exact information about the sensation . . . ." Accordingly, Wright's interests, reflected in this book, have extended well beyond classical colorimetry to the use of color in art and television, the teaching of color in schools, and the practical and theoretical problems presented by color-defective vision.

The difficult problem raised by the colored appearance of objects provides a recurring theme for some of the nine essays of this slim volume. Is it possible that the man in the street is right to believe what he sees? Wright struggles hard to find a proper basis for restoring color to the object. He notes that the main task of vision, for which color is not necessary, is to render objects visible. Although the initial basis for color vision does lie in the spectral modification of light by the object—just as Newton discerned—such modified light is far from the only basis for color perception. Somehow, Wright says, color projects back out to, is modified by, and becomes an inherent property of the object.

Most of the book consists of the texts of invited lectures delivered from 1951 to 1966; it is easy to see why Wright is so often asked to speak. His remarks are lucid and reflect his enthusiasm for a subject with which he has had more than 40 years of experience. Most of the material will be readily understood by the nonexpert. The lectures point more to problems than solutions, since they do not attempt to deal with a large percentage of the experimental evidence bearing upon the topics discussed.

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Evolution of the Amphibia

The Origin of Terrestrial Vertebrates. I. I. SCHMALHAUSEN. Translated from the Russian edition (Moscow, 1964) by Leon Kelso. Keith Stewart Thomson, Ed. Academic Press, New York, 1968. xxii + 314 pp., illus. $15.

I. I. Schmalhausen, who died in 1963 after more than half a century of scientific productivity, was unquestionably one of the outstanding morphologists and evolutionary biologists of the present century. His valuable researches have not, however, received the general recognition they deserve. The reason is linguistic. In recent decades the centers of research in this subject have been in the English-speaking world, whereas most of Schmalhausen's works have been available only in Russian—a language which, lamentably, is a sealed book to most of us of the older generation of workers in the field. It is thus fortunate that in the present translation of his last major publication we have available an English summary of his work and thoughts on the origins of vertebrate land life. This important evolutionary topic has been of interest to many English and American workers, such as Watson and Gregory, and I myself have devoted much of my scientific career to this topic. Most of us, however, have been primarily concerned with the paleontological side of the subject; it is thus refreshing to have the field reviewed by an able man who has concentrated on a very different aspect—the evolutionary implications gained from a study of the ontogeny and morphology of the surviving amphibian orders.

The first third of the volume is devoted to a summary of the paleontological evidence of the fish-amphibian transition. Here Schmalhausen has to rely on the literature, and while his summary is highly interesting and stimulating, he labors under the handicaps necessarily experienced by one not actively engaged in the field, and adopts here and there viewpoints now badly "dated," or at least abandoned by a majority of current workers.

Despite Goodrich's clear demonstration of the palaeoniscoid resemblances of *Polypterus* (with which he agrees), and the numerous anatomical and ontogenetic features which he cites as linking lungfishes and crossopterygians, Schmalhausen nevertheless deviates from general usage and follows the specialized nomenclature of the Stockholm school in placing *Polypterus* in a distinct major group Brachyopterygii and separating Dipnoi widely from Crossopterygii. Watson has, of course, been one of the most distinguished students of fossil amphibians. But in accepting his beliefs in the special relationship of *Amphibamus* to frogs and his claims that in embolomeres the fenestra ovalis was absent and the shoulder girdle connected with the skull, Schmalhausen has failed to catch up with the more recent studies which show that in these regards Watson was incorrect.

Some decades ago, the nomenclature of the bones of the crossopterygian skull roof was much debated. It was once generally held that, for example, the bones surrounding the pineal foramen in crossopterygians were equivalent to the tetrapod frontals, rather than to the partietals which enclose this opening in all higher vertebrates. Thirty years ago Westoll showed convincingly that the crossopterygian bones are actually the parietals and that the seeming confusion is due to a shift in proportions of skull regions and roofing elements. Almost all recent students of fossil tetrapods have accepted Westoll's conclusions. Schmalhausen argues for the older view; but his arguments are not convincing.

Two-thirds of the volume is centered on the living amphibian orders and their origins. The anurans and apodans are treated but briefly; on the other hand, there is an extended discussion of urodele morphogenesis and the bearing of the findings here on urodele origins. Treated in detail are the external gills, the circulatory system of the head, the lateral line system, the nasal apparatus, the ear, chondrocranium, and bony skull. Among the points of interest are the theses that the venous system is functionally important in amphibian hearing and that the lacrimal duct is derived partly from the posterior external fish nostril and partly from the infraorbital lateral line canal. Schmalhausen believes that the living orders are ultimately of labyrinthodont derivation, but is uncertain (as are paleontological workers) as to the intermediate stages, although suggesting the microsaurs as transitional to urodeles and apodans. In various places he points out basic similarities, despite marked adaptive differences, between frogs and urodeles; he does not, however, press this argument to the point of advocating, as Parsons and Williams have recently done, a common origin for these two modern orders. Today, advocacy of polyphyletic origins for various groups is a popular theme. Holmgren, Säve-Söderbergh, and Jarvik in succession have proposed a dual origin for tetrapods. Schmalhausen discusses this possibility and on reasonable grounds rejects, quite properly, I believe, the polyphyletic argument.

The transition between the Paleozoic amphibians and the "modernized" forms is almost completely a blank; Schmalhausen makes the interesting suggestion that Mesozoic survival of amphibians despite reptilian competition was due to their inhabiting (as they do today) colder and mountainous regions where reptiles could not flourish.

I have pointed out above that Schmalhausen's discussion of paleontological data shows some lack of familiarity with the recent literature, and the lack of a consideration of anuran ontogeny and structure comparable to his treatment of the urodeles is to be regretted. But even so this volume is of extreme value, worthy of the thoughtful study of every student of vertebrate evolution, and remains a lasting monument to the memory of a great Russian morphologist.

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Cell Components

The Biogenesis of Mitochondria. D. B. RODYN and D. WILKIE. Methuen, London, 1968 (distributed in the U.S. by Barnes and Noble, New York). viii + 123 pp., illus. $4. Methuen's Monographs on Biological Subjects.

Although Ephrussi, the Mitchells, and others established over 15 years ago that fungi contain cytoplasmic determinants which possess hereditary information related to mitochondrial function, it was probably the finding of DNA within mitochondria, Luck's work on the mode of mitochondrial replication, that stimulated current research in this area. As a result of the intensive research of the last few years, ideas have crystallized and a central dogma has emerged. Mitochondria are semiautonomous and carry out some biosynthesis necessary for their own replication. Mitochondria have been now demonstrated to contain most of the components necessary for synthesis of DNA, RNA, and protein. Strangely enough, it appears as if chromosomal genes code for the large majority of mitochondrial proteins, whereas mitochondrial DNA appears to encode a limited number of their "structural" proteins and possibly some of their ribosomal components.

Although numerous symposia are devoted either completely or in part to these problems, it seems timely to attempt a summary statement in the form of a modern textbook. Roodyn and Wilkie fill this need with their lucid and unified monograph. This book is not an extensive review of the literature, but is devoted primarily to describing some of the major lines of investigation currently under way. In some cases an overall view was acquired by integrating some of the older, "classical" genetic studies with up-to-date material. The authors divide their treatment into two sections: the first concerns biochemical and cytological aspects and the second concerns genetic and regulatory aspects. There are sufficient cross references to help interconnect much of the material obtained with diverse techniques.

The book is intended for graduate and advanced undergraduate students in biology, and could be used as a supplement in advanced courses or as a basic text for a seminar course. Nonspecialists and those with a peripheral interest will find it an excellent introduction and inventory of the field.

The authors are so active in the field that they yielded to the temptation of giving considerable space to some minor problems from their laboratory. Apart from this, the balance of the book is good. Some statements may be oversimplified, such as the "lack of an inner membrane" and the "effective loss of mitochondrial DNA" from mitochondria of ρ^- yeast. Nevertheless, the book as a whole is critical, authoritative, and surprisingly up-to-date for a field which is rapidly changing. Readers may find the chapter on the effects of antibiotics on mitochondrial synthesis especially intriguing. The cytoplasmic inheritance of antibiotic resistance and its possible relationship to mitochondrial ribosomes may prove to be a major avenue of approach for future studies. The low price is an additional incentive for acquiring this book for your personal library.

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Metal Compounds

Interstitial Alloys. H. J. GOLDSCHMIDT. Plenum, New York; Butterworths, London, 1967. viii + 632 pp., illus. $40.

As would be expected from one who had devoted most of his work to the subject, Goldschmidt has produced a mine of information on interstitial compounds which is painstakingly stocked with data, diagrams, and references, the only serious omission being the convenience of a formula index. The inclusion of a chapter on silicides is useful for analogy with borides, although most silicides are not normally considered as interstitial compounds. The book can be highly recommended as a source of considered information and reference.

It is essentially a practical man's book and as such is beyond criticism, but in searching for ideas the reader might wish for recognition of and explicit theoretical discussion of various features in terms of known energy band forms and the like. For example, Goldschmidt regards it as a borderline case whether oxygen ever enters an array of metal atoms interstitially with its covalent size (radius 0.66 Å) or only with its ionic size (radius 1.3 to 1.4 Å), but definitely accepts oxygen as an interstitial atom in the lower oxides of the transition metals. He states, for instance, that O in TiO has a radius of about 0.7 Å (p. 350), but does not give the explicit justification of this contention that would seem to be called for in view of the known form of the band structure of TiO, its metallic conductivity by electrons in *d* bands, and the fact that the Ti^{2+} and O^{2-} ionic-radii sums also account for the observed interatomic distance. Or as a second example, there is considerable evidence that can be interpreted conveniently if it is assumed that C and N increase the electron number of Group IV to VI transition metals in their carbides and nitrides. However, the statement (p. 353 and elsewhere) that "the interstitial atom acts as an electron donor to the *d* orbital of the [transition] metal" is unconvincing in view of the high electronegativity of the N atom, and a justification of how this can occur in terms of plausible energy band structures would be more satisfying.

One of the things that one might have hoped to find in the book, in view of all the work recently done in Russia, is an assessment of the reliability of the electron diffraction method for determining the structures of carbides and nitrides. Although scattering factors are favorable, the method involves various difficulties; however, electron diffraction is not discussed as a method of investigation.

Overall this is a good book and we must thank the author for his efforts, for it will save us much time as a source of reference. It will join the other metals reference books such as those by Hansen and by Pearson.

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