The Mammalian Cochlear Nuclei

Organization and Function

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Preface

The presence of sophisticated auditory processing in mammals has permitted perhaps the most significant evolutionary development in humans: that of language. An understanding of the neural basis of hearing is thus a starting point for elucidating the mechanisms that are essential to human communication. The cochlear nucleus is the first region of the brain to receive input from the inner ear and is therefore the earliest stage in the central nervous system at which auditory signals are processed for distribution to higher centers. Clarifying its role in the central auditory pathway is crucial to our knowledge of how the brain deals with complex stimuli such as speech, and is also essential for understanding the central effects of peripheral sensorineural hearing loss caused by, for example, aging, ototoxic drugs, and noise. Ambitious new developments to assist people with total sensorineural deafness, including both cochlear and cochleus nuclear implants, require a detailed knowledge of the neural signals received by the brainstem and how these are processed. Recently, many new data have been obtained on the structure and function of the cochlear nucleus utilizing combinations of anatomical, physiological, pharmacological and molecular biological procedures. Approaches such as intracellular dye-filling of physiologically identified neurons, localization of classical neurotransmitters, peptides, receptors and special proteins, or gene expression have opened the door to novel morphofunctional correlations.

In order to provide an opportunity for leading scientists working on the cochlear nucleus to present and discuss their recent results, a NATO Advanced Research Workshop was held at the University of Salamanca, Spain, in September, 1991. The resulting volume consolidates the large amount of information presented at this meeting into a book that will be available to the scientific community. The studies presented here reemphasize our knowledge on how parallel channels of information processing are established in the cochlear nucleus and indicate means by which particular cell types in the nucleus are modulated by intrinsic and feed-back mechanisms. We hope that these proceedings will not only help advance further neural network strategies, some of which were discussed at the workshop, but also stimulate the design of mammalian neuroethological approaches, which have so far been promoted almost solely in bats.

The workshop as well as the book were dedicated to the memory of the Spanish neuroscientist, Dr. Rafael Lorente de Nó, (1902-1990). Born in Zaragoza and a follower of the famous neurohistologist Ramón y Cajal, Lorente de Nó produced one of the most extensive early descriptions of the morphology of the cochlear nucleus, a body of work that is still widely referred to by auditory scientists today. During the preparation of the present book, Dr. A. Gallego, one of the contributors to the meeting and a colleague of Lorente de Nó, died in Madrid. Because of his relevant role in the continuity of the Spanish scientific tradition during the last decades, we also wish to extend this dedication to the memory of Dr. Gallego.

Many people were involved in the organization of the meeting and the production of this volume. We gratefully acknowledge the invaluable financial support from the NATO Scientific Affairs Division and the contribution from the Spanish Ministry of Science and Education (MEC-DGICYT), Fondo de Investigaciones Sanitarias de la Seguridad Social (FISS), Town Council of Salamanca, and the Institute of Neuroscience of the University of Alicante. We wish to take this opportunity to acknowledge all the contributors and participants, the Scientific Committee, and the team in Salamanca for their support, advice, and hard work in making this conference and volume a reality. We also wish to extend our thanks to Lisbet Sϕrensen, who processed the entire text, and to Maria E. Rubio and Adelaida Baso for their help with the tedious work of figure placement.

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In Memory of Rafael Lorente de Nó

The National Institute on Deafness and Other Communication Disorders joins in your salute to Rafael Lorente de Nó. An innovator who successfully translated experimental results into new concepts, Lorente de Nó's significant contributions remain as testimony to his creative genius in central nervous system research. His concentualization of the organization of the cochlear nuclei provides the foundation for understanding the auditory system.

A scientist who held positions with the Central Institute for the Deaf, Rockefeller University, and the University of California, Los Angeles, Lorente de Nó's interest in the biochemical mechanisms of nerve conduction continued throughout his career. Honored on both sides of the Atlantic for his work, he received the highest scientific accolade the United States can bestow, membership of the National Academy of Sciences. Our thoughts are with you today as you honor the memory of this distinguished scientist, a man whose insight and discoveries form a legacy of knowledge for all investigators of the auditory system.

James B. Snow, Jr., M.D.
Director of National Institute on Deafness and
Other Communication Disorders
September, 1991

In Memory of Antonia Gallego

While this book was being prepared for publication, one of its contributors, Prof. A. Gallego, died in Madrid in February 1992, shortly after writing that paper. Antonio Gallego was the most prestigious Spanish neurobiologist of the last 50 years and also a symbol of the scientists that struggled to develop a favorable scientific environment in a country devastated by the material and psychological consequences of a Civil War. Antonio Gallego was born in Madrid in 1915. He obtained his M.D. degree at the University of Madrid and initiated there, still as a medical student, his career in physiology. After a forced interruption during the war and post-war years because of his alignment with the republican side, Gallego travelled to the Rockefeller Institute to work with Rafael Lorente de Nó on electrophysiology of the nerve. Back in Spain in 1950, Antonio Gallego resumed his academic activity and finally became Professor and Chairman of the Department of Physiology at the University of Madrid Medical School in 1960. There, he attracted a whole generation of young Spanish scientists that were impressed by his intellectual independence, his modern scientific views, and his courage to defy established doctrines in politics and science. Most of the present professors of Physiology in Spanish medical schools have been, directly or indirectly, pupils of Antonio Gallego.

His scientific work was mainly dedicated to study the functional structure of the retina. Main findings include the description of a new type of horizontal cell devoid of axon in the external plexiform layer, the report with J. Ćruz of retinal association ganglion cells, and the first morphological description of the "interplexiform cell," to which he gave this name.

Antonio Gallego was deeply involved in university politics, directing his enormous energy, intelligence, and brilliant personality to the renovation of medical education and the improvement of research resources at the Spanish university. A whole generation of Spanish scientists owes a debt of gratitude to this man, who sacrificed his time and personal success to obtain a better future for science in his country.

Carlos Belmonte, M.D., Ph.D.
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June, 1992

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**There is an Abstracts Book with a complete list of participants, including contributors to the poster sessions of the workshop. The Abstracts Book also contains the summaries of these poster presentations, some of which are cited in several chapters of this volume.*

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