



## LESSON PLAN: Lights, Camera, Action Potential

**Topic:** Demonstrating Action Potentials

**Subject | Stream:**

Biology

Science

**Grade Level:**

Intermediate (7-10)

Senior (11 & 12)

**Objective(s):**

- To familiarize participants with changing electrical potentials (excitatory and inhibitory postsynaptic potentials - EPSP and IPSP respectively) as catalysts for generating action potentials.
- To demonstrate neuronal dependence on neurotransmitters as they bind to receptors on dendrites to facilitate changes in electrical potentials.

**Brief Summary:**

This activity entails a race to raise the resting potential of neurons, above threshold values, to generate action potentials. Participants are encouraged to use this demonstration to familiarize themselves with the process of action potential conduction.

**Background Information:**

- Neurons employ neurotransmitters, chemical messengers that enable neurotransmission, to communicate with each other. When neurotransmitters cross the synaptic cleft, a gap junction between neighboring neurons, they bind to receptors on the dendrites.
- The binding of a neurotransmitter to its designated receptor site results in a change in the electrical potential of a neuron.
- Excitatory postsynaptic potentials (EPSP) result when a neuron becomes depolarized; its electrical potential is raised from -70 mV baseline towards threshold





value (-55 mV). Such increases in electrical potential raise the likelihood of firing an action potential.

- Inhibitory postsynaptic potentials (IPSP) result when a neuron’s electrical potential is lowered, decreasing the likelihood of generating an action potential.
- Action potentials are generated/fired down an axon when electrical potentials are raised enough to surpass the threshold value.

### Resources | Materials Required per Pair:

- 3 large reusable containers
- 32 ping pong balls
- A black marker
- A stopwatch

### Activity Instructions:

This activity is a race between two teams.

Step 1: The facilitator must first use a black marker to label each ping pong ball as -5, +5, -10, +10 respectively (8 ping pong balls within each group).

- Each ball should also be labeled with the team name, *EPSP* or *IPSP*.

Step 2: Participants must be divided into one of two teams (*EPSP* or *IPSP*).

Step 3: Participants from each team must stand up and form a line (i.e. one line is the *EPSP* team and another line is the *IPSP* team) to act like a dendrite.

Step 4: Participants at the front of each line must grab ping pong balls from the *Dendrite Buckets* (placed in front of them) and begin passing them from person to person (overhead-underhead).

- This process emulates the passing of an electrical signal down a dendrite towards the cell body (the last person in the line is considered the cell body)

Step 5: Each *EPSP* team signal that is successfully transferred to the ‘cell body’ is worth +5 or +10 mV (depending on the specific ping pong ball passed down); each *IPSP* team signal is worth -5 or -10 mV.





- The signals are passed down from person to person until they reach the final participant in line (the cell body); this individual must toss the ping pong ball into their designated *Cell Body Bucket*.

**Note: Each team has its own respective *Dendrite Bucket*, but they must toss their ping pong balls into a common *Cell Body Bucket*.**

Step 6: Only one ping pong ball (signaling molecule).

