PROGRESS IN BRAIN RESEARCH

Volume 22

BRAIN REFLEXES

edited by E. A. Asratyan

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VOLUME 22

BRAIN REFLEXES

Proceedings of the International Conference dedicated to the centenary celebration of the publication of I. M. Sechenov's book *Brain Reflexes*

sponsored by the
Academy of Sciences of the USSR and the International Brain Research Organisation (IBRO)

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ELSEVIER PUBLISHING COMPANY
AMSTERDAM / LONDON / NEW YORK
1968

ELSEVIER PUBLISHING COMPANY
335 JAN VAN GALENSTRAAT, P.O. BOX 211, AMSTERDAM

AMERICAN ELSEVIER PUBLISHING COMPANY, INC.
52 VANDERBILT AVENUE, NEW YORK, N.Y. 10017

ELSEVIER PUBLISHING COMPANY LIMITED
RIPPLESIDE COMMERCIAL ESTATE, BARKING, ESSEX

LIBRARY OF CONGRESS CATALOG CARD NUMBER 65-25214

WITH 356 ILLUSTRATIONS AND 15 TABLES

PRINTED IN THE NETHERLANDS

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Preface

This book contains research reports and review articles given at an interdisciplinary international meeting in Moscow. This book is a follow-up of the first volume of this series (titled *Brain Mechanisms*) and was sponsored by the International Brain Research Organization and the USSR Academy of Sciences.

The meeting was dedicated to the century celebration of Sechenov's book *Brain Reflexes*. It therefore illustrates the tremendous increase in our field since the publication of the famous book.

In order to give an overall review of the main aspects of the brain sciences the following three symposiums were being held:

(a) "Brain reflexes" and central inhibition;

(b) General principles of self-regulation in cortico-subcortical correlations;

(c) Evolutionary physiology of the nervous system and brain ontogenesis.

It was expected that this book will serve as a guide to classical and modern Soviet neurophysiologists.

The Editor

1st Symposium
"Brain Reflexes" and Central Inhibition

2nd Symposium
General Principles of Self-regulation in Cortico-subcortical Correlations

3rd Symposium
Evolutionary Physiology of the Nervous System and Brain Ontogenesis

Contents

2. General Principles of Self-regulation in Cortico-subcortical Correlations

3. Evolutionary Physiology of the Nervous System and Brain Ontogenesis

'BRAIN REFLEXES' AND CENTRAL INHIBITION

Central Inhibition of Reflexes and the Problem of the Coupled Activity of Cerebral Hemispheres

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The fact that the process of inhibition appears in living tissue was first discovered experimentally by the Weber brothers. These authors observed that when the vagus nerve is excited with electric current, the heart ceases contracting. It was not long after this discovery that I. M. Sechenov attempted to prove the presence of inhibition centres in the regio thalamica by his famous experiment of 1862. Further experiments have made it clear that there are no special inhibiting formations in the central nervous system, but that the process of inhibition that occurs within it is always associated with the process of stimulation.

Sechenov's experiment played a great role in the development of physiology of the central nervous system, since it was the initial phase of systematic studies of central inhibition.

A century has passed since versatile and intensive studies of this process started, involving prominent physiologists, and yet the nature of inhibition, and its relation to the stimulation are far from fully discovered. Inhibition, in the broad meaning of the term, is understood to be complete temporary cessation or temporary suppression of the functioning of an individual organ or the whole organism. Proceeding from this definition, it is easy to understand the process of inhibition when drugs or other toxic agents are introduced, when inhibition results from exhaustion of the energy-producing material in a working organ, with fatigue or when there is no stimulation; on the other hand, inhibition is difficult to understand when it appears with complex co-ordinated movements. This act is known to alternate rapidly between excitation and inhibition within one and the same group of muscles, or both of them proceed simultaneously in different groups of muscles, which ensures well-co-ordinated movement. It remains obscure how this co-ordinated correlation between excitation and inhibition is actually exercised. Almost every author believes that inhibition is an innate process and always appears alongside excitation of any afferent nerve, but this assumption does not solve the problem of their correlation, for instance, when excitation may partly or completely displace inhibition from some organ, and *vice versa*.

The great physiologist I. P. Pavlov introduced a new productive idea into the theory of inhibition by his experiments with conditioned reflexes. He demonstrated that