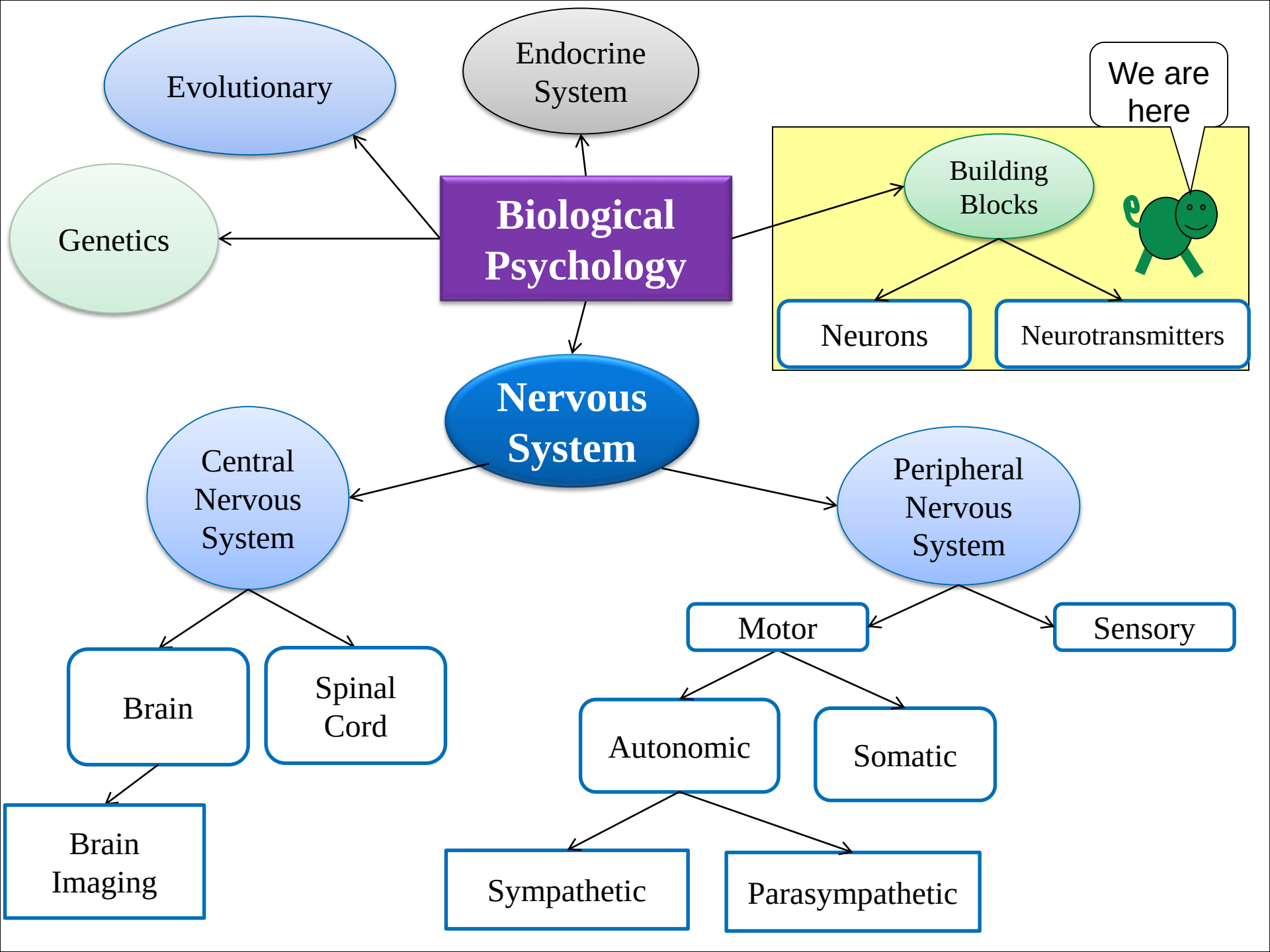
WHS AP Psychology

Unit 3: Biological Psychology

Essential Task 3-2:

Describe the electric process of neural firing *(ions, resting potential, action potential, threshold of excitation, all-or- none law, sub-threshold excitations, sumnation, absolute refractory period, relative refractory period.)*


Evolutionary
Endocrine System
We are here
Genetics
Biological Psychology
Building Blocks
Neurons
Neurotransmitters
Nervous System
Central Nervous System
Peripheral Nervous System
Brain
Spinal Cord
Motor
Sensory
Brain Imaging
Autonomic
Somatic
Sympathetic
Parasympathetic

Essential Task 3-2:

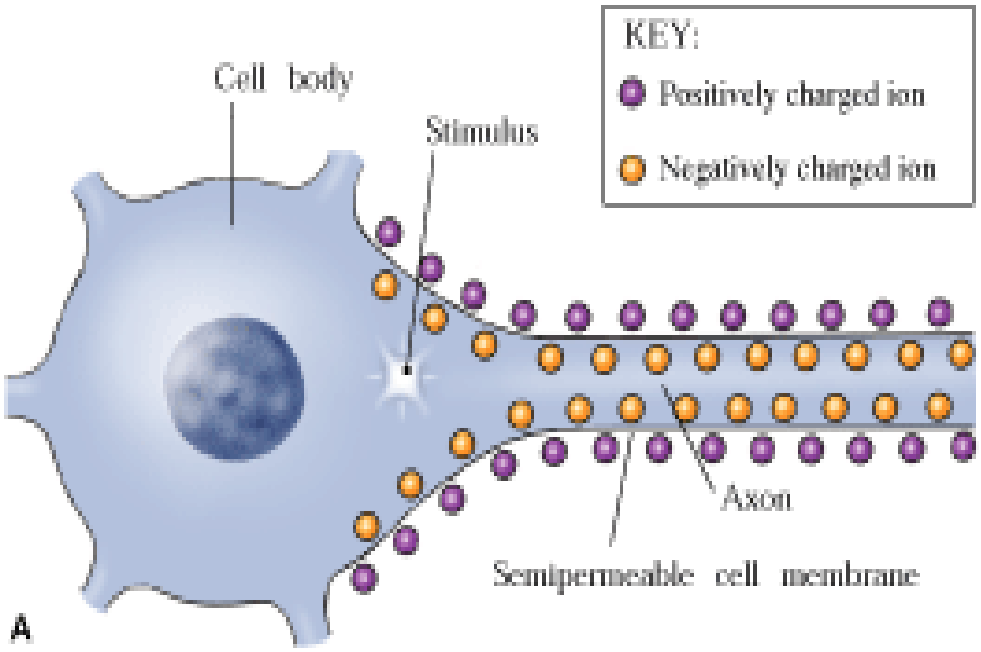
Outline

- Describe the electric process of neural firing
  - *Ions*
  - *resting potential (Polarized)*
  - *action potential (Depolarization)*
  - *all-or- none law*
  - *threshold of excitation*
  - *sub-threshold excitations*
  - *Sumnation*
  - *Refractory Period*
    - *absolute refractory period*
    - *relative refractory period*

Before a neuron fires – Resting Potential

Outline

- **Resting Potential**
  - Neuron is not transmitting information
  - It is not firing, it is resting
  - Negatively charged ions are in the axon.
  - At this stage the neuron is said to be 'polarized'



1. **Resting Potential**

At rest there are more negative ions inside the neuron compared with the outside. When a point on the semipermeable neural membrane is adequately stimulated by an incoming message, the membrane opens at that point, and positively charged ions flow in.

Before a neuron fires – Resting Potential

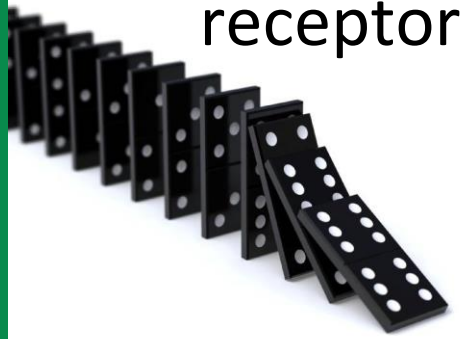
Outline

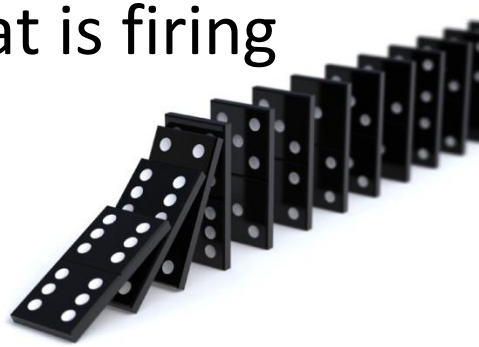
- **Resting Potential**
  - Nothing is happening. The gates of the axon are closed.
  - Positive ions are on the outside with the negative ions on the **inside** of the cell.
    - "**N**egative Ions inside the **N**euron is **N**atural"

Neural Firing!

Outline

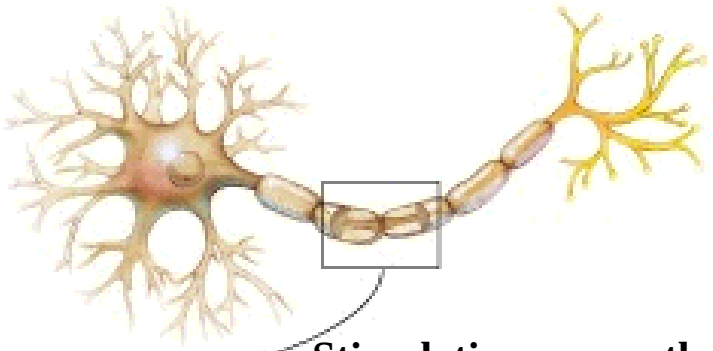
- Action Potential
  - a brief electrical charge that travels down an axon
  - Also called neural impulse or nerve firing or depolarization
  - generated by the movement of positively charged ions into the axon.
  - This process starts due to stimulation of the receptor sites for the neuron that is firing



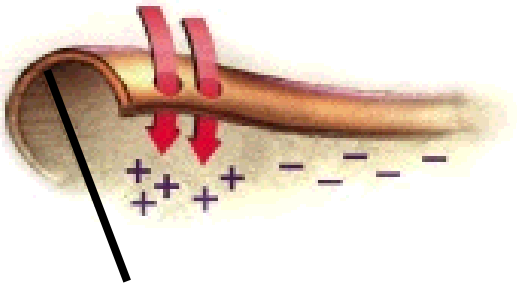


Neural Firing!

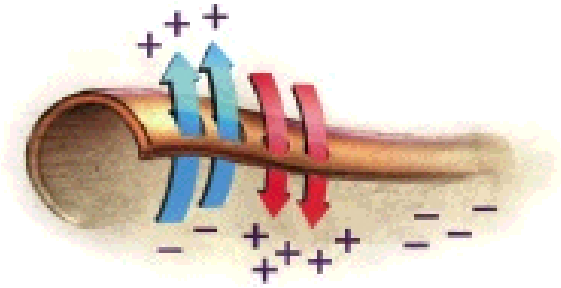
Outline



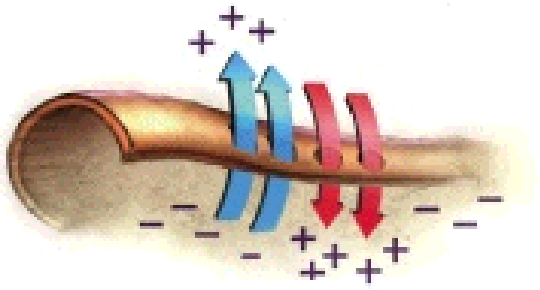
Stimulation causes the gates to open and the positive ions enter the cell. An electrical spark is produced by the process call depolarization. The positive ions are then pumped out.



Cell body end of axon



This chain reaction can occur up to 100 a second.



Direction of neural impulse: toward axon terminals

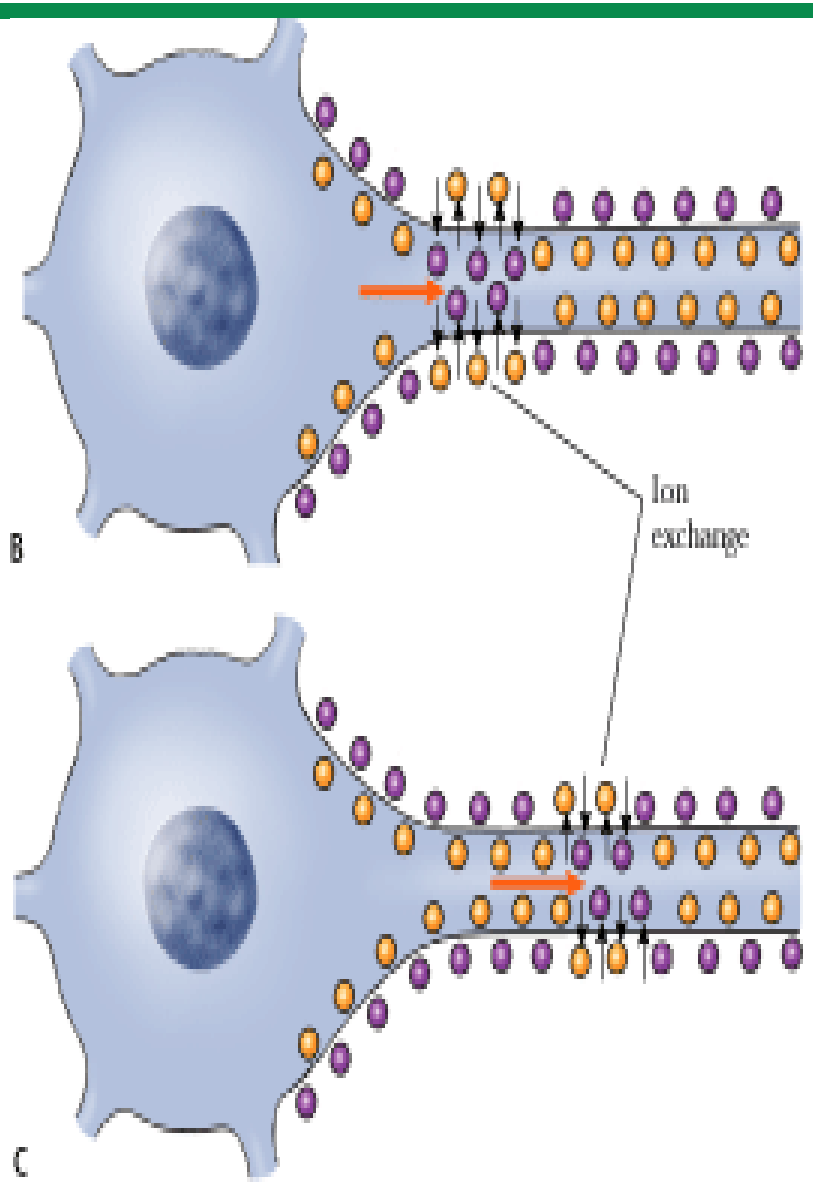
Neural Firing!

Outline

- Polarization
  - When the inside of the Neuron is negatively charged relative to the outside
  - Resting potential
- Depolarization
  - When the electrical charge of a cell moves toward zero
  - Action potential

Thank your glial cells

Outline



400 ft per second (Myelinated) to 3 ft per second

2. **Action Potential**

This process is repeated along the length of the membrane, creating the neural impulse that travels down the axon, causing the neuron to fire.

The Neural Impulse

Outline

- All-or-None Law
  - A neuron either fires or it does not
  - When it does fire, it will always produce an impulse of the same strength
  - Intensity of a stimulus is seen by the **frequency** of action potentials

frequency frequency
frequency frequency
frequency frequency
frequency frequency

What starts this whole process?

Outline

- Graded Potentials
  - A shift in the electrical charge in a tiny area of a neuron.
  - Many *subthreshold depolarizations* are added together to produce an action potential (a process known as *summation*)
  - The stimulation must exceed the *threshold of excitation* in order for the neuron to fire.
    - Threshold is the minimum level of charge needed for an action potential

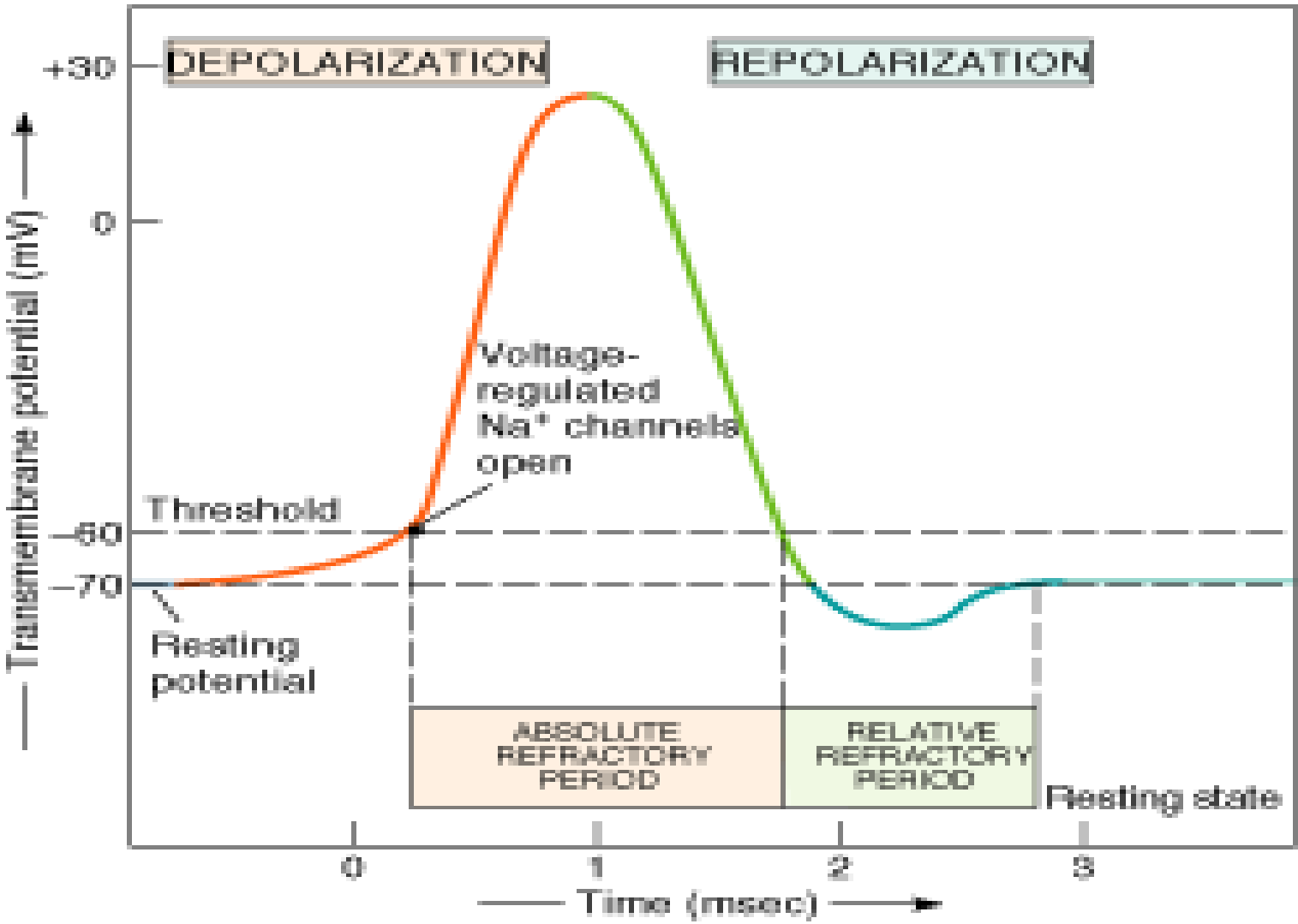
When can it fire again?

Outline

- Refractory Period
  - The time it takes for the positive ions to be pumped out.
    1. **Absolute Refractory period** - Period immediately after an action potential when another action potential CANNOT occur. (1/1000th of a second)
    2. **Relative refractory period** - Period following absolute refractory period when a neuron will only respond to a stronger than normal impulse

Refractory Period

Outline



OA: Dominos Simulation

Give examples of the following terms according to the dominos simulation

1. Resting Potential
2. Graded Potential
3. Threshold
4. Action Potential
5. All or None Law
6. Refractory Period

Action Potential Video

- http://www.youtube.com/watch?v=o4Srx4mUmaI