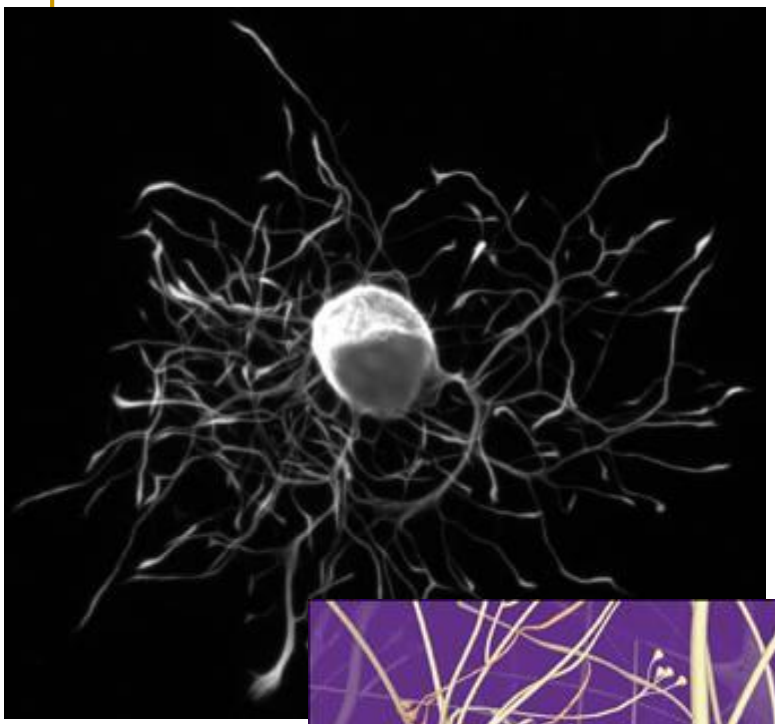
Students will recognize how neurons are involved with multiple sclerosis (MS).

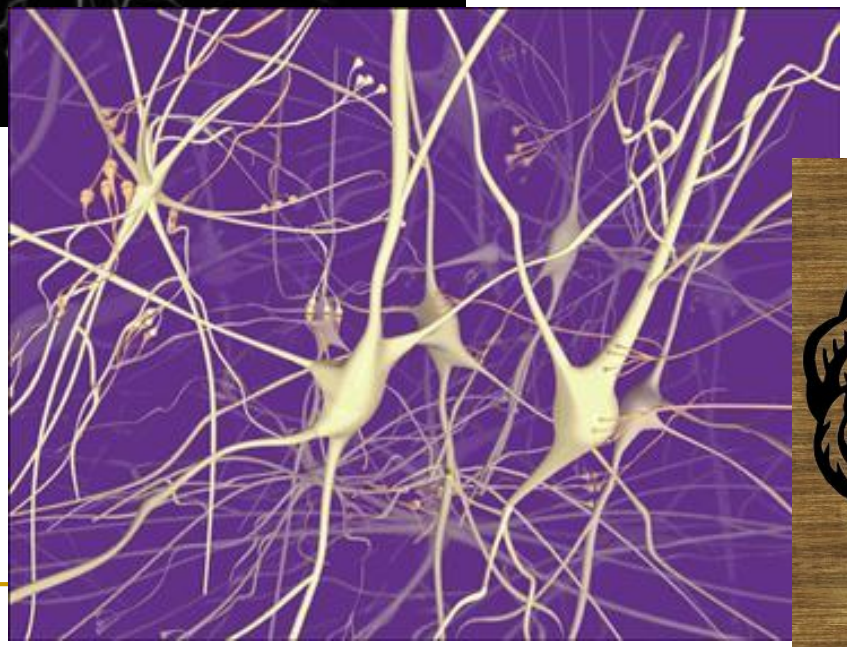
Students will discover how a neuron fires.

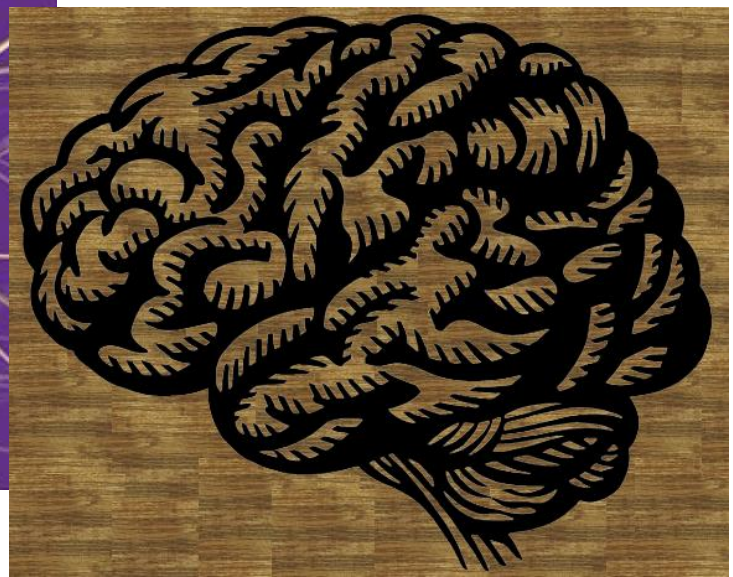
Students will demonstrate knowledge of how a neuron fires by comparing it to a flushing toilet.

Brain Facts



- 100 billion neurons
- A typical neuron has about 1,000 to 10,000 synapses (that is, it communicates with 1,000 –10,000 other neurons, muscle cells, glands, etc.).
- 100 trillion synapses
- Weight 46 - 50 ounces (≈ 3 pounds)





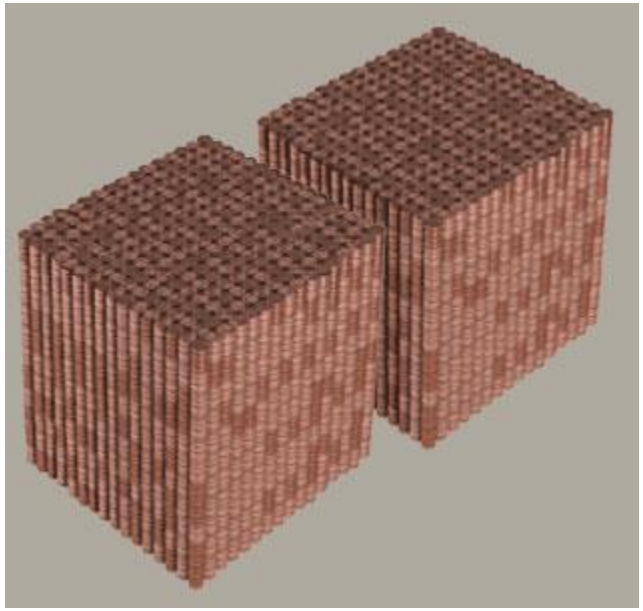
100 Million, Billion, Trillion… What's the diff? *Shrug*

value	1¢, (one cent)
width	0.75 inches, (3/4 of an inch)
height	0.75 inches, (3/4 of an inch)
thickness	0.0625 inches, (1/16 of an inch)
weight	0.1 ounces, (1/10 of an ounce)

value	16¢, (sixteen cents)
width (side-by-side)	12 inches, (one foot)
height (stacked)	1 inch
thickness	0.0625 inches, (1/16 of an inch)
weight	1.6 ounces

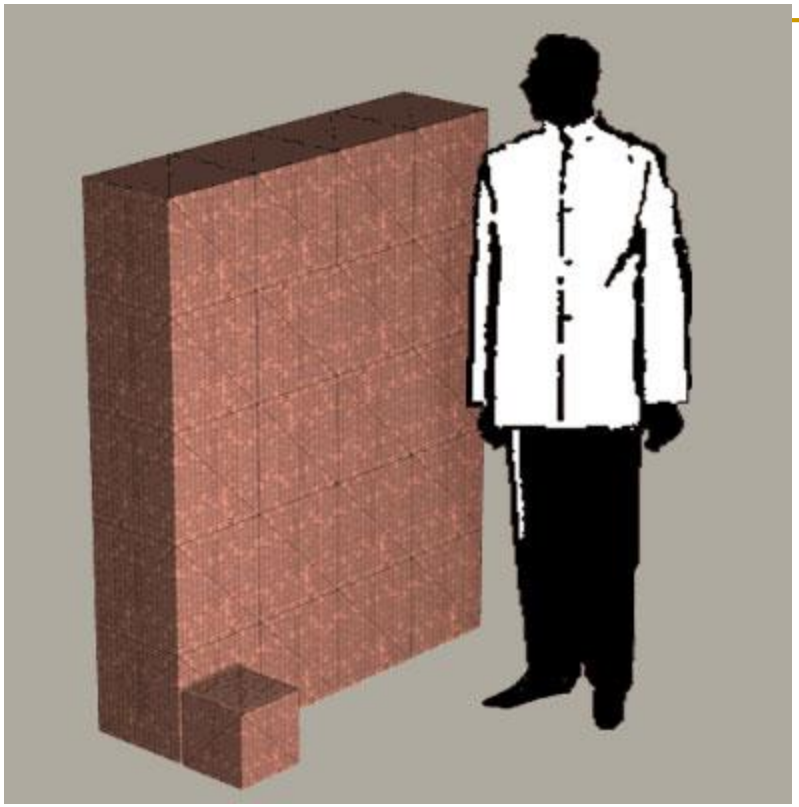
1,000 pennies

value	**$10.00, (Ten dollars and no cents)**
width	**3.75 inches**
height	**3.75 inches**
thickness	**2.5 inches**
weight	**100 ounces, (6.25 pounds)**
height stacked	**62.4 inches, (5.2 feet)**
area (laid flat)	**562.5 square inches (3.9 square feet)**



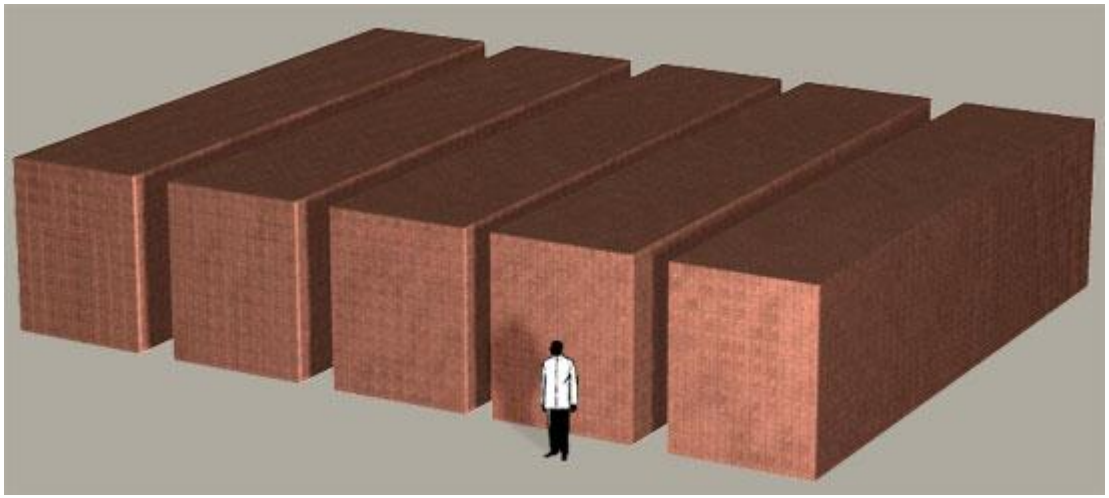
100,000 pennies

value	**$1000.00**
width	**24 inches, (two feet)**
height	**12 inches, (one foot)**
thickness	**12 inches, (one foot)**
weight	**614.4 pounds**
height stacked	**512 feet**
area (laid flat)	**384 square feet**



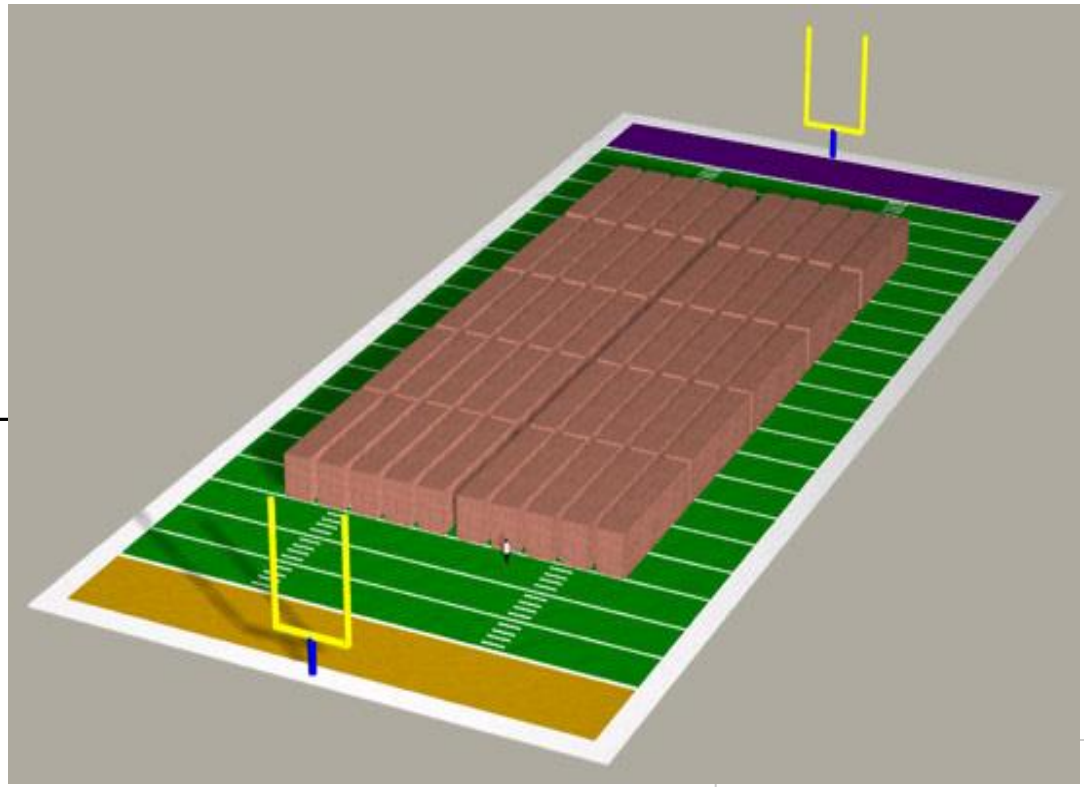
1,000,000 pennies

value	**$10,000**
width	**Four feet**
height	**Five feet**
thickness	**12 inches, (one foot)**
weight	**6273.6 pounds (3.14 tons)**
height stacked	**5,228 feet (0.99 Miles)**
area (laid flat)	**3,921 square feet**



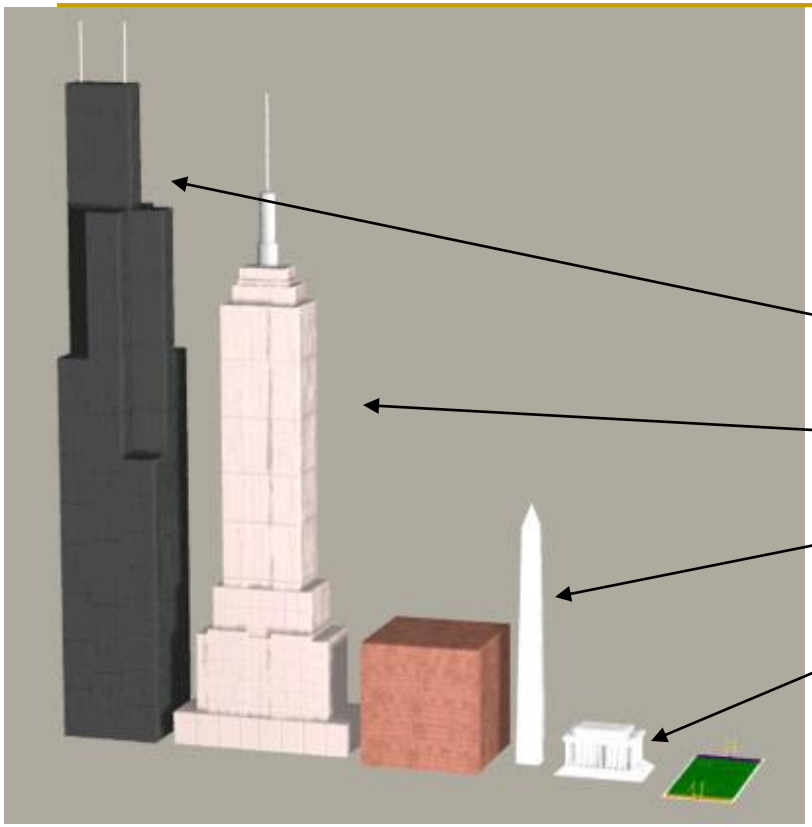
1,000,000,000 pennies

value	$10,000,000
width	45 feet
height	11 feet
thickness	41 feet
weight	3,125 tons
height stacked	987 Miles
area (laid flat)	3,906,321 square feet (89.7 acres)



100,000,000,000 Neurons in the brain!

value	$1,000,000,000
width	90 feet
height	11 feet
thickness	205 feet
total weight	31,250 tons
height stacked	9,864 Miles
area (laid flat)	897 acres



100,000,000,000 pennies

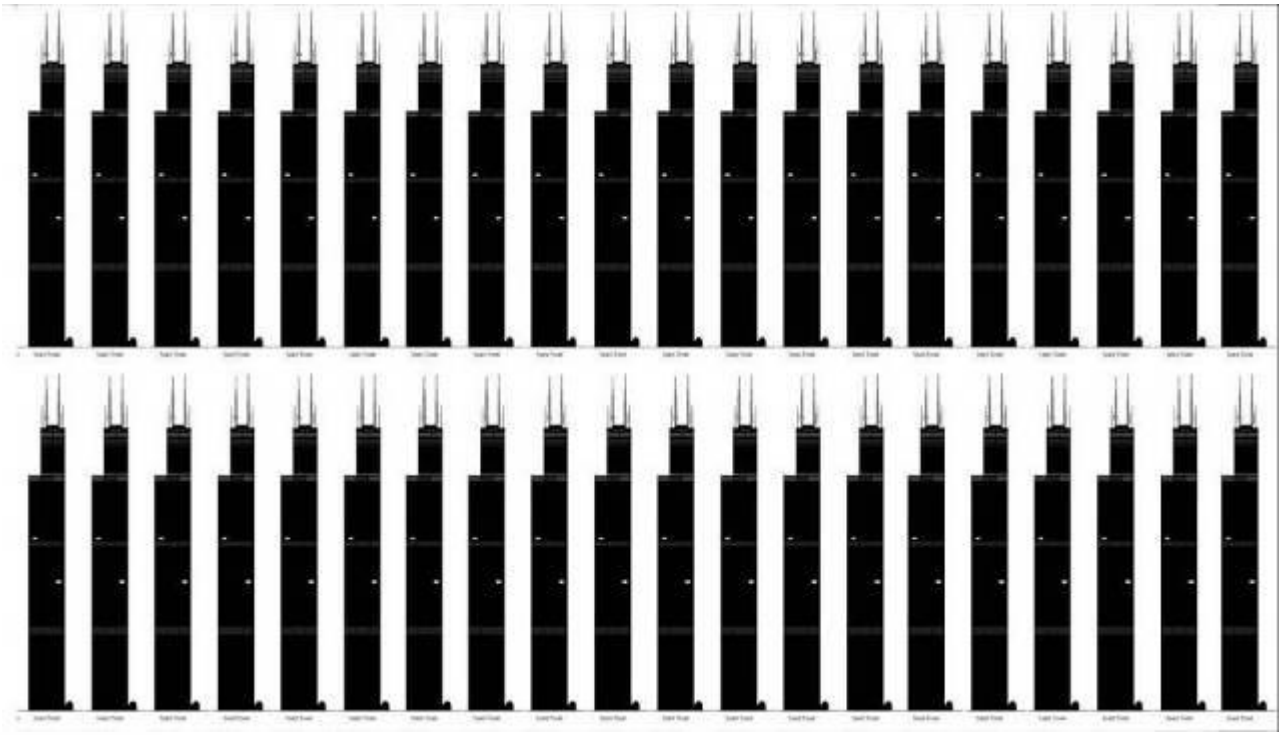
- Sears Tower
- Empire State Building
- Washington Monument
- Lincoln Memorial

value	**$1,000,000,000**
width	**273 feet**
height	**273 feet**
thickness	**273 feet**
total weight	**3,125,000 tons**
height stacked	**986,426 Miles**
area (laid flat)	**89,675.2 acres**

2,623,684,608,000 pennies.

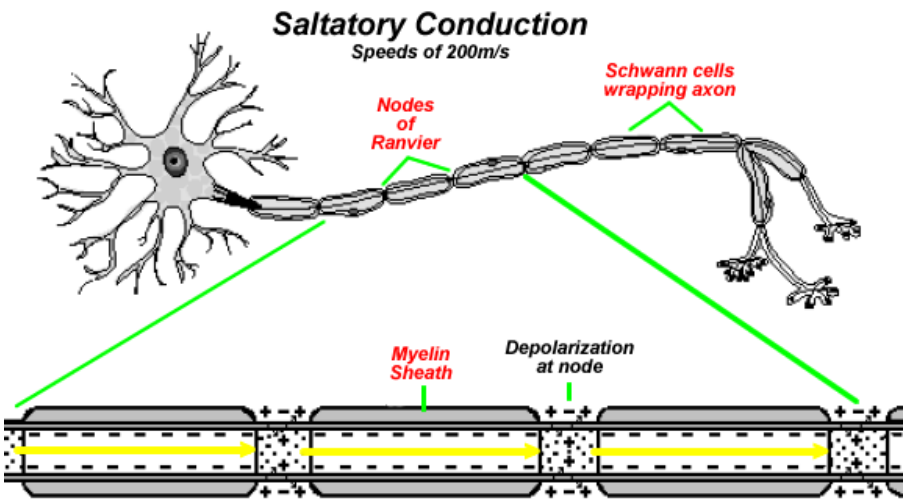
value	**$26,236,846,080.00** **(Twenty-six billion, two hundred thirty-six million, eight hundred forty-six thousand and eighty dollars)**
total weight	**8,199,014 tons**
height stacked	**2,588,073 Miles**
area (laid flat)	**235,279.3 acres**

100,000,000,000,000 synapses in the brain!

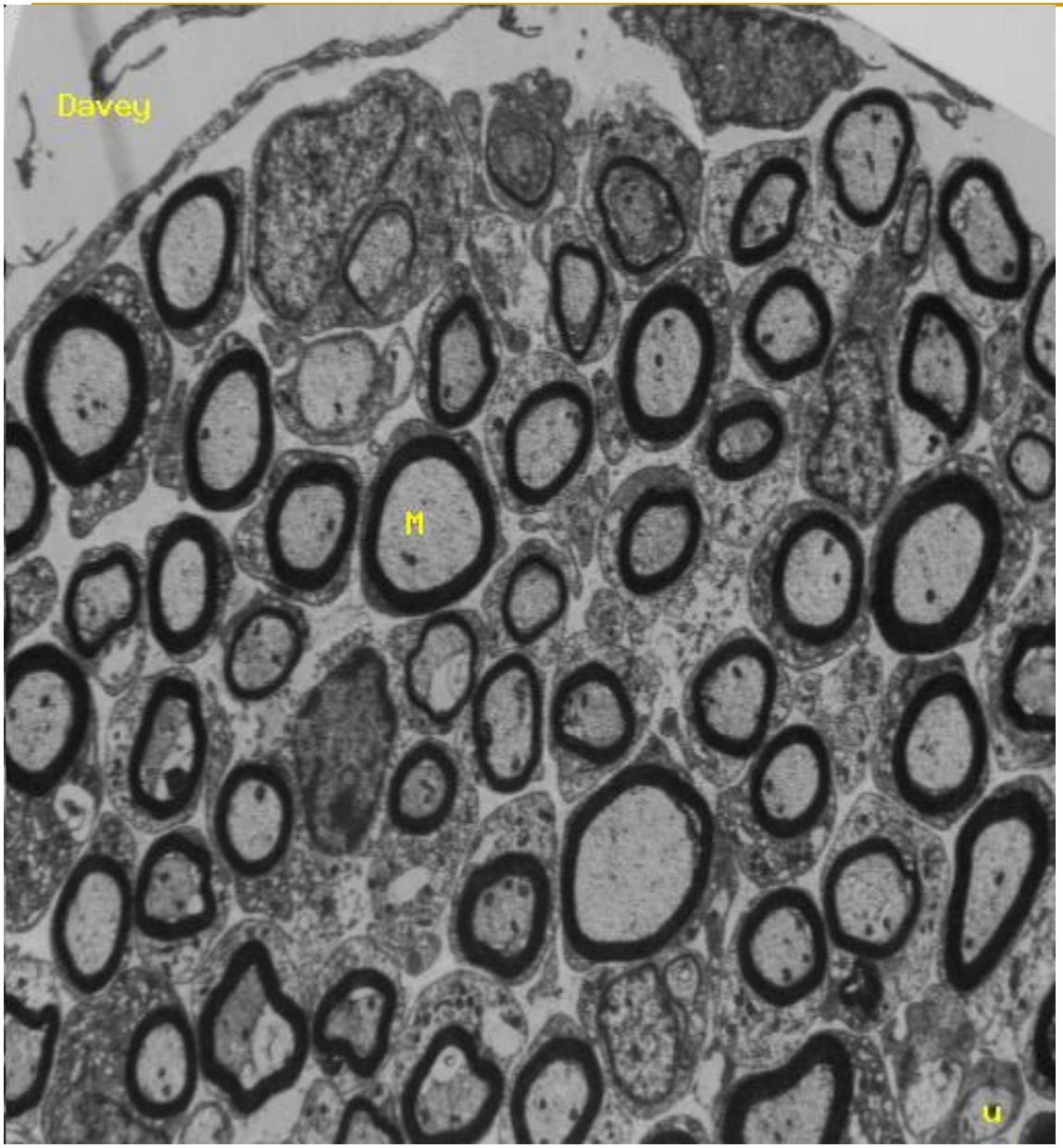


Myelin Sheath and Multiple Sclerosis

- In MS, the body mistakenly directs antibodies and white blood cells against proteins in the myelin sheath
- This results in inflammation and injury to the sheath and ultimately to the nerves that it surrounds. The result may be multiple areas of scarring (sclerosis).
- **Nodes of Ranvier:** Gaps between the "beads" of the Myelin Sheath

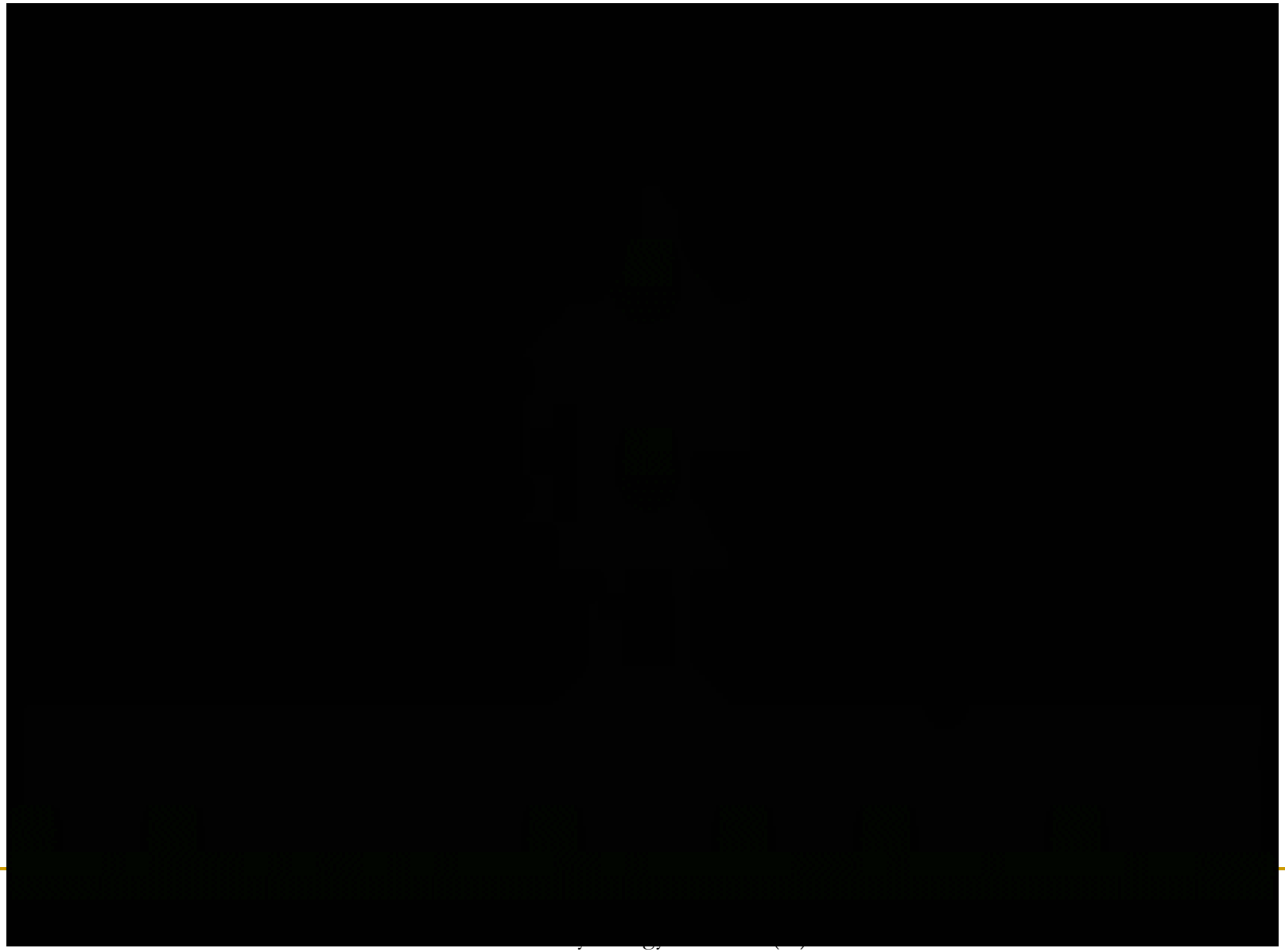


Schwann Cells: Cells that wrap around the axon, and create the Myelin Sheath.



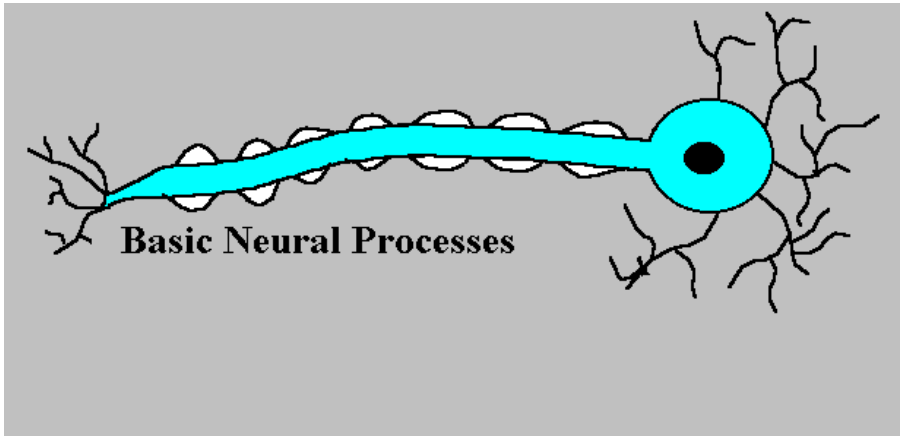
In this picture, the dark circles are ***Schwann cells*** surrounding PNS axons creating a protective layer known as the myelin sheath.

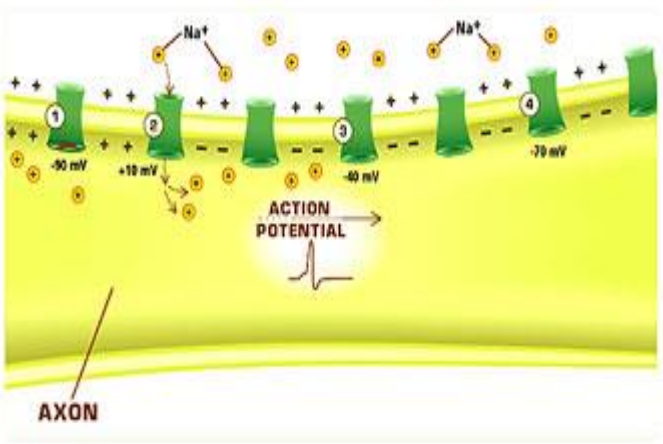
MS – The Myelin Sheath



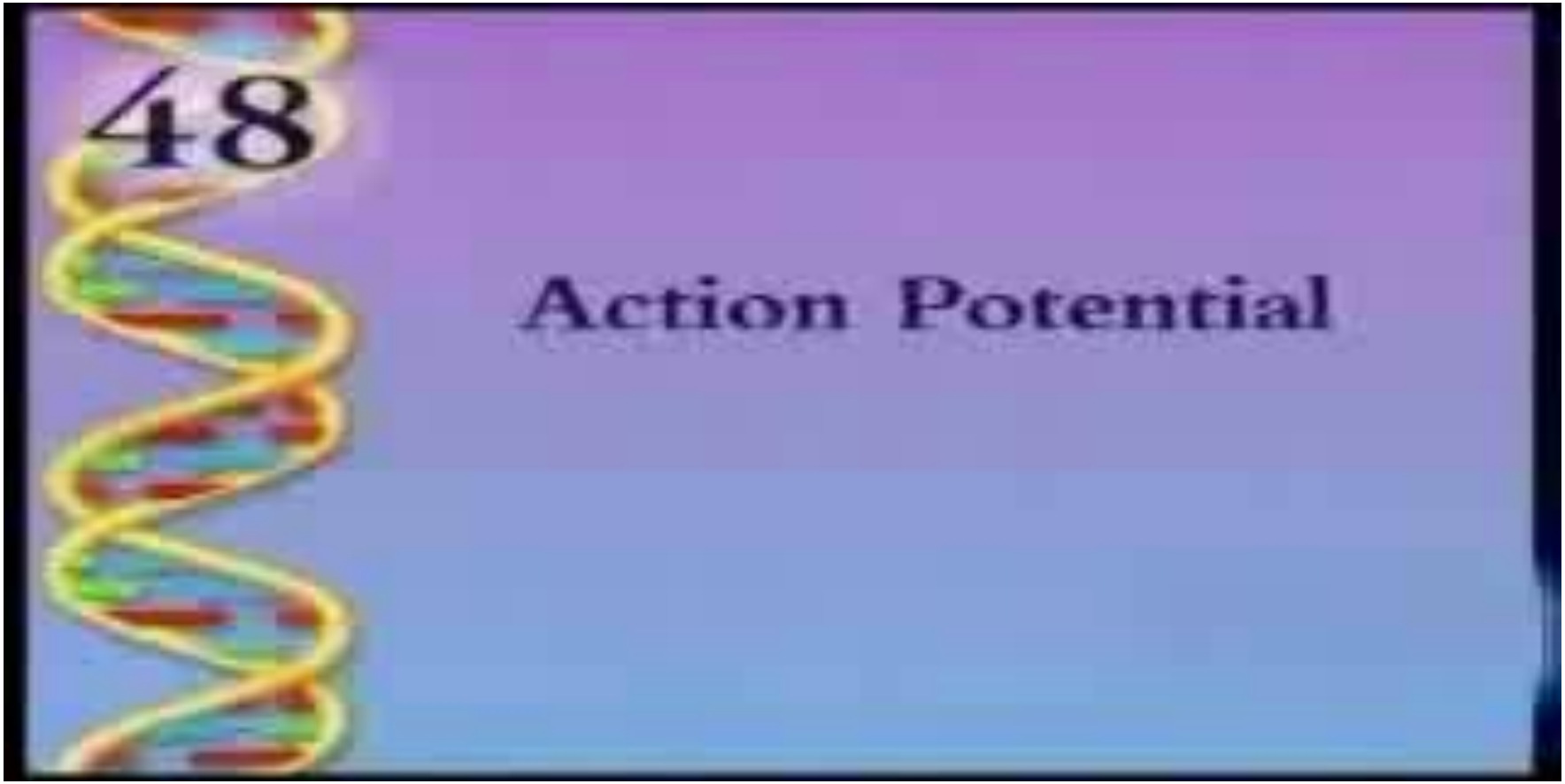
Neural Bases of Psychology: Neural Communication

- *Within* a neuron, communication occurs through an **action potential** (neural impulse that carries information along the axon of a neuron).





Action Potential



Threshold

Action potentials occur only when the membrane in stimulated (depolarized) enough so that sodium channels open completely. The minimum stimulus needed to achieve an action potential is called the **threshold.**

The **threshold** is reached when excitatory ("Fire!") signals outweigh the inhibitory ("Don't fire!") signals by a certain amount.