Avian Auditory-Vocal Motor Interfaces

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Preface

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This issue comprises the proceedings of the Fifth Annual Karger Workshop at the J.B. Johnston Club, held on Saturday, November 6, 1993. The workshop focused on the nature of avian auditory-vocal motor interfaces, exploring our current understanding of the nature of the interface(s) between auditory and vocal motor structures that have evolved in extant avian species. In view of the broad nature of past workshops, the exploration of a specific neural system in a single vertebrate group may seem somewhat narrow. Within the scope of this topic, however, lie some of the most profound scientific questions in comparative neurobiology today.

Avian vocal learning is a particularly fascinating and important subject for the comparative neurobiologist. Professor Masakazu Konishi, our special invited guest, describes the historical development of the field in his paper in this issue. As he points out, there is striking diversity in the manifestations of vocal learning ability in avian species. In some species, such as budgerigars (*Melopsittacus*), for example, vocal learning can be remarkably flexible and open throughout life. In others, such as zebra finches (*Taenopygia*), song learning is apparently restricted to a well defined sensitive period occurring early in life. In other avian species, such as canaries (*Serinus*), vocal learning is seasonal. Some species of birds, such as pigeons (*Columba*), do not learn their vocalizations with reference to an external model. Others, do not require auditory feedback for vocalization. In many oscines song learning is sexually dimorphic, while in others females as well as males sing. Gonadal steroids may play an important role in both learning and production of song in some species but not in others. Moreover, there is ample evidence that the social milieu, including the presence of live tutors, often plays a contributing role, influencing both what song elements are learned as well as how song is learned.

It seems clear that vocal learning in birds reflects multiple interfaces, which must vary in important ways among

species. Such diversity, within a single class of vertebrates, involving motor responses dependent on the same peripheral organs, is surely grist for the mill of comparative neurobiology!

The papers in this issue deal with the comparative anatomy and chemoarchitecture of the neural circuitry by which auditory and motor nuclei are interconnected [Wild; Brauth et al.], the comparative chemoarchitecture of vocal nuclei [Ball], the neurophysiological basis of vocal motor control [Margoliash et al.], and the neurologic bases of vocal learning [Brauth et al.; Vicario; Konishi]. Taken together, they provide a basis for addressing four questions, which were specifically raised in the workshop and which lie at the heart of the comparative neurobiology of avian vocal learning: (1) By what pathways may auditory information influence forebrain motor structures in birds? (2) How does the organization of these pathways differ among currently existing avian species? (3) What roles do such interfaces play in mediating vocal performance and vocal learning? (4) How do such functional relationships vary among existing species?

The success of this workshop would not have been possible without the generous support of S. Karger A.G., publishers, the intellectual and logistical support of Glenn and Mary Sue Northcutt, and the enthusiastic participation of the membership of the J.B. Johnston Club attending the workshop itself. The lively question and answer periods and discussions that ensued helped to provide the invited participants with insights, incentives and inspiration in completing their contributions, which are published here. To one and all, we offer our thanks as editors!