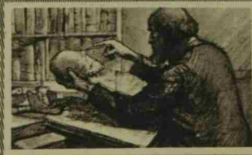
THE WORLD OF SCIENCE.



CENTENARY OF DARWIN'S IDEAS.

By MAURICE BURTON, D.Sc.

ACCORDING to estimates by radioactive time-clocks, and by other methods, it is now generally accepted that living matter first appeared on this planet 2,000,000,000 years ago. During that time there has been a succession of plants and animals in inestimable numbers. How many species are in existence to-day can only be stated in the most general terms, and computations vary from 2,000,000 to 10,000,000. When we try to express this in numbers of individuals, words become even more inadequate. It is equally impossible to say how many species have existed in the past. And when we try to link the enormous expanses of time with the tremendous numbers, we can but take single instances and hope these will convey an adequate impression of what is involved. Thus, in the history of the genus *Equus* (horses, asses and zebras) from the first ancestor (*Hyracotherium*) recognisable as of horse-stock, G. G. Simpson has made the following calculation: The transition from *Hyracotherium* to *Equus* has occupied a mere 60,000,000 years, involving the passage through eight genera each of an average duration of 7,500,000 years, thirty species of a duration-time of 2,000,000 years each, and 15,000,000 generations each reaching maturity in four years.

Beside these figures the task of the historian seems puny. He has only to deal with a mere 2000 years or so, from the time when the inhabitants of Britain were painting themselves with woad to the time when they are building nuclear reactors. Yet the course of his studies and those of the natural historian are not dissimilar. Each is reconstructing the past by fitting together what he can see to-day with relics preserved from former times. Moreover, both have to deal with a progression caused by a multitude of small and relatively insignificant events. The main difference between them is that the natural historian must deal in figures and concepts immeasurably more immense. Even so, he has reduced his problem to a simple formula: the evolution of living things is the result of random variation channelled by natural selection. Perhaps we should say rather that one natural historian did this a hundred years ago and that the work of his successors has tended to confirm his theory. The man was Charles Darwin, and this year we celebrate the centenary of the publication of his ideas. In "A Handbook on Evolution" (a booklet published this year by order of the Trustees of the British Museum (Natural History) at 5s.) we read: "Variation produces novelties at random, but selection determines which are preserved. Only a genius could have discovered a key of such simplicity to so great a problem. Only ignorance, neglect of truth, or prejudice could be the excuse for those who in the present state of knowledge, without discovering new facts in the laboratory or in the field, seek to impugn the scientific evidence for evolution."

In spite of these words, there are still, and will still remain, those who refuse to accept evolution as a thesis to explain the world in which we find ourselves. There are also those who, taking a less extreme view, prefer to go no further than to say that the theory of evolution is the only workable hypothesis that permits us adequately to interpret the observed facts. These, and others, have consistently asked whether there is a single instance of undoubted evolution having been observed. The best example is described in the British Museum's booklet, and is demonstrated in one of the series of fifteen new exhibition cases in the main hall of the Museum specially laid out to mark the centenary of Darwin's publication. The booklet is, indeed, a printed exposition of this series of exhibits.

This example has to do with industrial melanism, "the name given to the phenomenon in which moths are changing their complicated patterns from light to all-black coloration. Of the 780 species of British Macrolepidoptera, more than 70 are in the process of doing this. Industrial melanism is the most striking evolutionary change actually witnessed, and it demonstrates the effects of natural selection in producing adaptation conferring survival value, in accordance with Darwin's theory.

"Tree-trunks covered with lichen occurred all over Great Britain before the Industrial Revolution. To-day they are only found in unpolluted areas such as the West of England and the Highlands of Scotland. The typical light-coloured Peppered Moth (*Biston betularia*) when resting on such a trunk or bough by day is almost invisible to birds, and thereby protected, whereas the melanic form *carbonaria* is extremely conspicuous and rapidly eliminated.

ADAPTATION IN THE HUIA-BIRD OF NEW ZEALAND WHICH IS NOW BELIEVED TO BE EXTINCT: THE MALE BIRD HAS A SHORT, STOUT BEAK "WITH WHICH IT CHISELS HOLES IN TREES," WHILE THE FEMALE HAS A LONG, SLENDER BEAK "WHICH REACHES THE GRUBS AT THE BOTTOM OF THE HOLES."

The photographs on this page are reproduced from "A Handbook on Evolution," by permission of the Trustees of the British Museum (Natural History).

INDUSTRIAL MELANISM: ON THE LEFT IS A TREE-TRUNK FROM A RURAL AREA COVERED WITH LICHENS ON WHICH ARE ONE TYPICAL LIGHT-COLOURED PEPPERED MOTH AND ONE MELANIC ONE. ON THE RIGHT IS A TREE-TRUNK FROM AN INDUSTRIAL AREA COVERED WITH SOOT ON WHICH ARE ONE TYPICAL LIGHT-COLOURED PEPPERED MOTH AND ONE MELANIC FORM.

From an exhibit in the British Museum (Natural History) prepared by H. B. D. Kettlewell.

"Since the Industrial Revolution, the atmosphere of many areas in Great Britain has become progressively polluted by smoke. In and around industrial areas the pollution is measured in tons per square mile per month. This has resulted in the disappearance of visible lichens from trunks and boughs of trees, and their darkening due to deposition of soot. The typical light-coloured Peppered Moth when resting on such trunks and boughs by day is extremely conspicuous and is rapidly eliminated by birds, whereas the melanic form *carbonaria* is protected on the dark background.

"The first melanic *carbonaria* form of the Peppered Moth was taken in Manchester in 1848. By 1900 the proportions of the melanic *carbonaria* form to the typical light-coloured Peppered Moth in Manchester was approximately 99 to 1. This represents a 30 per cent. advantage of the melanic over the light-coloured form in Manchester for this period of fifty years. In addition to the advantage which the melanic *carbonaria* form derived from its protective coloration, it has also been shown to differ from the light-coloured form in its physiology and behaviour. Meanwhile, in unpolluted areas the typical light-coloured form was the only one found except for occasional melanic *carbonaria* mutants.

"A map of the distribution of the varieties of the Peppered Moth shows that to-day there is a correlation between the industrial areas and a high proportion of the melanic *carbonaria* form. Furthermore, the *carbonaria* form never drops below 80 per cent. of the population throughout the Eastern Counties of England. This is brought about by the indirect effects of smoke-drift from the industrial areas, due to the prevailing south-westerly wind.

"Selective predation of the varieties of the Peppered Moth by birds has been directly observed, and may be illustrated by photographs of a robin taking a melanic *carbonaria* from a lichened tree-trunk in Dorsetshire on which there were two typical light-coloured forms which the bird missed, and of a redstart taking the typical light-coloured form on a heavily polluted tree-trunk near Birmingham on which there were three melanic *carbonaria* forms which the bird missed. The melanic *carbonaria* form enjoys a 10 per cent. advantage in polluted areas, and suffers under a 17 per cent. disadvantage in unpolluted areas."

The British Museum exhibits take us through Variation, Adaptation, Selection, the Fossil Record, Morphology and Embryology, Geographical Variation, Isolation, the Formation of new Species, Classification, and the Evolution of Man, although it is admitted that "it is naturally impossible to present more than the barest framework of selected examples to illustrate its (*i.e.*, evolution's) general principle." One could have wished, nevertheless, that some of the exhibits had a little more information. Thus, there is the Huia-bird, of New Zealand, "an example of adaptation involving both sexes but without reference to reproduction. The male bird has a short, stout beak with which it chisels holes in trees containing grubs of the particular beetle on which it feeds. The female has a slender, curved beak, twice as long as that of the male and therefore with a longer reach, but not capable of chiselling. Co-operation between the members of a pair of mated Huia-birds is therefore indispensable for both to obtain food." But how exactly does this work? If the male can obtain food with his short beak, why does the female need a long beak, anyway, whether or not she does the chiselling? And if the co-operation of the two of a mated pair is needed to obtain food, how do the sub-adult birds, as yet unmated, fare? Perhaps the answer is not known, since the Huia-bird is now believed to be extinct. In any case, either more information should be given, or, if it is not known, such dogmatic words should have been avoided.