# The Biology of Behavior

*General Psychology: Chapter 3*

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## Chapter Outline

- Neurons: Structure and Function
- Neurotransmitters
- The Nervous System: Structure & Function
- Brain Structures
- Lateralization
- Endocrine System
- Drugs

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## Neuroscience

Deals with the biological bases of our thoughts, feelings, and behaviors

- Where are memories stored in the brain?
- How do we experience joy, anger, or desire?
- Why do drug addictions occur?
- Are there parts of the brain that have specialized functions?
- What causes mental illnesses?

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## Neurons: Structure

Neurons: Cells specialized for communicating information (building blocks of nervous system)

- Structure of Neurons
  - cell body
  - axon
  - dendrites
  - glial cells (myelin sheath)
  - axon terminal
  - synapse

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## Neurons: Function

Function of neurons is to receive, process and move information

- Communication within neurons
  - graded potentials- signal within neurons
  - action potentials- change in electrical charge – all or none
- Communication among neurons
  - synaptic transmission

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## Effects of Neurotransmitters

Neurotransmitters (NT): Chemicals that carry information across the synapse

- excitatory- depolarize neurons⇨↑ firing
- inhibitory- hyperpolarize neurons⇨↓ firing

- How are NT's cleared from synapse
  - metabolized- enzymes break down NT in synapse
  - reuptake- NT is taken back into terminal button
- Effect of Drugs on NT
  - agonist: facilitates the action of a NT (nicotine)
  - antagonist: inhibits the action of a NT (alcohol)

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## Major Neurotransmitters

- Acetylcholine- excites muscles, learning, memory
  - linked to Alzheimer's disease
- Norepinephrine- arousal, mood, pleasure
- Dopamine- movement, attention, learning
  - linked to schizophrenia, Parkinson's
- Serotonin- mood, sleep, arousal
  - linked to depression, aggression
- GABA- inhibits Central Nervous System activity
  - linked to sleep and eating disorders
- Endorphins – natural opiates, reduce pain
- Glutamate – long term potentiation – learning & memory

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## Organization of Nervous System

- Central Nervous System
  - brain
  - spinal cord
    - afferent (sensory) and efferent (motor) nerves
- Peripheral Nervous System
  - Somatic Division- controls voluntary muscles
  - Autonomic Division- controls involuntary functions
    - sympathetic (accelerator)- regulates energy (arouses)
    - parasympathetic (brake)- conserves energy (calms)

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## Lower Brain Structures

- Brainstem (hindbrain)
  - medulla- controls breathing, respiration
  - pons- controls sleep, arousal
  - cerebellum- controls basic motor activity
- Midbrain
  - reticular formation- regulates sleep, arousal
  - superior colliculi (vision)
  - inferior colliculi (hearing)

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## Higher Brain Structures

- hypothalamus- regulates endocrine system, eating, drinking
- thalamus- brain's primary relay station for impulses
- limbic system
  - hippocampus- memory storage
  - amygdala- controls emotions and emotional memories

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## Higher Brain Structures (cont.)

- corpus callosum- mass of neurons that connects L & R hemispheres
- cerebral cortex- involved in higher mental functions
  - frontal lobe- abstract thinking
  - parietal lobe- sensation
  - occipital lobe- vision
  - temporal lobe- hearing

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## Language Centers

- Broca's area- speech production
  - frontal lobe
  - damage leads to difficulty articulating words
- Wernicke's area- comprehension
  - temporal lobe
  - damage leads to difficulty understanding speech

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## Brain Specialization

- Left Hemisphere
  - processing language
  - logical thought
- Right Hemisphere
  - visual spatial processing
  - reading emotions
- Evidence comes from:
  - research with intact (noninjured) persons
  - split-brain research

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## Split Brain Research

- Split-Brain Participants
  - to reduce epileptic seizures the corpus callosum is severed
- Divided Visual Field Task
  - Subject (S) fixates on point in center of screen⇨an image is projected to L or R of fixation point (visual field) ⇨S asked to identify object verbally or by touch
    - projected to R visual field, the S can identify verbally b/c image processed in L hemisphere
    - projected to L visual field, the S cannot identify verbally, but can use L hand to identify by touch

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## Studying the brain

- Lesions via injury or surgical
- Brain stimulation
- Electroencephalogram (EEG)
  - electrodes placed on scalp record brain waves
- Computerized Axial Tomography (CAT)
  - Multiple x-rays pieced together from “slices”
- Positron Emission Tomography (PET scan)
  - detects where brain is most active by measuring blood flow
- Magnetic Resolution Imaging (MRI)
  - patient’s head is positioned in strong magnetic field

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## Endocrine System

Endocrine Glands: Secrete hormones (which regulate bodily processes) into bloodstream

- pituitary- releases hormones that control other glands
- adrenal- regulates sugar and sodium levels
- thyroid- hormones affect metabolic rate
- pancreas- secretes insulin to regulate metabolism
- ovaries- secrete estrogen for ovulation
- testes- release androgens for sperm production

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## Drugs

- Depressants, stimulants, hallucinogens
- Depressants
  - Sedatives, opiates, alcohol
- Stimulants
  - Caffeine, nicotine, amphetamines, cocaine
- Hallucinogens
  - LSD, ecstacy
- Marijuana

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