

EXPERIMENTAL EMBRYOLOGY.

Lehrbuch der vergleichenden Entwicklungsgeschichte der wirbellosen Thiere. By Profs. E. Korschelt and K. Heider. Allg. Theil, Erste Lief., Erste und Zweite Auflage. Pp. x+538. (Jena: Fischer, 1902.) Price 14 marks. Zweite Lief., Erste und Zweite Auflage. Pp. 539 to 750. (Jena: Fischer, 1903.) Price 5.50 marks.

ZOOLOGISTS who are already acquainted with the "special" part of Profs. Korschelt and Heider's "Comparative Embryology" will have been anxiously looking forward to the publication of the present volume; we are sure that they will in no wise be disappointed. At present we have only a first instalment, but even this contains an enormous amount of matter, including, as it does, a review of all the recent work on the physiology of development, besides a complete history of the sexual cells.

The latter portion, we may as well say at once, should have come first. Logically, the phenomena of what Roux has called "Vorentwicklung" are more closely related to descriptive than to experimental embryology; and if the order of the first and second portions had been reversed, the authors would have been able to include under a common discussion the kindred problems of ontogeny and heredity.

Of this second portion we have no space to treat at length. It must suffice to say that the student will find here an excellent *résumé* of all that is known on the structure, maturation, and fertilisation of the germ-cells. Criticism is hardly called for; but the definition of the mammalian placenta (p. 292) is out of date, and we should have liked to have seen a less fragmentary account of the maturation phenomena in plants. On the other hand, the difficult subject of maturation is treated with remarkable lucidity, while the attitude of the authors towards the vexed questions of qualitative reduction, and, in the next chapter, the individuality of the centrosome, is admirable in its judicial impartiality.

By far the most important part of the book, however, is the first section—that dealing with the work of the new school of experimental embryologists. The problems at issue are sharply defined in an introductory preface. As the authors rightly remark, ontogeny consists of a series of changes in which every stage is—in the strictest sense of the word—a cause of that which immediately follows. The business of the experimenter is to analyse the phenomena, to determine what is due to external, what to internal factors, and, in respect to the latter, how much is attributable to the initial structure visible or invisible of the ovum, how much to the mutual interaction of the parts that are successively developed.

With this object in view the ground is first cleared by a discussion of the external factors, beginning, quite rightly, not only from a logical, but from a historical point of view, with the pioneer work of Pflüger on the influence of gravity on the segmentation of the frog's egg. An account of the subsequent, and consequent, work of Born, Roux and Hertwig naturally follows. Next are described the

effects of heat, light, and physical and chemical changes in the gaseous and liquid environment, and lastly, a little out of their proper place we think, the few experiments that have been made to determine the influence of electricity and magnetism, and of mechanical disturbances on the course of development.

It is a pity that the authors have not introduced at this point a critical summary of the results. It is of the first importance to decide whether these external conditions constitute a series of "specific" or merely "indifferent" causes. Hertwig's artificial production of monsters by heat and salt solutions would have made an apt text for an interesting essay on "Abhängige Differenzierung," and would have served to carry on the reader to the next chapter, "Das Determinationsproblem," in which we are taken straight to the heart of the "Streitfrage" of modern embryology.

While the restoration of the eighteenth century doctrine of preformation to a prominent place in embryological literature dates from His's theory of "Organbildende Keimbezirke," the attempt to gauge its worth experimentally begins with Roux's work on the production of half-embryos from a single blastomere of the frog's ovum. Roux's results, or rather his interpretation, were wholly in favour of this doctrine; their value has, however, been diminished by Hertwig's criticism and Herlitzka's work on the newt. The Amphibia, indeed, together with Amphioxus, the Teleostei, and the Coelenterata, stand, so far as the "regulative" capacity of their ova are concerned, at one end of a series, at the other extreme of which are forms, the Ctenophora and Mollusca, the isolated blastomeres of which are incapable of developing into anything but partial larvæ. The intermediate position is occupied by the Echinoderms and Ascidians; here the segmentation of such blastomeres is partial, but a whole larva is ultimately formed. Any general theory, therefore, of the necessary predetermination of the parts of the organism in the cytoplasm of the ovum is out of the question. A similar criticism, based on the pressure experiments of Driesch (Echinus) and Hertwig (Rana), is applicable to the nucleus, and, of course, cuts at the root of the "Mosaik-Theorie."

The failure of the attempt to demonstrate a preformed, though invisible, structure in the ovum throws us back on epigenesis, and compels us to search for the internal causes of ontogeny in the mutual interaction of the parts as they are formed. To deduce such interaction, however, from the known functions of cells is a very different matter; but such facts as are significant for the purpose are brought together in the third chapter under the heading of "morphogenetic cellular processes."

The general discussion of the whole problem is reserved for a separate appendix. The authors display a commendable caution in reviewing the theories of Weismann, Hertwig, and Driesch. This caution, indeed, is characteristic of the whole book, and will certainly win the approbation of every embryologist who is content to say with the authors, "wir werden die Speculation nie entbehren können, aber es wird die Aufgabe sein, das ihr zu Grunde liegende Beobachtungsmaterial möglichst zu erweitern."