

chapters in this book discuss the best approaches to successful analysis of higher auditory function. These arguments underscore the book's most significant omission. Major advances in our understanding of the processing of complex sounds have come from studies on bats, but this work is not described in any detail in the book. Bats emit biosonar pulses and listen to the echoes for orientation and for hunting insects. These pulses and echoes have been used as behaviorally relevant stimuli to identify the algorithms underlying the perception of complex stimuli. For example, neurons in the auditory periphery encode stimulus frequency, amplitude, and time. In their work on the bat forebrain, however, Suga and his co-workers have described the systematic mapping not only of such simple aspects of the stimulus but also of behaviorally relevant stimulus parameters such as echo delay, which the bat uses to determine target distance. Thus studies on bats have shown that the central auditory system computes and encodes behaviorally relevant complex stimuli. The same neuroethological principles may be applied to the analysis of complex sounds in other mammals.

This is an important and timely book with many strong points. It will be a useful reference for any student of the central auditory system. No other book has surveyed the anatomy, physiology, and pharmacology of central auditory nuclei, and these chapters alone make the book worthwhile. The book also shows that even such a simple task as the coding of sound source location has proved to be full of unexpected surprises; people should come away from *The Neurobiology of Hearing* with the sense that auditory neurobiology will continue to illuminate sensory biology.

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Biotic Immigrants

Biogeography of Mediterranean Invasions. R. H. GROVES and F. di CASTRI, Eds. Cambridge University Press, New York, 1992. xvi, 485 pp., illus. \$125.

Unlike its predecessors in the series sponsored by the SCOPE (Scientific Committee on Problems of the Environment) program on biological invasions, this volume focuses on one biome: the five regions with Mediterranean-type climates. As a rationale for this focus, Francisco di Castri, one of the book's editors, contends that the amount of

species exchange between these regions has been far greater than for other ecosystems. This matter is difficult to assess, especially given the untallied failed immigrations. Perhaps a better justification lies simply in the opportunity these five climatically similar and geographically well-defined regions provide for addressing questions about the traits and circumstances that have led a comparatively small number of species from the world's biota to be naturalized in these widely separated regions. To this goal, the book certainly makes a contribution, although one could reasonably form the impression that definitive answers will not come soon.

The volume consists of 31 chapters that reflect the organizers' desire to achieve comprehensive coverage. Although a laudable goal, particularly in its effect of producing reports on work not well known to English-speaking biologists, it comes at the price of depth on any one topic. Because biological invasions often unfold over decades, older, sometimes obscure literature that reports the circumstances of an immigration takes on an importance that is becoming rarer in science. For the most part the opportunity to evaluate this literature in the light of modern ideas in evolution, ecology, and population biology is not seized. (Exceptions include chapters by Kloot and Rejmanek *et al.* on invasive plants in southern Australia and California, respectively, and Blondel's insightful chapter on bird invasions in the Mediterranean region.)

In general approach the chapters are representative of published work on biological invasions. Whether reporting on the spread of mammals in South Africa (Bisgalke and Pepler), European rabbits in central Chile (Jaksic and Fuentes), or invasive plants in the Mediterranean Basin (Le Floch), most of the authors bring an "epidemiological" organization to their subject, reporting on the probable mode and timing of the introduction and the range expansion and environmental (and economic) consequences, if any, of the invasion. Unfortunately, many of these chapters do not go much beyond compiling invasion history. (Exceptions include Traub's assessment of the role of fire as an agent facilitating plant invasions and Cheylan's overview of mammalian speciation in the Quaternary of the Mediterranean Basin.) Until this pattern of assembling anecdotes is broken, the contributions that the study of biological invasions could make to both fundamental and applied biology will be unnecessarily limited. I don't think we have too few documented invasions to warrant raising broader questions. For example, why have so many plant species from the Mediterranean Basin become naturalized

elsewhere? Why has the biota of the Mediterranean Basin been comparatively little altered by invasion by comparison with the four other Mediterranean-like regions?

Generalizations do appear with greater frequency in the overview chapters by the editors. For instance, Groves points out that most of the introduced plant species in Mediterranean regions are European representatives of the four large families Gramineae, Compositae, Cruciferae, and Leguminosae, families that have often contributed the bulk of alien species within temperate biomes. More surprising, however, is Groves's report that the majority of these species were intentionally introduced as forage, as ornamentals, or for medicinal use. Once again, environmental catastrophes have arisen through our own actions. Groves's claim that the rate of plant invasion (as gauged by mean number of new entries per year) is no higher among the five Mediterranean regions than other regions is probably impossible to verify, partly because all such estimates are confounded by the varying extent of commerce. Among his generalizations di Castri cautions that the long-held view that invaders are most likely to be successful when climates of their new and home ranges are similar may be simplistic, echoing the main theme of the chapter by Roy *et al.* on grasses. This contention is certainly plausible, although its evaluation requires more accurate knowledge of the local source of the immigrants than we usually possess.

This book will certainly provide intriguing reading for anyone who is interested in rapidly unfolding biological phenomena. It also serves, however, to illustrate that we have much work ahead of us before we can explain and predict the course of biological invasions in Mediterranean climates or elsewhere.

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