

Behavioral Neuroscience

Biology of Behavior

I. Biopsychology and Behavior

- A. Many biopsychologists, comparative psychologists, and neuropsychologists adopt an evolutionary perspective in their approach to studying biological systems related to behavior
- B. A set of interrelated responses is necessary for human survival
 - 1. Sensing events requires that a stimulus activates a receptor
 - 2. Processing events takes place in the brain
 - 3. Responding to events occurs when the brain sends messages to the muscles

II. The Nervous System

- A. Peripheral nervous system
 - 1. Somatic division: Afferent nerves versus efferent nerves
 - 2. Autonomic division
 - a. Sympathetic division prepares the body for “fight or flight”
 - b. Parasympathetic division returns the body to homeostasis
- B. Central nervous system
 - 1. Spinal cord
 - a. Sensory, motor, and interneurons course through the spinal cord
 - b. Reflexes are automatic responses that occur prior to reaching the brain

III. The Endocrine System

- A. Major endocrine glands
 - 1. Pineal gland: Produces melatonin, regulating sleep-wake cycle
 - 2. Pancreas: Secretes insulin
 - 3. Hypothalamus: Both a gland and a brain structure
 - 4. Pituitary gland
 - a. Posterior secretes vasopressin and oxytocin
 - b. Anterior secretes prolactin, somatotrophin, ACTH, thyroid-stimulating hormone
 - 5. Thyroid gland: Thyroxin to regulate metabolism
 - 6. Gonads: Testes and ovaries produce androgens and estrogen
 - 7. Adrenal glands: Adrenal cortex and adrenal medulla

IV. Neurons: Basic Cells of the Nervous System

- A. Components of the neuron
 - 1. Cell membrane is a semipermeable boundary
 - 2. Dendrites receive signals from receptors
 - 3. Soma (cell body) performs metabolic processes of the neuron
 - 4. Axons send signals to other neurons and to muscles and glands
 - 5. Terminal buttons are found at the ends of axonic branches
 - 6. Myelin sheath is a glia cell covering that speeds transmission by an axon
- B. The synapse and neurotransmitters
 - 1. Synapse
 - a. Terminal button sends a signal

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- b. Dendrite receives a signal
- c. Synaptic cleft is the gap between the two
- 2. Neurotransmitters
 - a. Synaptic vesicles hold chemicals to transport signal across the synapse
 - b. Through excitation or inhibition neurotransmitters activate cells
 - c. Norepinephrine, GABA, serotonin, substance P, dopamine, acetylcholine, endorphins are examples
- 3. Clearing the synapse
 - a. Neurotransmitter is broken down
 - b. Reuptake returns neurotransmitter to terminal button
- 4. Neurotransmitters and drug action
 - a. Agonists enhance the operation of neurotransmitters
 - i. Caffeine is a familiar example
 - b. Antagonists block the operation of neurotransmitters
 - i. Haloperidol is an example
 - c. Neuromodulators have a widespread effect on neurotransmitter release
 - i. Morphine, opioid peptides are examples
- C. The nature of the neural signal
 - 1. Neuron's resting state means more negative ions inside membrane
 - a. Depolarization or hyperpolarization change the negative charge
 - 2. Depolarization and excitatory synapses
 - a. Action potential describes neuron's all-or-none firing
 - b. Refractory period can be absolute or relative
 - 3. Hyperpolarization and inhibitory synapses
- V. The Brain: A Closer Look**
 - 1. Investigating brain functioning
 - a. Early surgical approaches mapped functions through lesion, removal
 - b. Case study method inferred function from deficit
 - c. Studies of brain damage shed light on the normal functioning of the brain
 - d. Stereotaxic surgery gave more precision to studying subcortical regions
 - e. Electroencephalography displays the electrical activity of the brain
 - f. Computerized brain imaging (PET, CAT, MRI) is the most recent advance
 - 2. Major components of the brain
 - a. Hindbrain: Medulla, pons, cerebellum
 - b. Midbrain: Reticular formation coordinates arousal and alertness
 - c. Forebrain
 - i. Limbic system, hypothalamus, thalamus, basal ganglia
 - ii. Cortex: Two hemispheres, four lobes
 - 3. The plastic brain

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- a. Neural plasticity is an amazing feature of the brain
- 4. The split brain
 - a. Severing the corpus callosum eliminates communication between the hemispheres
 - i. In the case of severe epilepsy this provides some relief
 - ii. “Split-brain patients” also allow us to understand cerebral functions