



Contents

Preface

Acknowledgments

Section I Gross Anatomy of the Brain

1 Overview of the Central Nervous System

Gross Anatomy of the Brain

Neuroanatomical Terms

Components of the Central Nervous System

Cerebral Topography

Lateral Surface of the Brain

Frontal Lobe

Parietal Lobe

Occipital Lobe

Temporal Lobe

Medial Surface of the Brain

Inferior (Ventral) Surface of the Cerebral Cortex

Posterior Aspect of the Cerebral Cortex: Temporal and Occipital Lobes

Forebrain Structures Visible in Horizontal and Frontal Sections of the Brain

Ventricles

Basal Ganglia

- Diencephalon
- Limbic Structures
- Topography of the Cerebellum and Brainstem
 - Cerebellum
 - Brainstem
 - Dorsal View of the Brainstem
 - Ventral View of the Brainstem
- 2** Development of the Nervous System
 - Early Aspects of Development
 - Morphogenesis of the Central Nervous System
 - The Spinal Cord
 - The Brain
 - Myelencephalon (Medulla)
 - Metencephalon
 - Mesencephalon (Midbrain)
 - Prosencephalon (Forebrain)
 - Myelination in the Central Nervous System
 - Abnormalities in Development of the Nervous System
 - Spina Bifida
 - Syringo(hydro)myelia
 - Tethered Cord
 - Encephalocele
 - Dandy-Walker Syndrome
 - Anencephaly
 - Folate Therapy for Prevention of Neural Tube Defects
 - Mechanisms Underlying Neural Development
 - Signal Induction and Neural Cell Differentiation
 - Neuronal Generation and Cell Death
 - Factors Affecting Formation and Survival of Neurons
 - How Axons Are Directed to Their Targets and Synapses Are Formed: Neurochemical Specificity
- 3** Meninges and Cerebrospinal Fluid
 - The Meninges

Coverings of the Brain

Dura Mater

Arachnoid Mater

Pia Mater

Coverings of the Spinal Cord

Spinal Dura Mater

Spinal Arachnoid Mater

Spinal Pia Mater

Lumbar Cistern

Brain Ventricular System

The Choroid Plexus

Cerebrospinal Fluid

Formation

Circulation

Functions

Composition

Alteration of the Cerebrospinal Fluid in Pathologic Conditions

The Blood-Brain Barrier and Blood–Cerebrospinal Fluid Barrier

Disorders Associated With Meninges

Meningitis

Meningiomas

Disorders of the Cerebrospinal Fluid System

Hydrocephalus

Increase in Intracranial Pressure

Section ii The Neuron

4 Histology of the Nervous System

The Neuron

The Cell Membrane

The Nerve Cell Body

The Nucleus

The Cytoplasm

Nissl Substance or Bodies

Mitochondria

Golgi Apparatus

Lysosomes

Cytoskeleton

Dendrites

Axon

Axonal Transport

Fast Anterograde Transport

Slow Anterograde Transport

Fast Retrograde Transport

Types of Neurons

Multipolar Neurons

Bipolar Neurons

Pseudo-Unipolar Neurons

Unipolar Neurons

Other Types of Neurons

Neuroglia

Astrocytes

Protoplasmic Astrocytes

Fibrous Astrocytes

Radial Glia

Functions of Astrocytes

Oligodendrocytes

Microglia

Ependymal Cells

Myelinated Axons

Peripheral Nervous System

Central Nervous System

Differences in the Composition of Myelin in the Central Nervous System and Peripheral Nervous System

Composition of Peripheral Nerves

Clinical Considerations

Disorders Associated With Defective Myelination

Multiple Sclerosis

Guillain-Barré Syndrome

Neuronal Injury

Injury of the Neuronal Cell Body

Axonal Damage

5 Electrophysiology of Neurons

Introduction

Structure and Permeability of the Neuronal Membrane

Structure of Proteins

Membrane Transport Proteins

Carrier Proteins (Carriers or Transporters)

Channel Proteins

Transport of Solutes Across Cell Membranes

Simple Diffusion

Passive Transport (Facilitated Diffusion)

Active Transport

Sodium-Potassium Ion Pump

Calcium Pump

Intracellular and Extracellular Ionic Concentrations

Electrophysiology of the Neuron

Terminology

Ion-Related Terms

Electrical Charge-Related Terms

Current Flow-Related Terms

Membrane Potential-Related Terms

Ion Channels

Classification of Ion Channels

Equilibrium Potentials

Ionic Basis of the Resting Membrane Potential

Ionic Basis of the Action Potential

Propagation of Action Potentials

Clinical Considerations

Lambert-Eaton (Eaton-Lambert) Syndrome

Guillain-Barré Syndrome

Multiple Sclerosis

Prion Diseases

Cystic Fibrosis

6 Synaptic Transmission

Introduction

Types of Synaptic Transmission

Electrical Transmission

Chemical Transmission

Cotransmission

Types of Central Nervous System Synapses

Receptors

Directly Gated Synaptic Transmission at a Peripheral Synapse
(Neuromuscular Junction)

Directly Gated Transmission at a Central Synapse

Clinical Considerations

Diseases Affecting the Chemical Transmission at the Nerve–Muscle
Synapse

Myasthenia Gravis

Lambert-Eaton (Eaton-Lambert) Syndrome

Defects in Myelination

Charcot-Marie-Tooth Disease

Disorders Associated With Toxins

Botulism

Tetanus

7 Neurotransmitters

Introduction

Definition

Criteria Used for Identifying Neurotransmitters

Major Classes of Neurotransmitters

Mechanism of Transmitter Release

Exocytosis

- Recycling of Synaptic Vesicle Membranes
- Steps Involved in Neurotransmitter Release
 - Small-Molecule Neurotransmitters
 - Neuropeptide Neurotransmitters
- Individual Small-Molecule Neurotransmitters
 - Acetylcholine
 - Synthesis
 - Removal
 - Distribution
 - Physiological and Clinical Considerations
 - Excitatory Amino Acids: Glutamate
 - Synthesis
 - Removal
 - Physiological and Clinical Considerations
 - Inhibitory Amino Acids
 - γ -Aminobutyric Acid
 - Glycine
 - Catecholamines
 - Dopamine
 - Norepinephrine
 - Epinephrine
 - Indoleamines
 - Serotonin
 - Imidazole Amines
 - Histamine
 - Purines
- Neuroactive Peptides
 - Opioid Peptides
 - Nociceptin
 - Physiological and Clinical Considerations
 - Tachykinins: Substance P
- Gaseous Neurotransmitters
 - Nitric Oxide

Differences From Other Transmitters
Synthesis and Removal
Physiological and Clinical Considerations

Cotransmission

Receptors

Nicotinic Acetylcholine Receptor

N-Methyl-D-Aspartic Acid Receptor

Kainate Receptor

AMPA/Quisqualate Receptor

GABA_A Receptors

Glycine Receptor

5-HT₃ Receptor

Metabotropic Receptors

Cholinergic Muscarinic Receptors

Metabotropic Glutamate Receptors

Dopamine Receptors

Adrenergic Receptors

GABA_B Receptors

Opioid Receptors

Nociceptin Receptors

Serotonin (5-HT) Receptors

Histamine Receptors

Adenosine Receptors

Pattern Recognition Receptors

Toll-Like Receptors

Mechanisms of Regulation of Receptors

Desensitization

Down-Regulation

Ionotropic Receptors

Section **iii** Organization of the Central Nervous System

8 The Spinal Cord

Introduction

Gross Anatomy

Internal Structure

Cytoarchitectural Organization of the Spinal Gray Matter

Spinal Segments

Spinal Cord Tracts

Long Ascending Tracts

Fasciculus Gracilis

Fasciculus Cuneatus

Dorsal (Posterior) Spinocerebellar Tract

Cuneocerebellar Tract

Ventral (Anterior) Spinocerebellar Tract

Rostral Spinocerebellar Tract

Spinothalamic Tract

Long Descending Tracts

Corticospinal Tract

Rubrospinal Tract

Tectospinal Tract

Lateral Vestibulospinal Tract

Medial Vestibulospinal Tract

Reticulospinal Tracts

Medial Longitudinal Fasciculus

Fasciculi Proprii

Spinal Cord Lesions

Spinal Cord Transection

Brown-Séquard Syndrome

Amyotrophic Lateral Sclerosis (Lou Gehrig's Disease)

Syringomyelia

Tabes Dorsalis

Multiple Sclerosis

Combined Systems Disease

Lesions of the Dorsal Root

Lesions of the Ventral Root

Spinal Cord Injury

Spinal Reflexes

Myotatic Reflex

Receptors

Circuitry and Mechanisms

Reciprocal Inhibition in the Myotatic Reflex

Inverse Myotatic Reflex

Resetting of the Muscle Spindle Through the Gamma Loop

Modulation of Muscle Tone by Gamma Motor Neurons

Flexion (Withdrawal) Reflex

Receptors

Circuitry and Mechanism

Crossed Extension Reflex

Receptors

Circuitry and Mechanism

Locomotion

9 Brainstem I: The Medulla

Gross Anatomical View and Internal Organization

Gross Anatomical View

Internal Organization

Major Fiber Tracts and Associated Nuclei

Internal Nuclei of the Brainstem

Levels of the Medulla

Clinical Considerations

Lateral Medullary Syndrome

Medial Medullary Syndrome

Dorsal Medullary Syndrome

10 Brainstem II: Pons and Cerebellum

Introduction

Gross Anatomical View of the Pons

Internal Organization of the Pons

Fiber Pathways

- Major Cell Groups
 - Caudal Pons
 - Rostral Pons
- Basilar Aspect of the Pons
- Pontine Tegmentum
 - Lower (Caudal) Half of the Pons
 - Upper (Rostral) Half of the Pons
- The Cerebellum
- Clinical Considerations
 - Caudal Tegmental Pontine Syndrome
 - Caudal Basal Pontine Syndrome
 - Rostral Basal Pontine Syndrome
 - Rostral Tegmental Pontine Syndrome
 - Other Related Syndromes of the Pons
 - The Locked-In Syndrome
 - The Medial Tegmental Syndrome
 - The One-and-a-Half Syndrome

11 Brainstem III: The Midbrain

- Introduction
- Internal Organization of the Midbrain
 - Level of the Inferior Colliculus
 - Tectum
 - Tegmentum (Including the Periaqueductal Gray Matter)
 - Crus Cerebri
 - Level of the Superior Colliculus
 - Tectum
 - Tegmentum
 - Crus Cerebri
- Clinical Considerations
 - Weber's Syndrome
 - Benedikt's Syndrome
 - Gaze Palsy (Parinaud's Syndrome)

12 The Forebrain

Introduction

Diencephalon

- Thalamus

- Epithalamus

 - Habenular Complex and Stria Medullaris

 - Pineal Gland

- Subthalamus

- Hypothalamus

 - Lateral Hypothalamus

 - Medial Hypothalamus

 - Anterior–Posterior Levels of Hypothalamus

Basal Ganglia

- Principal Component Structures

 - Caudate Nucleus

 - Putamen

 - Globus Pallidus

- Fiber Pathways of the Basal Ganglia

Limbic System and Associated Structures of the Basal Forebrain

- Hippocampal Formation

- Septal Area

- Bed Nucleus of the Stria Terminalis

- Nucleus Accumbens

- Substantia Innominata

- Amygdala

Other Major Pathways of the Forebrain

- Internal Capsule

- Anterior Commissure

Clinical Considerations

- Thalamus

- Hypothalamus

- Basal Ganglia

- Limbic Structures

- Cerebral Cortex

13 The Cranial Nerves

Introduction

Classification of the Cranial Nerves

Efferent Nerves (From the Central Nervous System)

- General Somatic Efferents

- Special Visceral Efferents

- General Visceral Efferents

Afferent Fibers (to the Brain)

- General Somatic Afferents

- Special Sensory Afferents

- Special Visceral Afferents

- General Visceral Afferents

Anatomical Organization of the Cranial Nerves Within the Brainstem

Cranial Nerves Associated With the Lower Brainstem and Adjoining Regions of the Spinal Cord

- Hypoglossal Nerve (Cranial Nerve XII)

- Spinal Accessory Nerve (Cranial Nerve XI)

- Vagus Nerve (Cranial Nerve X)

- Glossopharyngeal Nerve (Cranial Nerve IX)

- Vestibulocochlear Nerve (Cranial Nerve VIII)

Cranial Nerves of the Pons and Midbrain

- Facial Nerve (Cranial Nerve VII)

- Trigeminal Nerve (Cranial Nerve V)

Cranial Nerves of the Pons and Midbrain Associated With the Control of Eye Movements

- Abducens Nerve (Cranial Nerve VI)

- Trochlear Nerve (Cranial Nerve IV)

- Oculomotor Nerve (Cranial Nerve III)

- Control of Eye Movements: Role of the Pontine Gaze Center

- Cortical and Vestibular Control of Extraocular Eye Muscles

- Vertical Gaze Center

Cranial Nerves of the Forebrain

- Optic Nerve (Cranial Nerve II)

Olfactory Nerve (Cranial Nerve I)

Section IV Sensory Systems

14 Somatosensory System

General Organization of Sensory Systems

Sensory Receptors

Modality

Intensity

Duration

Location

Stimulus Transduction

Receptive Field

Relay Nuclei

Cortical Mechanisms

Classification of Nerve Fibers

Somatosensory System

Sensory Modalities

Tactile Sensations (Touch, Pressure, and Vibration)

Proprioception

Pain

Temperature

15 Visual System

Introduction

Components of the Eye

Different Layers of the Retina

The Pigment Epithelium Layer

The Layer of Rods and Cones

The External Limiting Membrane

The Outer Nuclear Layer

The Outer Plexiform Layer

The Inner Nuclear Layer

The Inner Plexiform Layer

- The Layer of Ganglion Cells
- The Optic Nerve Layer
- Müller Cells
- The Photoreceptors
 - Cones
 - Rods
 - Melanopsin-Containing Retinal Ganglion Cells
- Phototransduction
- Processing of Signals From the Photoreceptors by Different Retinal Cells
 - Bipolar, Horizontal, and Ganglion Cells
 - Significance of Changes in On-Center and Off-Center Bipolar and Ganglion Cell Activities
- Color Vision
- Blood Supply of the Retina
- Visual and Retinal Fields
- Visual Pathways
 - The Lateral Geniculate Nucleus of Thalamus
 - The Geniculocalcarine Tract
 - Visual Cortex
 - The Superior Colliculus
- Binding Mechanism
- Visual Reflexes
 - Pupillary Light Reflex
 - Accommodation Reflex
- Prominent Defects in Vision
 - Hypermetropia
 - Myopia
 - Astigmatism
 - Strabismic Amblyopia
 - Night Blindness
 - Color Blindness
 - Argyll Robertson Pupil

- Adie's Pupil
- Marcus-Gunn Pupil
- Weber's Syndrome
- Parinaud's Syndrome
- Retinitis Pigmentosa
- Macular Degeneration

Deficits After a Lesion at Different Sites in the Visual Pathway

16 Auditory and Vestibular Systems

Introduction

Auditory System

- Physics of Sound

- Components of the Ear

 - External Ear

 - Middle Ear

 - Inner Ear

- Mechanism of Sound Conduction

- Central Auditory Pathways

 - Cochlear Nuclei

 - Superior Olivary Nuclei

 - Lateral Lemniscus and Associated Nuclei

 - Inferior Colliculus

 - Medial Geniculate Nucleus

 - Primary Auditory Cortex

- Descending Pathways

- Clinical Disorders Associated With the Auditory System

 - Conduction Deafness

 - Sensorineural Deafness

 - Hearing Tests

 - Tinnitus

Vestibular System

- Anatomical Components

 - Saccule

 - Utricle

Semicircular Canals

Vestibular Sensory Receptors

Central Pathways

Ascending Vestibular Pathways

Cerebellar Afferent and Efferent Projections

Vestibulocortical Pathway

Descending Vestibular Pathways

Vestibular System and Control of Eye Movements

Summary of the Functions of the Vestibular System

Clinical Disorders Associated With the Vestibular System

Nystagmus

Vertigo

Motion Sickness

Inflammation of the Vestibular Labyrinth

Ménière's Disease

17 Olfaction and Taste

Introduction

Olfactory System

Stimulus

Receptors

Sensory Transduction

Central Pathways

Spatial Organization

Clinical Conditions in Which the Olfactory Sensation is Altered

Taste

Stimulus

Receptors

Transduction of the Taste Stimulus

Central Pathways

Taste Perception

Clinical Conditions in Which the Taste Sensation is Altered

Section V Motor Systems

18 The Upper Motor Neurons

Introduction

The Corticospinal Tract

Origin of the Corticospinal Tract

Histology of the Motor Cortex

Course of the Corticospinal Tract

Distribution of the Corticospinal Fibers Within the Spinal Cord

Functions

Primary Motor Cortex

Primary Somatosensory Cortex

Supplementary and Premotor Area Cortices

Role of the Posterior Parietal Cortex

Summary of the Components and Functions of the Corticospinal Tract

The Corticobulbar Tracts

Lesions of Corticobulbar Fibers That Supply Nuclei of Cranial Nerves

Other Projections of the Corticobulbar Tracts

To Sensory Relay Nuclei

Corticoreticular Fibers

Cortical Projections to the Red Nucleus

Descending Motor Systems From the Brainstem

Reticulospinal Tracts

Vestibulospinal Tracts

Rubrospinal Tract

Tectospinal Tract

The Upper Motor Neuron Syndrome

19 The Basal Ganglia

Introduction

Composition of the Basal Ganglia

Afferent Source of the Basal Ganglia

Internal Connections of the Basal Ganglia

Connections of the Neostriatum With the Globus Pallidus

Connections of the Neostriatum With the Substantia Nigra

Connections Between the Globus Pallidus and Subthalamic Nucleus

Output of the Basal Ganglia

Functional Mechanisms of the Basal Ganglia

Possible Role of Intrinsic Circuits

Modulatory Role of Dopamine

Movement Disorders

Parkinson's Disease

Chorea (Huntington's Disease)

Hemiballism

Athetosis

Dystonia

Tardive Dyskinesia

Tourette's Syndrome

Restless Legs Syndrome

Myoclonus

Essential Tremor

20 The Cerebellum

Introduction

Gross Organization of the Cerebellum

Afferent Connections of the Cerebellum

Spinal Cord (Spinocerebellum)

Dorsal (Posterior) Spinocerebellar Tract

Ventral (Anterior) Spinocerebellar Tract

Cuneocerebellar Tract

Rostral Spinocerebellar Tract

Brainstem

Inferior Olivary Nucleus

Brainstem Structures Associated With Posture and Balance

Cerebral Cortex

- Red Nucleus
- Deep Pontine Nuclei
- Other Inputs to the Cerebellar Cortex
 - Tectum
 - Trigeminal System
 - Monoaminergic Systems
- The Anatomical and Functional Organization of the Cerebellar Cortex
 - Mossy and Climbing Fibers
 - Mossy Fibers
 - Climbing Fibers
- Cerebellar Cortex
 - Histology
 - Granular Cell Layer
 - Purkinje Cell Layer
 - Molecular Layer
 - Functional Properties of the Cerebellar Cortex
- Efferent Projections of the Cerebellar Cortex: The Feedback Circuitry
 - Efferent Connections of the Vestibulocerebellum and Spinocerebellum
 - Efferent Connections of the Cerebellar Hemispheres
- Motor Learning and the Cerebellum
- Cerebellar Disorders
 - Ataxia
 - Hypotonia
 - Cerebellar Nystagmus and Gait Ataxia
 - Syndromes Associated With the Midline Region of the Cerebellar Cortex
 - Syndromes Associated With the Cerebellar Hemispheres

Section VI Integrative Systems

- 21 The Autonomic Nervous System**
 - Introduction

Divisions of the Autonomic Nervous System

Sympathetic Division

- Spinal Sympathetic Preganglionic Neurons

- Paravertebral Ganglia and the Sympathetic Chains

- Prevertebral Ganglia

- Functions of the Sympathetic Nervous System

Parasympathetic Division

- Brainstem Parasympathetic Preganglionic Neurons

- Spinal Parasympathetic Preganglionic Neurons

- Functions of the Parasympathetic Nervous System

Enteric Nervous System

- Nonadrenergic Noncholinergic Neurotransmission

Autonomic Innervation of Some Selected Organs

Upper Eyelid

Iris and the Ciliary Body of the Eye

- Sympathetic Innervation

- Parasympathetic Innervation

Sublingual and Submandibular Salivary Glands

- Sympathetic Innervation

- Parasympathetic Innervation

Parotid Salivary Glands

- Sympathetic Innervation

- Parasympathetic Innervation

Lacrimal Glands

- Sympathetic Innervation

- Parasympathetic Innervation

Heart

- Sympathetic Innervation

- Parasympathetic Innervation

Lungs

- Sympathetic Innervation

- Parasympathetic Innervation

Gastrointestinal Tract

- Sympathetic Innervation
- Parasympathetic Innervation
- Adrenal Medulla (Suprarenal Gland)
- Kidney
 - Sympathetic Innervation
 - Parasympathetic Innervation
- Urinary Bladder
 - Sympathetic Innervation
 - Parasympathetic Innervation
 - Afferent Innervation
 - Somatic Innervation
 - Micturition
- Male Reproductive System
 - Erectile Tissue
 - Sympathetic Innervation
 - Parasympathetic Innervation
 - Somatic Innervation
 - Afferent Innervation
 - Male Sexual Response
 - Male Erectile Dysfunction
- Female Reproductive System
 - Sympathetic Innervation
 - Parasympathetic Innervation
 - Somatic Innervation
 - Afferent Innervation
- Blood Vessels
 - Sympathetic Innervation
 - Parasympathetic Innervation
 - Systemic Blood Pressure
- Neurotransmitters in the Autonomic Nervous System
 - Preganglionic Terminals
 - Postganglionic Terminals
- Major Receptors Involved in the Autonomic Nervous System

Cholinergic Receptors

Adrenergic Receptors

Brainstem Areas Regulating Cardiovascular Function

The Nucleus of the Solitary Tract

Caudal Ventrolateral Medullary Depressor Area

Rostral Ventrolateral Medullary Pressor Area

Nucleus Ambiguus

Intermediolateral Cell Column

Baroreceptor Reflex

Cardiopulmonary Reflex

Brainstem Areas Regulating Respiratory Function

Respiratory Neuronal Groups

Chemoreceptor Reflex

Selected Disorders of the Autonomic Nervous System

Orthostatic Hypotension

Horner's Syndrome

Argyll Robertson Pupil

Hirschsprung's Disease (Megacolon)

Frey's Syndrome

Raynaud's Disease

Congestive Heart Failure

Chagas' Disease

Neurogenic Bladder

22 The Reticular Formation

Introduction

Anatomical Organization of the Reticular Formation

General Characteristics

Afferent Connections

Sensory Systems

Motor Systems

Autonomic (and Higher Order Visceral Regulatory) Regions

Efferent Projections

Organizational Considerations

Pathways to Regions Mediating Sensory Functions and Effects on Cortical Excitability Levels

Pathways to Regions Mediating Motor Functions

Pathways Mediating Autonomic Functions

Pathways Modulating Functions of the Hypothalamus and Limbic System

Sleep and Wakefulness

Stages of Sleep

Rapid Eye Movement (Paradoxical) Sleep and Its Anatomical Loci

Role of Other Regions in Sleep and Wakefulness

Sleep Disorders

Narcolepsy

Other Conditions Associated With Hypersomnia

Insomnia

Somnambulism (Sleepwalking)

Night Terrors

Restless Legs Syndrome

Sleep Apnea

Sleep Disorders in Psychiatric Patients

Coma

23 The Hypothalamus

Introduction

Hypothalamic Anatomy

Hypothalamic Nuclei

Connections of the Hypothalamus

Afferent Connections

Efferent Projections

Nature and Functions of Hypothalamic Peptides

Hormones That Target the Anterior Pituitary

Growth Hormone

Thyroid-Stimulating Hormone

Adrenocorticotrophic Hormone

Gonadotropic Hormones

Prolactin

Other Peptides Found in the Hypothalamus

Vasoactive Intestinal Polypeptide

Cholecystokinin

Neurotensin

Substance P

Pro-Opiomelanocortin Peptides

Angiotensin II

Overview of the Integrative Functions of the Hypothalamus

Regulation of Cardiovascular Processes

Hypothalamic Control of Cardiovascular Functions

Temperature Regulation

Feeding Behavior

Early Concept on Regulation of Feeding

More Recent Views

Signals That Induce Feeding

Signals That Induce Satiety

An Overall View

Drinking Behavior

Sexual Behavior

Aggression and Rage

Biological Rhythms

Sleep

Dysfunctions of the Hypothalamus

Hyperthermia

Genital Dystrophy and Abnormalities in Sexual Development

Feeding, Obesity, and Emaciation

Diabetes Insipidus

Effects Upon the Cardiovascular System: Hypertension and Horner's Syndrome

Sleep Disorders

Aggression and Rage

24 The Limbic System

Introduction

Hippocampal Formation

Histology and Local Anatomical Connections

Afferent Connections

Efferent Connections

Functions and Dysfunctions of the Hippocampal Formation

Aggression and Rage

Endocrine Functions

Learning and Memory Functions of the Hippocampal Formation

Septal Area

Histology

Afferent Connections

Efferent Connections

Functions of the Septal Area

Related Basal Forebrain Nuclei

Amygdala

Histology

Afferent Connections

Efferent Connections

Functions and Dysfunctions of the Amygdala

Limbic Components of the Cerebral Cortex

Anatomical Connections

Functions of the Cerebral Cortex

Prefrontal Cortex

Anterior Cingulate Gyrus

Pathological Activity Within Limbic Circuits

Measurement of Brain Activity: The Electroencephalogram

Epilepsy

25 The Thalamus and Cerebral Cortex

Introduction

Anatomical and Functional Characteristics of the Gray Matter of the Cerebral Cortex

Morphological Features

- Cytoarchitectonic Division of the Cerebral Cortex
- Neurotransmitters
- Cortical Layers Associated With Inputs and Outputs
- Excitability Characteristics of Neurons Within a Cortical Column
- Afferent Connections of the Cerebral Cortex
 - The Thalamus
 - Defining Characteristics of Thalamic Nuclei
 - Functional Organization of the Thalamus
 - Other (Nonthalamic) Regions That Project to the Cerebral Cortex
 - Brainstem Reticular Formation
 - Forebrain
- Localization of Function Within the Cerebral Cortex
 - The Parietal Lobe
 - Effects of Lesions
 - Regions Associated With Visual Functions
 - Projection Patterns From the Lateral Geniculate Nucleus
 - Analysis of Form Perception
 - Features of Cortical Columns Within the Occipital Cortex
 - Functions of the Temporal Neocortex
 - Inferotemporal Cortex (Inferior Temporal and Occipitotemporal [Fusiform] Gyri)
 - Middle Temporal Gyrus
 - Superior Temporal Gyrus
 - Effects of Lesions of the Occipital and Temporal Regions of the Cortex
 - Regions Associated With Speech Deficits
 - Temporal–Parietal Region (Wernicke’s Area)
 - Frontal Lobe (Broca’s Area)
 - Functions of the Frontal Lobe
 - Motor Regions of the Cortex
 - Summary and Review of Descending Cortical Pathways
 - Lesions of the Motor Regions of the Frontal Lobe
 - Functions of the Prefrontal Cortex

General Functions of the Cerebral Cortex: Cerebral Dominance, Cortical Excitability, and Learning and Memory

Cerebral Dominance

Role of the Corpus Callosum in Hemispheric Transfer of Information

Examples of Cerebral Dominance

Cortical Excitability: A Summary

Learning and Memory

Disorders Affecting Cognitive Processes and Mental Status

26 Blood Supply of the Central Nervous System

Introduction

Arterial Supply of the Brain

Internal Carotid Arteries

The Ophthalmic Artery

The Posterior Communicating Artery

The Anterior Choroidal Artery

The Anterior Cerebral Artery

The Middle Cerebral Artery

Vertebro-Basilar Circulation

The Vertebral Artery

The Anterior Spinal Artery

The Posterior Inferior Cerebellar Artery

The Posterior Spinal Artery

The Basilar Artery

The Anterior Inferior Cerebellar Artery

The Labyrinthine (Internal Auditory) Artery

The Pontine Arteries

The Superior Cerebellar Artery

The Posterior Cerebral Arteries

Cerebral Arterial Circle (Circle of Willis)

Watershed Brain Areas

Meningeal Arteries

Venous Drainage of the Brain

The Sinuses

The Superior Sagittal Sinus

The Inferior Sagittal Sinus

The Transverse Sinuses

The Confluence of Sinuses

The Cavernous Sinuses

The Sphenoparietal Sinuses

The Cerebral Veins

The Superficial Cerebral Veins

The Deep Cerebral Veins

The Meningeal Veins

The Spinal Cord

Arteries

Posterior Spinal Arteries

Anterior Spinal Artery

The Spinal Medullary Arteries

Radicular Arteries

Veins

27 Vascular Syndromes

Introduction

Neuroimaging

Computed Tomography

Magnetic Resonance Imaging

Functional Magnetic Resonance Imaging

Magnetic Resonance Angiography

Magnetic Resonance Spectroscopy

Positron Emission Tomography

Single-Photon Emission Computed Tomography

Angiography (Arteriography)

Vascular Syndromes

Cerebral Vascular Syndromes

Anterior Cerebral Artery Syndrome

Middle Cerebral Artery Syndrome

Posterior Cerebral Artery Syndrome

Midbrain Vascular Syndromes

Weber's Syndrome

Claude's Syndrome

Parinaud's Syndrome

Benedikt's Syndrome

Superior Cerebellar Artery Syndrome

Pontine Vascular Syndromes

Caudal Basal Pontine Syndrome

Locked-in Syndrome

Medial Tegmental Pontine Syndrome

Caudal Tegmental Pontine Syndrome

One-and-a-Half Syndrome

Rostral Basal Pontine Syndrome

Dorsolateral Tegmental Pontine Syndrome

Rostral Tegmental Pontine Syndrome

Medullary Vascular Syndromes

Lateral Medullary Syndrome

Medial Medullary Syndrome

Dorsal Medullary Syndrome

Hematomas

Epidural Hematoma

Subdural Hematoma

Subarachnoid Hemorrhage

Stroke

Watershed Stroke

28 Behavioral and Psychiatric Disorders

Introduction

Schizophrenia

Behavioral Aspects

Major Subtypes

Paranoid Schizophrenia

Disorganized (Hebephrenic) Schizophrenia

- Catatonic Schizophrenia
- Undifferentiated Schizophrenia
- Course of Development
- Hereditary Factors
- Brain Abnormalities
- Neurochemical Factors
 - Dopamine
 - Serotonin
 - Other Transmitters
- Drug Treatments
- Depression and Other Mood Disorders
 - Major Depressive (Unipolar) Disorder
 - Bipolar Disorder
 - Dysthymia and Cyclothymia
 - Hereditary Factors
 - Brain Abnormalities
 - Neurochemical Factors and Drug Treatments
 - Dopamine
 - Norepinephrine
 - Serotonin
 - The Role of Lithium for Treatment of Bipolar Disorder
 - Neuroendocrine Function and Sleep
- Anxiety Disorders and Drug Treatments
 - Panic Disorder
 - Obsessive-Compulsive Disorder
 - Posttraumatic Stress Disorder
 - Conversion Disorder (Functional Neurological System Disorder)
 - Generalized Anxiety Disorder
- Autism Spectrum Disorders
- Substance Abuse and Brain Function
 - Neural Mechanisms
 - Molecular Sites
 - Brain Circuits Mediating the Rewarding Effects of Drugs

Examples of Specific Drugs of Abuse

Hallucinogens

Opioids

Drugs of Abuse Used by Those Afflicted with Anxiolytic Disorders

Stimulants

Attention Deficit Hyperactivity Disorder

Eating Disorders

Anorexia Nervosa

Bulimia Nervosa

Glossary

Index