A DARWINIAN CENTENARY

THE SHAPING OF AN IDEA

STAGES IN EVOLUTION

The Zoological Section of the British Association will this afternoon mark the Centenary of the landing of Charles Darwin on the Galapagos Islands and of the birth of the hypothesis of the "Origin of Species"

By Sir Edward Poulton

Reprinted from
THE TIMES
SEPTEMBER 6 1935

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The voyage round the world (1831-36) as naturalist in the Beagle was described in Darwin's words as " by far the most important event in my life," the one which " has determined my whole career." His pocket-book for 1837 contains these sentences : " In July opened first notebook on Transmutation of Species. Had been greatly struck from about the month of previous March on character of South American fossils, and species in Galapagos Archipelago. These facts (especially latter) origin of all my views." We must therefore recognize September 16, 1835 (not September 17, as given in the " Naturalist's Voyage "), when Darwin first landed on Chatham Island, as a memorable day in the history of science.

Darwin, a young man not yet 23, left Cambridge in 1831 with little systematic scientific knowledge other than that which he had picked up in long walks and talks with a revered friend, the Professor of Botany, a companionship so well known that he was called the " man who walks with Henslow." By the advice of this friend he had considered volunteering for the post of unpaid naturalist in the Beagle, a man-of-war about to sail for South America on a surveying expedition, but he had refrained on account of his father's disapproval. Feeling much disappointed, he went to shoot at the house of his uncle, Josiah Wedgwood. Fortunately for science this wise man intervened in his favour and drove him the 30 miles to Shrewsbury for a talk with his father, whose opposition was then withdrawn. Fitzroy, the captain, after a two hours' interview with Darwin, and after they had dined together, wrote to the hydrographer, Captain Beaufort : " I like what I see and hear of him much, and I now request that you will apply for him to accompany me as a naturalist."

THE GALAPAGOS LANDING

Darwin's surroundings on the voyage, which began on December 27, 1831, were by no means conducive to scientific work. The space available was so cramped as to have given an

ample excuse for idleness, though when at meals with Captain Fitzroy, whom he greatly admired, he was comfortable enough. Whenever the weather was unfavourable he suffered terribly from seasickness. He received no instruction or guidance before starting, nor any encouragement or advice on the voyage, except occasional letters from his beloved teacher and friend Henslow. But for one so inspired by his own zeal for natural history this was glorious freedom. Darwin took with him the first volume of Lyell's " Principles of Geology " (first edition, 1830), which Henslow had advised him to read " but on no account to accept the views therein advocated," advice which he was quite unable to follow. The second volume reached him at Montevideo in 1832, the year of publication. Long after his return he wrote to a friend :—" I have always thought that the great merit of the Principles was that it altered the whole tone of one's mind."

Nearly four years after joining the ship Darwin landed on the Galapagos Islands, lying under the Equator and between 500 and 600 miles westward of America. Here he observed how every kind of animal on each island differed slightly from those on the other islands and still more from those on the mainland, yet all were of South American affinity. In Darwin's " Diary of the Voyage," edited from the manuscript by his granddaughter, Mrs. Barlow, and published in 1933, we read in the entry for September 26 and 27, 1835 :—

> It will be very interesting to find from future comparison to what district or " centre of creation " the organized beings of this archipelago must be attached.

The words " centre of creation " were evidently quoted from Lyell's " Principles," Vol. II., p. 126. The affinities of the Galapagos fauna, together with his thoughts on the fossil bones of extinct animals, allied to but different from the living inhabitants of the same continent, convinced him that he must abandon the idea of the separate creation of species, though he was as yet entirely unable to account for their origin. The solution of this problem which had haunted him in the Beagle became the great work of his life.

THREE PERIODS

The past century of evolutionary thought may be conveniently divided into three periods. First came a time of inactivity—for nearly every one except Darwin ; until 1858 probably not half a dozen men in the world were continuously and systematically pondering over the problem. Without any theory of the causes by which species had changed their forms, Darwin in 1837 opened his first notebook on evolution, a study which ceased only with his life. In the following year he read Malthus " On Population," and there at once flashed upon him the thought

that inferior types would be gradually displaced by those more fitted to survive—the principle of Natural Selection. " Here then," he wrote, " I had at last got a theory by which to work." It was not entirely new to him, for he had already applied it to single examples, suggesting in his 1837 notebook " that Death of species is a consequence . . . of non-adaptation to circumstances," but the conception of Natural Selection as the great motive force of evolutionary progress only came to him, as it came 20 years later to Wallace, " in a sudden flash of insight," after reading Malthus. Yet such was Darwin's caution that it was not until 1844 that he wrote to Hooker :—

> At last gleams of light have come, and I am almost convinced (quite contrary to the opinion I started with) that species are not (it is like confessing a murder) immutable. . . .

The second period in the century of evolutionary thought opened in 1858 with a dramatic incident, the receipt by Darwin on June 18 of Wallace's letter and manuscript written at Ternate, in the Moluccan Islands, where no communication could reach him for months. The effect may be inferred from the letter posted to Lyell on the same day :—

> Your words have come true with a vengeance—that I should be forestalled. . . . I never saw a more striking coincidence, if Wallace had my MS. sketch written out in 1842, he could not have made a better short abstract !

No time was lost, for, with the wise advice of Lyell and Hooker, Darwin prepared a statement consisting of extracts from his 1844 manuscript and an abstract of a letter he had written to Asa Gray in 1857, and this was read, together with Wallace's essay, before the Linnean Society on July 8. At the fiftieth anniversary of that great day Wallace in noble words protested against the too great credit assigned to himself, concluding :—

> It was really a singular piece of good luck that gave me any share whatever in the discovery . . . it was only Darwin's extreme desire to perfect his work that allowed me to come in as a very bad second.

The theory of Natural Selection being thus published to the world in two brief but admirable statements, Darwin devoted " 13 months and 10 days " to the " hard labour " of writing the " Origin of Species," the result of 20 years' continuous thought. The views set forth were attacked fiercely by some opponents, but less hotly than might have been expected, and that great interest was aroused is proved by the whole edition of 1,250 copies having been sold on the day of publication, November 24, 1859. There can be no doubt that the Darwin-Wallace essays played an important part in preparing the way for the " Origin."

It is interesting to note that the naturalists who first adopted the Darwinian explanation of evolution were, as a rule, those who, like Bates, Belt, and Fritz Müller, had spent long years in the tropics with constant opportunities for watching Nature at her work, as had the authors of the two essays.

A very curious feature about the early criticisms is their being so often directed not against Darwin's Natural Selection but against Lamarck's hypothesis of the inherited effects of use and disuse. Thus the amusing " Song of the Ornithorhynchus " in Courthope's " Paradise of Birds " is wholly based upon this hypothesis, which was indeed accepted by Darwin but not given an important place in the " Origin," the essential teaching of which is set forth on the title-page :—

> On the Origin of Species by means of Natural Selection, or the preservation of favoured races in the struggle for life.

LAMARCK AND WEISMANN

Returning to the element of Lamarckism accepted by Darwin, it must be remembered that the effects of use and disuse were almost universally assumed to be inherited until Weismann " awoke us from our dogmatic sleep " in 1883, a year which marks the beginning of the third period in the century of evolution. Francis Galton had, indeed, concluded several years earlier, from the study of " identical twins " developed from a single fertilized egg, that " nature is far stronger than nurture " and that " necessitarians may derive new arguments from the life histories of twins." Weismann was led by his researches to conclude that the essential germinal substance is not created afresh in each generation, but is developed from an unused portion of the germ-cell from which each parent originated. Since this carrier of hereditary qualities grows shielded and withdrawn, how improbable becomes the belief that it is affected by the happenings in distant parts of the parental body—how doubly improbable that it is so changed as eventually to reproduce the result of these happenings in the offspring ! Weismann's illuminating hypothesis of the " continuity of the germplasm " leads us to regard children as the younger brothers and sisters of their parents, with likenesses caused by development from the same substance, or rather substances, inasmuch as two parents are concerned, introducing complications briefly referred to below.

Although the possibility of the hereditary transmission of characters or powers acquired in the parents' lifetime cannot be looked upon as a question entirely closed, most biologists will maintain that, if it occurs at all, such transmission is extremely rare. Indeed, it now seems strange to most of us that the

foundation of Lamarck's and Herbert Spencer's theories was accepted so unreservedly.

MENDEL

The third period of evolutionary history was illuminated also by a dramatic event—the rediscovery and reissue in 1900 by three biologists, in Austria, Germany, and Holland respectively, of the immensely significant work on the laws of inheritance, published unnoticed in 1866, by that patient monk Mendel, who had died some years before he became famous. With the sure insight of genius Mendel restricted his researches on heredity in plants to single sharply differing characters. When the germinal causes (factors or *genes*) of these met in the fertilized germ-cells he observed that all the resulting offspring, although wholly composed of cells with the twofold nature derived from the germ, exhibited but one of the differences hence called " dominant," while the other, equally present but hidden, was " recessive." The offspring of these superficially dominant parents exhibited a characteristic proportion of three apparent dominants to one recessive, a result brought about because the factors had parted company and entered separate germ-cells, half of them bearing the one and half the other. When plants with such mixed germs are mated, one recessive out of two will on the average meet a recessive and one a dominant, while similarly one dominant will meet a recessive and one a dominant. The first of these unions will produce a pure recessive, the last a pure dominant, the second and third hybrids like the parents, and like them resembling the pure dominant. Hence the superficial appearance of a three to one ratio. All these facts with the essentials of their interpretation were discovered by Mendel.

THE MODERN VIEW

It will be realized that Mendelian theory explains the re-appearance after many generations of a recessive character apparently lost but only hidden until its partner in the germ-cell happens to be another recessive, and the meeting may be very long delayed. Furthermore, the factors of single characters may be linked together and the whole group inherited in the three to one ratio, and may also be controlled by a factor which acts as a switch determining presence or absence. Sex itself may also act in this way as a switch.

Although Mendelian heredity was the result of experiments on plants, the laws were proved to be equally applicable to animals very soon after the rediscovery—an extension with which the name of Bateson will ever be associated. Mendelism was at first supposed by many to be opposed to Darwinism, a view the falsity of which has been demonstrated by mathematical investi-

gation and by an intensive experimental study of Mendelian inheritance. Many of these latter researches have been carried on in America, where Lamarckian as contrasted with Darwinian evolution had been greatly favoured. It is sad to reflect that Darwin did not live to rejoice in the results achieved by these two great discoverers—Weismann, who was led to believe in "the all-sufficiency of Natural Selection," and Mendel, who threw new light on inheritance, leading to innumerable facts consistent with Natural Selection, and also solved the difficulty Darwin had felt to be the greatest of all, the supposed "swamping effect of inter-crossing."

There have been many fluctuations of opinion during the past century, but all the time numberless significant facts have been accumulating, and I believe that most biologists are now in agreement with the views which began to take shape in the mind of Darwin on the Galapagos Islands 100 years ago.

Printed and Published by THE TIMES PUBLISHING COMPANY, Limited, Printing House Square, London, E.C.4, England. 2636