interest of his general treatment of the strength of ships.

The book will be heartily welcomed by all connected with the design and construction of ships; the appearance of the second volume will be awaited with interest.

W. H. WHITE.

HEREDITY AND EDUCATION.

Education and the Heredity Spectre. By Dr. F. H. Hayward. Pp. xv+147. (London: Watts and Co., 1908.) Price 1s. net.

WHAT Mr. Bernard Shaw means when he says that "the bubble of heredity has been pricked" is that the theory that the moral characters acquired by an individual during his lifetime are transmitted to his descendants has been exploded. We are all, including the author of the book before us, pretty well agreed that this is so. It is not supported by the scanty evidence on this point which the biologist has collected. Nor need we grieve that it has gone. For, if it can be maintained that a belief in it was an incentive to virtue, it is equally certain that such a belief was an excuse for vice, as was clearly seen by a little girl who, when told by her nurse that if she was naughty her grandchildren would be naughty too, pointed out that, if that was true, the reason that she was naughty was that her grandmother had been.

The conclusion reached by Mr. Shaw as to the bearing of the pricking of the bubble on education is that "the vilest abortionist is he who attempts to mould a child's character." That reached by Mr. Hayward is the diametric opposite of this. He is a Herbartian. Herbart asked:—

"Does a human being bring with him into the world his future shape, or does he not? In respect to his body he doubtless does; but that is not our question. We speak of the mind, the character, the entire disposition."

And Herbart's and Mr. Hayward's answer is that he does not; and that, that being so, it is not merely legitimate, but desirable, to attempt to mould a child's character.

But before we proceed further we must make sure that we keep two questions, which are probably puzzling our mind at the same time, perfectly distinct. One is a question for the biologist, the other for the educationist. The one is, "Can a child's character be moulded?" the other, "Is it desirable to do it deliberately?" With regard to the former question, the answer given by Dr. Archdall Reid, who has devoted much thought to this point, is "Yes." According to Dr. Reid, all the attributes which distinguish a civilised man from a barbarian (the two terms are relative, of course) have been acquired by the former during his lifetime. If this is true, an English boy brought up from birth in a Zulu kraal will, when a man, have the morals and ideals of a Zulu. He will only differ from the other inhabitants of the kraal in having a paler skin and the other physical characters which distinguish the two races. Such experiments may have been made, but it is highly unlikely that they have been accurately recorded. The presence of anyone capable of doing so would spoil the conditions of the

experiment. But even if this view of the nature of our morality is correct, it does not follow that it is desirable to attempt to mould a child's character. It rather shows that we cannot help moulding it by everything that we do, and that any little deliberate attempts that we make will count for so little in comparison with what we have already done, and will go on doing, that they will not make much difference.

From the educational side the book is well worth reading, and the subject discussed is of first-rate importance; but our author is not a biologist either by sympathy or achievement. Was it worth while to poke fun at Mendel for his researches on green peas (p. 134)? People lay so much too much stress on the material that is dealt with in an investigation. Personally, we set more value on a man who discovers, not *everything*, as some Mendelians hold, but, say, "a rough quarter" by experiments "with green peas," than on one who discovers practically nothing by an excursus on man. We quote the whole passage:—

"(3) Mendelism.

"The question of heredity has entered on a new phase during the past ten years, owing to the unearthing of Mendel's researches on green peas. The plant again! We are to discover the laws of human nature by the study of heredity in non-conscious, non-moral plants."

Does Mr. Hayward really think that we investigate natural processes for the benefit of those who apply the information which we give them? The reason that Mr. Hayward dislikes the plant so is that, according to him, the non-Herbartian doctrine of education is based on what he calls the "plant" metaphor.

"The future form of a plant is admittedly determined in advance. True, there are 'variations' and 'mutations,' the laws of which we are likely, sooner or later, to know; true, also, *even plants*¹ are plastic in a measure, to environmental influences. Broadly, however, we may say that the fate of a plant is fixed by the nature of the germ from which it springs."

We quote this to show that Mr. Hayward's biology is shaky. For it is now generally recognised that one fundamental difference between animals and plants is the much greater susceptibility of the latter to environmental changes.

RECENT STUDIES IN ATMOSPHERIC ELECTRICITY.

Die. Luftelektrizität. Methoden und Resultate der neueren Forschung. By Prof. Albert Gockel. Pp. vi+206. (Leipzig: S. Hirzel, 1908.) Price 6 marks.

OF late years there has been great activity in this country in investigating electrical phenomena in gases and in advancing and discussing theories as to the nature and properties of ions. But this work has been mainly done in the laboratory or by mathematicians. In central Europe, thanks largely to the influence of Exner and of Elster and Geitel, there have been many workers studying the electrical phenomena presented by nature. Amongst them Prof. Gockel takes a distinguished place. In the present volume he gives an exceedingly up-to-date account of our knowledge of atmospheric electricity. The amount that has recently been written on the subject will

¹ The italics are ours.

impress itself on anyone who refers to the *Physikalische Zeitschrift* or the publications of the Vienna Academy. The references in the present volume are evidence of Prof. Gockel's familiarity, not merely with recent work in German, but also with that in English, whether done here or in America. He makes, for instance, numerous references to Simpson's observations in Lapland.

The book consists of a three-page introduction, five chapters, and a short conclusion, and has a table of contents. Chapter i., pp. 4 to 61, deals with the electrical conductivity of the atmosphere. After describing Elster and Geitel's dispersion apparatus, and the instruments of Ebert and of Gerdien for measuring ionic charges and conductivity, it gives an account of the results obtained with these instruments by different observers in different places, and deals with the questions of diurnal variation and the influence of various meteorological conditions. Chapter ii., pp. 62 to 120, deals mainly with the potential gradient and its determination by means of water-droppers, flame and radium collectors. This includes the results obtained—especially in recent years—at the ground and those derived from balloon ascents. The diurnal and annual variations in the potential gradient, the relationships of potential gradient and ionisation, and the influence of meteorological conditions are amongst the subjects discussed. Chapter iii., pp. 120 to 149, describes the measurements by Gerdien and others of the vertical current in the atmosphere, deals with the charges brought down by rain and snow, and includes two or three pages on aurora. As evidence of its up-to-date character, it may be mentioned that it describes Mr. C. T. R. Wilson's apparatus for measuring the earth-air current. Chapter iv. is devoted to earth-currents. Its length, only 9½ pages, forbids much detail, but there is an account of several of the more important observations, including those by Weinstein in Germany. Chapter v., pp. 159 to 202, deals with the sources of ionisation in the atmosphere. It discusses the radio-activity of air from the ground, and of rain, and the radio-active emanation in springs, the observations made by Elster and Geitel and others with negatively charged wires, and refers to recent work by Gerdien, Rutherford, Strutt, Campbell, Dike, Eve, and others. A few pages at the end relate to various theories.

In a book of such modest dimensions it is inevitable that some parts of the subject should not be very fully discussed, but it is unquestionably a work which every serious student of atmospheric electricity should possess and study. Very few points call for criticism. There are, however, two historical references which seem to overlook the work of British investigators. Mascart is referred to on p. 80 as the first to introduce photographic registration of potential difference, but in reality the Kelvin water-dropper at Kew has recorded photographically since 1861. Again, the discovery of the resemblance between the diurnal variations of potential gradient and barometric pressure is said on p. 114 to have been made by Hann in 1889. Prof. J. D. Everett, however, detected it in 1867 (*Phil. Trans.*, vol. clviii., p. 358, and plate xxi.).

C. CHREE.

OUR BOOK SHELF.

The Ethical Aspects of Evolution, regarded as the Parallel Growth of Opposite Tendencies. By W. Benett. Pp. 220. (Oxford: The Clarendon Press, 1908.) Price 6s. net.

THIS book is full of original opinions vigorously and uncompromisingly expressed. As the title indicates, the author's main thesis is that the process of evolution does not mean the progressive elimination of evil and pain, or a progressively increasing surplus of good and pleasure. He adduces biological evidence to show that the organism which has attained the finest adjustment to its environment is the organism which can be most easily thrown out of adjustment, and the one to which misadjustment, when it comes, is most disastrous. So history teaches us that if civilisation has meant higher forms of virtue, it has also meant lower depths of vice; and that as our knowledge increases so does the consciousness of ignorance.

From this point of view, Mr. Benett makes an effective destructive criticism on all optimistic evolutionary theories of ethics which have as central principle the possibility of perfect adjustment and the extrusion of all inharmonious factors from experience. He then proceeds to put forward his own theory. Failing the criterion of a net surplus result of progress in good or pleasure, Mr. Benett holds that our system of valuations must rest on the conception of progress itself. A teleological basis, he admits, would be more adequate. But we are unable to find any finite end which will give unity to the divergent tendencies of human nature; and the transcendental end, though we are compelled to posit it, is for ever beyond our ken. The essential characteristic of progress is, for Mr. Benett, increase of force; it is this which in the last possible analysis commands man's esteem and admiration, and affords a criterion of good and evil.

There is here an attempt to unite a scientific neutrality with a positive ethical construction. Progress is no increase in the net value of life; it means the impartial development of good and evil; yet progress must be our criterion of value and good. One need only point to Mr. Benett's criticism of hedonism, where he points out that just because pleasure is an impartial stimulant of all sorts of action it cannot be the criterion of good, to show the inconsistency of this position. To avoid the difficulty by making progress represent only the positive aspect of evolution is to fall on the other horn of the perpetual dilemma of ethical construction, and make good the criterion of good. Apart from this defect of fundamental theory, Mr. Benett's book shows considerable power of psychological analysis; his treatment in the later chapters of complex moral facts and concrete virtues is often admirable. His argument is always forceful, his style is powerful, and one feels throughout the presence of a straightforward insistence that we must face the facts as we find them of human nature and the world. These are qualities which go far towards a valuable re-handling of moral problems.

The Poisonous Terrestrial Snakes of our British Indian Dominions and how to recognise Them. By Major F. Wall. Second edition. Pp. x+69; illustrated. (Bombay: Natural History Society, 1908.) Price 2 rupees.

To those whose travels have never extended beyond western Europe it is a difficult matter to realise how largely poisonous snakes loom in the life of our native fellow-subjects in India, or to appreciate the heavy annual list of casualties due to snake-bite. To mitigate the evil, the European and the native medical staff of the country are now bringing into play the latest remedies of their science, but they are frequently