

## Activity 3

# Dough Creatures



### LIGHT UP A ROOM WITH ELECTRIFYING PLAY DOUGH CREATIONS.

You can use anything that conducts electricity to make an electrical circuit—copper, pencil lead, fruit, even play dough! Adding salt to the dough helps electricity move through the material. With enough power, the electrical current can light LEDs and sound a buzzer!



**SMART START:** Prepare the conductive and insulating dough beforehand, as described below.

#### *Conductive dough*

Mix all ingredients except  $\frac{1}{2}$  cup flour in a pot and cook over medium heat, stirring continuously. Add food coloring. (This will differentiate the two types of dough.) The mixture will begin to boil and get chunky. Keep stirring until a ball forms in the center of the pot, then remove the saucepan from the heat. **CAUTION:** The dough will be very hot! Allow it to cool before handling. Once cooled, mix flour into the dough until it is firm, but moldable.

#### *Insulating dough*

Mix the oil and solid ingredients (setting aside  $\frac{1}{2}$  cup flour) in a bowl. Mix in 1 tbsp. deionized water and stir. Continue to add deionized water 1 tbsp. at a time until the mixture becomes moist and dough-like. Remove it from the bowl and slowly knead in flour until the desired consistency is reached.

Store the dough in an airtight container until needed. It will keep for 3 weeks.

### You'll Need (per small group):

- ◆ conductive and insulating dough (See Smart Start for directions.)
- ◆ 4 AA batteries with battery holder or one 9 V with snap connector (RadioShack or sparkfun.com)
- ◆ 4-8 LEDs, 1.9–2.4 V / 20 mA–40 mA (RadioShack or evilmadscience.com)
- ◆ paper and pencil
- ◆ safety glasses (for each girl)
- ◆ optional: assorted craft supplies (straws, sticks, etc.)

#### For dough preparation:

- ◆ mixing bowl
- ◆ wooden mixing spoon
- ◆ saucepan
- ◆ hot plate or stove
- ◆ 2 airtight containers
- ◆ measuring cups/spoons



#### For conductive dough (makes enough for 3-4 girls):

- ◆  $1\frac{1}{2}$  cups flour
- ◆ 1 cup water
- ◆  $\frac{1}{4}$  cup salt
- ◆ 3 tbsp. cream of tartar
- ◆ 1 tbsp. vegetable oil
- ◆ food coloring

#### For insulating dough (makes enough for 3-4 girls):

- ◆  $1\frac{1}{2}$  cups flour
- ◆  $\frac{1}{2}$  cup sugar
- ◆ 3 tbsp. vegetable oil
- ◆  $\frac{1}{2}$  cup deionized or distilled water
- ◆ optional: 1 tsp. granulated alum (preservative)



# Dough Creatures continued

Here's how:

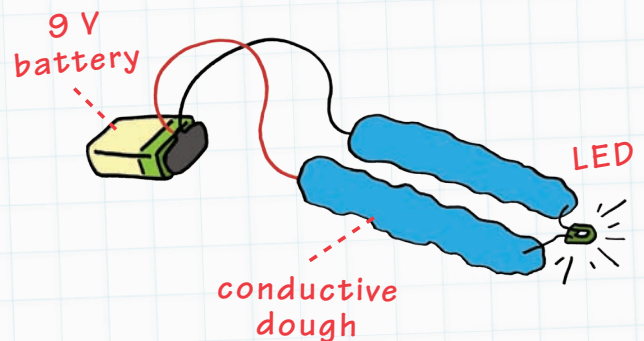
**1. Introduce insulators and conductors.** Ask girls what a conductor is. (A material that allows energy, such as heat, electricity, light or sound, to pass through easily.) What materials make good electrical conductors? (salt water, metals such as copper, gold, aluminum) What is an insulator? (A material that does not allow energy to pass through easily.) What materials make good electrical insulators? (glass, rubber, plastic, cotton) Why might electric circuits include insulating materials? (Insulation protects us from wires that might give us a shock and helps direct the flow of electricity.)

Never connect the LED directly to the battery! It could shatter the LED. Always use dough to add resistance

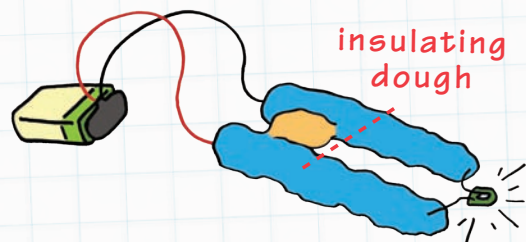
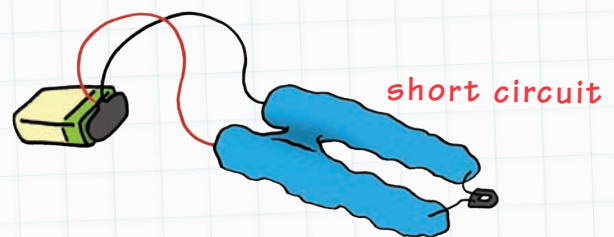
**2. Build a simple circuit.** Break into small groups <sup>1</sup> and pass out some conductive dough, batteries, battery holders, and LEDs. Have girls brainstorm and sketch a simple circuit that uses these materials. (A circuit is a closed loop, allowing electricity to flow in a circle.) Insert the two terminals from a battery holder or connector into two pieces of conductive dough. Insert an LED into both pieces of dough, so the positive lead (longer leg) is attached to the positive terminal of the battery and the negative lead (shorter leg) is attached to the negative terminal of the battery. (See above, right.) Have girls discuss why the LED lights up. <sup>6</sup> (For current to flow, there must be a complete path from one pole of the battery, through the wire, to the light, and back to the other pole of the battery.)



**POINTER:** If the girls have never worked with LEDs before, see the Smart Start on page 9.



**3. Experiment.** What happens if two pieces of conductive dough touch? Have girls test this. (The bulb will not light because you created a short circuit.) What happens if insulating dough is placed between the two pieces of conductive dough? (See below.)





# Dough Creatures continued



#### 4. Brainstorm.

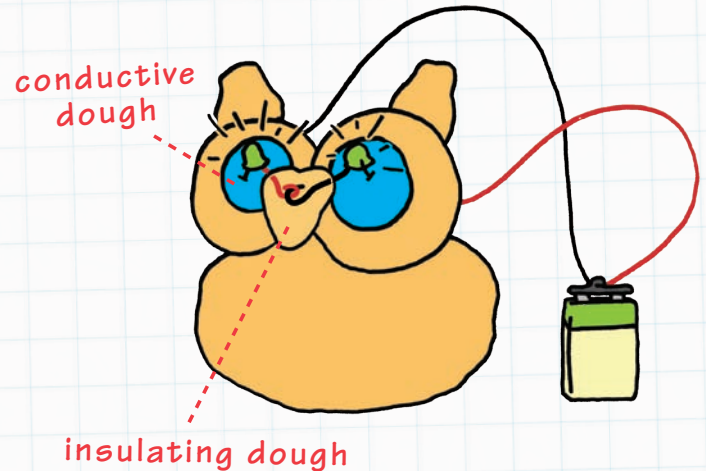
**Introduce the SciGirls Challenge:** Use conductive and insulating dough to make battery-powered creatures that light up. Ask each group to brainstorm possible creature designs. They should consider using sticks, straws, or other materials as supporting structures.

#### 5. Sketch and build.

Have groups draw sketches and then agree on one design to build.<sup>3</sup>

#### 6. Test.

If girls are having problems getting the creature to perform a complicated task, encourage them to start small.<sup>5</sup> Suggest they first try to achieve a simpler function, such as getting one eye to light up, and then, once they have accomplished this, move on to a more complicated task, such as getting two eyes to light up. (See right for examples.)



**POINTER:** Remind girls that dough does not conduct as well as metal. They may find it helpful to use small chunks of dough (to reduce resistance) or check that all LEDs require the same voltage.



#### Special thanks

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#### 7. Share.

When everyone is done, have groups demonstrate their creations and discuss. Talk about possible real world uses for the creatures.<sup>2</sup> If they could design an enhanced creature, what would they have it do? For additional ideas, visit [courseweb.stthomas.edu/apthomas/SquishyCircuits](http://courseweb.stthomas.edu/apthomas/SquishyCircuits).

