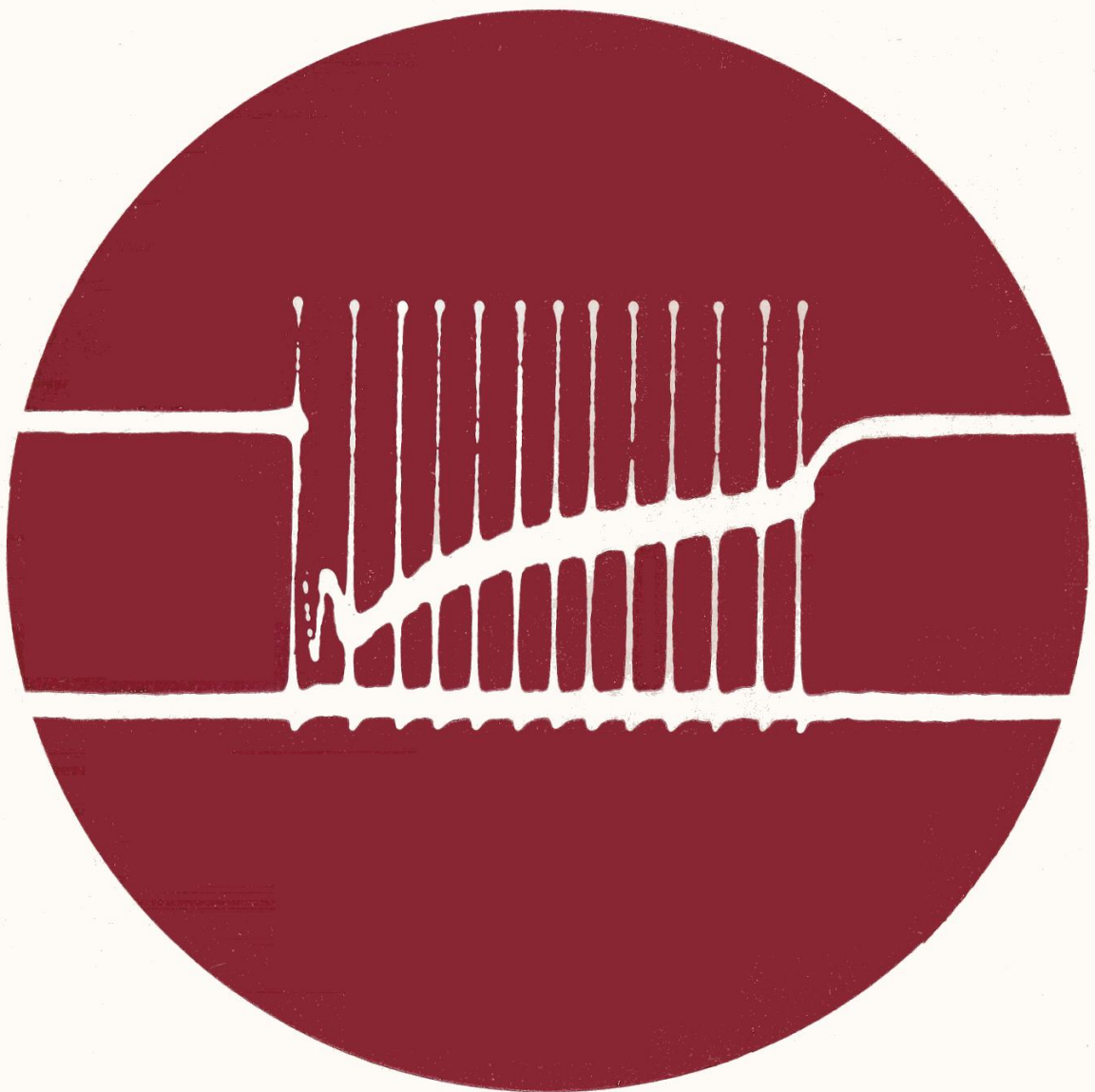


The Basis of Motor Control

Integrating the activity of muscles,
alpha and gamma motoneurons and their
leading control systems

Ragnar Granit



Academic Press
London and New York



Lagman Gränt

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The Basis of Motor Control

INTEGRATING THE ACTIVITY OF MUSCLES, ALPHA AND
GAMMA MOTONEURONS AND THEIR LEADING CONTROL
SYSTEMS

by

RAGNAR GRANIT

*The Nobel Institute for Neurophysiology
Karolinska Institutet, Stockholm, Sweden*

1970



Academic Press : London and New York

Preface

The original motive for writing this book was a purely selfish one: having spent some twenty years in this field I felt the need to bring my knowledge and notions into some final order. As the book gradually took shape, didactic considerations dictated its form and format.

The last two decades have seen an exciting development, experimentally as well as conceptually. The muscle spindles and the motoneurons have provided the lion's share of excitement in the experimental field; conceptually the advance has concerned fresh modes of approaching control problems, as they have arisen from the elucidation of the role of a new motor system, the gamma motoneurons, in posture and locomotion. It seems a long way since the time I began in the late forties, moved by a desire to understand something of the muscle receptors as receptors and not merely as parents of afferent nerves of different conduction velocities.

The vast field of motor activity obviously exceeds the limits of one man's knowledge. The output from the central nervous system is, after all, mainly motor. The subject is virtually boundless. Had I wanted to write a comprehensive review, it would have been possible to expand every paragraph. This volume begins with a presentation of the basic physiological facts pertaining to the triad consisting of muscles, their sense organs and motoneurons, in other words the "executive" that is carrying out the automatic and volitional commands emanating from the central nervous system. The remaining chapters discuss our knowledge about these commands to alpha and gamma motoneurons from specific structures such as the respiratory centres, the motor cortex, the brain stem, etc.

The approach is that of classical physiology in the sense that auxiliary sciences such as biophysics, mathematics, engineering etc. are never brought in for their own sake but merely in order to throw light on integrated functions and biological adaptations in general. Essentially the understanding aimed at is teleological even though the facts presented have been obtained by experimentation based on causal reasoning in the usual way. I have been at pains to point out a large number of missing facts of the kind needed for understanding motor control problems.

The reading of this book requires some basic knowledge of physiology. From that background it provides the next step to the

subjects discussed. It will be of interest to neurophysiologists, neurologists, bio-engineers, physiologists and those interested in orthopaedics and physiotherapy.

It has been my privilege to have had many chapters read and criticized by friends at Oxford and in Stockholm and Uppsala. One of them, Dr Daniel Kernell, has read all chapters. For this help I am most grateful. As this work developed over the years it was presented in the form of lectures at the Rockefeller University in New York from 1956 to 1966. In 1969 the whole book was summarized in a series of lectures at the Smith-Kettlewell Institute of the Pacific Medical Center in San Francisco.

My former secretary, Miss Gunvor Larsson, once more has given of her time to type the manuscript and Mrs Evi Reigo is responsible for the reproductions of figures from the periodicals cited below. Their invaluable help is gratefully acknowledged. Miss Antoinette Steinacker, San Francisco, has suggested a number of textual improvements.

The great care taken by Academic Press in publishing this book is gratefully acknowledged.

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