SHRINKING SUTURES

Target Population:
Students, ages 9–11

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Credits:
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Model suture images & gummy bear image:Ryan Seymour, Smithsonian Science Education Center

Shrinking Sutures

Challenge

Design a suture model that has observable changes in its properties due to a chemical reaction.

Target Population

Students, ages 9–11

Activity Description

Students will design a suture model and observe how different conditions can change the properties of their model. Students will discuss how chemical reactions can change the properties of objects to improve the lives of people.

Materials for Each Student:

- 2 Gummy worms (5 cm, 2 inches long)
- 4 Pieces of milk carton cardboard cut into 2½-cm (1-inch) pieces
- Hole puncher or Scissors (shared)
- Ruler
- Student Sheet 1
- Student Sheet 2
- Pencil (shared)
- 2 Large bowls
- Warm to hot water
- Table salt
- Spoon
- Newspaper or paper towels

Safety

In science classrooms do not eat or taste any of the materials. Do not directly touch hot or boiling substances.

Background Information

Sometimes humans and other animals get a cut or wound. Some wounds require nothing more than a bandage and time to heal. Other wounds cannot heal on their own. Wounds that are deep, long, that have jagged edges, that gape open, or that continue to bleed after 15 minutes of applying pressure often will not heal on their own. Wounds that are in difficult locations, such as the face or near a joint (like a shoulder or knee), also may have trouble healing on their own. A wound that cannot heal on its own is a problem. It can lead to significant blood loss, infection and make the person sick. Engineers and doctors have come up with solutions to this problem. The solutions are sutures and staples. Sutures are surgical threads that are used to repair cuts. They also are used to close wounds from surgery. Staples are small medical devices that can be used instead of sutures. Doctors make decisions about when different types of sutures or staples are necessary based on the type of wound they are repairing and its location on the body.

Explaining the Problem Conversation Starters

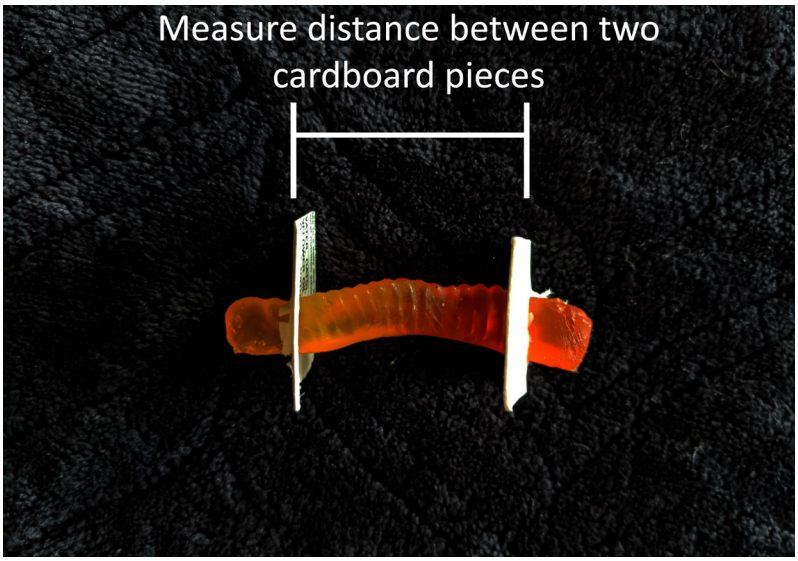
- Has anyone ever had a cut? Has anyone ever had surgery? (Introduce phenomenon of wound closure.)
- Has anyone ever had sutures?
- Did you know sutures get tighter? What do you think is causing this? Why is it important for a suture to do this?
- Let's look at these two images of gummy worms. Do you notice any differences between the two? Why do you think they are different?
- We will use gummy worms to model how sutures can help a patient heal.

Step-by-Step Instructions

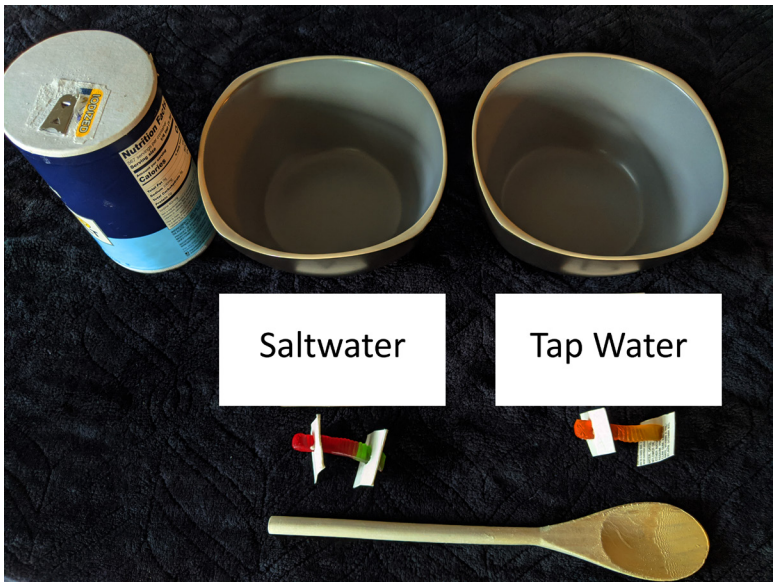
- Divide the students into groups.
- Each student collects 2 gummy worms and 4 pieces of milk carton cardboard.
    - Explain how the gummy worm is like the suture

bringing the two pieces of the body together (represented by the milk carton cardboard).

- Students use a hole puncher or scissors to make a small hole in the middle of each of the cardboard pieces.
- Students write their initials on one of the cardboard pieces and also mark that piece with the letter A.
- Students feed one of the gummy worms through the center holes in two of the cardboard pieces.
- Students then repeat the previous steps with the second gummy worm and the remaining two pieces of cardboard. They initial and mark one piece of cardboard with the letter B. Students record the measurement between the two cardboard pieces on their Student Sheet 1.



- Prepare two bowls of water for the students' suture models. One bowl contains warm to hot water and salt. A 500ml (2.1c) bowl needs 180g (3/4 c) of salt. The second bowl contains only warm tap water. Label one bowl "Saltwater"and the other bowl "Tap Water."



- Place the gummy worm suture models marked with the letter A into the Saltwater bowl and those marked B into the Tap Water bowl.
- Set a timer for 30 to 45 minutes. Tip: the longer you are able to leave the gummy worm in the water the more obvious the difference between the two will be. If there is no difference be prepared to talk about why the experiment didn't work. Reasons could be that there was not enough salt, you didn't wait long enough, or the gummy worms weren't moist enough at the start.

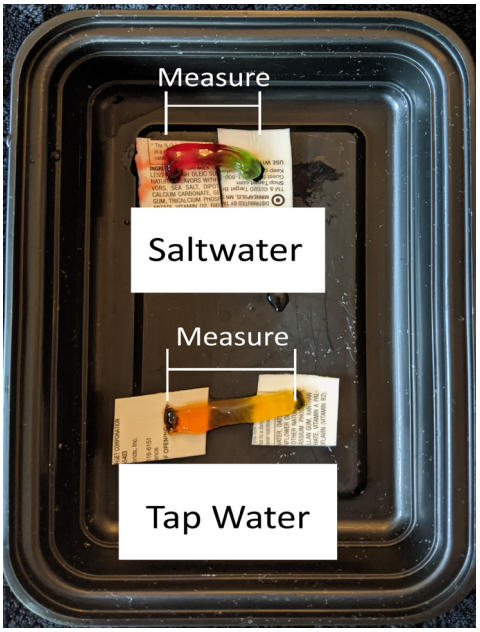
o While you're waiting, have students write their predictions for each of their suture models on Student Sheet 1.

o Have students share their predictions with the class. Then they work on Student Sheet 2.

o After students complete Student Sheet 2, ask the following questions:

- Have you ever seen any of these chemical reactions before? Can you tell us when?
- Can you think of any chemical reactions that are like the ones on Student Sheet 2? What was the object like before the chemical reaction? What was it like after the chemical reaction?

- Bring it together by explaining that sutures are normally activated by saline. The ions interact with the chemical structure of the sutures that results in a structural change in the suture that causes it to shrink. In our model we are hoping to see a similar change in our gummy worms that is caused by the movement of water into or out of the gummy worm.
- When the timer is up, use a large spoon to remove the gummy worms from the bowls. Students collect their worms and remeasure the distance between the two cardboard pieces. They add those measurements to Student Sheet 1.
- Ask the following questions:
  - Which gummy worm suture brought the two pieces of cardboard closer together? What do you think caused this change?
  - How are the two gummy worms different from each other? How are they different from a normal gummy worm?



Vocabulary

Chemical Reaction: when two substances react with each other, causing changes

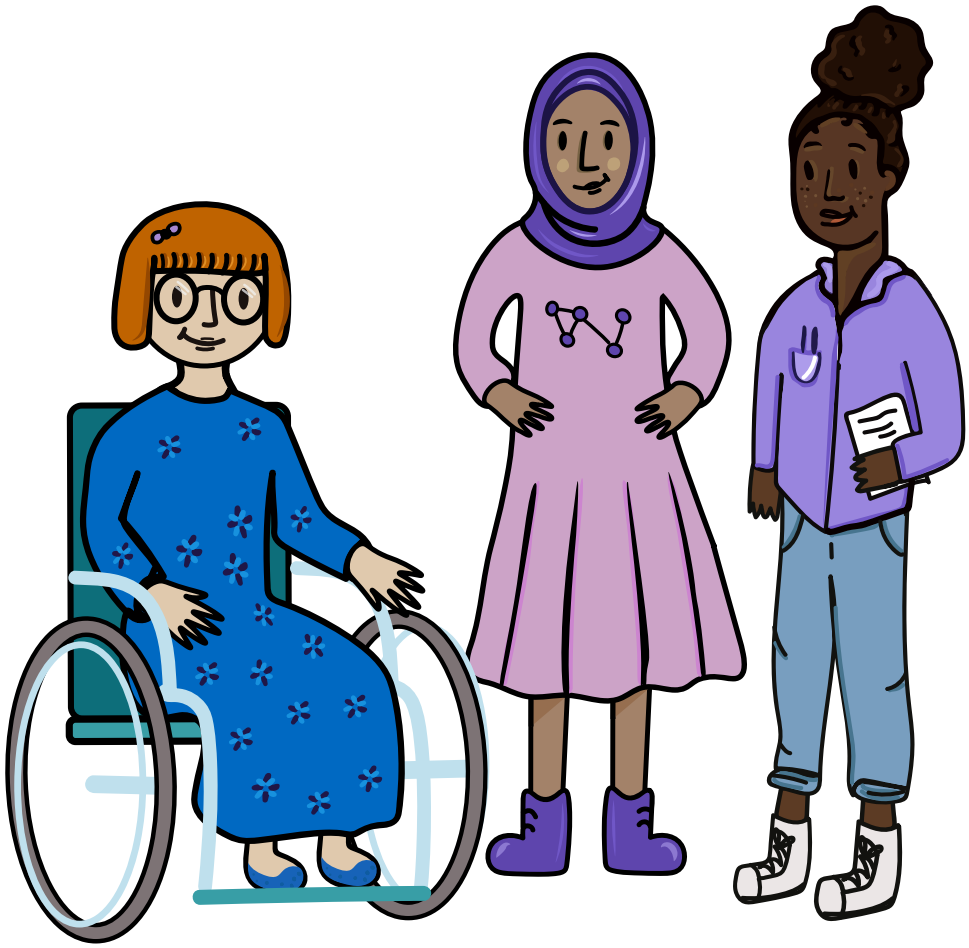
Length: the measurement from end to end

Property: a characteristic of an object

Stitch: a single loop of thread or yarn

Suture: a thread used to sew together parts of the body

Wound: an injury to the body that usually breaks the skin



Student Sheet 1

Before the Experiment

Describe the gummy worms before the experiment:

_____

_____

Gummy worm A distance

_____

Gummy worm B distance

_____

After the Experiment

Gummy worm A distance

_____

Gummy worm B distance

_____

Describe gummy worm A after the experiment:

_____

_____

Describe gummy worm B after the experiment:

_____

_____

Student Sheet 2

These objects have changed because of a chemical reaction. Observe and write down how they are different. There might be many answers.

1. An apple is cut in half and left out in the air for a full day. How does this change the apple?

_____

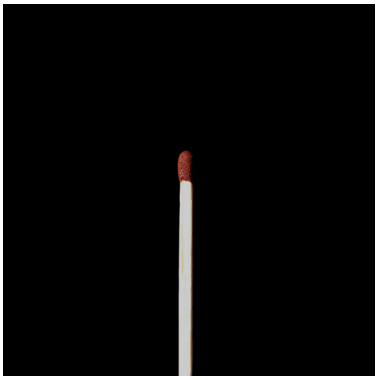
_____

2. A gummy bear is placed into a bowl of vinegar. How is the gummy bear changed?

_____

_____

3. A match is lit. How does this change the match?



_____

_____

3. Baking soda is mixed with vinegar. How does this change the baking soda?

_____

_____

"Tell My Story" Form

This form will help volunteers serving as activity leaders prepare to talk about their STEM²D interests, education, and career path.

ABOUT YOU

Name: _____

Job Title: _____

Company: _____

When/Why did you become interested in STEM²D? _____

_____

_____

What do you hope young people, especially girls, will get out of this activity? _____

_____

FUN FACT

Share a little about your background. Ideas:

- Share a memory from childhood where you first had your "spark" or "interest" in STEM.
- Detail your journey; highlight what you have tried, what you learned, steps to success, etc.
- Failures or set backs are also great to talk about—difficulties, and/or challenges and how you overcame them.

EDUCATION AND CAREER PATH

What classes/courses did you take in secondary school and in college that helped or interested you most? _____

How did you know you wanted to pursue a STEM²D career?

_____

What was your postsecondary path, including the institution you attended and your degree? *If you switched disciplines, make sure you explain why to the students.*

_____

What your current position entails. *Be sure to include how you use STEM²D on a typical work day.*

_____

_____

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