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Book Review

THE SENSORY PHYSIOLOGY OF AQUATIC MAMMALS. Alexander Ya. Supin, Vladimir V. Popov, Alla M. Mass. Kluwer Academic Publishers, 2001. ISBN number 0-7923-7357-X, 332 pp, 137.50 Euro

The rich history of Russian physiology, and the techniques developed there, are apparent in this volume. Three principal investigators from the Severtsov Institute of Ecology and Evolution of the Russian Academy of Sciences have written an interesting summary of the physiology of hearing, vision and the somatic senses of marine mammals. Many of their investigations, as a team, were carried out at the Utrish Marine Station along the Black Sea Coast. They began in the 1960s and have continued an active and productive research program. In addition to presenting the results of over a quarter of a century of experience of their team, the book also serves to summarize a considerable body of information from the general literature. Their goal was to create a synthesis in a written, rather than an edited, volume on the sensory physiology of aquatic mammals.

The amount of text within the book devoted to each of the sensory modalities reflects the general pattern found in the study of sensory systems in marine mammals. Approximately two-thirds of the book is devoted to the physiology and measurement of hearing mechanisms with the remainder divided between vision and somatic senses. That two-thirds related to hearing mechanisms presents a very full picture of hearing—particularly in cetaceans. While most of what I previously learned about hearing in marine mammals has been derived from trained, behavioural psychophysical experiments (Nachtigall *et al*., 2000), most of the hearing data in this book comes from the study of auditory evoked potentials from the brainstem. I believe that relatively few people that study marine mammals have taken the opportunity to read the large number and variety of evoked potential papers completed by this group. This book provides a new window of understanding previously only open to those people that work with electrophysiological methods and read that literature.

The author's sensitivity to, and thorough awareness of, the ability of odontocetes to echolocate, provides a very full perspective on odontocete hearing. Both behavioural and evoked auditory potential data are reasonably presented. Perhaps the best practical explanation that I have ever read for the evolutionary development and use of the ability to hear high frequencies is presented on pages 193 and 194. In a very reasoned and clear exposition, the authors explain the reason that high frequencies are so valuable to the animal is that they provide excellent cues for echolocation, for spatial resolution, with short time periods allowing the echolocation of targets nearby, and for excellent time resolution. This sort of writing is reflective of very clear scientific thought and a broad understanding of the topic.

Reading this book requires some effort, but the expenditure is very worthwhile. While, the electrophysiological techniques were originally developed for acute preparations, the drive toward sensitivity to animals has resulted in some creative new ways of obtaining electrophysiological data while maintaining healthy and normal animals. Human EEG sensors voluntarily accepted on the skin surface by well-trained odontocetes likely provide very little stress to an animal having its hearing tested using the evoked potential procedure. The only requirement is that the test animal voluntarily wear a soft rubber suction cup placed on the surface of its skin. The suction cup is easily removable by animal or experimenter, thus animal training and trust become important in electrophysiological experiments.

The book contains summaries of previous work that used other procedures, procedures that will not likely soon be repeated and therefore, make these data all that more valuable. The 'cartoon' of the relative proportion of the projection areas recorded from the brain cortex of the fur seal, *Callorhinus ursinus*, devoted to particular body areas (not unlike the human 'homunculus' frequently presented in introductory psychology textbooks) demonstrated the very large percentage of the somatosensory area devoted to the vibrissae in these animals and therefore, provides the reader with a new appreciation of the importance of the vibrissae to the pinnipeds. Similar sorts of work recording from the surface of the brain cortex of the bottlenose dolphin, *Tursiops truncatus*, and the harbor porpoise, *Phocoena phocoena*, demonstrated the relatively small amount of cortical area devoted to

vision compared to audition and that the projection area of the dolphins is shifted toward the frontal direction as compared to other mammals.

Perhaps the strongest portion of this book is chapter 2 on hearing in cetaceans. The electrophysiological understanding of hearing in dolphins is far greater than most people imagine. A careful reading of *The Sensory Physiology of Aquatic Mammals* is a requirement for anyone truly interested in developing a thorough understanding of the sensory mechanisms of marine mammals.

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References

Nachtigall, P. E., Lemonds, D. W., & Roitblat, H. L. (2000) Psychoacoustic Studies of Whale and Dolphin Hearing. In: W. W. L. Au, A. N. Popper, & R. J. Fay (eds.) *Hearing By Whales*, pp. 330–364. Springer-Verlag, New York.