

Preface

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Phil. Trans. R. Soc. Lond. B 2000 **355**, doi: 10.1098/rstb.2000.0648, published 29 September 2000

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Preface

The way in which other animals perceive their environment is very different to our visually dominated sensory experience of the world. This is nowhere more obvious than underwater, and although we now frequently visit this world with SCUBA and submersible, we still mainly attempt to decode underwater information from visual cues. As light may not travel more than a few millimetres in murky water and at best travels less than a kilometre in clear oceanic water, this is a severe limitation. As a result, aquatic animals often invest more in detecting sound and odour, both of which are effective over long ranges. Some animals can even use changes in the Earth's magnetic field to migrate long distances and use electroreception to detect the nervous impulses of otherwise hidden organisms. This collection of short papers, all from leading experts in sensory systems, examines some of the problems facing aquatic animals all which need to detect the world around them and some of the fascinating solutions which have evolved to solve these problems.

This is not the first time that our knowledge of underwater sensory systems has been collected together. In 1985, Jelle Atema, Dick Fay, Art Popper and William Tavolga held a conference to spark an exchange of ideas and to review the current status of sensory biology in aquatic animals. This resulted in their now classic volume *Sensory biology of aquatic animals*. Almost 15 years later, we decided it was time for an update because advances in technology and increased interest in the area have led to a number of exciting new discoveries. The collection of papers presented here is a mixture of mini-reviews and recent discoveries from different fields with special emphasis on new concepts and interpretations.

The impetus for presenting such a unique collection of papers again stems from a conference recently held on Heron Island on the Great Barrier Reef in Australia between 22 and 28 March 1999. Sponsored by both The University of Queensland (Brisbane) and The University of Western Australia (Perth), the conference brought together an international forum of research scientists, many of whom also participated in the 1985 meeting, to focus attention on new advances relating to how aquatic animals perceive their environment. Current research was presented on vision, audition, olfaction, gustation, mechanoreception, electroreception, magnetoreception and vestibular control. The comparative nature of the conference allowed a broader approach to defining basic and ubiquitous concepts spanning a range of model systems from deep-sea invertebrates to marine mammals. In some cases, this highlighted the high degree of specialization required by some organisms for survival but, on the other hand, common principles could be clearly identified across distantly related organisms and between different sensory systems. The contributions here are arranged into thematic sections, each relating to a specific sensory modality, but with function and solution underlying each section, rather than anatomy or taxonomy.

We thank The Royal Society for their support in compiling this special issue of *Philosophical Transactions*. We also thank the 20 expert reviewers that we called upon, for their invaluable help and feedback. Our hope is that this issue will be a valuable reference and source of inspiration to anyone interested in aquatic sensory systems.

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April 2000

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