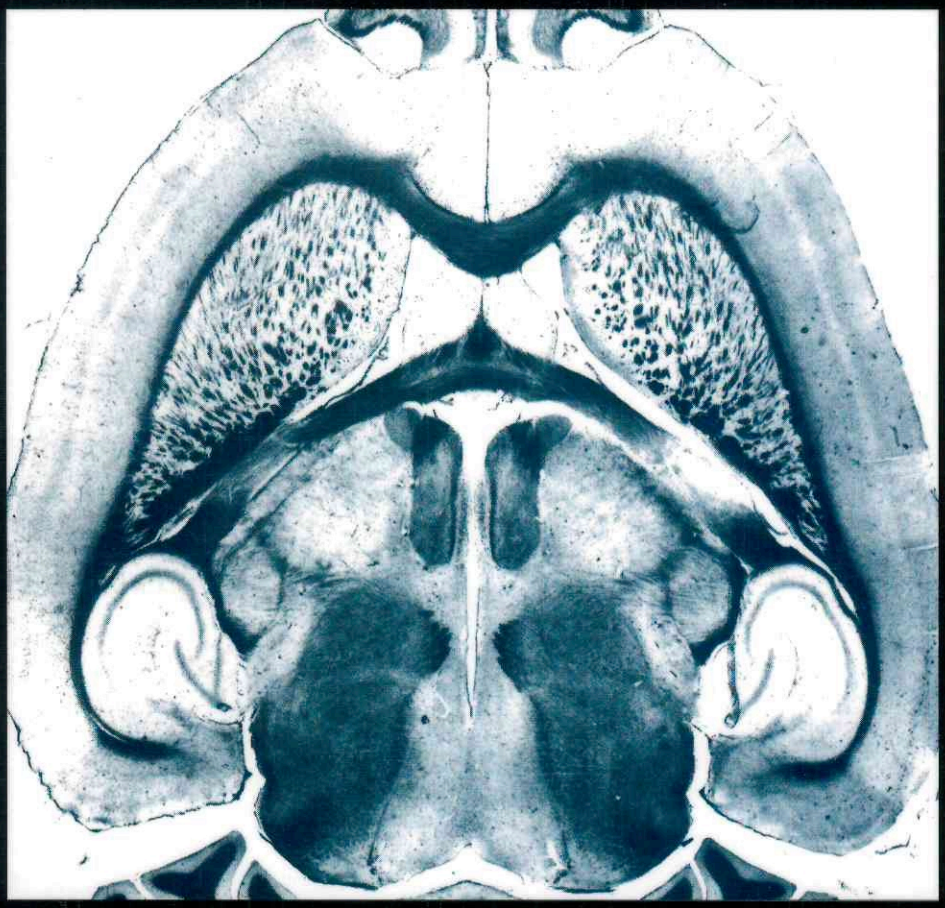
BRAIN THEORY

BIOLOGICAL BASIS AND COMPUTATIONAL PRINCIPLES

A. AERTSEN & V. BRAITENBERG
EDITORS



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Photograph on front cover:
Horizontal section through the brain of a mouse. Myelin stain.

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Preface

This book is the fifth in a series of volumes, trying to define a theory of the brain by bringing together formal reasoning and experimental facts. This endeavour was started some ten years ago by a group of researchers, mostly of theoretical inclination, who were guided by the uneasy feeling that more facts were being produced than they had been able to understand. At the same time, there was an awareness that theoretical reasoning about the brain was perhaps not duly constrained by factual considerations. Thus, the first volumes were dedicated mainly to the task of making neural theories and neural facts more palatable to each other. This epistemological problem is not anymore in the foreground now. A new breed of brain scientists has learned to appreciate and to competently use both the methods of sophisticated experimentation and those of model building. Rather than striving to forge a marriage, we can now happily draw on a new generation, the offspring of a connubium already consumed.

The present collection of papers focuses on the subject of vision, and brings together new insights and facts from various branches of experimental and theoretical neuroscience. The experimental facts presented in this book stem from disparate fields, such as neuroanatomy, electrophysiology, optical imaging, and psychophysics. The theoretical models in part are home-spun, but no less inspiring for that, while others judiciously apply sophisticated mathematical reasoning to results of experimental measurements. We trust that the reader will feel, like we do, that these various attempts may well present the prelude to a new kind of brain science, where facts and theory begin to blend in a manner reminiscent of the development of physics in the last centuries.

Starting point of this enterprise were the presentations and discussions at the Fifth International Meeting on Brain Theory, held at the Istituto per la Ricerca Scientifica e Tecnologica (IRST) in Trento (Italy) on April 5-7, 1994. This meeting, organized by Moshe Abeles, Ad Aertsen, Valentino Braitenberg and Luigi Stringa, was the fifth in a series, starting in 1984 at the International Center for Theoretical Physics in Trieste [1], and continuing in 1986 in Bad Homburg [2], in 1990 at Schloss Ringberg [3] and in 1992 at the IRST in Trento [4]. The meeting lasted three full days, providing a natural segmentation of the presentations and discussions according to three main headings:

(1) Visual perception: psychophysics and physiology
(2) Cortical implementation: physiology and anatomy
(3) Cortical models and computational principles.

We adopted the same tripartition to organize the material in the present book.

The Fifth International Meeting on Brain Theory was jointly sponsored by the European Commission (DG XII), the Fritz Thyssen Stiftung, the Istituto per la Ricerca

Scientifica e Tecnologica (Trento), as well as by contributions from the various institutions who financed the participation of their delegates. Splendid hospitality, together with most efficient organization (thank you, Nadia Oss!) was provided by IRST, Trento. The generous support by all these institutions is most gratefully acknowledged.

Ad Aertsen
Valentino Braitenberg

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