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*MAN AND EVOLUTION.*

*Evolution and Man's Place in Nature.* By Henry Calderwood, LL.D., F.R.S.E., Professor of Moral Philosophy, University of Edinburgh. (London: Macmillan and Co., 1893.)

THIS work appears to have been written for the purpose of setting forth the author's views as to the twofold nature and origin of man. He admits, fully and unreservedly, that both the bodily organism and the lower mental nature of man have alike been developed by a process of evolution from a lower animal form; but he urges with much force, and often with both eloquence and dialectic skill, that the rational and moral nature of man has not been thus developed.

The book, however, has many defects; and one cannot but feel that the writer has undertaken a task somewhat beyond his powers. Most prominent is its extreme diffuseness and vagueness, the want of systematic treatment, the frequent reiteration of the same ideas under different forms of words, and the misconceptions arising from want of familiarity with many of the subjects discussed. We are also annoyed by the frequent reference to problems to be discussed or solved, which are yet only hinted at or talked about later on. Thus, in the first chapter, we are told that a "fuller study of human life" is now required, and that the crowning effort of science in the study of Nature must be "the solution of the problem of man's appearance" on earth. Yet no attempt is made in the whole volume, either to solve this problem or even to show what progress has been made towards solving it. At p. 154 we are told that—"We are now ready for consideration of Darwin's argument"—as to the relation of the mental nature of man and the lower animals. And on the next page—"The direction to be followed now becomes more obvious"—after which we have pages of general remarks on the intelligence of the dog and the ant. Then, at p. 162—"The method to be followed is clear: we must compare the higher animals with man"—and—"careful comparison of the two orders of life is the only course open for scientific inquiry," and again,—"The difficulties belonging to such a mode of inquiry are many; but no easier method is available." Then, at p. 167, we find that Darwin "has at least suggested the essential conditions of our inquiry." After this we have another series of vague general remarks, till at p. 171 we find another statement of the mode of inquiry, and we are told that "we must have in full view all that is common to man, as animal, with the higher mammals, making account of close approximation in organic structure." Yet we nowhere find any attempt to apply these principles or methods so laboriously set forth, but are put off with such statements as "In proof of exercise of intelligence, examples are many and familiar, making it unnecessary to enter upon detailed references." Then we are interrupted by fifteen pages of remarks on instinct among insects, although it has been repeatedly stated that the relation of man to the higher animals was the problem to be discussed; and at p. 193, we are told that—

"Now at length, after careful survey of lower levels, we advance towards the height, on which the grand problems of intelligence become visible. Study of comparative intelligence now becomes possible." Then follow again page after page of what can only be described as "general remarks" on horses, dogs, monkeys, and other animals. We are told, for example—"When the higher animals are compared with the lower, it is clear that a power of intelligence must be attributed to the higher, which cannot be credited to the lower. Phenomena of domestication come to our aid here, confirming this generalisation." And a little further on, as a proof that dogs can interpret signs and act upon them, we have the following concrete illustration, among the very few in the book, and therefore we may presume it is considered a valuable one. "'Go home' will send one dog back, but the Gaelic equivalent alone will be effective in the case of a dog reared in the Highlands of Scotland, where the Celtic tongue is in common use." And then, as if the intelligent reader might doubt this astounding fact, the author adds, "Observation affords ample testimony for this."

Although the author has evidently read very widely on the subject of evolution, his want of grasp of the subject is continually shown. Thus, when discussing the struggle for existence, he seems to think that this is usually considered to be limited to a struggle for food. He says:—"A general view of the relations of life and environment will guard against interpretation of facts exclusively by reference to struggle for existence consequent on the relations of numbers to food-supply." . . . "Life is too rich in variety to find adequate explanation of its history in the mere balancing of our numbers with food-supplies." . . . "In no life is progress to be explained exclusively by reference to amount of food-supply" . . . "environment must be read much more largely than could be suggested by mere dependence on materials for nutriment"—the above passages all occurring in a single paragraph.

We have to thank the author, however, for the very clear manner in which he admits, and even enforces the application of evolution to man. He states this conclusion in several places. Thus, at page 261, we find the following:—

"The novelty of the situation lies in this, that man's alliance with all animal life has been established with a clearness and fulness of representation never before possible in the history of the world. The long-hidden secrets of nature are disclosed, and, behold! man has his heritage among the beasts of the field. The discovery is indeed a large one; the demonstration has been worked out in minute detail till no place is left for doubt."

By far the best portion of the work is that which is its special feature—the discussion of the rational as contrasted with the mere perceptive and intelligent nature of man and of the lower animals. A few quotations will explain the author's views, and show him at his best.

"The conditions of action are changed when rational self-direction comes into view. This change is so great as to amount to a complete contrast with all that has appeared in lower forms of life. Passion and appetite have not disappeared; they are present as before; but instead of determining conduct, a new exercise of power has appeared to control them. Life has here a duality within it, which has not been seen at any lower stage.

Life's history becomes in this way a history of conflict, of which no trace has appeared at any earlier point in natural history. The struggle between individuals has not disappeared, but a struggle within the individual life occurs, which has never been visible in the history of any inferior order of life" (p. 55).

Another aspect of the rational nature is thus defined:—

"The difference which severs man from the animals lies beyond the craving, and the cunning, and the consuming of what has been captured. We trace it in his plans for the day, in his preparation of his weapons, in his survey of the heavens, in his taking of reckonings for direction. He deals with the relations of means to ends; he utilises past experience in his reflections over what has happened; he reaches general conclusions" (p. 270).

Perhaps the finest passage in the book is at p. 287, tracing the moral element in the thought of all kinds of men and all diversities of race, as shown by the sense of wrong and injustice. We can only give here the concluding lines:—

"To this appeals the criminal in the heart of our surging crowds, placed under arrest, if he should be condemned on insufficient evidence. To this appeals every buyer in the market, defrauded by the thrusting of adulterated goods into his hands. And to this does every gentle one make appeal, defrauded in ways still worse, by false expressions of love, from whose falseness recoils a blighted life, bearing through long and weary years witness to the cruel wrong that has been done. Where, along the devious paths in which man is found, is justice not honoured, at least by outcry against harsh wrongs?"

There is much in this volume that will attract readers more disposed towards the esthetical and moral than towards the scientific aspects of evolution. Agreeing, as the present writer does, with most of the conclusions of the author, he can but regret that they have not been set forth in a manner more likely to attract scientific readers.

A. R. W.

POINCARÉ'S "THÉORIE MATHÉMATIQUE DE LA LUMIÈRE."

*Théorie Mathématique de la Lumière.* Par H. Poincaré, Membre de l'Institut. (Paris: G. Carré, 1889 and 1892.)

THIS work consists of two volumes, the first of which comprises a course of lectures delivered by the author in 1887-1888, whilst the second contains a further course delivered in 1891-1892.

The first volume commences with a discussion of the constitution of the luminiferous ether, in which the latter is regarded as a system of discrete molecules in stable equilibrium under the action of molecular forces, and the author finally deduces equations of motion of the same form as those which are furnished by the ordinary theory of isotropic elastic media. He then adopts the hypothesis, originally due to Lord Kelvin, that the velocity of propagation of the longitudinal wave is practically zero. The principle of Huygens is next dealt with, and this is followed by a chapter on diffraction. A complete discussion of all the difficulties attending the resolution of waves would carry us too far, but the author does not appear to be acquainted with the masterly

investigation of Sir G. Stokes, or the formula deduced by him, which gives the effect of an element of a plane wave at a distant point, and which enables the unsatisfactory reasoning on which the principle of Huygens depends to be dispensed with. The diffraction of light diverging from a focus is next discussed, and the intensity of light diffracted by a circular aperture or disc is obtained in the particular case in which the point of observation is the projection of the centre of the aperture or disc upon a screen; but no mention is made of Prof. Lommel's able investigation in the general case of an excentric point. A few stock problems relating to the diffraction of parallel rays are also discussed, but nothing is said about the resolving power of optical instruments, or the theory of gratings, including Prof. Rowland's ingenious invention of concave gratings.

Chapter V. commences with the theories which have been proposed to explain the photogyric properties of quartz and certain organic substances, and concludes with an account of some of the theories of *ordinary* dispersion. This is followed by a long chapter which begins with Fresnel's theory of double refraction, and then proceeds to discuss the theories of Cauchy, Neumann, Sarrau and Bousinesq.

In all these theories the ether is regarded as an ælotropic elastic medium, and in considering them the author is to be congratulated on having shown no sympathy with the small minority who regard the writing down of equations as a foolish process; but although during recent years much time has been spent in elaborating such theories, it may be questioned whether the majority of them have contributed any very substantial addition to scientific knowledge. The theory of the propagation of waves in an ælotropic elastic medium was rigorously investigated by Green as long ago as 1839; and although a theory of this kind is useful in enabling the mind to form a mental representation of the mechanism which is required to produce double refraction, it is well known that Green's theory, and all others of a similar character, fail to furnish a satisfactory explanation of this phenomenon. The principal defects of such theories are, that although most of them lead to Fresnel's wave surface, or to one which is a very close approximation thereto, they require us to suppose that the vibrations of polarized light are parallel instead of perpendicular to the plane of polarization; and they also fail to give results which explain crystalline reflection and refraction, unless certain additional assumptions of a very questionable character are made. Probably it will not be thought an exaggeration to say, that the only theory of elastic media which satisfactorily explains double refraction is the one which is due to the joint labours of Lord Rayleigh, Lord Kelvin, and Mr. Glazebrook.

At the commencement of Chapter VII., which deals with reflection, the following statement is made (see p. 320):—

"La réflexion vitreuse a donné lieu à trois théories également confirmées par l'expérience, ce sont celle de Fresnel, celle de Neumann et MacCullagh et celle de Cauchy."

The theories of Neumann and MacCullagh depend upon the hypothesis that the *density* of the ether is the same in all media, and that it is the rigidity which