Cortical Sensory Organization

Multiple Auditory Areas

Cortical Sensory Organization

Edited by **Clinton N. Woolsey**

Volume 1: **Multiple Somatic Areas**

Volume 2: **Multiple Visual Areas**

Volume 3: **Multiple Auditory Areas**

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Volume 3

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- Cortical Visual Areas of the Temporal Lobe: Three Areas in the Macaque, **C. G. Gross, C. J. Bruce, R. Desimone, J. Fleming** and **R. Gattass**

Preface

In April 1979 a symposium on “*Multiple Somatic Sensory Motor, Visual and Auditory Areas and Their Connectivities*” was held at the FASEB meeting in Dallas, Texas under the auspices of the Committee on the Nervous System of the American Physiological Society. The papers presented at that symposium are the basis of most of the substantially augmented, updated chapters in the three volumes of *Cortical Sensory Organization*. Only material in chapter 8 of volume 3 was not presented at that meeting.

The aim of the symposium was to review the present status of the field of cortical representation in the somatosensory, visual and auditory systems. Since the early 1940s, the number of recognized cortical areas related to each of these systems has been increasing until at present the number of visually related areas exceeds a dozen. Although the number is less for the somatic and auditory systems, these also are more numerous than they were earlier and are likely to increase still further since we may expect each system to have essentially the same number of areas related to it.

Discovery of second somatic, visual and auditory areas in the early 1940s followed soon after the development of the evoked potential method for the study of cortical localization. The great increase in the number of recognized areas in the last 10 years has resulted from the use of microelectrode recordings from small clusters of neurons and from single units, which permit far more detailed examination of the brain than did the technology of earlier years. Other factors have been the study of more lightly anesthetized animals and of unanesthetized animals, whose brains have been explored through chambers implanted over the areas to be studied. One can expect the number of recognized areas to increase as more of the cortical surface is explored in detail in various species of animals.

Most individual studies to date have dealt with a single system for which the investigators have developed specialized equipment and skills in its study. There is evidence, however, that some cortical areas may respond to more than one modality of sensory input. This is particularly true of the so-called “association” cortex of the suprasylvian gyrus of the cat. It now seems very desirable to explore

under optimal conditions all cortical areas with stimuli of more than one sensory modality. This will require that investigators acquire sophisticated equipment for the study of somatic, visual and auditory systems and develop skills in its use. An alternative method would be for experts on each system to join forces, so that the methods specialized for the three systems can be applied in a single given experiment.

Increasing quantities of information on the organization of afferent and efferent systems are being derived from the application of techniques for the study of connectivities within the central nervous system, through the use of tritiated amino acids and horseradish peroxidase, as illustrated by several of the studies reported in these volumes.

An important area of research not covered in these volumes is the study of behaving animals with implanted recording electrodes. I foresee that ultimately all areas of the cortex will be examined in this way.

Another area requiring study is the sensory input to the cortical motor areas. Corticocortical connections to these areas have been studied, as reported in volume 1, but more detailed sensory input using electrophysiological methods have not yet defined the sensory inputs to the precentral and supplementary motor areas. Similarly, less work has been done on the motor output from the postcentral sensory areas and its relation to the sensory input to these areas. There is practically no modern work on the effects of electrical stimulation of the visual and auditory areas of the cortex, although motor effects were obtained on stimulation of these areas by Ferrier and other early students of cortical localization.

An important problem for the future concerns the terminology to be applied to the many new cortical areas. If these areas correspond to recognized cytoarchitectural areas of Brodmann, that terminology should be applied. At present there is considerable confusion in terminology, perhaps best illustrated by the terms used to describe the various auditory areas in cat and monkey, where terms for the cat are related to the position of the areas in the auditory region. However, because the auditory region changes its orientation with evolution, the same terms used for cat cannot be used for the monkey. Perhaps when all areas have been identified and their corticocortical connections and relations with subcortical structures have been fully defined, a more rational terminology can be proposed.

The three volumes of this work do not include reports from all the important workers in the fields surveyed. It was not possible in the time available to the symposium to include all those we should have liked to invite.

The editor wishes to express his deep appreciation to all those who took part in the Dallas symposium, and to thank them for the manuscripts which they prepared for these three volumes on *Cortical Sensory Organization*. He is also grateful to Drs. J. C. Coulter, J. H. Kaas and J. F. Brugge, who chaired the three programs. Finally, special thanks is due to Thomas Lanigan of the Humana Press for his interest in publishing this work and the care that he has devoted to seeing the material through the press.

The editor also wishes to thank Evadine Olson for several typing tasks that she performed in relation to his editorial functions.