

THURSDAY, AUGUST 1, 1907.

ZOOLOGY AS AN EXPERIMENTAL SCIENCE. *Experimental Zoology.* By Prof. Thomas Hunt Morgan. Pp. xii+454; illustrated. (New York: The Macmillan Company; London: Macmillan and Co., Ltd., 1907.) Price 12s. net.

THIS welcome book may be regarded as a landmark, since it vindicates the position of zoology as an experimental science. It is the modern successor of Semper's famous "Animal Life," and it has had its forerunners in various smaller books, such as De Varigny's "Experimental Evolution." But it is, we believe, the first scholarly and critical review of a large part of the enormous mass of experimental investigations which have been a feature of zoological science during the last fifteen years. Thus it gives the student a comprehensive and orderly survey (with well-selected bibliography) of a widely-scattered scientific literature; it enables him rapidly to bring himself up to date as regards experiments on the influence of environment, on hybridising, on inbreeding, on the conditions of growth and reproduction, on the determination of sex, and so on; and the data are presented in a manner so critical and stimulating that the book is bound to have a great influence in promoting experimental research, which is likely to be prominent in zoological laboratories for centuries to come. For

"while the historical study of zoology must always remain a legitimate field for activity, as human history has been a time-honoured study, there can be little doubt that the more promising and searching method of zoological study in the future will be found in experiment."

To have furthered this movement is sure to be the reward of Prof. Morgan's book, which is at once a careful balance-sheet of past results and an incentive to add to them. The author has made all zoologists his debtors, for the work is uncommonly well done. It is an interesting sign of the times that the author is "professor of experimental zoology" in one of the leading universities of the world.

The author's general point of view is thus indicated:—

"The branches of biology that have made most extensive use of the experimental method are physiology, bacteriology, and physiological chemistry. The zoologist and the embryologist have also to deal with physiological problems, and already the beginning of important experimental work has been carried out in this field; but the most distinctive problem of zoological work is the change in form that animals undergo, both in the course of their development from the egg (embryology) and in their development in time (evolution)."

It is to an examination of the experimental study of these changes in form that the book is mainly devoted.

"Experimental morphology would perhaps nearly indicate the field to be examined; but since the line between experimental physiology and experimental morphology is often hard to draw, and since I shall not hesitate at times to enter upon the physiological side of many problems, I have chosen the somewhat

broader title of Experimental Zoology to include the subjects to be treated."

The principal topics discussed fall under six headings:—evolution, growth, grafting, the influence of the environment on the life-cycle, the determination of sex, and the secondary sexual characters; and if there are any zoologists who have not been following the recent development of experimental work, they will be amazed at the amount of profoundly interesting work that has already been done. New vistas are being opened out on all sides, and zoology is entering upon a fresh and most promising phase. It should be noted, too, that Prof. Morgan tells his tale in a style so lucid and graphic that even the uninitiated cannot fail to follow what is certainly one of the most fascinating zoological books ever published.

The main theme of the book is "the central problem of morphology—the causes of the changes in form, or at least the determination of the conditions under which changes in form occur." It must be noted, however, as the author is well aware, that the title "Experimental Zoology" is much wider than the contents of the book. He has deliberately refrained from discussing, (a) recent experimental work on the psychical aspects of vital phenomena as dealt with in recent works by Loeb, Lloyd Morgan, Jennings, Bethé, and others; (b) the study of regeneration (to which he devoted a previous excellent treatise); and (c) experimental embryology, which has also received comprehensive treatment in more than one recent volume. The exclusion of the last-named department is especially regrettable, though it is ungracious to say so. For, after all, the central problem of morphology is not so much concerned with the environmental production of modifications, or with the Mendelian phenomena of inheritance, or with the determination of sex, but with *morphogenesis*. Thus a treatise on experimental zoology which refrains from a thorough-going discussion of the fundamental researches of men like Roux and Wilson, Driesch and Herbst, illustrates what the experimentalists have called "autotomy." Let us hope that in subsequent editions the missing parts—absolutely necessary to completeness—may be regenerated. The author's competence to secure this is well known. Of course, a book should always be received with due consideration of the author's aim and prescribed limits, and what we have ventured to say is in no sense intended as criticism, but we may further remark that under the title of "Experimental Zoology" we may justly include not only experiments bearing on morphogenesis (individual and racial), but also those which enable us better to understand the daily life of the fully formed creature. Much of the work that has been done in comparative physiology and psychology is definitely experimental, and just as essential to an all-round outlook as the work of Mendel and de Vries.

It is of course impossible to give a summary of the author's conclusions, but we may give two or three samples.

"The experimental evidence in favour of the inheritance of acquired characters is unsatisfactory." "Used with discretion Mendel's law may still unlock many

problems, but if attempts are made to force it to interpret cases that do not belong to its proper field of action, especially in regard to dissociation in the germ-cells, harm rather than good may temporarily result." "It seems arbitrary to speak of unit characters as immutable and quite unnecessary to make this idea a cardinal point of the mutation theory." "On the mutation theory selection destroys species; it does not originate them." "Admitting that all eggs and all sperm carry the material basis that can produce both the male and female, the two conditions being mutually exclusive when development occurs, the immediate problem of sex determination resolves itself into a study of the conditions that in each species regulate the development of one or the other sex. It seems not improbable that this regulation is different in different species, and that, therefore, it is futile to search for any principle of sex determination that is universal for all species with separate sexes; for while the fundamental internal change that stands for the male or the female condition may be the same in all unisexual forms, the factor that determines which of the alternate states is realised may be very different in different species."

We may be allowed to compliment the author on his highly successful execution of an arduous task; his workmanship is marked by carefulness, lucidity, and impartiality, by the salt of good-tempered criticism, and by a stimulating suggestion throughout that the whole business of experimental zoology is only beginning.

J. A. T.

BOOKS ON PATENT LAW.

- (1) *The Inventors' Guide to Patent Law and the New Practice*. By J. Roberts. Pp. viii + 109. (London: John Murray, 1906.) Price 1s. net.
- (2) *Notes on the New Practice at the Patent Office*. By J. Roberts. Pp. 32. (London: Eyre and Spottiswoode, Ltd., n.d.) Price 1s.

(1) **T**HIS book is intended to give inventors an explanation of the law and rules relating to the grant of patents in the United Kingdom, and information as to the proper manner of protecting inventions. The book is to a great extent an abstract from the larger book of Mr. Roberts, and, as a guide to the student of patent law, should be extremely useful. In addition to the parts of the book dealing directly with the Patent law, information is given specially for the use of an inventor who is in possession of an invention which he considers it desirable to protect; but the ordinary inventor, even with this book in his hand, would meet with considerable difficulty in drafting his specification in the best manner. It is frequently noticed that inventors themselves are quite unable to appreciate and describe what is the real point of their invention; and this difficulty cannot be met by any guide-book. The various matters dealt with in the book comprise practically the whole of the Patent Law, and the questions of the application for a patent, and procedure at the Patent Office, as well as proceedings for infringement, and other proceedings, on a patent already granted, are all referred to, and references given to other works in which fuller information is contained.

It is, of course, impossible in such a small space—about one hundred pages—to give any full account of

the Patent Law, and Mr. Roberts has perhaps given as much information as possible in the space at his disposal. The reader, however, will have to refer to the larger works to get any clear ideas on the different points dealt with. It is impossible, for instance, to explain the difference between patentable and non-patentable inventions in a few pages. Every particular case must be judged on its own merits, and reference to a few cases is of little or no use on the question of sufficiency of invention.

At the end of the book, the Patents Act, 1902, is fully set out, together with the rules made under the Act. An index is given which appears to be fairly complete.

(2) This publication deals shortly with the alterations in the Patent Law introduced by the Patents Act of 1902, and the rules made under that Act. The effect of the new provisions is given very clearly, and certain controversial points arising on the construction of the Act and the rules are very fully dealt with. Among these may be mentioned the question of post-dating the specification, which is the subject of Rule 5 of 1905. This rule gives the comptroller power to post-date the application, and this power, if used against the applicant, is no doubt outside the scope of the Act of 1902. There is, however, little reason to suppose that the rule will be exercised by the comptroller to the prejudice of an applicant, and in practice the applicant may find the power of the comptroller to post-date extremely convenient in cases where he is unable to meet the Patent Office objections within the prescribed time.

Another point very fully dealt with is the question of the meaning to be given to the words "in part described" in Section 1 of the Act of 1902. The author suggests that these words should be narrowly read, and that the words "partly described" should mean that part of the invention as claimed by the applicant has already been described, so that one claim at least includes what is old. This is a reasonable construction, and is practically that adopted by the Office under the new practice.

The author also deals with the question of the compulsory insertion of references at the instance of the comptroller, and the form in which the reference is to be inserted. In the Act of 1902 there is an ambiguity as to whether the comptroller should have power to settle the form of the reference or whether he could decide only what specifications should be referred to. The view taken by the Patent Office is that they are entitled to settle the form, but the author does not consider they are justified in this interpretation. The official view, however, does not really cause any hardship to the patentee, as if there is really an invention the specification can be quite well drafted in such a way that all necessity for the compulsory reference is avoided, and the officials at the Patent Office always give great facilities for amendment to define the invention more clearly, if there is any invention of any sort contained in the application.

Mr. Roberts's notes give a very clear idea of the changes introduced in the Patent Law by the new Act and rules.