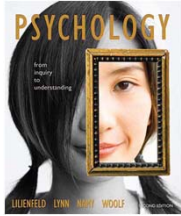


Psychology:
From Inquiry to Understanding 2/e

Scott O. Lilienfeld
Steven Jay Lynn
Laura Namy
Nancy J. Woolf

Prepared by Caleb W. Lack



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Chapter Three
Biological Psychology:
Bridging the Levels of Analysis

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Lecture Preview

- **Nerve cells and communication in the brain**
- The central and peripheral nervous systems
- Glands, hormones, and the endocrine systems
- Mapping the brain
- Nature and nurture

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Biological Psychology

- *Neuroscientists* have made huge strides in understanding how the brain works
- Bridging the gap between the nervous system and our behavior allows us to span multiple levels of analysis

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Nerve Cells

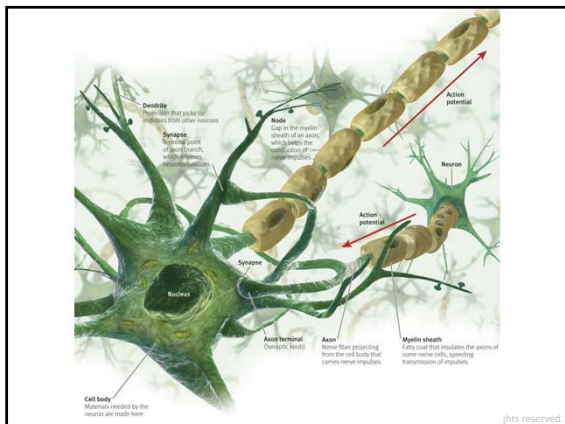
- **Neurons** are brain cells that specialize in communication
- There are around 100 billion neurons, with around 160 billion connections between them

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Neuronal Components

- **Cell body (soma)**
 - Center of neuron; builds new cell components
- **Dendrites**
 - Branchlike extension that receive information from other neurons
- **Axons**
 - “Tails” of the neuron that spread out from the cell body and transmit information

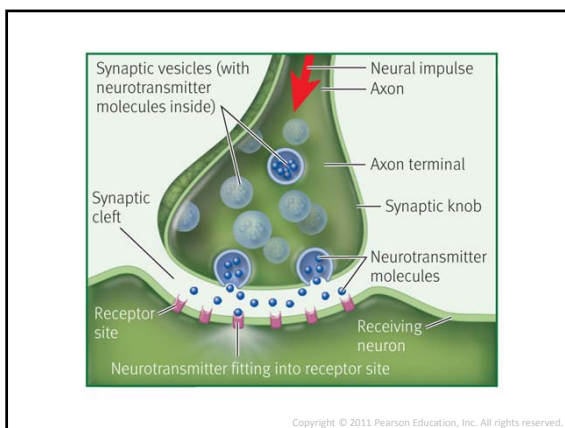
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Neuronal Components

- Axon terminal
 - Knob at the end of the axons that contains synaptic vesicles filled with neurotransmitters
- Neurotransmitters (NTs)
 - Chemical messengers that allow neuron to neuron communication
- Synapse
 - Space between neurons through which NTS travel

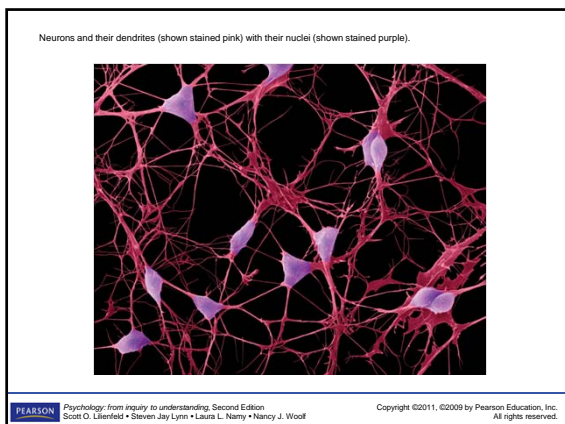
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ReCap: Nerve Cells

- **Neurons** are brain cells that specialize in communication
- There are around 100 billion neurons, with around 160 billion connections between them

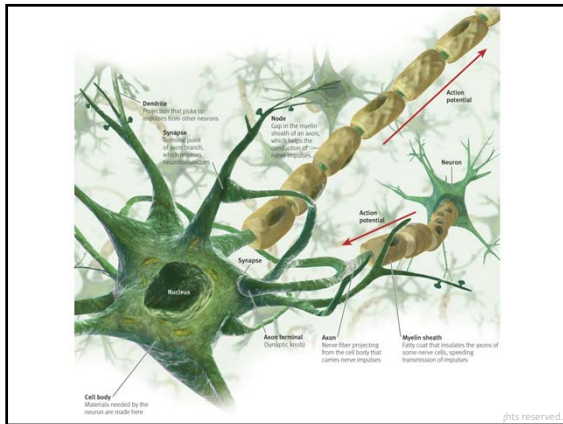
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Glial Cells

- Cells that are plentiful in the brain (1:1 ratio with neurons)
- Astrocytes are most abundant and increase reliability of neuronal transmission
- Oligodendrocytes promote new connections and produce the myelin sheath around axons

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Electrifying Thought

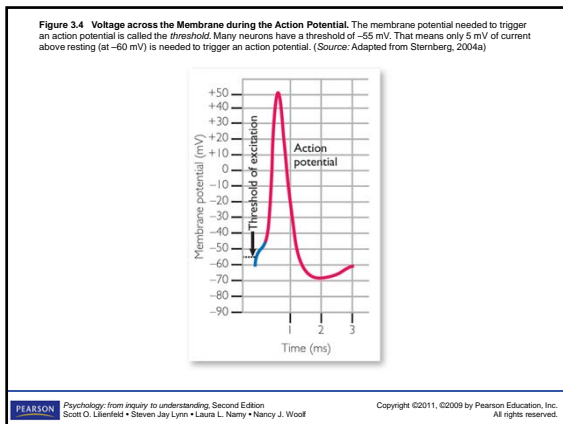
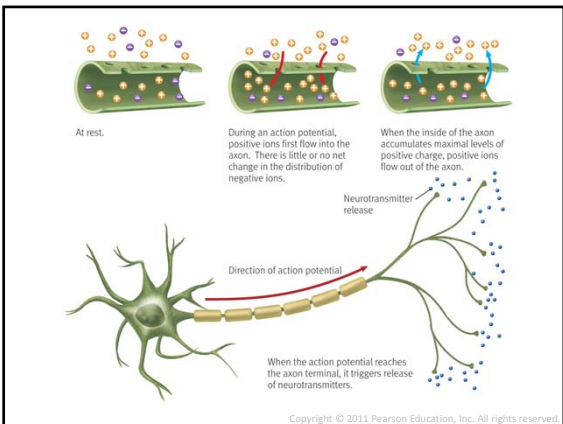
- Neurons respond to NTs by generating electrical activity
- When there are not NTs acting on a neuron, it is at the resting potential
- When there is enough of a charge inside the neuron (threshold), an action potential will occur

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Action Potentials

- Abrupt waves of electric discharge triggered by a change in charge inside the axon
- This is the neuron “firing,” an all-or-none response
- Originate near cell body and travel down the axon to the axon terminal, triggering NT release

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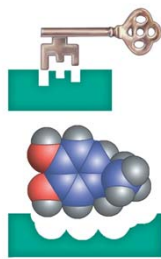
Action Potentials

- Neurons can fire 100 to 1,000 times per second
- The longer the axon, the more limited their *maximal firing rate* is

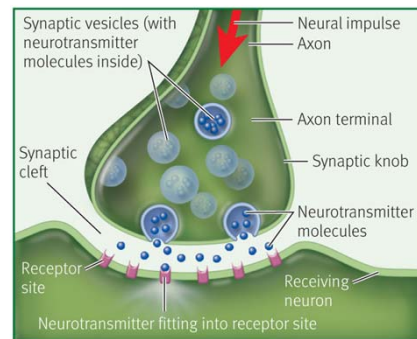
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Neurotransmission

- Communication *inside* neurons is electrical, but communication *between* neurons is chemical via NTs
- When NTs are released, they bind with **receptor sites** of the next neuron



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Neurotransmission

- **Reuptake**, NTs going back into the axon terminal
- Different: NTs are different messengers; some excite and others inhibit the nervous system
- Each NT has a specific role and function in brain and body function

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Video

- MultiMedia Library
- Explore
 - The Action Potential
 - Neuronal Transmission
- <http://www.mathxl.com/info/mmlib.aspx?bookcode=Lilienfeld2e>

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NTs and Psychoactive Drugs

- *Psychoactive drugs* target the production or inhibition of certain NTs and impact mood, arousal, or behavior
- Opiates mimic endorphins and increase activity (**agonists**), while SSRIs block reuptake of serotonin
- **Antagonists** decrease activity, like dopamine blockers for schizophrenia

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Video

- Episode 3 Biological Psychology
- In the Real World : Neurotransmitters
- http://visual.pearsoncmg.com/mypsychemlab/episode03/web_index.html?clip=7&tab=tab0

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Video

- Episode 3 Biological Psychology
- What's In It For Me?: Your Brain on Drugs
- http://visual.pearsoncmg.com/mypsychlab/episode03/web_index.html?clip=7&tab=tab0

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Neural Plasticity

- Changes over time in brain and nervous system
- Neurons change in four ways during development
 - Growth of dendrites and axons
 - Synaptogenesis
 - Pruning
 - Myelination

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Neural Plasticity

- During learning, *long-term potentiation* occurs and makes synapses perform better
- Once we reach adulthood, our plasticity decreases sharply and we can recover only partially from brain injury and illness

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Figure 3.6 Neurons in Standard and Enriched Conditions. Neurons from rats reared in standard (top) or enriched (bottom) conditions. Note the increase in branching and extension of dendrites in the enriched condition. (Source: Giuseppe Leggio et al., 2005)



PEARSON Psychology: from inquiry to understanding, Second Edition
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