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INTRODUCTION

Susan E. Shore · Stephanie Clarke · Eric M. Rouiller

Central auditory processing: integration with other systems

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The present volume of *Experimental Brain Research* covers a substantial part of the scientific content of a scientific meeting that took place in May 2002 at the Conference Center of the Stefano Franscini Foundation at Monte Verita (Ascona), Switzerland. The aim of the invited editors and organizers of the meeting (S.E. Shore, S. Clarke and E.M. Rouiller) was to survey the current knowledge concerning *processing of acoustic information in the central auditory system* with emphasis on various aspects of *integration of auditory and non-auditory information*. Most scientific contributions thus focused on interactions between discrete auditory structures, or anatomical and functional connections with other sensory systems or with the motor system. Along the same line, the meeting addressed issues related to the role of auditory processing in animal or human behavioral models. Some contributors discussed the mechanisms by which central auditory processing is altered as a result of peripheral hearing impairment, resulting in the perception of phantom sounds, or tinnitus. This disease is a good example of pathological changes affecting several stations of the central auditory system as well as its interactions with other sensory modalities.

A substantial integration of information is already apparent at the first relay structure of the auditory pathway, the cochlear nucleus. Several authors presented recent experimental or review data on the functions of distinct neuronal populations in the cochlear nucleus, and how they are altered by connections from other brainstem locations (Verhey et al., Palmer et al., Shore et al., Loquet et al., Manis et al., Babalian et al.). A relatively new concept is that a structure as peripheral as the cochlear nucleus can be directly influenced by the auditory cortex, via the corticobulbar projection, an issue addressed in the present volume in two papers (Doucet al., Jacomme et al.). The corticobulbar projection terminates principally in the so-called “granular cell domain”, a zone of the cochlear nucleus specialized for the integration of multiple auditory and non-auditory inputs, as reviewed by Ryugo et al. Finally, the cochlear nucleus is under control of diffuse systems of modulation, such as noradrenergic inputs, whose origin has been described here (Thompson).

A prominent feature of the auditory system is the feedback control exerted by central auditory nuclei on more peripheral structures. For instance, the sensory cells (hair cells) of the acoustic receptor organ are influenced by efferent projections coming from the superior olivary complex, corresponding to the so-called olivocochlear system (see Brown et al., Warr and Boche) or from other sources (Kim et al.). Another important feedback system is the corticofugal projection directed to the inferior colliculus and the auditory thalamus, described here by Bledsoe et al. and He, respectively. The influence of identified inputs, state of vigilance, or learning, on responses of single neurons in the auditory midbrain and thalamus were detailed in several contributions (Malmierca et al., Hu, Lui and Mendelson, Edeline, Massaux and Edeline).

Mechanisms underlying auditory perception in human subjects were addressed here in a context of age dependence (Grube et al.) or of the specialized and segregated acoustico-motor pathways involved respectively in the localization or in the recognition of sounds (Adriani et al.). More basic mechanisms of acoustico-motor integration were reported in the present volume from investigations conducted in the auditory and motor cortices of behaving subhuman primates (Durif et al., Keysers et al.). Still at a cortical level, and pertinent for polymodal interactions, the consequences of congenital deafness on reorganization (developmental plasticity) were examined in an animal

S. E. Shore
Kresge Hearing Research Institute, Department of Otolaryngology, University of Michigan,
Ann Arbor, MI 48109, USA

S. Clarke
Division de Neuropsychologie, CHUV,
1011 Lausanne, Switzerland

E. M. Rouiller (✉)
Institute of Physiology, University of Fribourg,
Rue du Musée 5,
1700 Fribourg, Switzerland
e-mail: Eric.Rouiller@unifr.ch
Tel.: +41-26-3008609

model of hearing loss (Kral et al.). Tinnitus, another pathological outcome of altered peripheral inputs, strongly linked to plastic changes at various levels of the auditory system, including interactions with non-auditory inputs, was debated, both in human subjects (Levine et al.) and in animal models (Wallhäuser-Franke et al., Zhang et al).

We believe that the present special issue of *Experimental Brain Research* reflects the benefits of: (a) comparing data derived from animal models with those obtained in human subjects, and (b) evaluating the normal system in the context of the consequences of pathological changes. Moreover, a special effort was made to consider a particular relay station of the auditory system, not in isolation, but rather in the broader context of interactions between the sequential stages of the auditory pathways as well as with other sensory systems or the motor system, ultimately for the production of auditory-dependent behaviors.

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