What We Will Cover in This Section

- Overview
- Genetics
- The nervous system.
  - Neurons.
  - Nervous system.
  - Brain
- Endocrine System.

Overview

- Much of your behavior is determined by how you are built.

\[ B = f(P \cdot E) \]
Overview

- Focus on internal (physiological) aspects of behavior.
- Emphasis on:
  - Genetics.
  - Natural selection and evolutionary processes.

Sociobiology

The systematic study of the biological bases of all social behavior in animals.
Evolutionary Model

VARIATION
Organisms vary in many ways.

INHERITANCE
Some of these variations are heritable.

SELECTION
Variations that are adaptive become more common in the population.

Evolutionary Theory

1. Living organisms can produce more offspring than environmental resources can support.
2. This leads to Struggle for Survival.
3. Organisms that compete better to reach reproductive maturity produce offspring (Survival of the Fittest).
4. The heritable characteristics that allow organisms to survive will be passed on to offspring.

Inclusive Fitness

The biological goal of living creatures is to ensure that their genes (their own and those of their offspring) get carried on.
Basic Assumptions

1. We live to pass copies of our genes into the next generation and to ensure their survival.
2. Natural selection influences social behavior as well as anatomical and physiological structures.

Ideas About Human Nature

Cultural Universals

If a class of social behavior occurs in every culture, it is probably genetically determined.
**Question?**

What social behaviors occur in all human cultures?

**Biogrammar**

The innate, genetic programming that structures our social behavior.
- This is a template for behavior.
- Provides a potential, not the implementation.

**Behavioral Interaction**

Biological Predispositions  
Environmental Experiences
Key Terms

- **Genotype**
  The genetic structure an organism inherits from its parents.

- **Phenotype.**
  The observable characteristics of an organism that results from the interaction between its genotype and the environment.

The Nervous System

Pathways
Anatomy of the Neuron

- **Dendrites**
  - Parts of the neuron that receive the message.
- **Axon**
  - Parts of the neuron that transmit the message.
- **Terminal buttons.**
  - Parts of the neuron that communicate the message to other parts of the body.
- **Myelin Sheath**
  - The fatty coating on a nerve.
Neuron Signals

- All-or-None
  - Each neuron fires completely or not at all.
- Strength of the signal is determined by
  - the number of neurons firing.
  - the frequency of the firing.
Neurotransmitters

The chemicals released into the synapse that either excite or inhibit activity.

Acetylcholine

- Excitatory transmitter found throughout the brain and body.
  - Influences memory in the brain.
    - Alzheimer’s disease destroys cerebral neurons that secrete acetylcholine.
  - Causes muscles to contract.
    - Botulism poisoning works by blocking acetylcholine release in the lungs.
    - Curare is used in open heart surgery.

GABA

- Most common inhibitory transmitter in the brain.
  - Works as a transmitter in 30% of the brain synapses.
  - When there are low levels some forms of emotional problems occur.
    - Related to anxiety disorders.
Catecholamines

- Norepinephrine
  - Related to mood states.
  - Low levels related to depression.
- Dopamine
  - Related to psychoses.
  - High levels related to schizophrenia.
- Serotonin
  - Found in neurons in the brain stem.
  - Related to arousal and autonomic processes.
  - Related to mood disorders.

Endorphins

- Play a role in controlling emotional behaviors.
  - Enhance pleasure.
  - Inhibit pain.
  - Reduce anxiety.
- Opiate drugs mimic endorphins.

How Drugs Work

1. Block the release of the neurotransmitter from the sending neuron.
2. Block the receptor site of the receiving neuron.
3. Block the reuptake of the neurotransmitter from the synaptic gap.
The Nervous System
Nervous System

Central Nervous System (brain and spinal cord)

Peripheral Nervous System (nerve tissue outside brain and spinal cord)

Somatic nervous system (sensory and motor nerves, voluntary)

Autonomic nervous system (internal systems, involuntary)

Sympathetic division ("troubleshooter")

Parasympathetic division ("housekeeping")

Sympathetic and Parasympathetic Systems

<table>
<thead>
<tr>
<th>Fight or Flight</th>
<th>Relax</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dilates pupils</td>
<td>Constricts pupils</td>
</tr>
<tr>
<td>Relaxes bronchi</td>
<td>Constricts bronchi</td>
</tr>
<tr>
<td>Slows digestion</td>
<td>Stimulates digestion</td>
</tr>
<tr>
<td>Accelerates heart</td>
<td>Slows heart</td>
</tr>
<tr>
<td>Constricts capillaries</td>
<td>Relaxes capillaries</td>
</tr>
</tbody>
</table>

Question?

Have you ever been in a situation where you were terrified?

What sensations did you feel?
Functions of Basic Brain Elements

<table>
<thead>
<tr>
<th>Brain Element</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spinal Cord</td>
<td>Connects the brain to rest of the body; controls some simple reflexes.</td>
</tr>
<tr>
<td>Medulla</td>
<td>Controls heart rate, breathing, waking; cross over point for spinal nerves.</td>
</tr>
<tr>
<td>Cerebellum</td>
<td>Controls muscle coordination, posture, balance.</td>
</tr>
<tr>
<td>Midbrain</td>
<td>Switching area for signals to and from the brain.</td>
</tr>
<tr>
<td>Forebrain</td>
<td>Advanced thinking</td>
</tr>
<tr>
<td>Cortex</td>
<td>Outer surface of the brain where all of the 'thinking' takes place.</td>
</tr>
</tbody>
</table>
The Limbic System

Controls and coordinates motivated behavior, emotional states, and memory.

<table>
<thead>
<tr>
<th>Structure</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hippocampus</td>
<td>Mediates the acquisition of memory; involved in storing new explicit memories.</td>
</tr>
<tr>
<td>Thalamus</td>
<td>Relays sensory impulses to the correct place in the cerebral cortex.</td>
</tr>
<tr>
<td>Hypothalamus</td>
<td>Regulates homeostasis; Hunger and thirst.</td>
</tr>
<tr>
<td>Amygdala</td>
<td>Controls emotion, aggression, and the formation of emotional memory.</td>
</tr>
</tbody>
</table>
**Elements of the Cerebral Cortex**

<table>
<thead>
<tr>
<th>Area</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visual Cortex</td>
<td>Processes visual information.</td>
</tr>
<tr>
<td>Auditory Cortex</td>
<td>Receives and processes auditory information.</td>
</tr>
<tr>
<td>Broca’s Area</td>
<td>Involved with speech production.</td>
</tr>
<tr>
<td>Wernicke’s Area</td>
<td>Language understanding and interpretation</td>
</tr>
<tr>
<td>Motor Cortex</td>
<td>Controls voluntary muscle movement.</td>
</tr>
<tr>
<td>Somatosensory Cortex</td>
<td>Processes sensory input from the body.</td>
</tr>
</tbody>
</table>

**Motor and Somatosensory Cortex**

**Brain Lateralization**
Lateralization of Brain Functioning

- Right Hemisphere Controls: 
  - Speech Production
  - Visual Cortex

- Left Hemisphere Controls: 
  - Optic Chiasm
  - Relay Center

Effects of Split Brain

- "I see an apple." (Left Hemisphere)
- "I don't know what the word is." (Right Hemisphere)
The Endocrine System

Endocrine System

• What is it?
  *Network of glands that secrete hormones into the bloodstream.*

• What are hormones?
  *Chemical messengers that regulate mood, influence growth, sexual characteristics, etc.*

Common Hormones

• Testosterone.
  - Male sex hormone that stimulates production of sperm and the development of male secondary sex characteristics.

• Estrogen.
  - Female sex hormone responsible for the release of eggs, maintenance of female reproductive system, and development of female secondary sex characteristics.
The end