

unique developmental pattern involving dispersion and reaggregation of blastomeres and the occurrence of diapause at three distinct stages invites many questions on morphogenesis and the control of differentiation. The section is continued with chapters on selected invertebrates, and plants ranging from angiosperms to slime moulds. Choice of biological material is an important decision and this section is a much-needed addition to the literature.

The second section deals with culture methods for cells, tissues, organs and embryos *in vitro*, diffusion chambers and insect imaginal disks *in vivo*, and includes a chapter on the grafting of embryonic rudiments, mainly to the chick embryo.

The third section contains a wide range of other techniques currently used in developmental biology; plant growth regulator assay, organelle isolation, protein and nucleic acid determination in embryonic cells, surgical techniques in plants and animals, cell marking and fixation procedures for electron microscopy. There is also a discussion of lighting systems for controlled plant growth, and some experimental techniques for eggs and embryos of marine invertebrates.

The whole volume makes up a well-balanced source-book with the chapters carefully edited to prevent undue repetition. Although the practical aspects are emphasized throughout (including some previously unpublished techniques) and references (up to 1966) are freely quoted, the text remains immensely readable. It is inevitable in such a central discipline that the book contains a certain amount of information available elsewhere. This applies especially to the section on culture methods which competes with at least half a dozen books on this subject published in the past three years. Nevertheless, the value of *in vitro* culture in contemporary developmental biology justifies bringing together a wide range of such techniques under one cover. In places there is evidence for the long gestation period often incurred in the production of a book with numerous contributors. In particular, some of the techniques described for nucleic acid determination have now been modified and supplemented.

Apart from a personal aversion to the double-column page, the format is very pleasing; the text illustrations have a welcome simplicity and clarity (even the gravity defying culture chamber in Fig. 6, page 391, printed upside-down). Minor criticisms include the photographic reproduction, particularly of the electron micrographs, which is not of the highest standard, and occasional variation in the density of the print.

There is a wide range of organisms and techniques currently available to the developmental biologist and here is a book embodying a good deal of this information at a reasonable price. The editors hope that it might be used by existing and intending researchers in the field and by teachers looking for new material. Their optimism should be well rewarded.

W. D. BILLINGTON

ORIGIN OF THE AMPHIBIA

The Origin of Terrestrial Vertebrates

By I. I. Schmalhausen. Translated from the Russian by Leon Kelso. Edited by Keith Stewart Thomson. Pp. xxi+314. (Academic Press: New York and London, 1968.) 140s.

In his early work, Schmalhausen published a number of papers on the appendages of lower vertebrates and on the phylogeny of the auditory ossicles. In 1950, at the age of 65, he again became interested in the problem of the transition between the fish and the Amphibia. During the next ten years he carried out a series of investigations on the development of urodele amphibians. These studies, together with a survey of much relevant palaeontological information, are incorporated in the present volume.

Aspects of urodele development take up nearly half of the book. This certainly provides the first account in English of a large and important volume of recent research by several Russian workers. Nevertheless, it appears only occasionally to be relevant to the problem of the evolution of the Palaeozoic amphibians from the fish—unless it is assumed, without real justification, that the living and the Palaeozoic Amphibia were closely alike in details of development, soft-part anatomy and physiology. Because of illness, Schmalhausen was unable to include a similar section on anuran development. It is therefore not even possible to gain an understanding of the comparative ontogeny of these two modern groups. Such a comparative account would have been useful in view of the current reconsideration of the possible monophyly or polyphyly of the modern Amphibia. Furthermore, though Williams's important 1959 paper on the development of modern amphibian vertebrae is included in the bibliography, his results and views are neither mentioned in the text nor taken into account.

The remainder of the book, dealing directly with the evolution of the Amphibia, is well written and frequently stimulating and original. For example, Schmalhausen demolishes the idea that early amphibians could have perceived sound vibrations travelling from the ground via the limbs to the inner ear, and points out that the new adaptive features of the labyrinthodont middle ear imply that a new method of hearing (that is, through the air) was now being used. He also notes a number of similarities between the microsaur and the Urodela and Apoda, and suggests that the microsaur may be the ancestors of these living groups. Schmalhausen, however, also accepts the view that the Anura are only distantly related to the Urodela and Apoda, having evolved from the labyrinthodonts. He therefore believes that the features found in both the Anura and the Urodela are themselves evidence of the monophyletic origin of the Amphibia as a whole.

This question of the monophyly or diphyly of modern amphibians is one of a number of subjects on which Schmalhausen's views will seem a little dated to those familiar with the papers by such workers as Carroll, Panchen, Parsons and Williams, Romer, Szarski and Thomson, published in the last few years. It should be remembered, however, that the Russian edition of Schmalhausen's book appeared in 1964, and his views on amphibian history were originally published in 1957, also in Russian. Therefore, though this is for most Western workers their first opportunity to read an extended account of Schmalhausen's theories, these do in fact predate all these recent publications, and have in many cases influenced them. Though many workers would disagree with various aspects of his views, Schmalhausen's book does contain a coherent and self-consistent theory of the way in which the vertebrates may have solved the many problems involved in the most difficult ecological transition in their history.

The translation and editing are so good that one is hardly ever aware that one is reading a book in translation. On the other hand, even though the book is well produced and contains 165 figures, its price does seem somewhat high.

BARRY COX

ESTUARINE ANIMALS

Biology of Estuarine Animals

By J. Green. (Biology Series.) Pp. x+401. (Sidgwick and Jackson: London, 1968.) 21s.

THE series in which this work is the latest title is intended to provide broad accounts of subjects not covered adequately in basic textbooks; Dr Green's contribution fulfils this intention admirably. He defines estuaries broadly enough to include brackish or inland seas and hypersaline lagoons, and takes as many examples from