of social reality by the entire structure of language and conceptualization. When the bloody struggle to register Blacks in the South becomes the frictionless "extension" of the franchise, a mechanical way of viewing *all* social change is implicitly communicated.

The myth-consecrating impulse among some sociologists has recently found its ideological justification in an article, published elsewhere, by Talcott Parsons and Charles Ackerman, where we are told: "The 'facts' of science are myths. This is not a new thought. It is, however, one whose implications for theory-building have not always been recognized; we believe that they must be." Perhaps this formulation is a sign that Parsons has lately become aware of the mythological character of his own work. In any event, the rest of us should. As if much in the body of this work were not enough to lend disturbing substance to Nicolaus' charge that many sociologists are propagandists for the American *status quo*, Parsons adds a certain literalness to this in his preface (p. xviii) by explaining that "The chapters of this book stem from materials prepared for the *Forum* series of the Voice of America."

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Mechanics of Support and Motion

Animal Locomotion. JAMES GRAY. Norton, New York, 1968. xiv + 479 pp., illus. $15. The World Naturalist.

Most of the research ever done on animal locomotion has come from Britain, most British research on locomotion has been done at Cambridge, and no one anywhere has contributed as much to the field as Sir James Gray of Kings College. Now, in an active retirement, Gray has written a major book which will long be a valued reference.

A background is assumed in systematics and anatomy (particularly of vertebrates and arthropods), algebra and trigonometry, and basic mechanics, particularly of resolution and components of forces, torque, and fluids in motion. A short introductory chapter presents Newton's laws and then, skipping the relation of muscle force to gross and fine structure, comments on power, energy, and efficiency. Six chapters on aspects of the locomotion of fishes and amphibians—Gray's principal research materials—are excellent presentations of both experimental and theoretical work. The chapter on reptiles stresses snakes. That on birds is one of several that are in part difficult to follow. The long chapter on mammals, a class not studied at Cambridge, is perhaps least satisfactory. Too much is covered too superficially for the discussion to be entirely accurate or to provide continuity and insight. The treatment of gaits is limited to the classic, but now dated, books by Muybridge and Howell. In one chapter on terrestrial arthropods Gray relates waves of limb movements to displacement, forces, and footfalls; in another, S. M. Manton herself writes a summary of her many outstanding contributions to the description, analysis, and functional interpretation of arthropod locomotion. Other chapters are about annelids, nemerteans, and mollusks, but even the locomotion of fibroblasts is included.

Understandably, emphasis is given to the author's own contributions and to those of his associates: R. Bainbridge, O. R. Barclay, R. H. J. Brown, J. E. Harris, A. V. Hill, H. W. Lissman, and others. Specialists will recognize that the book weaves together papers previously published. Gray disclaims thorough, even, or inclusive coverage of his vast subject; "Studies in Animal Locomotion" might have been a more apt title. Climbing per se, digging (except by some arthropods), insect flight, and locomotion in most invertebrate taxa are omitted.

The book suffers from organization along systematic instead of functional lines. Thus, gliding amphibians, flying reptiles, bats, and birds are treated in separate chapters, and several modes of swimming appear again and again. Forces between whole animals and their environments are stressed, with frequent attention to posture and equilibrium. Consequences of the inertia of oscillating systems are mentioned but not emphasized; levers are usually presented as weightless. Similarities among animals are noted repeatedly (for example, the myopodia of nemerteans and the coils of the sidewinder, and undulations of sperm, snake, and eel). The overall impression is of a progression of exercises based on the mathematical description of representative situations. Gray largely leaves to the reader the task of relating his subject to evolution and to the fine points of structural and functional adaptation.

The bibliography of 312 titles will be of great value to all who study animal locomotion. Unfortunately it omits several papers cited in text and includes incomplete citations. Some omissions are puzzling: despite Gray's studies in the mechanics of support, E. J. Slijper's pioneering monograph on the spine, B. Kummer's contributions, and principles developed in these papers are neglected. The 17 papers on animal locomotion by P. Magna de la Croix are not credited.

One must be impressed by the scope and scholarship of this book. Gray notes the great demands placed on the sensory apparatus, makes notable contributions to the understanding of the complex neurocontrol mechanism, and impresses the reader that coordination of the response system is intricate almost beyond belief. In this able summary of the major part of a distinguished career, it would have been welcome had he let a sense of awe and wonder subtly show now and again among the formulas.

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A Disposition of Objects

The Rays Are Not Coloured. Essays on the Science of Vision and Colour. W. D. WRIGHT. Elsevier, New York, 1968. x + 154 pp., illus. $5.95.

Newton first understood, more than 200 years ago, that "the Rays to speak properly are not coloured," and "Colours in the Object are nothing but a Disposition to reflect this or that sort of Rays more copiously than the rest . . . ." Yet color seems so compellingly to be a property of an object that few among us doubt the obvious. Indeed, the insights of Newton, supported by two centuries of scientific elaboration, are not fully appreciated even by the practitioners of color, such as the artist and the paint manufacturer, let alone the man in the street.

W. D. Wright is a physicist and one of the fathers of the CIE (Commission Internationale de l'Éclairage) system of color specification. Despite the proven usefulness of this system, Wright admits (pp. 126–27) that it "does not give precise information about the spectral composition of the light [or] any

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.