**Neural Communication**

- **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 are sent to other neurons or to muscles or glands
- **Myelin [MY-uh-lin] Sheath**
  - a layer of fatty cells segmentally encasing the fibers of many neurons
  - enables vastly greater transmission speed of neural impulses

- **Action Potential**
  - a neural impulse; a brief electrical charge that travels down an axon
  - generated by the movement of positively charged atoms in and out of channels in the axon’s membrane
- **Threshold**
  - the level of stimulation required to trigger a neural impulse

- **Synapse [SIN-aps]**
  - junction between the axon tip of the sending neuron and the dendrite or cell body of the receiving neuron
  - tiny gap at this junction is called the synaptic gap or **cleft**
- **Neurotransmitters**
  - chemical messengers that traverse 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 it will generate a neural impulse
**Neural Communication**

**TABLE 2.1**

<table>
<thead>
<tr>
<th>Neurotransmitter</th>
<th>Function</th>
<th>Examples of Malfunctions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acetylcholine (ACh)</td>
<td>Enables muscle action, learning, and memory</td>
<td>Undersupply as ACh-producing neurons deteriorate, marks Alzheimer’s disease</td>
</tr>
<tr>
<td>Dopamine</td>
<td>Influences movement, learning, attention, and emotion</td>
<td>Causes dopamine receptor activity linked to schizophrenia; staved of dopamine, the brain produces the tremors and decreased mobility of Parkinson’s disease</td>
</tr>
<tr>
<td>Serotonin</td>
<td>Affects mood, hunger, sleep, and arousal</td>
<td>Undersupply linked to depression, Psychosis; and other antidepressants drugs raise serotonin levels</td>
</tr>
<tr>
<td>Norepinephrine</td>
<td>Helps control attention and arousal</td>
<td>Undersupply can depress mood</td>
</tr>
<tr>
<td>GABA (gamma- aminobutyric acid)</td>
<td>A major inhibitory neurotransmitter</td>
<td>Undersupply linked to seizures, tremors, and tremor</td>
</tr>
<tr>
<td>Glutamate</td>
<td>A major excitatory neurotransmitter; involved in memory</td>
<td>Oversupply can overstimulate brain, producing high stress or seizures (which is why some people avoid MSG, monosodium glutamate, to food)</td>
</tr>
</tbody>
</table>

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**Neurotransmitters**

- **Dopamine**: affects voluntary movement, attention, thought and memory
  - Too much leads to Psychosis – schizophrenia
  - Too little leads to Parkinson’s
- **Norepinephrine**: Emotional arousal, anxiety and fear – involved in the activation of the sympathetic nervous system
- **Serotonin**: Sleep and emotional arousal; implicated in aggression
  - Too low leads to depression and increased aggression
  - High achievers or leaders tend to have higher levels of serotonin
- **GABA**: Inhibits brain excitability and anxiety (naturally produces GHB-classified as date rape drug such as Rohypnol)

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**Common Drugs and their Interactions**

- **Depressants**
  - Alcohol: stimulates release of dopamine and mimics GABA
  - Valium: causes the release of GABA which causes relaxation
- **Stimulants**
  - Cocaine: blocks the reuptake of dopamine causing heightened elevation in mood – causes blood vessel constriction used in eye surgeries
  - Caffeine: slows reabsorption of NT by blocking enzymes
  - Amphetamines: increases release of Dopamine and norepinephrine and blocks reabsorption – in the past used for weight loss – today used for narcolepsy and ADHD (Ritalin)
**Neurotransmission Quiz**

1. The function of dendrites is to:
   A. receive incoming signals from other neurons
   B. release neurotransmitters into synaptic gap
   C. coordinate activation of parasympathetic and sympathetic nervous symptoms
   D. control pain with release of opiate-like chemicals

2. The chemical messengers released into spatial junction between neurons are called
   a. hormones
   b. neurotransmitters
   c. genes
   d. glial cells

3. The speed at which a neural impulse travels is increased when the axon is encased by a(n):
   a. myelin sheath
   b. agonist
   c. action potential
   d. synaptic vesicle
The Nervous System

- Nervous System
  - the body’s speedy, electrochemical communication system
  - consists of all the nerve cells of the peripheral and central nervous systems
- Central Nervous System (CNS)
  - the brain and spinal cord
- Peripheral Nervous System (PNS)
  - the sensory and motor neurons that connect the central nervous system (CNS) to the rest of the body

The Nervous System

- Nerves
  - neural “cables” containing many axons
  - part of the peripheral nervous system
  - connect the central nervous system with muscles, glands, and sense organs
- Sensory Neurons
  - neurons that carry incoming information from the sense receptors to the central nervous system

Neurotransmission Quiz

4. What is the minimum level of stimulation required for a neural impulse to trigger?
   a. reflex
   b. threshold
   c. synapse
   d. action potential

Neurotransmission Quiz

5. Schizophrenia is most closely linked with excess receptor activity for the neurotransmitter:
   a. dopamine
   b. epinephrine
   c. acetylcholine
   d. serotonin

The Nervous System

- Nerve cells
  - neurotransmitters
  - interneurons
  - a. dopamine
  - b. epinephrine
  - c. acetylcholine
  - d. serotonin

The Nervous System

- Interneurons
  - CNS neurons that internally communicate and intervene between the sensory inputs and motor outputs
- Motor Neurons
  - carry outgoing information from the CNS to muscles and glands
- Somatic Nervous System
  - the division of the peripheral nervous system that controls the body’s skeletal muscles

The Nervous System

- Nervous system
  - Peripheral
  - Central (brain and spinal cord)
  - Autonomic (controls self-regulated action of internal organs and glands)
  - Sympathetic (arousing)
  - Parasympathetic (calming)
  - Skeletal (controls voluntary movements of skeletal muscles)
The 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)

- **Sympathetic Nervous System**
  - division of the autonomic nervous system that arouses the body, mobilizing its energy in stressful situations

- **Parasympathetic Nervous System**
  - division of the autonomic nervous system that calms the body, conserving its energy

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The Nervous System

- **Reflex**
  - a simple, automatic, inborn response to a sensory stimulus

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The Nervous System

- **Neural Networks**
  - interconnected neural cells
  - with experience, networks can learn, as feedback strengthens or inhibits connections that produce certain results
  - computer simulations of neural networks show analogous learning

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Infancy and Childhood: Physical Development

- **Maturation**
  - biological growth processes that enable orderly changes in behavior
  - relatively uninfluenced by experience