Chapter 3
Nervous System
Nervous System

- Central Nervous System
  - Brain and Spinal Cord
- Peripheral Nervous System
  - Connects the CNS to all other parts of the body
Nervous System

Central Nervous System (brain, spinal cord)

Peripheral Nervous System (cranial nerves, spinal nerves)

- sensory neurons (afferent neurons)
- motor neurons (efferent neurons)

somatic nervous system (voluntary)
- sympathetic nervous system (fight or flight)
- parasympathetic nervous system (rest and digestion)

autonomic nervous system (involuntary)
- cardiac muscles
- smooth muscles
- glands

skeletal muscles
The CNS
CNS – Brain Divisions (p. 44)

- **Forebrain** (prosencephalon, *Gr.* “*pros*” forward)
  - Cerebrum
  - Corpus Callosum (R-L sides)
  - Thalamus (PNS-CNS)
  - Hypothalamus (thermostat)
- **Midbrain** (mesencephalon, *Gr.* “*mesos*” middle)
  - Upper portion of the Brain Stem that connects the forebrain and the hindbrain
- **Hindbrain** (rhombencephalon, *Gr.* “*rhombos*” parallelogram)
  - Pons
  - Medulla oblongata
  - Cerebellum
Central Processor: thinking, emotions, language, motor function, thirst, hunger, reproductive function, sleep, temperature control

Vision, hearing, motor control, dopamine release (motivation)

Motor learning, balance, coordination, language, breathing, heart rate, digestion
Meninges: Protective membranes

- **Dura mater** – tough mother
- **Arachnoid mater** – web-like layer
  - Subarachnoid space – filled with cerebrospinal fluid (CSF)
- **Pia mater** – tender mother, fine vascular membrane
Dural Layers

Frontal Lobe

Inner Dura

Middle Meningeal Arterial Branches

Occipital Lobe

Outer Dura
Spinal Cord

- Conducts signals between periphery (PNS) and the Brain
- Simple reflexes
- Protected by vertebrae (bones of the spine)
Nervous System

Central Nervous System
(brain, spinal cord)

Peripheral Nervous System
(cranial nerves, spinal nerves)

sensory neurons
(afferent neurons)

motor neurons
(efferent neurons)

somatic nervous system
(voluntary)

autonomic nervous system
(involuntary)

sympathetic nervous system
(fight or flight)

parasympathetic nervous system
(rest and digestion)

skeletal muscles

cardiac muscles
smooth muscles

glands
Peripheral Nervous System

- **Somatic** – carries signals to and from skeletal muscles
- **Autonomic** – regulates internal environment to maintain homeostasis
  - Sympathetic Pathways – “Fight or Flight”
  - Parasympathetic Pathways – “Rest and Digest”
Autonomic Nervous System

Parasympathetic
- Stimulates flow of saliva
- Slows heartbeat
- Constricts bronchi
- Stimulates peristalsis and secretion
- Stimulates release of bile
- Contracts bladder

Sympathetic
- Dilates pupil
- Inhibits flow of saliva
- Accelerates heartbeat
- Dilates bronchi
- Inhibits peristalsis and secretion
- Conversion of glycogen to glucose
- Secretion of adrenaline and noradrenaline
- Inhibits bladder contraction
Structure of Living Tissue

- Organism
  - Systems
    - Organs
    - Tissues
  - Cells
Cells of the Nervous System

- Neurons
  - Sensory
  - Motor
  - Interneurons
- Neuroglia
  - “glue”
  - Non-neural cells
  - Structure, insulation, nutrients, destroy pathogens, removal of dead neurons
How do Nerves Work?

- Electrical charge (difference in + and – ions) across the membrane (negative inside)
- Stimulus
- Na+ rushes into cell across membrane – “action potential”
- Pump restores Na+ ion concentrations back to resting
How do nerves talk to each other?

- Via a chemical signal
- Neurotransmitters
- Across a synapse (gap) between adjacent neurons
The Brain’s Role in Mental Health

- Mental illnesses are diseases that affect the brain.
- The brain is the central control station for human intelligence, feeling, and creativity.
- Since the 1980s, knowledge of the structure and function of the brain has increased dramatically.
- Advances in imaging technologies (CT scans, PET scans, MRIs) – learn, diagnose, treat.
- **Imbalances of NT** seem to be particularly important in a variety of mental disorders.