

# Volume Preface

Bats are one of the most vociferous of all mammalian groups. They not only use sound and hearing for communication but also for echolocation in ways that are rivaled only by toothed whales. While most papers, including previous SHAR volumes, focus on the echolocation behavior of bats, this volume extends the story to include overall bioacoustics, including communication and behavior.

Chapter 1, by Alan Grinnell, Ed Gould, and M. Brock Fenton, goes into the history of the study of bat bioacoustics, including a description of the work by some of the pioneers in the field (with photographs). This is followed by Chapter 2 in which Emma Teeling, Steve Rossiter, and Gareth Jones review the contributions of genetic and genomic databases in advancing our understanding of the phylogeny of bats and their classification among the mammals.

In Chapter 3, Walter Metzner and Rolf Müller review the diversity of laryngeal and facial structural specializations for production of both echolocation pulses and communication signals in echolocating bats. This is followed by Chapter 4 in which Patricia Jones, Rachel Page, and John Ratcliffe discuss the use of laryngeal echolocation when bats are foraging, including the differences and similarities among aerial hawkers, substrate gleaners, and bats that alternate between those two strategies. In Chapter 5, Erin Gillam and M. Brock Fenton consider the many situations in which bats communicate with acoustic signals, from behaviors underlying social systems to interactions between mothers and their young.

In Chapter 6, Annette Denzinger, the late Eli Kalko, Marco Tschapka, Alan Grinnell, and Uli Schnitzler review the evidence supporting the view that communities of bats consist of guilds of species. They focus on the overlaps among sympatric species in terms of echolocation strategies, foraging behavior, habitat use, and diet, and they define seven different guilds that suffice to include all species.

In the first of two chapters that deal with central processing of sound, Paul A. Faure and Uwe Firzlaff (Chapter 7) discuss the importance of temporal resolution in the hearing of echolocating bats. They consider the neural mechanisms that code signal duration and the functional significance of this information in achieving selectivity of the responses to communication sounds and echolocation signals. In Chapter 8, George Pollak considers the diversity of communication and echoloca-

tion sounds used by different bats and the diversity of neural adaptations for processing the sounds, especially at the level of the inferior colliculus.

Chapter 9, by Shizuko Hiryu, Emanuel Mora, and Hiroshi Riquimaroux, examines how bats use Doppler shift compensation (DSC) in the context of high-duty cycle echolocation. Chapter 10, by Annemarie Surlykke, Jim Simmons, and Cynthia Moss, considers the question of “scene analysis” via echolocation. They compare the information available to the auditory system, through echoes, with information processing in the visual system. In Chapter 11, Lutz Wiegrebe, Brock Fenton, and Alan Grinnell identify some of the major challenges to understanding mechanisms of echolocation and the technological advances that make it feasible to address them.

This volume in the *Springer Handbook of Auditory Research* has close ties to several earlier volumes that discuss aspects of bat bioacoustics. Hearing is covered extensively in *Hearing by Bats* (Vol. 5, edited by Arthur N. Popper and Richard R. Fay), while biosonar is covered in a chapter in *Auditory Computation* (Vol. 6, edited by Harold L. Hawkins, Teresa A. McMullen, Arthur N. Popper, and Richard R. Fay) and in multiple chapters comparing bats and toothed whales in *Biosonar* (Vol. 51 edited by Annemarie Surlykke, Paul Nachtigal, Richard R. Fay, and Arthur N. Popper).

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