coveries" made by Lysenko's followers were forgeries. My personal opinion (Medvedev does not raise this issue) is that Lysenko himself was not a deliberate faker—he was a fanatic who deluded himself as well as others. Some of his "discoveries" were too farfetched and useless to be worth forging. An example is his declaration that cuckoo chicks arise by a kind of mutation from songbird eggs. He cannot, however, escape the responsibility for having created a milieu which invited and glorified forgeries. This is what academician Sakharov meant by "infamous pages in the development of Soviet science." Medvedev deserves admiration for his courageous and scrupulous recording of the contents of these pages for his contemporaries and for history. Those who fail to learn from history are bound to repeat it.

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Epiphysis Cerebri

The Pineal. RICHARD J. WURTMAN, JULIUS AXELROD, and DOUGLAS E. KELLY. Academic Press, New York, 1968. xii + 204 pp., illus. $11.50.

Although it has photosensory capacities in some lower animals, an embryological derivation primarily from the central nervous system, and endocrine characteristics among adults of many higher vertebrate animals, the pineal has received scant attention from specialists in sensory physiology, vertebrate neurology, or endocrinology. A wealth of diverse discoveries during the past 15 years reveals the pineal organ, or epiphysis cerebri, to be worthy of attention as probably functionally significant within these three realms. The present review by Wurtman, Axelrod, and Kelly "attempts to summarize the present state of knowledge on pineal organs, and to suggest areas where further investigation might be profitable." Each of the authors has contributed notably to the investigation of the pineal, and in the present volume they organize their own related discoveries into a compact survey. The authors state in their preface, "Although most of the chapters are the creation of a single author, each of us has reviewed the work as a whole and accepts responsibility for its contents." Nevertheless, the contents and presentations of the chapters are strongly influenced by the interests and opinions of the individual authors.

A brief review of pineal anatomy and evolution with major attention to results from descriptive electron microscopy forms the first chapter. Terseness and specialized descriptions may pose difficulties here for the less well prepared reader. Eleven full-page electron micrographs in this chapter are all of excellent quality and manifest significance.

Pineal biochemistry, pharmacology, and photic relations, which constitute the area in which the greatest advances and some unresolved disagreements have occurred in recent work, are the subjects of the next three chapters. The accent is on the pineal's content of 5-hydroxytryptamine, melatonin, noradrenaline, and related amines. Although some errors (as in table 2, p. 57) of citation, statement, or implication can be found, the overall result remains a stimulating and logically developed account.

Pineal physiology and the human pineal and its diseases are the subjects of the last two chapters. These are the briefest and weakest ones, and ones on whose subjects important findings have been more fragmentary and have been made at a slower rate. These final chapters also epitomize the relatively scant attention paid by the authors to articles published in languages other than English. Extensive work by several European schools deserves better coverage.

As a summary of present knowledge of pineal organs this book is far from complete or definitive. It is, however, in many respects more detailed and more likely to be conducive to further research than other books on the subject. For these reasons its utility should become evident, and it should acquire a grateful readership.

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Life in the Cold and Wet

The Biology of Marine Mammals. HARALD T. ANDERSEN, Ed. Academic Press, New York, 1969. xiv + 514 pp., illus. $21.50.

The sea is a hostile environment for warm-blooded, air-breathing mammals. The chilling power of cold water is readily appreciated by anyone who has fallen into winter seas, and air breathing is a decided inconvenience to a predator seeking its prey in a three-dimensional world of water. A biologist who had studied only terrestrial species might conclude mammals could not live in the sea, but there they are in both diversity and number. And it is inevitable that they should receive attention both from scientists and from publishers.

Porpoises and whales in particular have a popularity which spans a period from early mythology through Moby Dick to modern television. This has resulted in a copious fringe literature which entertains the public and annoys scientists. We must frequently admit to disappointed questioners that we really don't know if porpoises can play chess. This separation of fact from hypothesis, both reasonable and wild, will continue to be a problem for the general reader. It is even a problem in the serious scientific literature.

The Biology of Marine Mammals edited by Harald Andersen has the strengths and weaknesses of a volume with many contributors. The chapters are as illuminating as the individuals writing them. Several of the chapters show little change from previous treatment of their subjects by the same authors. This is probably inevitable, but one should realize that perhaps only half the material in this book is original. In spite of this it is a pleasure to read again such repeats as Irving on temperature regulation.

Porpoises are very different from man. Only by extended observation and experiment can one perhaps begin to think like one. A chapter on the general aspects of communication (Evans and Bastian) shows the fruitful results of such extended looking at pinnipeds and cetaceans.

Hertel attempts a treatment of swimming based on modern tow-tank hydrodynamics. From the usual grist of models and Reynolds numbers, he "shows" that a porpoise shape has a lower drag than that of a tuna fish. In the real world the tuna apparently doesn't know this and swims twice as fast as the supposedly better-designed porpoise. The extrapolation from a towing tank to a live swimming animal in nature is a great one, and Hertel's treatment, although learned, does not illuminate the subject significantly. Final answers may come only from instrumented animals.

The rarity of solid data on marine

mammals feeds the temptation to extrapolate beyond what we know. Observations show that many small cetaceans can swim at a speed of 18 to 20 knots. This is more than engineers think they ought to and is known as "Grey's paradox." From this volume one gathers that the animals achieve this speed by a low-drag shape and skin properties that encourage laminar flow. But another alternative, not cited here, is that the porpoise "puts more coal on the fire" and thus has more energy to expend in reaching this speed.

The diving of these animals is equally fascinating, and our understanding of it is equally hazy. We know that whales and seals can dive down several thousand feet. Whales tangle in telegraph cables, and Weddell seals have obligingly carried depth time recorders which they later returned. But the means used by the diving animal to sustain the temporary oxygen deprivation is not clear. We don't know if the lungs are at all functional at a depth corresponding to 100 atmospheres pressure. Thus much of the explanation offered in this book by Kooyman and Andersen is speculative. It may remain so for some time because of the elusive nature of the experimental material. Most of the book is in this vein of intelligent best guesses. There is also a solid contribution of conventional natural history by R. J. Harrison.

Evolution shows some of its most fascinating workings in environments that produce great stress. The sea is surely such a one for mammals. This volume offers a good sampling of current work and thinking on the biology of these animals.

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The History of Fishes

Current Problems of Lower Vertebrate Phylogeny. Proceedings of the fourth Nobel Symposium, Stockholm, 1967. TOR ØRVIG, Ed. Interscience (Wiley), New York; Almqvist and Wiksell, Stockholm, 1968. 540 pp., illus. $35.

In no area of vertebrate paleontology is work more active than in the early history of fishes, and in no area are there more points of controversy. Many of these debatable topics are discussed, pro and con, in the present volume. Although there is no specific statement to this effect, it is obvious that the Nobel Symposium was essentially a gathering to honor Eric Stensiö, whose major works on ostracoderms ushered in the modern period of study of fossil fishes. Stensiö, although nominally retired, is still active, and work at the Stockholm Museum is being carried forward by Jarvik and Ørvig.

Opinions on the relationships and phylogeny of fish groups held by the Stockholm school differ strongly in many regards from those of a majority of workers from other countries. The points of view held by Stensiö and his colleagues on various debatable problems are fully set forth in a paper by Jarvik which concludes this volume. The organizers of the symposium are to be congratulated for their breadth of vision in inviting a broad array of paleoichthyologists of highly varied beliefs, so that all major points at issue could be fully aired.

Marked differences of opinion are present in the consideration of every major fish group, from the jawless ostracoderms and cyclostomes to the "highest" bony fishes. Among ostracoderms, Stensiö demonstrated clearly in his classic work of 1927 that the cephalaspids and anaspids of the Silurian and Devonian are allied to the modern lampreys. He believed, however, that the hag fishes are not at all closely related to the lampreys, but descended from a very different ostracoderm group, the Heterostraci. Many paleontologists have disagreed with this conclusion; Stensiö, however, has adhered to his early belief, and in the present volume argues ingeniously, by hypothetical restorations of the unknown internal structure of heterostracans, in defense of his belief.

Oldest of known jawed vertebrates are the acanthodians. Watson believed them primitive in the absence of bracing of the jaw joint by the hyomandibular. More recent work, however, has shown that this is not the case; in this volume Miles, most recent worker on the group, gives further information concerning these interesting and problematical little fishes. He believes that they have broad phylogenetic relations with the bony fishes. In another symposium paper, however, Nelson discusses the gill-arch structure of the group, and votes for elasmobranch relationship.

Prominent in the Devonian fish world are the Placodermi, curious armored types of which the Arthrodira are the most abundant. Arthrodires are abundant in all Devonian horizons. Stratigraphically, their history has seemed clear. The early forms have large pectoral spines, with but little development of a movable fin behind the spine. In the Middle Devonian, the spines are generally smaller and there is a modestly developed pectoral fin. Toward the end of the period, the spine is much reduced, and even the spinal bone may be lost, and the pectoral fin is broadly expanded. In recent years, however, Stensiö has advocated a theory of arthrodire evolution, flatly opposed to the stratigraphic evidence and to the beliefs of most workers, to the effect that the most primitive arthrodires are the broad-finned late Devonian types lacking the spinal bone entirely, and that the earlier, spine-bearing arthrodires are specialized. This topic is not treated in detail in the symposium volume, but Heintz points out that at least two familiar forms which Stensiö has included in his supposed primitive group of "Aspinothoracidi" do possess spinal elements; Stensiö admits that at least some revision of his classification is called for.

Of the living cartilaginous jawed fishes, it is quite possible that the elasmobranchs are of placoderm origin, but there is no positive evidence. Many workers are of the opinion that the chimaeras (Holocephali) are definitely of placoderm ancestry. There are, however, two contrasting theories as to the path of descent. One, suggested long ago and most recently advocated by Ørvig, is that the connecting limbs are the ptyctodonts, late Devonian placoderms with powerful jaws. A second theory, recently proposed by Patterson, is that the transitional forms lie among the bradyodonts, the "pavement-toothed sharks" of the late Paleozoic. In the present volume, Patterson maintains this thesis, discussing particularly the Permian bradyodont *Menaspis;* Bendix-Almgreen, on the other hand, in a discussion of bradyodonts, expresses skepticism as to their chimaeroid relationships.

Among the higher bony fish groups, the Dipnoi, or lungfishes, are of perpetual interest. In earlier days they were advocated as ancestors of land vertebrates because of their notable similarity to lower tetrapods in mode of development and in many features of their soft anatomy. It is now agreed