branches of mathematics aroused interest in their fundamental interconnections and principles; and Mehrtens believes that mathematicians had to secure their foundations in order to legitimize their subject for its part in *Allgemeinbildung*. We have a choice among, or a synthesis of, institutional, intellectual, and social explanations.

The contributors were not well served by their editors and publisher. The press reproduced the papers from typescript with little or no editorial intervention. The English of some German contributors is poor, and pompous claptrap abounds. An American professor writes: "The University of Berlin, founded in 1810, was relatively new when compared with older German universities, which traced their origins back to the Middle Ages."

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Inland Fishes

Fishes in North American Deserts. Papers from a symposium, Fort Worth, Texas, June 1980. ROBERT J. NAIMAN and DAVID L. SOLTZ, Eds. Wiley-Interscience, New York, 1981. xii, 552 pp., illus. $42.50.

"Desert fishes" may sound incongruous, but lying within the vast stretches of arid lands in the American Southwest are small, often ephemeral bodies of water, islands in a sea of sand and rock. The vertebrate inhabitants of these waters are primarily teleost fishes, the few remnants of a diverse Neogene-Pleistocene ichthyofauna. Interest in these fishes from an evolutionary perspective and the realization that the entire fauna is threatened with extinction have resulted in a great increase in attention from many quarters. In 1980, in concert with the American Society of Ichthyologists and Herpetologists, the editors organized a symposium to summarize the state of knowledge of American desert fishes. The chapters in the book fall into four major conceptual areas: the history of the geological areas and their faunas, ecology, desert fishes as models for the study of evolution, and conservation. The reader comes away from the book with increased conviction of the worth not just of the fishes but of the ecosystems, in economic, scientific, and aesthetic terms.

The history of these desert areas and of the fishes is summarized by M. L. Smith and R. R. Miller. The latter author presents a useful and detailed summary of the paleohydrology of southwestern deserts and of the history of the pupfishes, *Cyprinodon*. Aquatic ecology is dealt with by G. R. Smith, G. A. Cole, and R. J. Naiman. These papers describe many of the factors that make up the unique desert environment, including aquatic chemistry, thermal conditions, flow characteristics, and habitat size.

A large portion of the book is devoted to desert fishes as models for evolutionary study. Taken together these papers show that relatively little in the way of trenchant adaptation to the desert environment has occurred. The contributions of G. D. Constantz (life histories), A. Kodric-Brown (facultative changes in reproductive behavior), S. D. Gerking (stress responses in reproductive behavior), D. L. Soltz and M. F. Hirshfield (lack of differentiation in structural genes), C. R. Feldmeth (temperature tolerance), and S. D. Hillyard (energy metabolism and osmoregulation) show that the living fishes have survived by virtue of facultative behavioral and physiological adjustments. Fishes endowed by their ancestors with the appropriate tolerant constitution and the luck to be in permanent water have survived; fishes less well endowed or less lucky have failed.

Conservation is the dominant theme of authors E. P. Pister and J. D. Williams. Pister discusses the formation and role of the Desert Fishes Council, illustrating how concerned academics, government employees, and citizens can be effective in molding public policy and perceptions about conservation. Williams explains the ins and outs of the federal programs concerned with endangered species, although in the light of recent developments it remains to be seen how much of this protective structure will survive. A. A. Schoenherr discusses the effects of introduced exotic fishes on native desert fishes; he concludes that, contrary to popular opinion, exotics often eliminate native species not by competition for food resources but by predation and disruptive social interactions. R. J. Behnke's plea for the maintenance of genetic diversity is eloquent and should be read by fisheries biologists responsible for resource management.

This book has both the strengths and weaknesses of a symposium volume—experts discussing what they know best but with some unevenness in perception and writing ability. Some contributions are of highest quality, and a few could have been more tightly edited, shortened, or questioned with respect to fundamental assumptions. Nevertheless, as a summary of our immature but growing knowledge of desert fishes, the book deserves serious consideration.

Potential buyers should know that the book was apparently prepared on a word-processor and photo-offset and it does not have the look of a book this expensive. The book is available through the American Fisheries Society at a $7.50 discount.

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Chemical Senses

Biochemistry of Taste and Olfaction. Papers from a symposium, Philadelphia, Apr. 1980. ROBERT H. CAGAN and MORLEY R. KARE, Eds. Academic Press, New York, 1981. xxiv, 540 pp., illus. $38.50. Nutrition Foundation Monograph Series.

Despite the inherently chemical nature of gustation and olfaction, biochemists have avoided the study of these processes, preferring simpler systems where methods are well established and background literature is plentiful. However, with the development of modern analytical techniques, the mushrooming of literature in the neurosciences, and an increasing interest in nutrition and the palatability of foods, some biochemists and biochemically oriented investigators have begun serious research on taste and smell. In *Biochemistry of Taste and Olfaction*, a collection of papers from a symposium, investigators both present work from their own laboratories and review the relevant literature.

The first and second sections of the book deal with the receptor mechanisms of olfaction (six chapters) and taste (four chapters). Here, the term "receptor mechanisms" is somewhat confusing until one realizes that it is the receptor membrane, not the receptor cell, that is being discussed. The book begins with a well-developed paper by Gower, Hancock, and Bannister on the biochemistry of pig pheromones. The paper raises the possibility that androst-16-enes, or similar compounds, are involved in human social interactions. For example, it has been reported that the menstrual cycles of close female friends or of women living in residence halls become synchronized after a time, probably due to odor cues. In chapters 5 and 6, the major histocompatibility complex is treated with respect to its olfactory role. This is a special case of discrimination between

"self" and "nonself," for it has been proposed that histocompatibility genes direct the synthesis of odorants as well as of olfactory receptors. Understanding of the presumed olfactory-receptor proteins, of central importance to olfactory biochemistry, is at a primitive stage, as is shown in a paper by Price. Taste membrane-receptors, too, are not yet well understood at the molecular level, although the specificity of some receptors, particularly those for sweet taste, to sugars and other compounds is being characterized electrophysiologically. In chapter 10 Cagan describes an interesting experiment in which the isolation of an amino-acid taste receptor from catfish is attempted by the use of a covalent probe.

The third section (six chapters), Physicochemistry and Transduction, is somewhat vague in content as well as in title. The studies presented in this section deal largely with correlations between electrophysiological responses and models for gustatory and olfactory function. Hirsch and Margolis contribute a provocative paper on the isolation of olfactory epithelial cells, a technique that opens the way to meaningful biochemical work on olfactory mechanisms at the level of the sense cell. Also, Brand, Kron, and Senseman provide a coherent account of how intracellular calcium probably acts in taste-cell transduction.

A section on neurotransmitters (four chapters) deals mainly with the olfactory bulb and tubercle (Margolis, Quinn and Cagan, Krieger), with some mention of the efferent cholinergic enzymes of the taste receptors and olfactory bulb (Matschinsky, Godfrey, Ross, and Norfleet). It is disappointing that the problem of the identity of the presumed afferent neurotransmitter of the taste receptor cell is hardly addressed. However, the recent status of the dipeptide carnosine as a primary, afferent olfactory neurotransmitter is concisely reviewed by Margolis. In elucidating histochemically the cholinergic enzymes in taste buds and olfactory bulb, Matschinsky and colleagues establish further biochemical correlates of cholinergic early processing, which may characterize all higher sensory systems.

The book concludes with four short papers on "analogous chemoreceptors." These papers come from the laboratories of investigators who research simple biochemical systems: bacterial chemical sensing by Paoni, Maderis, and Koshland, glutathione-activated feeding response of hydra by Lenhoff, acetylcholine receptor vesicles by Hartig, Moore, and Raftery, and brain receptors by Pert and Herkenham. Although these papers introduce a certain discontinuity to the book's theme of chemoreceptor function of higher systems, they do increase the value of the book to the biochemist.

As a whole, the book is well worth reading. Discussions by the symposium participants at the end of each section are particularly helpful, and attempts that are made to relate chapters add a sense of continuity. Although a brief summary of relevant gustatory and olfactory morphology at the beginning of the book would have been useful, such information is available in individual papers. In all, the book is interesting, suggests new experiments to investigators initiated to the field, and will undoubtedly help draw young biochemists into the study of taste and olfaction.

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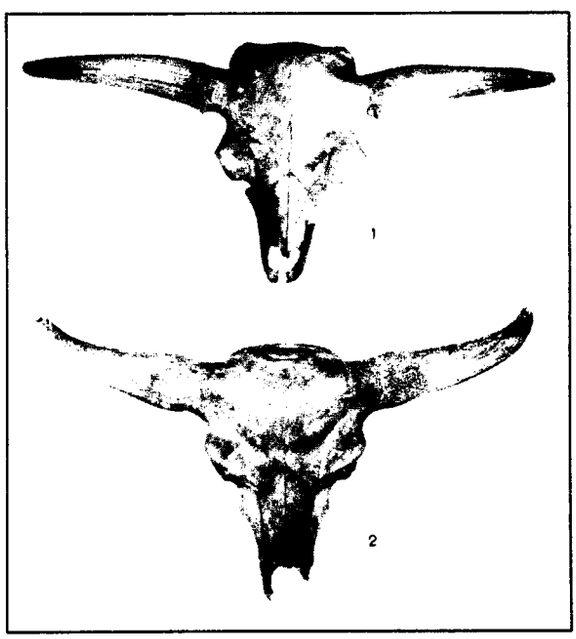
Evolution of a Mammal

North American Bison. Their Classification and Evolution. JERRY N. MCDONALD. University of California Press, Berkeley, 1981. viii, 316 pp., illus., + plates. $35.

Until fairly recently, most studies of extinct bison of North America have dealt with typological rather than biological species. The result has been proliferation in the literature of extinct species; the diagnostic characteristics of these species are usually the size, curvature, and roundness of the horn-cores. Horn-cores are the most variable element of the bison skeleton, and, though species-specific horn-core characters certainly did exist, most investigators have tended to ignore individual variation when describing new species. The problems have also been compounded by the fact that there is amazingly little variation in postcranial skeletal elements. New taxa have been established on the basis of supposed differences in these elements; however, they have not been taken seriously by most investigators.

McDonald treats extinct bison as biological species, attempts to explain morphological differences from a functional viewpoint, accounts for individual variation, and brings the evidence and techniques from many allied fields to bear on the problem. In short, he departs from the classical treatment of fossil bison.

After an introductory chapter, McDonald discusses the classification of North American bison. He recognizes five species as having been present in North America: *Bison priscus, Bison alaskensis, Bison latifrons, Bison antiquus,* and *Bison bison,* the first two being Eurasian autochthons and the last three North American. He then attempts to explain the morphological differences in the North American forms as features representing adaptation to the three dominant habitats of the Late Pleistocene (forest-woodland, savanna–wooded-steppe, and grassland). He sees *B. latifrons* (the largest form) as having been adapted to the forest-woodland habitat. He concludes that this species had the lowest biological potential and



"Locating and identifying the *Bison priscus* lectotype has been a . . . complicated process. . . . Most bison taxonomists accept Cuvier's 1825 figure as the type illustration for the taxon. Cuvier indicated that the figured specimen was in the University of Pavia. Vialli attempted to identify [it] among the Pavia bison and selected the top specimen. . . . The bottom skull, however, in the University of Turin, more strongly resembles Cuvier's figure and is here considered more likely the lectotype if, in fact, Cuvier's figure was based on a single specimen." [From *North American Bison*]