

## Lab Assistant: The Nervous System – Conductors and Insulators

### Student Lab Objectives:

- Construct a working circuit
- Test various objects for conductivity
- Observe that certain liquids (salt water vs. sugar water) can be conductive or not. Relate this to nerve cells in our body that contain conductive and non conductive fluids.
- Inspect a cross section of a computer data cable under the microscope to see that it is made of bundles of conductive wire surrounded by insulators. Relate the similarities in construction nerve cells in our bodies and the computer cable.



### Lab Prep:

1. **Get Electricity Koa** – Supplies for each student: 3 connecting wires (Whiney the Wire likes to eat Oreo cookies), 1 battery, 1 rubber battery loop, 2 paper clips, 1 Christmas light (named Nova). 1 computer cable cross section for microscope viewing (pass out in petri dishes)
2. **Print student lab sheets** – one per student
3. **Prepare teacher demonstration of conductive and insulating**– Supplies: 1 tablespoon sugar, 1 tablespoon salt, 2 nails, 2 small cups, 2 AA batteries connected in series with a light as shown on lab web page.

### Running the Lab Activity:

1. **Read the letter from Koa** to your class (posted on lab page).
3. **Watch the class movie:** The Nervous System: Conductors and Insulators.
4. **Class Exploration Activity:** Students build test circuits. Distribute student electrical supplies and let each student build a test circuit to test their conductors and insulators. Students hypothesize, test and record the results of their conductivity tests on their lab sheets. Allow students to explore additional things in the classroom to test their conductivity. Warn students that touching electrical outlets in the classroom is dangerous and not allowed.
5. **Microscope observation** of electrical cable cross sections. Now that students understand conductors and insulators, allow students to observe a wire cross section, sketch it, label the conductors and insulators on their drawing, and compare it to the diagram of the peripheral nerve on their worksheet.
6. **Teacher Demonstration:** Conduct teacher demonstration showing that salt water is a conductor and sugar water is an insulator.
7. **Relate the lab activity to the nervous system:** Discuss with your class that your nervous system is similar to the electrical circuits that they explored. Your nervous system has conductors and insulators in it, just like the wires. It is comprised of circuits that send signals to our brains much like the lights in their electrical circuit. The signals that our nervous system sends to our brain are simple on and off signals, just like the light. Our nervous system can vary the speed of the on off signal (frequency) to add meaning to the communication signal, for example, “It hurts a lot (fast blink)” or, “It hurts a little (slow blink).”

Students saw that the salt allowed the water to conduct electricity. Sodium is a metal and when its particles float in the water solution, they conduct electricity. Your nervous system also uses salt. It is the Sodium ( $\text{Na}^+$ ) ions provided by the salt that make our nervous system work. That is why athletes drink Gatorade and other sports drinks containing electrolytes, which are salts. Our nerve cells concentrate Sodium particles ( $\text{Na}^+$ ) and Potassium particles ( $\text{K}^+$ ) from salts in order to function. The chlorine ( $\text{Cl}^-$ ) from the salt is used by our bodies to make stomach acid ( $\text{HCl}$ ).