

face of a drum intervals of one-hundredth part of a second. He claims to obtain almost absolute uniformity of motion for a sufficient length of run, and accurate records of the corresponding tractive force and velocity of advance during the part of the run when uniform motion occurs. The system is said to have been adopted by the German Admiralty, and in some of the technical institutions of Germany. Its operation and results will be watched with interest; but in the opinion of the writer the new method is not likely to supplant the Froude system, although it may come into use as a supplementary method of making rapid and fairly accurate "first approximations" to resistance. Even minute errors are magnified so greatly in passing from a model to a full-sized ship or propeller that the nearest possible approach to accuracy in the model experiments must be obtained, and this may justify a continuance of the greater expenditure on the experimental tanks and apparatus involved in the Froude system. Experience will decide this matter, and an extended comparison of results obtained on the old system and the new with models of identical form should afford conclusive evidence as to the best course to be followed in future. Experiment alone can be trusted, as no theoretical investigation or mathematical formulæ can deal adequately with the complex conditions of ship-propulsion.

Scientific analysis of the results obtained from systematic series of experiments on the forms of ships and propellers will certainly exercise great influence, and enable designers to proceed with greater certainty in future. There are already many examples of what may be hoped for ultimately in the published papers of Mr. R. E. Froude, Mr. Taylor and others. At present the volume of such information is insufficient, and many departments of knowledge remain obscure. As to methods of analysis, little can or need be said at present; when materials are available suitable methods will be devised. An interesting attempt to deal with the matter in the light of present knowledge will be found in a paper read before the Institution of Naval Architects by Captain Hovgaard, now professor of naval architecture in the Massachusetts Institute of Technology, and responsible for the training of the naval constructors of the United States Navy. Like Mr. Taylor, Captain Hovgaard owes his professional training to the Royal Naval College, Greenwich, and does honour to that institution. His "Analysis of the Resistance of Ships" is worthy of close study, and is based on wide knowledge of the subject. But his conclusion will commend itself to every student. "Not until tanks are established for research work . . . will questions like the present one and many others equally important find their solution." Much may be looked for from the tank at Bushy which Mr. Yarrow has offered to establish, provided shipbuilders, marine engineers and shipowners will guarantee the cost of its maintenance. Such an offer cannot fail to be accepted, and the sooner the work of constructing the tank is begun the better will it be for British shipping.

W. H. WHITE.

#### LECTURES ON EVOLUTION.

*Vorlesungen über Deszendenztheorien mit besonderer Berücksichtigung der botanischen Seite der Frage.* By Prof. J. P. Lotsy. Pp. vi+381-799. Theil ii. (Jena: Gustav Fischer, 1908.) Price 12 marks.

THE second part of Prof. Lotsy's book contains the substance of twenty-eight lectures, completing his course on evolution. Though making no claim to have broken new ground, the work is of real use. The presentation of contemporary knowledge of these subjects which it gives is comprehensive in scope and accurate in treatment. The author does not suffer from the delusion that in evolutionary science finality was reached fifty years ago, and it is a pleasure to see the results of modern research incorporated without ludicrous mistakes. This is probably the best text-book of the subject yet compiled.

There are occasional signs of vacillation between the old and the new conceptions. For example, as an instance of a dissimilarity between reciprocal crosses, Prof. Lotsy brings forward *Bilbergia nutans* × *vittata* on evidence which would have satisfied the older observers. Knowing the sources of ambiguity which affect such evidence, he remarks that possibly the dissimilarity may nevertheless be due merely to "Pleiotypie in  $F_1$ ." Rather, until it shall have been ascertained by repeated experiment that there is consistent dissimilarity between the reciprocals, the presumption is strong that the differences observed are an expression of heterogeneity in the cross-bred generation as such, and are not dependent on the parental rôles allotted to the respective species. The break with tradition which Mendelian discovery has made is, indeed, so wide that a generation must pass before the older interpretations disappear, and evolutionists come to think easily and habitually in terms of the new system. This book will do a good deal towards accelerating the change.

To professed students of genetics this text-book may be recommended as bringing a quantity of fresh materials under consideration which have not previously been dealt with in a consecutive treatise. Of these materials some are ancient and some modern. For the first time, probably, Gärtner's work is presented in summary, and though, judged by modern standards, his experiments are fragmentary and imperfect, many readers will thus become aware of the range of observation which they covered. In another useful chapter a clear abstract of Nägeli's views is provided. Prominence is given to the remarkable experiments of Klebs on *Sempervivum Funkii* showing the influence of external conditions. Facts of this class are extraordinarily difficult to interpret, and until exhaustive work has been done on the same lines we must perhaps abstain from confident interpretation altogether. As a subject for genetic research the *Sempervivums* are most attractive. To turn over Jordan's plates of this polymorphic genus in the "Conspetus"—still more to see his actual collection of living plants now preserved in Miss Willmott's garden—is to realise the great possibilities which the material provides. It is to be hoped that someone will devote himself in good earnest to an analysis of those protean forms.

The book suffers from want of compression, and there are some repetitions. The long chapters on the geographical aspects of the problem serve rather to show how little help must be expected from that line of inquiry until much more minute treatment can be applied. No one supposes that any fresh lesson of importance is to be derived from the broad facts of geographical distribution, and the deductions that have been already drawn could, in so far as they are of consequence, be amply stated in half a dozen pages. On the other hand, as to the more interesting phenomena of geographical inter-relationship, the problems, for instance, of intergrading species, too little is said. In a text-book of this scope it would have been well to direct the attention of students to the necessity for thorough study of facts of this class, a field in which there is room for much analytical research.

There is one rather serious omission. The phenomena of regeneration and the mechanics of development are among the most obscure with which a theory of descent has to cope. In the minds of many evolutionists, the existence of those strange and specific powers of response to injury which modern research has revealed constitutes a formidable problem, and though for its solution we still wait, the facts should have been stated.

In dealing with matters of opinion, Prof. Lotsy shows good judgment and critical power. This is especially manifested in his discussion of adaptation, of the evidence for mutation, and of the assertions by which an attempt has been made to revive Lamarckian views. Sometimes, perhaps, one is conscious of an exaggerated patience. Conventional arguments which the author plainly recognises as bad are repeated out of deference to their originators. The expert is not in doubt as to his real opinion, but the lay reader will carry away the impression that decided questions are still open. When he deals with the writings of Wallace, indeed, he allows himself the remark that this is "*Selectionstheorie à outrance*," but such freedom of expression is rare.

The author gives a full but somewhat non-committal account of the views of Eimer, and discusses the relation of Nägeli to the conception of orthogenesis as a main factor in evolution. Yet, after reading all that is said on this question, it is not easy to seize the exact point which is relied on as a proof of the reality of orthogenesis. The adaptation may be very perfect, and selection of indeterminate variations an unpromising account of the origin of that perfection, but it will never do to attribute this wonderful power of orthogenetic variation to organisms simply because we do not see how they could have become what they are without it. This, apparently, is Prof. Lotsy's view also, but many would have been glad of a more definite lead.

If the book reaches a second edition, as it probably will, the question of reducing it to two-thirds its present size should be considered. In that event also the proofs should be submitted to a professional proof-reader, for in this second part, as in the first, the abundance of typographical slips exceeds all reasonable limits.

W. BATESON.

## METALLOGRAPHY.

*Introduction to Metallography.* By Dr. Paul Goerens. Translated by Fred Ibbotson. Pp. x+214; illustrated. (London: Longmans, Green and Co., 1908.) Price 7s. 6d. net.

ALTHOUGH metallography is a very young science, a number of little books on it have already made their appearance, and of these Dr. Goerens's "*Einführung in die Metallographie*" is not the least successful. The author says in his preface that before the publication of his work the numerous papers on the subject had not undergone systematic collection in Germany. If it is not the only book in this country, it is nevertheless welcome, and Mr. Ibbotson's excellent translation greatly increases its usefulness.

Alloys can be studied in several ways, of which the most important have been found to be the preparation of their cooling curves and the examination of polished and etched specimens under the microscope. The whole book is devoted to these two methods, and no reference is made to the electric and heat conductivity of metals and alloys, to their density, hardness, malleability, ductility, colour, resistance to shock, &c. No doubt this is due to the small amount of systematic investigation that has been devoted to these properties, but when a complete work on metallography is written these points cannot be entirely ignored.

However, the preparation of cooling curves by the use of thermocouples is adequately described by the author, and the various means of detecting critical points explained clearly. There is not much discussion of pyrometers, and the platinum resistance pyrometer, with which Heycock and Neville did their classical work, is not mentioned, presumably because it is not much used in Germany.

Physical mixtures, or bodies of perfectly uniform composition not governed by the laws of valency, are divided by Dr. Goerens into aqueous solutions, fused salts and alloys. He defends this use of the historical method on account of its expediency, observing that the reader will find out for himself as he proceeds that the division is arbitrary. The author, however, soon reaches the alloys, and thereafter for seventy-five pages gives a valuable account of the existing views on their constitution. This part is illustrated by descriptions of a number of series of binary alloys drawn from work on cooling curves done in England, Germany, and France, and the references are numerous and accurate. So many examples are given in each subdivision that it is a pity that here at least completeness was not attempted by including all the binary alloys which have been worked out. The additional space required in a second edition would not be great, and the author would produce a book of reference without destroying its usefulness as an introductory volume for students. There seems no reason to exclude even the mixtures of metals with oxygen, sulphur, arsenic, &c., many of which have been studied by Friedrich. These series of bodies are of