Equine Neurology
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Preface

It has been 6 years since the publication of the first edition of *Equine Neurology*, and new information continues to accumulate about equine neurology; hence, it seems timely to offer the second edition of this work. Our goal in the first edition was to provide a comprehensive review of the field of equine neurology and to structure a textbook that provided not only the clinical descriptions of various equine neurologic disorders but also foundation material to assist in understanding neurologic dysfunction in general. With the second edition, we have attempted to continue in this same theme, with the basic organization remaining the same—however, all chapters have been reviewed, modified, and updated—some a little and others more substantially. In addition, we have added chapters on imaging of the nervous system, neuronal physiology, sleep disorders, head shaking, differential diagnosis of muscle trembling and weakness, and cervical articular process joint disease. The chapters on equine neuropathology and electrodiagnostic evaluation have been substantially expanded. The major change is the inclusion of videos illustrating many of the described conditions. These videos were selected to be representative and high-quality instructional videos to aid the reader in their understanding of the text and equine nervous system disease in general.

We wish to acknowledge the hard work and talent of the many individuals who contributed to this work. The time commitment necessary to produce high-quality chapters is substantial, and this edition would not have been produced without their hard work and input. We hope that you read and study this text, use it aid your clinical work, and most of all enjoy learning about equine neurology.

Martin Furr
Stephen Reed
Video Clips Demonstrating Clinical Signs

This book is accompanied by a companion website:

www.wiley.com/go/furr/neurology

The website includes:

• Web exclusive videos
SECTION 1
Foundations of Clinical Neurology
In order to evaluate a patient with a neurologic disorder, a basic understanding of the structure and function of the nervous system is necessary. The goal of this chapter is not to expose the reader to intricate and perhaps daunting detail but rather to present a basic overview of neuroanatomy, highlighting some of the peculiarities of equine neuroanatomy. A basic understanding of the nervous system from an anatomic and functional perspective is an absolute prerequisite to interpreting the neurological examination and to assess if there is indeed a lesion in the nervous system and, if so, where the lesion is located (the “anatomic diagnosis”).

**Organization of the nervous system**

The nervous system is organized into central and peripheral divisions. The central nervous system (CNS) is composed of the brain and spinal cord and is located within the skull and vertebral column. The peripheral nervous system (PNS) is formed by neuronal cell processes that extend from the central axis to the periphery. There are also collections of neuronal cell bodies in the periphery (“ganglia”) that contribute to the components of the peripheral system. Functionally, the nervous system is divided into the somatic nervous system, a system under voluntary control that innervates skeletal muscle and whose sensory branch reaches consciousness, and the autonomic nervous system, which is concerned with subconsciously regulating visceral smooth muscle structures. Both the somatic and nervous system and CNS have central and peripheral motor and sensory components.

**Development**

The nervous system begins as a thickening of the embryonic layer identified as ectoderm. The initial growth of the neural ectoderm forms a thickened layer of cells identified as the neural plate. The neural groove is evident as a depression in the neural plate. As continued growth of the developing system occurs, neural folds develop at the margins of the neural plate caused by migration of the cells in a dorsal direction. Eventually, the neural folds meet and fuse at the dorsal midline thereby forming a cylindrical structure identified as the neural tube. This simplified explanation of the formation of the neural tube is shown in Figure 1.1.

As the neural tube is forming, cells in the region of the neural folds pinch off and migrate throughout the developing body. These are the neural crest cells that differentiate to become various structures in the adult: spinal ganglia, sensory ganglia associated with some of the cranial nerves, autonomic ganglia associated with various body systems, cells of the adrenal medulla and, interestingly, melanocytes.

Closure of the neural tube begins in the midsection of the developing embryo and progresses in a cranial and caudal direction. The opening at each end of the tube is identified as the neural pore. If complete closure of either neural pore is arrested during development, congenital malformations may be evident after birth such as anencephaly, which results in decreased formation of the cerebral hemispheres. In extreme conditions, the hemispheres may be completely absent. Failure of closure of the caudal neuropore results in spina bifida. This condition presents as varying degrees of lack of closure and fusion of the neural tissue and the bony tissue of the vertebral canal that would normally enclose the caudal portion of the spinal cord.

To understand the basic generalized arrangement of the adult nervous system, certain facets of development should be kept in mind. As the neural tube completes its closure, it becomes a fluid-filled cylindrical structure that serves as the template for further development of the adult structures. Segments of the neural tube undergo differential growth to become the adult divisions and