Unit 3A: Biological Bases of Behavior: Neural Processing and the Endocrine System
Unit Overview

- Neural Communication
- The Nervous System
- The Endocrine System

Click on any of the above hyperlinks to go to that section in the presentation.
Neural Communication
Introduction

- **Biological psychology**
  - Biopsychosocial systems
Neurons

- **Neuron**
  - Sensory neurons
  - Motor neurons
  - Interneurons
Neurons

- Parts of a Neuron
  - Dendrite
  - Axon
  - Myelin sheath
    - Multiple sclerosis
  - Terminal branches
  - Cell body
Neurons

Dendrites (receive messages from other cells)
Neurons

- **Dendrites**: Receive messages from other cells.
- **Axon**: Passes messages away from the cell body to other neurons, muscles, or glands.
Neurons

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- **Myelin sheath**: (covers the axon of some neurons and helps speed neural impulses)
Neurons

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- **Neural impulse** (action potential): Electrical signal traveling down the axon.
Neurons

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Terminal branches of axon (form junctions with other cells)

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Neural impulse (action potential) (electrical signal traveling down the axon)
Neurons

- **Dendrites** (receive messages from other cells)
- **Axon** (passes messages away from the cell body to other neurons, muscles, or glands)
- **Terminal branches of axon** (form junctions with other cells)
- **Cell body** (the cell’s life-support center)
- **Neural impulse** (action potential) (electrical signal traveling down the axon)
- **Myelin sheath** (covers the axon of some neurons and helps speed neural impulses)
Neurons

• Speed of a neuron impulse
  – Range from 2 to 200 MPH
  – Measured in milliseconds
    • (thousandths of a second)
Neurons

• Firing of a neuron
  – **Action potential**
  – Ions
    • Positively versus negatively charged
  – Resting potential
  – Selectively permeable
Neurons

• Firing of a neuron
  – Depolarize
  – Refractory period
  – Excitatory versus inhibitory
  – **Threshold**
  – All or none response
Action Potential
Action Potential

Direction of neural impulse: toward axon terminals
1. Neuron stimulation causes a brief change in electrical charge. If strong enough, this produces depolarization and an action potential.

Direction of neural impulse: toward axon terminals
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3. As the action potential continues speedily down the axon, the first section has now completely recharged.

Direction of neural impulse: toward axon terminals
How Neurons Communicate

- Synapse
- Synaptic gap (synaptic cleft)
- Neurotransmitters
- Reuptake
How Neurons Communicate
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2. When an action potential reaches an axon terminal, it stimulates the release of neurotransmitter molecules. These molecules cross the synaptic gap and bind to receptor sites on the receiving neuron. This allows electrically charged atoms to enter the receiving neuron and excite or inhibit a new action potential.

3. The sending neuron normally reabsorbs excess neurotransmitter molecules, a process called reuptake.
How Neurotransmitters Influence Us

- Acetylcholine (AcH)
- Dopamine
- Serotonin
- Norepinephrine
- GABA
- Glutamate
- Endorphins
Some Neurotransmitters and Their Functions

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<td>Glutamate</td>
<td>A major excitatory neurotransmitter; involved in memory.</td>
<td>Oversupply can overstimulate brain, producing migraines or seizures (which is why some people avoid MSG, monosodium glutamate, in food).</td>
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How Neurotransmitters Influence Us

How Drugs and Other Chemicals Alter Neurotransmitters

- Agonists versus antagonists
  - Agonists
  - Antagonists
Agonists and Antagonists

Neurotransmitters carry a message from a sending neuron across a synapse to receptor sites on a receiving neuron.
Agonists and Antagonists

Neurotransmitters carry a message from a sending neuron across a synapse to receptor sites on a receiving neuron.

This neurotransmitter molecule fits the receptor site on the receiving neuron, much as a key fits a lock.
Agonists and Antagonists

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This agonist molecule excites. It is similar enough in structure to the neurotransmitter molecule to mimic its effects on the receiving neuron. Morphine, for instance, mimics the action of endorphins.
Agonists and Antagonists

This neurotransmitter molecule fits the receptor site on the receiving neuron, much as a key fits a lock. (a)

This agonist molecule excites. It is similar enough in structure to the neurotransmitter molecule to mimic its effects on the receiving neuron. Morphine, for instance, mimics the action of endorphins. (b)

This antagonist molecule inhibits. It has a structure similar enough to the neurotransmitter to occupy its receptor site and block its action, but not similar enough to stimulate the receptor. Curare poisoning paralyzes its victims by blocking ACh receptors involved in muscle movement. (c)
The Nervous System
The Nervous System
The Nervous System

Peripheral nervous system
The Nervous System

Peripheral nervous system

Nervous system

Peripheral

Autonomic (controls self-regulated action of internal organs and glands)

Central nervous system

Central (brain and spinal cord)
The Nervous System

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Somatic (controls voluntary movements of skeletal muscles)
The Nervous System

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Autonomic (controls self-regulated action of internal organs and glands)

Sympathetic (arousing)

Parasympathetic (calming)

Central nervous system

Central (brain and spinal cord)

Somatic (controls voluntary movements of skeletal muscles)
Introduction

- **Nervous System**
  - Central Nervous System (CNS)
  - Peripheral Nervous System (PNS)

- **Nerves**
The Peripheral Nervous System

• **Somatic Nervous System**
• **Autonomic Nervous System**
  – Sympathetic nervous system
  – Parasympathetic nervous system
The Central Nervous System

- Brain and spinal cord
- Neural networks
- Spinal cord
  - Reflex
A Simple Reflex

- Skin receptors
- Muscle
- Brain
- Interneuron
- Spinal cord
1. In this simple hand-withdrawal reflex, information is carried from skin receptors along a sensory neuron to the spinal cord (shown by the red arrow). From here it is passed via interneurons to motor neurons that lead to muscles in the hand and arm (blue arrow).
A Simple Reflex

1. In this simple hand-withdrawal reflex, information is carried from skin receptors along a sensory neuron to the spinal cord (shown by the red arrow). From here it is passed via interneurons to motor neurons that lead to muscles in the hand and arm (blue arrow).

2. Because this reflex involves only the spinal cord, the hand jerks away from the candle flame even before information about the event has reached the brain, causing the experience of pain.
The Endocrine System
Endocrine System

- **Endocrine system**
  - **Hormones**
  - **Adrenal glands**
    - Epinephrine and norepinephrine
    - Adrenaline and noradrenaline
    - Fight or flight response
  - **Pituitary gland**
Pituitary gland (secretes many different hormones, some of which affect other glands)
Hypothalamus (brain region controlling the pituitary gland)
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Thyroid gland (affects metabolism, among other things)
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Adrenal glands (inner part helps trigger the "fight-or-flight" response)
Hypothalamus (brain region controlling the pituitary gland)

Pituitary gland (secretes many different hormones, some of which affect other glands)

Parathyroids (help regulate the level of calcium in the blood)

Thyroid gland (affects metabolism, among other things)

Adrenal glands (inner part helps trigger the “fight-or-flight” response)

Pancreas (regulates the level of sugar in the blood)
Hypothalamus (brain region controlling the pituitary gland)

Pituitary gland (secretes many different hormones, some of which affect other glands)

Thyroid gland (affects metabolism, among other things)

Parathyroids (help regulate the level of calcium in the blood)

Adrenal glands (inner part helps trigger the “fight-or-flight” response)

Pancreas (regulates the level of sugar in the blood)

Testis (secretes male sex hormones)

Ovary (secretes female sex hormones)
The End
Division title (green print)
subdivision title *(blue print)*

• xxx
  – xxx
  – xxx
Use this slide to add a table, chart, clip art, picture, diagram, or video clip. Delete this box when finished.
Definition Slide

= add definition here
Definition
Slides
Biological Psychology

= a branch of psychology concerned with the links between biology and behavior.

• Some biological psychologists call themselves
  – behavioral neuroscientists,
  – neuropsychologists,
  – behavior geneticists,
  – physiological psychologists, or
  – biopsychologists.
Neuron

= a nerve cell; the basic building block of the nervous system.
Sensory Neurons

= neurons that carry incoming information from the sensory receptors to the brain and spinal cord.
Motor Neurons

= neurons that carry outgoing information from the brain and spinal cord to the muscles and glands.
Interneurons

= neurons within the brain and spinal cord that communicate internally and intervene between the sensory inputs and motor outputs.
Dendrite

= the bushy, branching extensions of a neuron that receive messages and conduct impulses toward the cell body.
Axon

= the extension of a neuron, ending in branching terminal fibers, through which messages pass to other neurons or to muscles or glands.
Myelin Sheath

= a layer of fatty tissue segmentally encasing the fibers of many neurons; enables vastly greater transmission speed of neural impulses as the impulse hops from one node to the next.
Action Potential

= a neural impulse; a brief electrical charge that travels down an axon.
Threshold

= a level of stimulation required to trigger a neural impulse.
Synapse

= the junction between the axon tip of the sending neuron and the dendrite or cell body of the receiving neuron. The tiny gap at this junction is called the synaptic gap or synaptic cleft.
Neurotransmitters

= chemical messengers that cross the synaptic gaps between neurons. When released by the sending neuron, neurotransmitters travel across the synapse and bind to receptor sites on the receiving neuron, thereby influencing whether that neuron will generate a neural impulse.
Reuptake

= a neurotransmitter’s reabsorption by the sending neuron.
Endorphins

= “morphine within” – natural, opiate-like neurotransmitters linked to pain control and pleasure.
Nervous System

= the body’s speedy, electrochemical communication network, consisting of all the nerve cells of the peripheral and central nervous systems.
Central Nervous System

= the brain and spinal cord.
Peripheral Nervous System

= the sensory and motor neurons that connect the central nervous system (CNS) to the rest of the body.
Nerves

= bundled axons that form neural “cables” connecting the central nervous system with muscles, glands, and sense organs.
Somatic Nervous System

= the division of the peripheral nervous system that controls the body’s skeletal muscles.

• Also called the skeletal nervous system.
Autonomic Nervous System

= the part of the peripheral nervous system that controls the glands and the muscles of the internal organs (such as the heart). Its sympathetic division arouses; its parasympathetic division calms.
Sympathetic Nervous System

= the division of the autonomic nervous system that arouses the body, mobilizing its energy in stressful situations.
Parasympathetic Nervous System

= the division of the autonomic nervous system that calms the body, conserving its energy.
Reflex

= a simple, autonomic response to a sensory stimulus such as the knee-jerk response.
Endocrine System

= the body’s “slow” chemical communication system; a set of glands that secrete hormones into the bloodstream.
Hormones

= chemical messengers that are manufactured by the endocrine glands, travel through the bloodstream, and affect other tissues.
Adrenal Glands

= a pair of endocrine glands that sit just above the kidneys and secrete hormones (epinephrine and norepinephrine) that help arouse the body in times of stress.
Pituitary Gland

= the endocrine system’s most influential gland. Under the influence of the hypothalamus, the pituitary regulates growth and controls other endocrine glands.