

Neuroanatomy for the Neuroscientist

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To our families who showed infinite patience:

To our wives Avis Jacobson and Nuran Turksoy

*To our children Arthur Jacobson and
Robin Seidman*

Erin Marcus and David Letson

*To our grandchildren Ross Jacobson
Zachary Letson and Amelia Letson*

Preface

The purpose of this textbook is to enable a neuroscientist to discuss the structure and functions of the brain at a level appropriate for students at many levels of study, including undergraduate, graduate, dental, or medical school level. It is truer in neurology than in any other system of medicine that a firm knowledge of basic science material (i.e., the anatomy, physiology, and pathology of the nervous system) enables one to readily arrive at the diagnosis of where the disease process is located and to apply their knowledge at solving problems in clinical situations.

The two authors have a long experience in teaching neuroscience courses at the first- or second-year level to medical and dental students in which clinical information and clinical problem-solving are integral to the course. In addition, the first author has taught for many years an upper-level biology course on the central nervous system to undergraduates at Tufts University in Medford, MA, utilizing many of Dr. Marcus' cases to help engage the students. The second author has developed a case history problem-solving sessions in the book *Integrated Neurosciences* by E.M. Marcus and S. Jacobson (Kluwer, 2003) and he also conducts a problem-solving seminar in which all medical students at the University of Massachusetts participate during their clinical neurology clerkship rotation. This provides the students an opportunity to refresh their problem-solving skills and to review and update that basic science material essential for clinical neurology. At both levels, we have observed that this inclusion of case history materials reinforces the subject matter learned by markedly increasing the interest of the students in both basic and clinical science material. This text is a modified version of *Integrated Neurosciences*. This book is also an updated version of an earlier integrated textbook originally developed by the authors along with Dr. Brian Curtis and published by W. B. Saunders in 1972 as *An Introduction to the Neurosciences*. The text provides an updated approach to lesion localization in neurology, utilizing the techniques of computerized axial tomography (CT scanning), magnetic resonance imaging (MRI), and magnetic resonance angiography (MRA). Multiple illustrations demonstrating the value of these techniques in clinical neurology and neuroanatomical localization has been provided. The clinical cases illustrations have been utilized in the body of

the text. An anatomical atlas, including MRI images, is provided on the accompanying CD and they are referred to as Atlas CD.

Decisions had to be made so that the size of the textbook remained within limits that could be managed in most of today's neuroscience courses. The printed book contains the core topics concerned with the central nervous system. We have divided this book into three sections: I: Introduction to the Central Nervous System (Chapters 1–8), II: The Systems (Chapters 9–15), and III: The Non-Nervous Elements (Chapter 16–18). Section III includes Chapter 16 (Meninges, Ventricular System and Vascular System). Chapter 17 (An Overview of Vascular Disease) and Chapter 18 (Movies on the Brain—a review of the movies that feature diseases of the nervous system). We have used several of these movies as an adjunct to a course (*Young Dr. Frankenstein* directed by Mel Brooks has a wonderful scene introducing the central nervous system and *Little Shop of Horrors* directed by Frank Oz features Steve Martin as a dentist and this a great introduction to the trigeminal nerve). There are many movies in the Science Fiction genre that are also useful for discussion and *Star Trek* and its many episodes and with its Medical Manual are at the top of our list! A number of other topics, including cell biology, cell physiology, embryology, nerve, and muscle are usually covered in other courses and the student should examine these topics in those courses. We have included a discussion on the olfactory system and the eighth nerve on the CD. The anatomy of the peripheral nervous system and autonomic nervous system should be reviewed in one of the standard gross anatomy texts.

A webpage has been established by the publisher (www.springer.com). This will provide a means for sending information to our readers, including errata and additions.

Most of the case histories utilized in the chapters have been drawn from the files of Dr. Marcus. For a number of the cases, our associates at the New England Medical Center, St. Vincent Hospital, Fallon Clinic, and the University of Massachusetts School of Medicine either requested our opinion or brought the case to our attention, and they provided information from their case files. These individual neurologists and neurosurgeons are identified in the specific case histories. We are also indebted to the many referring physicians of those institutions. Medical house officers at St. Vincent Hospital presented some of the cases to Dr. Marcus during morning report. In particular, our thanks are due to our associates in Worcester: Dr. Bernard Stone, Dr. Alex Danylevich, Dr. Robin Davidson, Dr. Harold Wilkinson, and Dr. Gerry McGillicuddy. Dr. Sandra Horowitz, Dr. Tom Mullins, Dr. Steve Donhowe, Dr. Martha Fehr, and Dr. Carl Rosenberg provided clinical information from their files for some of the case histories. Our associates at the New England Medical Center, Dr. John Sullivan, Dr. Sam Brendler, Dr. Peter Carney, Dr. John Hills, Dr. Huntington Porter, Dr. Thomas Sabin, Dr. Bertram Selverstone, Dr. Thomas Twitchell, Dr. C. W. Watson, and Dr. Robert Yuan, likewise provided some of the clinical material. Dr. Milton Weiner at St. Vincent Hospital was particularly helpful in providing many of the modern neuroradiological images. Dr. Sam Wolpert and Dr. Bertram Selverstone provided this material for the earlier version of the text. Dr. Val Runge from the Imaging Center at Texas A&M provided the normal MRIs. Dr. Anja Bergman

(left-handed) had the patience to be our normal case and the images from her brain form the normal MRIs in the basic science chapters and atlas. Dr. Tom Smith and his associates in pathology provided much of the recent neuropathological material. Dr. John Hills and Dr. Jose Segaraa provided access to neuropathological material for the earlier version of the text. Dr. Sandra Horowitz and Dr. David Chad provided the critic of particular chapters. Dr. Brian Curtis contributed material for inclusion in the spinal cord chapter and on the physiology of the Visual System.

Dr. Mary Gauthier Delaplane provided many of the new anatomical drawings while a medical student at Boston University School of Medicine. Anne Que, Paul Ning, Tiffany Mellott, Elizabeth Haskins, and Tal Delman aided Dr. Delaplane. Dr. Marc Bard provided drawings for the earlier version of this text while a student at Tufts University School of Medicine. Dr. Brian curtis kindly provided much of the discussion in the spinal cord on its. We have continued to utilize or have modified some of the illustrations that were borrowed with permission from other published sources for the earlier version of this text. We have attempted to contact these original sources for continued permissions. We will acknowledge subsequently any sources that have been inadvertently overlooked. In many of the clinical chapters, various medications are recorded. Before utilizing these medications, the reader should check dosage and indications with other sources. It is with great pleasure that we extend our thanks to our publishers and particularly our editor Marcia Kidston and Joseph Burns. Any faults or errors are those of the authors and we would therefore appreciate any suggestions or comments from our colleagues.

Stanley Jacobson
Elliott M. Marcus

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