behavioral organization. Yet we need not be overly concerned that Victor's case may be closed without all the data being in. My own sense is that he had a central language disorder and took to the woods relatively late in life, but it is nice that there may be some historical riddles that will continue to suggest new hypotheses as our conceptual systems and knowledge expand.

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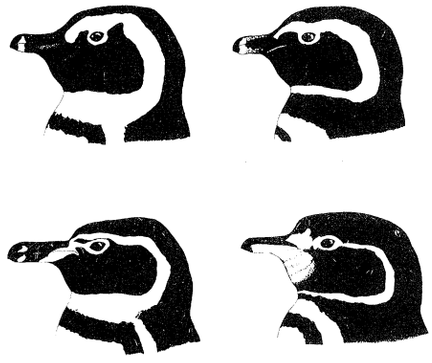
An Unusual Order of Birds

Penguins. Past and Present, Here and There. GEORGE GAYLORD SIMPSON. Yale University Press, New Haven, Conn., 1976. xii, 150 pp., illus. + plates. $10.

George Gaylord Simpson, interpreter of evolution, has written a love story about his 43-year affair with penguins. It is aimed at the biologically unsophisticated reader and tells in nontechnical language everything you want to know about these highly specialized aquatic birds.

Simpson's specialty is fossil mammals, but in the course of searching for Miocene mammal skeletons in Patagonia in 1933 he stumbled on the largest single collection of fossil penguin bones that has ever been found. He offered the fossils to a number of ornithologists to study, but since they were not osteologists they declined, and he took on the job himself. His 1946 monograph stands as a landmark in penguin study, and he has subsequently written several other papers on fossil penguins. On his travels all over the Southern Hemisphere he has seen most of the 18-odd species of living penguins. He has also read widely about living penguins, and distillations of that published material constitute the subject matter for most of the chapters of this book.

Simpson contributed the chapter on fossils to a recent technical symposium on penguins (*The Biology of Penguins*, edited by Bernard Stonehouse; reviewed in *Science*, 8 August 1975) and has drawn heavily on that volume. I had expected that his chapter on fossil penguins in the present volume would be more enlightening about their appearance. But it seems that fossil penguins, which date back some 40 million years and some of which may have weighed 300 pounds, left only wing and leg bones and provide no evidence linking them closely with any other order of birds. Anyway Simpson is intrigued with the history of European discovery of living penguins, their names, morphology, biology, and distribution. His account hangs together well, and he has a fine common touch that makes his firsthand presentation of biological principles easily comprehensible. He brings the account right up to the present by showing that, although penguins have fared pretty well in their encounters with man, oil spills by supertankers that now regularly round the Cape of Good Hope threaten the survival of South Africa's blackfooted penguins.



Recognition marks of penguins of the genus *Spheniscus*. Clockwise from upper left: *S. demersus*, the African penguin, commonly called the blackfooted penguin; *S. magellanicus*, the magellanic penguin; *S. mendiculus*, the Galápagos penguin; *S. humboldti*, the Peruvian penguin, sometimes called the Humboldt penguin. "The four species . . . are so much alike that their separation must have occurred fairly recently. . . . Surprise has been expressed that the Galápagos penguins should differ from the Peruvians and resemble the magellanics when it is highly likely that they are more closely related to the Peruvians. However . . . the biological need, and hence the impact of selection, was just to distinguish . . . Peruvian and Galápagos . . ., not to distinguish Galápagos and magellanics, which were not emerging from the same common ancestry and have never been in contact as developed species." [From *Penguins: Past and Present, Here and There*]

All the living species are illustrated in color or black-and-white photographs, and head studies are included to show recognition marks. A few of the photographs are good, but many are prosaic frontal or profile portraits. The book is marred by a few typographical errors and inaccuracies, a figure transposition, and crudely drawn distribution maps. But it is certainly worth reading. There are few 150-page biology books that present so much so well.

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The Family Sphecidae

Sphecid Wasps of the World. A Generic Revision. R. M. BOHART and A. S. MENKE in collaboration with H. S. Court, F. D. Parker, E. E. Grissell, and D. P. Levin. University of California Press, Berkeley, 1976. x, 696 pp., illus. $42.50.

Workers on the stinging Hymenoptera have looked forward to the publication of this volume, which has absorbed 12 years of the authors' time. The book deals with a group of wasps that is not only one of the largest (7634 species in 226 genera are listed) but also one of the most diverse, morphologically and behaviorally. A comprehensive survey of this group, considering all the scattered information that is available, thus not only should be of significance to wasp specialists, but should also serve as a model for similar studies of other groups of organisms. In many ways this book fulfills these expectations, although some aspects are disappointing.

The initial sections, dealing briefly with general sphecid behavior, zoogeography, morphology, and systematics, will be the most useful for nonspecialists. The morphology section, which includes a glossary, will be particularly useful, since the terminology for wasp structure is still unsettled. (It is unfortunate that the authors have chosen to use "gaster" for the "definitive abdomen," however, since this term has a different meaning when applied elsewhere in the Hymenoptera.) The remainder of the book consists of detailed and well-illustrated treatments of each of the 11 subfamilies, including general discussions of characteristics, systematics, and biology for subfamilies, tribes, and subtribes, keys down to genus, and for each genus a description, an account of systematics, distribution, and biology, and a checklist of species. This is information that is fundamental to any further study of the systematics or biology of any sphecid wasp, and the present compilation should provide a stimulus for further broad-based revisionary studies, not only of sphecids but also of other insect groups. Similar treatments of other hymenopterous groups, at least, would be extremely useful, and insect systematists in general should be grateful for the lead given by these authors.

In view of the significance of this work, which will undoubtedly be regarded as the standard work on sphecids for decades to come, it is a pity that the authors have adopted such a conservative approach, both in methods

used and in types of data considered. Phylogenies are apparently intuitive and not based on strict cladistic principles. There is virtually no attempt at quantification, the few numerical analyses being crude in the extreme. The characters considered are essentially restricted to the external morphology of adults; immatures are almost ignored although a fair amount is known about a variety of larvae. As a result, a few disagreements between the present classification and an earlier one based on larvae by Evans are glossed over. The authors' conservatism is further evident from the reasons given for rejecting a division of the group into a number of families which would be more nearly equivalent to the families of bees and other stinging Hymenoptera: "Even subfamilies are difficult to delimit except on a local basis, and it is only when we reach the level of the tribe that the subdivisions become readily definable" (p. 33). This surely begs the question, since ease of delimitation is by no means the most important consideration for family status; bees, for example, are often easier to key to genus than to family. The authors have thus missed the opportunity of creating an innovative and exciting work of modern systematics and have instead produced a book which is merely essential. Perhaps that is enough.

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Respiratory Adaptations

Respiration of Amphibious Vertebrates. Papers from a symposium, Bhagalpur, Bihar, India, Oct. 1974. G. M. HUGHES, Ed. Academic Press, New York, 1976. xx, 402 pp., illus. $29.75.

In the 17 papers collected in this book amphibious respiration, a mode of respiration in animals that partially or entirely emerge from the water to exchange gas with the atmosphere, is described from many points of view, morphological, physiological, behavioral, ecological, and evolutionary. The last approach is particularly interesting, since the ancestral vertebrates that made the transition from an aquatic to a terrestrial environment presumably possessed some of the many adaptations to air breathing here described.

The differences between air and water as respiratory media are considerable, as is pointed out by Dejours and by Rahn and Howell. Apart from factors such as viscosity, density, caloric capacity, and heat conductivity, oxygen and carbon dioxide behave differently in the two media. Oxygen capacitance in particular is much lower in water than in air, requiring relatively heavy energy expenditure for ventilation in aquatic breathing; carbon dioxide capacitance is approximately equal in air and water, but concentration in air is low, which makes small, air-filled respiratory spaces less suitable for carbon dioxide elimination in the absence of high rates of ventilation. Thus the functional requirements for aquatic and aerial respiration are opposed, and evaporative water loss in air breathing creates additional complications. Solutions to these problems have arisen independently in many groups, and the book deals with a wide spectrum of respiratory adaptations, from purely aquatic branchial respiration in dogfish (Scheid and Piiper), through truly amphibious respiration in fishes, amphibians, and sea snakes, to aerial respiration in amphibious reptiles (caiman, snapping turtle), whose ventilatory mechanisms are described by Gans. The overall picture emerging is a complicated one; almost any epithelial surface has been utilized by some vertebrate group for gas exchange, and parallel developments and convergences abound.

Most of the papers treat some aspect of bimodal respiration, in which oxygen is obtained through one respiratory organ (usually lungs, swim bladder, or accessory oral or pharyngeal structures) and carbon dioxide is released through another (most often gills or skin). A good review of the structure of teleost respiratory organs is given by Munshi; Hughes and Weibel use modern stereological techniques to describe the lung of the South American lungfish *Lepidosiren*. Satchell, describing the circulatory system of air-breathing fishes, clearly shows the intricate relationships between respiratory and other organ systems, implicitly providing an eloquent plea for an organismic approach to functional morphology. Graham explores a neglected field in a review of respiratory adaptations in marine fishes, contrasting these with freshwater teleost air breathers, which generally show higher degrees of specialization; he advances the hypothesis that amphibious behavior in freshwater forms is mainly a means of locating new aquatic habitats, and that the evolution of a highly amphibious freshwater fish fauna was prevented by the presence of terrestrial predators in and around bodies of fresh water.

In several papers the distinction between comparative treatment of recent groups and construction of phyletic lineages is obscured. This does not, however, detract from the value of the book as a complement to several recent texts on the comparative physiology of vertebrate respiration.

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Meteoritics

Handbook of Iron Meteorites. Their History, Distribution, Composition and Structure. VAGN F. BUCHWALD. Published for the Center for Meteorite Studies, Arizona State University, by University of California Press, Berkeley, 1976. Three volumes, in slipcase. Vol. 1, Iron Meteorites in General; Tables, Appendices, References. Vol. 2, Iron Meteorites: Abakan–Mejillones. Vol. 3, Iron Meteorites: Merceditas–Zerhamra; Supplement. xxiv, 1418 pp., illus. + indexes. $140.

Let it be said at the outset that this book is a formidable work and must be the product of extreme dedication. Any criticism made below should be considered with this fact in mind.

The first of the three volumes of the work is partly a general textbook on meteoritics and partly an introduction to the descriptions of almost 600 individual iron meteorites that constitute volumes 2 and 3.

Chapters 1 through 5 and chapter 12 in volume 1 cover relevant astronomical phenomena, physical phenomena related to meteorite falls and showers, meteorite craters and ages, and statistical and historical topics. These parts, apparently adopted from a university course, are simply, almost naively, written and are hardly intended for the specialist. Chapter 6, "Shapes and surface characteristics," is rather mixed. Some descriptions are almost artistic, and others, such as the discussion of features due to atmospheric heating, are highly technical classic metallography. It is worth noting that the author uses hardness data extensively and to great advantage.

In chapter 7, "Classification," stony and stony-iron meteorites are treated in about five pages. Irons appropriately are discussed in more detail, especially the correlation between the older structural classification and the current "chemical" system based on the content of nickel and some trace elements. The author wholeheartedly endorses the latter system, perhaps with too little critical