

Teacher Notes

Activity Guide

Thank you for using our tools to help your students visualize the molecular world! This activity guide will help you consider different ways in which you may use these materials. We encourage you to modify these lessons and activities to meet the learning objectives and needs of your specific students.

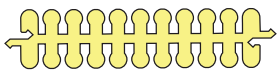
Carefully examine your student learning objectives to determine which parts of the Synapse Construction Kit® you will use in your students' study of neuronal signaling.

If your study of neuronal signaling includes a student learning objective focused on how chemical and electrical forces in neurons maintain the resting membrane potential, we recommend that you begin with **“Part I: Maintaining the Resting Potential”**. **Please Note:** You will need to include the potassium leak channels in your model.

The neuronal membrane has many more potassium channels than sodium channels, which allows potassium ions to more easily pass through the membrane than sodium ions. This difference plays a role in establishing the resting membrane potential.

If your study of neuronal signaling begins with a student learning objective focused on learning how an action potential is generated, you may wish to start with **“Part II: Modeling the Action Potential”**. **Please Note:** If starting from this point and in order to avoid student confusion, you may wish to omit the potassium leak channels in your model.

Materials Needed for Part I



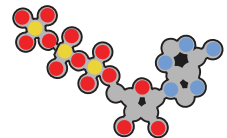
Membrane - 10x



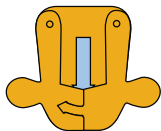
Potassium Ions (K^+) - 20x



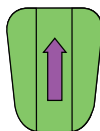
Sodium Ions (Na^+) - 20x



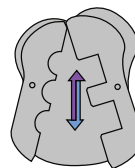
ATP Molecule



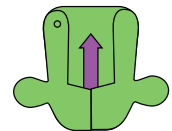
Gated Na^+ Channel - 2x



K^+ Leak Channel - 2x



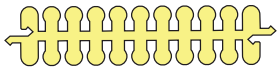
Na^+ / K^+ Pump - 1x



Gated K^+ Channel - 2x

Teacher Notes

Materials Needed for Part II



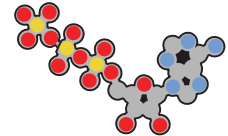
Membrane - 10x



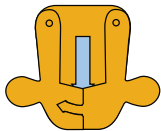
Potassium Ions (K^+) - 20x



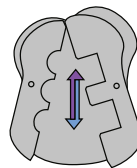
Sodium Ions (Na^+) - 20x



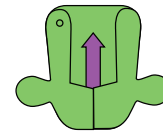
ATP Molecule



Gated Na^+ Channel - 2x



Na^+ / K^+ Pump - 1x



Gated K^+ Channel - 2x

Synapse Construction Kit® Connections to: A Framework for K-12 Science Education Practices, Crosscutting Concepts, and Core Ideas*

Dimension 1: Scientific and Engineering Practices

1. Asking questions (for science and defining problems (for engineering)
2. Developing and using models
6. Constructing explanations (for science) and designing solutions (for engineering)

Dimension 2: Cross Cutting Concepts

1. Patterns
2. Cause and effect: Mechanism and explanation
4. Systems and system models
6. Structure and function
7. Stability and change

Dimension 3: Disciplinary Core Ideas:

Life Sciences

LS1: From Molecules to Organisms: Structures and Processes

LS1.A: Structure and Function

LS1.D: Information Processing

Engineering, Technology, and Applications of Science

ETS1: Engineering Design

ETS1.A: Defining and Delimiting an Engineering Problem

ETS1.B: Developing Possible Solutions

ETS2: Links Among Engineering, Technology, Science, and Society

ETS2A: Interdependence of Science, Engineering, and Technology

ETS2.B: Influence of Engineering, Technology, and Science on Society and the Natural World

*The NSTA Reader's Guide to A Framework for K-12 Science Education, National Research Council (NRC), 2011. A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas. Washington, D.C.: National Academies Press.