SIMULATING SUTURES

Target Population:
Students, ages 7–11

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Simulating Sutures is part of the STEM2D Student Activity Series. The content and layout were developed by the Smithsonian Science Education Center as part of Johnson & Johnson's WiSTEM²D initiative (Women in Science, Technology, Engineering, Mathematics, Manufacturing, and Design), using a template provided by FHI 360 and JA Worldwide. This series includes a suite of interactive and fun, hands-on activities for girls (and boys), ages 5–18, globally.

Credits:
Design and cover: Sofia Elian, Smithsonian Science Education Center
Illustrated stitch types: Macrovector/iStock/Getty Images Plus
Model suture images: Hannah Osborn, Smithsonian Science Education Center

Simulating Sutures

Challenge
Model wound closure using types of suture material and stitch types.

Target Population
Students, ages 7–11

Activity Description
In this activity students will gain an understanding of different suture materials and stitches by designing a suture model using yarn, plastic lacing, and pipe cleaners. Using critical thinking and modeling medical stitch techniques, students will create a take-away key chain suture model. This activity will highlight Johnson & Johnson's variety of suture materials. The take-away key chain will meet all the following criteria:

- Use common surgical stitches used for sutures
- The pipe cleaners are securely held together
- The stitches are snug
- The stitches are evenly spaced

Materials for Each Student:
- Yarn
- Plastic lacing
- Pipe cleaners
- Tape
- Student Sheet
- Scissors (shared)
- Pen or pencil (shared)
- Ruler or tape measure (shared)
- Johnson & Johnson suture samples (shared for display)

Safety
Pipe cleaners can be sharp, especially when cut. Avoid injury to fingers and eyes. Younger students may need help cutting pipe cleaners.

Background Information

Sometimes humans and other animals get a cut or wound. Some wounds require nothing more than a Band-Aid 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 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.

There are many types of sutures. Some sutures are made of natural fibers such as silk, others are made of human-made materials such as plastic. Staples are usually made of metal. Doctors and veterinarians choose their suture material based on what type of tissue they need to suture, the location of the wound, and any allergies the patient has. Doctors and veterinarians must also choose the type of stitch they will use. Stitches are the types of knots that are used to hold the sutures into the tissue. Different types of stitches are used for different tissues and locations that need to be sutured.

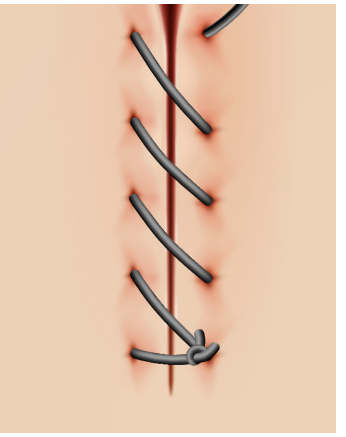
Explaining the Problem Conversation Starters

- Has anyone ever had a cut?
- Has anyone ever had sutures?
- Did you know sutures come in different materials? Can you think of why there are different materials?
- This is a good time to discuss the difference between sutures (the actual material securing a wound) and stitches (the style of knots and placement of the sutures).
- Do you know what a model is?

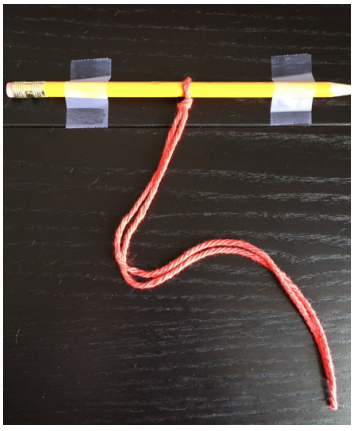
Step-by-Step Instructions

- Show options for engineering solutions and modeling.
  - Look at the materials of the Johnson & Johnson sutures.
  - Look at examples of stitches that show the images of surgical sutures next to images of yarn and plastic lacing models.
- Look at the materials: yarn, plastic lacing, and pipe cleaners.
- Make your model.
  - Choose your suture model: yarn, plastic lacing, or pipe cleaner (if you're using staples, take one pipe cleaner).
  - Choose your stitch type.
  - Follow the instructions for the stitch type (Option 1, 2, 3, or 4).

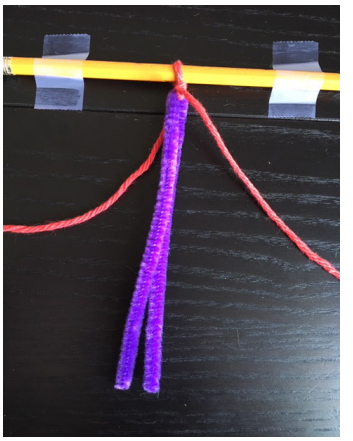
Option 1: Over and Over Continuous Stitch



- Cut a piece of thread or plastic lacing 50cm (19½ inches) long.
- Fold the thread over a pencil and secure it with a knot.
- Tape the pencil to the table.

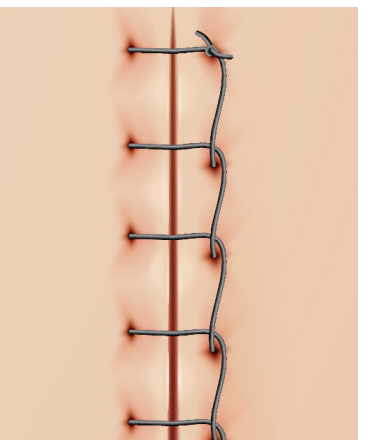


- Select one pipe cleaner to model two sides of a wound.
- Tie the thread around the center of the pipe cleaner (you can fold the pipe cleaner in half to find the center).
- Fold the pipe cleaner in half so that there are two pieces pointing away from the pencil.



- Wrap the thread in a circular pattern at a slight angle down the length of the pipe cleaner.
- Continue until you reach the end of the pipe cleaner.
- When you reach the end, tie a knot around the pipe cleaner to secure the thread.
- Remove the tape from the pencil and slide the loop off.
- Answer the questions on your Student Sheet.
- Enjoy your key chain.

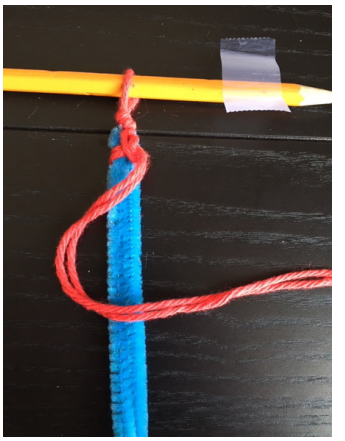
Option 2: Lock Stitch Continuous Stitch



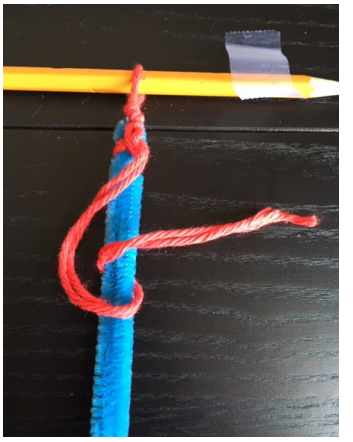
- Cut a piece of thread or plastic lacing 80cm (31½ inches) long.
- Fold the thread over a pencil and secure it with a knot.
- Tape the pencil to the table.
- Select one pipe cleaner to model two sides of a wound.
- Tie the thread around the center of the pipe cleaner

(you can fold the pipe cleaner in half to find the center).

- Fold the pipe cleaner in half so that there are two pieces pointing away from the pencil.
- Pull the thread to the left, then lay the thread over the pipe cleaner pieces to make it look like the number 4.



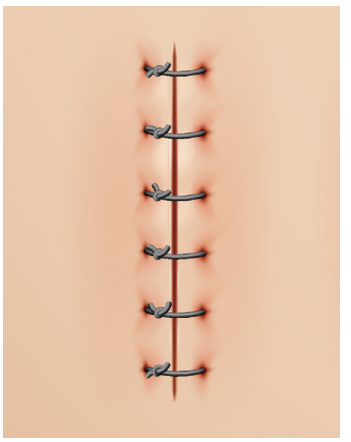
- Fold the thread around the pipe cleaner pieces and put it through the opening in the 4.

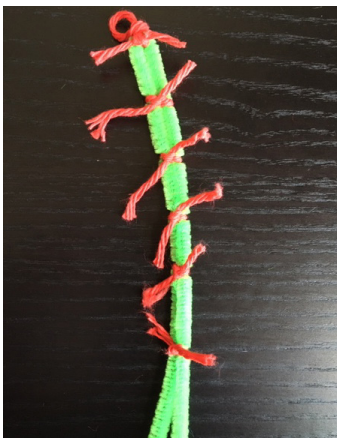


- Pull the loose ends of the thread to tighten them and move the stitch up the pipe cleaner pieces.
- Continue until you are out of thread or at the end of the pipe cleaner pieces.
- When you reach the end, tie a knot around the pipe cleaner to secure the thread.

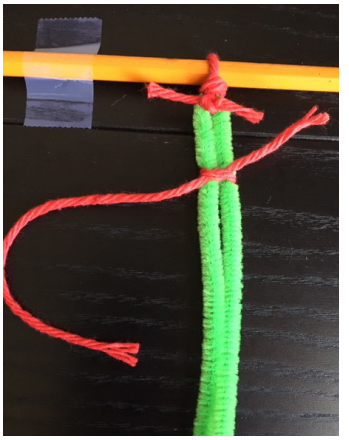
- Remove the tape from the pencil and slide the loop off.
- Answer the questions on the Student Sheet.
- Enjoy your key chain.

Option 3: Square Knot Interrupted Stitch



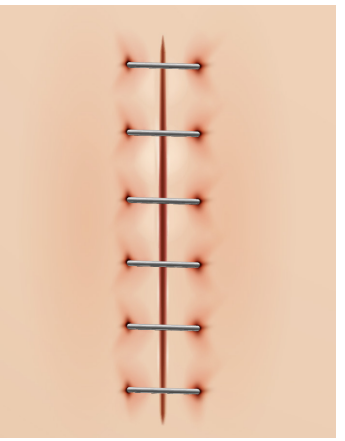


- Cut a piece of thread or plastic lacing 40cm (16 inches) long.
- Fold the thread over a pencil and secure it with a knot.
- Tape the pencil to a table.
- Select one pipe cleaner to model two sides of a wound.
- Tie the thread around the center of the pipe cleaner (you can fold the pipe cleaner in half to find the center).
- Fold the pipe cleaner in half so that there are two pieces pointing away from the pencil.
- Cut the thread below the knot around the pipe cleaner.
- Take one of the cut pieces of thread and place it behind the pipe cleaner pieces, with one side slightly longer than the other.
- Hold one end of the thread in each hand.
- Pass the right end over and under the thread in your left hand.



- Take the end that's now in your left hand and pass it over and under the end that's now in your right hand.
- Tighten the knot by pulling both ends at the same time.
- Cut the excess thread to use it for your next stitch.
- Continue until you are out of thread.
- Remove the tape from the pencil and slide the loop off.
- Answer the questions on the Student Sheet.
- Enjoy your key chain.

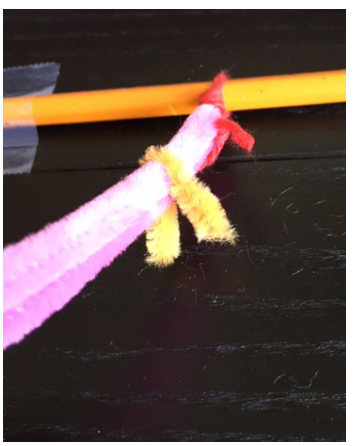
Option 4: Staples Interrupted Closure



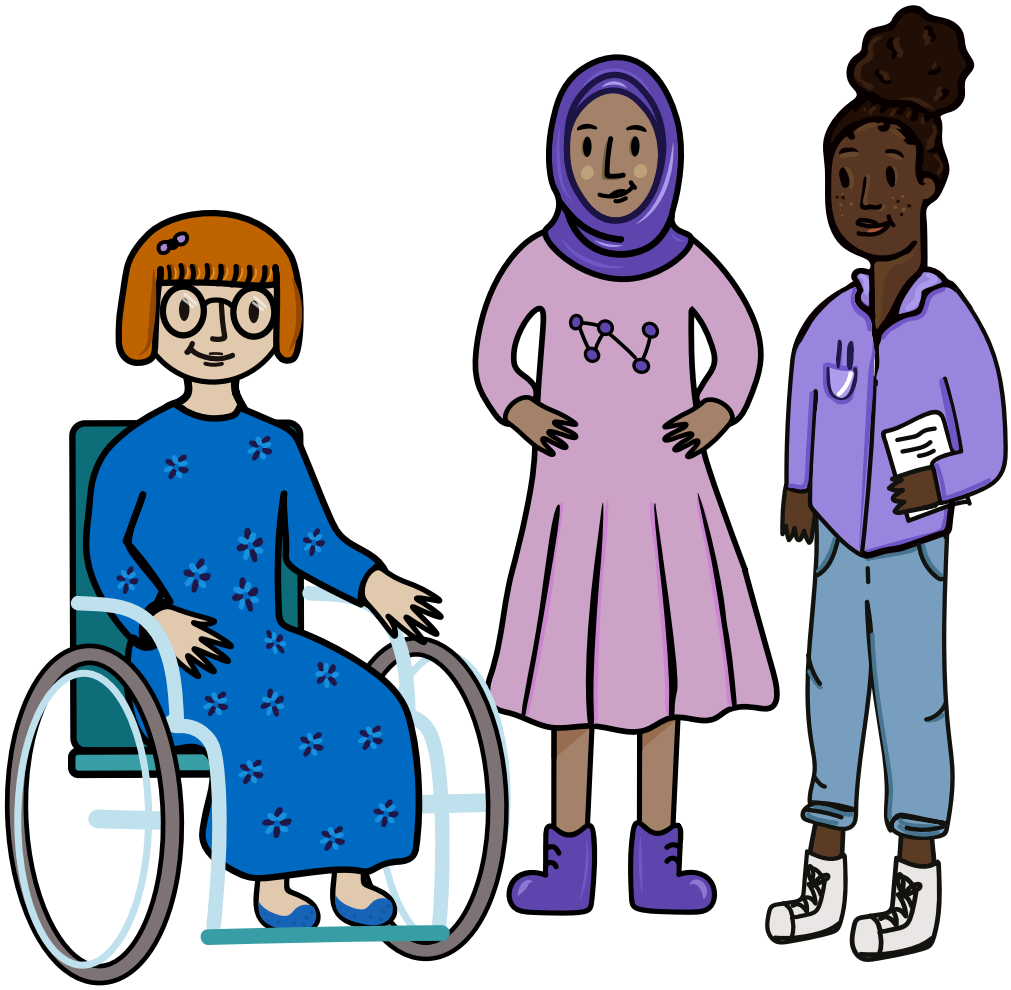
- Cut a piece of thread 20cm (8 inches) long.
- Fold the thread over a pencil and secure it with a knot.
- Tape a pencil to a table.
- Select one pipe cleaner to model two sides of a wound.

- Tie the thread around the center of the pipe cleaner (you can fold the pipe cleaner in half to find the center).
- Fold the pipe cleaner in half so that there are two pieces pointing away from the pencil.
- Cut the thread below the knot around the pipe cleaner.
- Take a second pipe cleaner and fold it in half.
- Fold the pipe cleaner in half two more times until it is about 4 to 5cm (1½ to 2 inches) long.

- Unfold it and cut it at the fold marks. You should now have 8 pieces of pipe cleaner to create your staples.
- Lay one of the staples on top of the pipe cleaner that is modeling the wound.
- Fold the sides of the staple behind the pipe cleaner and twist them together, so they hold the two sides of the pipe cleaner closed.



- Continue with the remaining staples.
- Remove the tape from the pencil and slide the loop off.
- Answer the questions on the Student Sheet.
- Enjoy your key chain.



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Vocabulary

Continuous: without being broken

Human-made fiber: thread made by people, not from nature

Interrupted: broken in parts

Model: a representation

Natural fiber: thread made from plants or animals

Plastic: a material made by people that can be formed into many shapes

Silk: thread made by a type of worm

Stitch: a single loop of thread or yarn

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

Tissue: parts of the body, such as skin and muscle

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

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Student Sheet

What suture material did you use?

Yarn (natural fiber) Plastic (synthetic fiber) Pipe cleaner (staples)

What type of stitch did you use?

Staples—interrupted Square knot—interrupted

Lock stitch—continuous Over and over—continuous

Does it meet the criteria?
Are the pipe cleaners held together without gaps?

Yes No

Do the stitches look like the examples?

Yes No

Are the stitches evenly spaced?

Yes No

Did you enjoy doing this engineering activity?

Yes No

If you were doing the activity again, is there anything you would change?

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_____

_____

_____

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