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Foreword

I would like to thank those responsible for making this book possible. During the course of my postdoctoral work in 1974 on the connections of the limbic region at Washington University in St. Louis, Max Cowan suggested that it might be useful to prepare an atlas of the rat brain. I was tracing pathways in paraffin-embedded material, and was never able to produce a series of sections through the full extent of the brain that did not display “shredding” in one region or another; and later experience with frozen sections was equally discouraging for other reasons. Finally, in 1982 I obtained an excellent though not perfect series of serial sections through an entire brain that had been embedded in celloidin, following advice from Tom Woolsey, David Amaral, and Janet Weber.

Photographic negatives were obtained with the advice and assistance of Jim Cox and Marc Lieberman of the Salk Institute Photographics Department in San Diego, and the final set of prints

from these negatives was obtained with the invaluable assistance of photographer Kris Trulock over the next five years or so. I would also like to thank Dave Warren for introducing me to the wonders of computer graphics and for invaluable help in editing and composing this book.

There are, of course, other less tangible influences on the publication of a book. I would especially like to thank Professors Anders Björklund and Tomas Hökfelt for their support and encouragement, and Dr. Nello Spiteri of Elsevier for accepting the responsibility of publishing the book in its present form.

And finally, I would like to thank colleagues who have taken time to help me understand some of the thornier problems in structural neuroscience, and I would especially like to thank Neely and Reid for the love and patience they have shown.

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I. Overview

This book is intended to present graphically an outline of mammalian brain structure, along with templates for preparing maps of the circuitry that underlies behavior. The result is two sets of maps or atlases, one summarizing the major features of brain development, and the other summarizing the major cell groups and fiber tracts that have been identified thus far in the adult rat brain. From this, a map based on the two atlases was designed to summarize the general disposition of major cell groups and fiber systems in the central nervous system.

A number of problems are associated with such a venture. For example, it is useful to appreciate the benefits and limitations of maps in general before attempting to understand and use maps of the rat nervous system in particular. How big is it; how many parts are there; what serves as a compass; what are the underlying design principles; and so on?

The primary literature in structural neuroscience presents another set of difficulties. Research to establish the organization of brain circuits is so time-consuming and technically challenging, and the resulting literature is so vast and yet still so incomplete, that there are critical disagreements about the number, boundaries, connections, and name of many cell groups. To help reduce confusion about the material presented here, references to the particularly relevant primary literature are provided for each labeled structure, and a number of the more common synonyms are included within the Index. And finally, it is important to consider how to use the adult brain atlas, as well as how it was produced. In essence, the atlas is intended to illustrate the major groups of neurons that can be identified in Nissl preparations (the basic neuroanatomical method for showing divisions of the gray matter), along with the major fiber tracts (white matter) that can be observed under darkfield illumination of brain sections. It is very much like an atlas that summarizes the distribution of water and land masses, along with the borders of each country, at a particular time in history. Such maps are quite useful because they can be used as templates for

plotting many other types of information: highway systems, population densities, energy production and distribution systems, and so on. However, with the passage of time, political boundaries change, and the amount of information available to plot continues to increase.

The maps presented here are meant to serve three basic purposes; first, they are an attempt to synthesize graphically our current understanding of the gross morphology of the rat brain; second, they may be used as templates to present the results of experimental work in a systematic way; and third, they could be used as a starting point for computer graphics models of the brain.