Butler—to exalt the old evolutionists at the expense of Charles Darwin, and to maintain that Darwinian evolution is evolution spoiled. This seems to me almost as ludicrous as to maintain that "Antony and Cleopatra" is Plutarch spoiled, and far more preposterous than to consider Tennyson's Idylls as a degenerate modification of Malory.

I have mentioned the weak points in the theory of evolution which were so candidly stated by Darwin: it will be instructive to recall what the research of the last twenty years has done towards strengthening these. In 1859 Darwin stated that the absence of transition forms in the first state was the chief objection to the theory. To-day such an objection is simply non-existent. No less than forty intermediate stages are already known between the American pliocene horse and the little tapir-like eohippus of the lower eocene; a perfect set of gradations has been found between hyænas and civets; and dogs and bears have been traced back to a common ancestor. Twenty years ago birds formed a perfectly isolated group; now the fact of their descent from reptiles is about as certain as in the nature of things it can well be.

Comparative anatomy, physiology, and embryology all tell the same tale. The distinction between vertebrates and invertebrates—once thought to be absolute—has broken down; so has that between worms and insects, and that between worms and molluscs. Finally, the distinction between plants and animals, as far as anything like definition goes, has completely disappeared. We have plants feeding upon meat, and animals upon carbonic acid; and with many of the lowest forms it can only be decided by analogy into which of the two kingdoms they should be placed.

After the publication of the "Origin of Species," Darwin began to issue detailed works in separate branches of the subject. In 1862 appeared the "Fertilisation of Orchids," and this was followed

by the "Variation of Animals and Plants under Domestication," in 1868; "The Descent of Man," in 1871; "The Expression of the Emotions," in 1872; "Insectivorous Plants," and "Climbing Plants," in 1875; "Cross and Self Fertilisation," in 1876; "Form of Flowers," in 1877; "Movements of Plants"—in conjunction with his son, Mr. Francis Darwin—in 1880; and "Vegetable Mould and Earthworms," in 1881. Besides these strictly scientific works, he wrote in 1879 a charming memoir of his grandfather, Dr. Erasmus Darwin, which is published along with Dr. Krause's essay on the latter's position as a pioneer in biology.

Although the foundation for most of these books was laid by the accumulation of a vast mass of material before the first of them was written, yet the mere putting together and getting out of such exhaustive and varied treatises, at the rate of about one every two years, is a very striking example of that "infinite capacity for taking pains" which is one of the chief marks of genius.

This fertility of Darwin's mind, as well as the force and clearness of his style, becomes even more surprising when one recollects that for the greater part of his life—ever since his return from the voyage of the Beagle—he was a confirmed invalid. I have been told by one who knew him that, when he was writing the "Origin of Species," he was so ill as to be unable to continue writing for more than a few minutes at a time. With a book so "woven close, both matter, form, and style," one cannot but wonder at the mental strength which could overcome such perpetual bodily pain and weakness.

So far I have said very little about Darwin's life, and indeed there is not much to be said; for, after his return from the voyage of the Beagle, the only events of his life, as far as the public was concerned, were the publication of his books, and the conferring upon him of one or two honorary degrees. Owing to the state of his health he rarely visited London, and spent nearly all his time in his study and hot-houses at Down—where by his neighbours he was probably looked upon as a country gentleman, with a taste for natural history. A friend of mine once made a pilgrimage into Kent, to see what he could of the great man's surroundings, and, with a view of getting information, entered into conversation with an old woman he met in the village. All he could learn from her was that Mr. Darwin was a very kind gentleman, and very good to the poor: she had evidently never heard that he was either a very great man or a very wicked one.

During the last three or four years of his life his health improved greatly; and, at two or three scientific meetings, I can well remember the suppressed excitement of some of us at learning that Darwin was present. What struck me in his face, almost more than the intellect, was the extreme kindliness. From hearing him speak at the Linnean Society, and from a few minutes' conversation, which forms one of the events of my life, I was impressed further with his fresh, simple enthusiasm and receptiveness. He seemed like one who

> "Drew toward the long frost and longest night,
> Wearing his wisdom lightly,"

and who had become infused with that utter modesty which comes only of vast knowledge.

For some time previous to his death he had been suffering from weakness of the heart; nevertheless he read two botanical papers at the Linnean Society, on March 16, which showed no falling-off of his old power, and he continued his observations and experiments until Tuesday, April 18, when he was taken seriously ill. On the following afternoon—Wednesday, April 19—he died, having ceased from work only twenty-four hours, and from consciousness only a quarter of an hour. On the Wednesday of the following week he was buried in the great Abbey where lay already the dust of Newton and Herschel, Hunter and Lyell. Of the universal homage to his genius from men of all shades of opinion which his death has called forth, those who read the English papers will be able to judge.

I may say, in conclusion, that it is not merely by the scientific world that Darwin's greatness is recognised. Professor Henry Morley says of him—"Charles Darwin is a man of genius in the world of science, whose place corresponds with that of a great poet in the world of literature." To my mind this exactly expresses the truth. To appreciate the achievements of pure science requires, in the present state of education, more special knowledge than to appreciate those of literature or art; but to anyone with the requisite training, it is impossible not to recognise in the first clear conception and thorough working out of such fundamental doctrines of science as universal gravitation, or the conservation of energy, or organic evolution, that supreme condition of the human mind which we call inspiration, and which we are all ready to acknowledge and bow before in Hamlet or in the Grand Sonata; in the Madonna of St. Sixtus, or the Venus of Milo, or Westminster Abbey.

A Great Man theory of science would be almost as absurd as a Great Man theory of history: in the one as in the other it is certain that the man is the product of his age, and his work to carry out the *zeit geist*. But it is none the less true that it is the men of genius—the heroes, in Carlyle's sense—whether in the realm of thought or in the realm of action, who have the leading of this world's affairs: the rest of us have but to follow with what speed we are able.

> "'Tis in the advance of individual minds
> That the slow crowd should ground their expectation
> Eventually to follow; as the sea
> Waits ages in its bed till some one wave
> Out of the multitudinous mass extends
> The empire of the whole, some feet perhaps,
> Over the strip of sand which could confine
> Its fellows so long time: thenceforth the rest,
> Even to the meanest, hurry in at once,
> And so much is clear gained."

It is mainly through the labours of Charles Darwin that the world has gained a noble and worthy conception of organised nature, and this conception the meanest, who has once intelligently grasped it, is not likely to abandon.

T. JEFFERY PARKER.