For Wendy and Rosalie, new lights in my life.
**Key Features of this Edition!**

- **300+ full-color illustrations**
- **Larger 8½ × 11 trim size** complements the new full-color art
- **Discussion of the latest advances in molecular and cellular biology** in the context of neuroanatomy
- **Coverage of the basic structure and function of the brain, spinal cord, and peripheral nerves** as well as clinical presentations of disease processes involving specific structures
- **Clinical Correlations and case studies** to help you interpret and remember essential neuroanatomic concepts in terms of function and clinical application

**CLINICAL CORRELATIONS**

Abnormal rodents (hamsters, ferrets, hampsters) may occur in any location in or around the spinal cord. Tests (tongue movements, uncoordinated) are often located in the lower extremity, and patients may exhibit the classic symmetrical upper motor neuron signs. The symptoms may progress rapidly and are severe in some cases. If diagnosed early, however, it may be slowly treated. This suggests that spinal cord compression requires urgent surgery. Structural abnormalities usually occur in the subarachnoid space, and rapid spinal cord compression may occur with the disease progression. The symptoms may include numbness, tingling, weakness, and paralysis. This leads to the dysfunction of spinal cord function. Clinical diagnosis is described in a patient with an epidural abscess.

**Maps of the World Within the Brain**

Maps of the world within the brain are unique aspects of the cortex of the human brain. For example, the auditory cortex is divided into the speech areas, which are concerned with the integration of auditory information. The visual cortex is divided into the visual areas, which are concerned with the integration of visual information. The somatosensory cortex is divided into the somatosensory areas, which are concerned with the integration of somatosensory information.

**PERIPHERAL NERVOUS SYSTEM**

The peripheral nervous system (PNS) consists of spinal nerves, cranial nerves, and their associated ganglia. The PNS is divided into two main parts: the somatic nervous system, which is responsible for voluntary control of movement, and the autonomic nervous system, which controls the involuntary functions of the body, such as heart rate, blood pressure, and digestion.

**TABLE 1-2**

<table>
<thead>
<tr>
<th>Terms Used in Neuroanatomy</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cranial</td>
<td>On the head and face</td>
</tr>
<tr>
<td>Spinal</td>
<td>On the backside</td>
</tr>
<tr>
<td>Superior</td>
<td>On the top side</td>
</tr>
<tr>
<td>Inferior</td>
<td>On the bottom side</td>
</tr>
<tr>
<td>Caudal</td>
<td>At the lowermost part (on the tail-end)</td>
</tr>
<tr>
<td>Medial</td>
<td>Close to the middle</td>
</tr>
<tr>
<td>Lateral</td>
<td>Far from the middle</td>
</tr>
<tr>
<td>Ipsilateral</td>
<td>On the same side</td>
</tr>
<tr>
<td>Contralateral</td>
<td>On the opposite side</td>
</tr>
<tr>
<td>Bilateral</td>
<td>On both sides</td>
</tr>
</tbody>
</table>
• Numerous computed tomography (CT) and magnetic resonance images (MRIs) of the normal brain and spinal cord; functional magnetic resonance images that provide a noninvasive window on brain function; and neuroimaging studies that illustrate common pathological entities that affect the nervous system, including stroke, intracerebral hemorrhage, and tumors of the brain and spinal cord

• Introduction to Clinical Thinking section explains how to use neuroanatomy as a basis for analyzing the disordered nervous system

• Numerous tables that make information clear and easy to remember

• A complete practice exam to test your knowledge
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Preface

Very few organ systems, if any, present as fascinating an array of structures and mechanisms as the human brain and spinal cord. Furthermore, it is hard to think of a clinical field that does not encompass at least some aspect of the neurosciences, from molecular and cellular neurobiology through motor, sensory, and cognitive neuroscience, to human behavior and even social interactions. It is the brain, in fact, that makes us uniquely human. No surprise, then, that neuroscience has emerged as one of the most exciting fields of research and now occupies a central role as a substrate for clinical medicine.

One of the unique things about the nervous system is its exquisite architecture. The nervous system contains more cell types than any other organ or organ system, and its constituent nerve cells—more than 100,000,000,000 of them—and an even larger number of supportive glial cells are arranged in a complex but orderly, and functionally crucial, way. Many disease processes affect, in a direct or indirect way, the nervous system. Thus, every clinician, and every basic scientist with an interest in clinical disease, needs an understanding of neuroanatomy. Stroke remains the most frequent cause of death in most industrialized societies; mood disorders such as depression affect more than 1 person in 10; and clinical dysfunction of the nervous system occurs in 25% of patients in most general hospital settings at some time during their hospital stay. An understanding of neuroanatomy is crucial not only for neurologists, neurosurgeons, and psychiatrists but also for clinicians in all subspecialties, since patients of every stripe will present situations that require an understanding of the nervous system, its structure, and its function.

This book, now in its 27th edition, is designed as an accessible, easy-to-remember synopsis of neuroanatomy and its functional and clinical implications. Since many of us learn and remember better when material is presented visually, this book is well illustrated not only with clinical material such as brain scans and pathological specimens but also with hundreds of diagrams and tables that are designed to be clear, explicative, and memorable. This book is not meant to supplant longer, comprehensive handbooks on neuroscience and neuroanatomy. On the contrary, it has been designed to provide a manageable and concise overview for busy medical students and residents, as well as trainees in health-related fields such as physical therapy; graduate students and postdoctoral fellows with an interest in neuroanatomy and its functional underpinnings; and clinicians in practice, for whom minutes are precious.

This book is unique in containing a section entitled “Introduction to Clinical Thinking,” which introduces the reader, early in the text, to the logical processes involved in using neuroanatomy as a basis for thinking about patients. Since some trainees remember patients better than isolated facts, I have included discussions of clinical correlates and clinical illustrations that synthesize the most important characteristics of patients selected from an extensive clinical experience. Also included are illustrative clinical images including computer tomography (CT) and magnetic resonance imaging (MRI), both of normal brain and spinal cord, and of common clinical entities that trainees will likely encounter.

As with past editions, I owe a debt of gratitude to many colleagues and friends, especially members of the Department of Neurology at Yale Medical School. Joachim Baehring, MD, and Joseph Schindler, MD, of Yale, as well as Catharina Faber, MD, at the University of Maastricht contributed invaluable clinical illustrations. Over the years, these colleagues and friends have helped to create an environment where learning is fun, a motif that I have woven into this book. I hope that readers will join me in finding that neuroanatomy, which provides much of the foundation for both neuroscience and clinical medicine, can be enjoyable, memorable, and easily learned.

Stephen G. Waxman, MD, PhD
New Haven, Connecticut
April 2013