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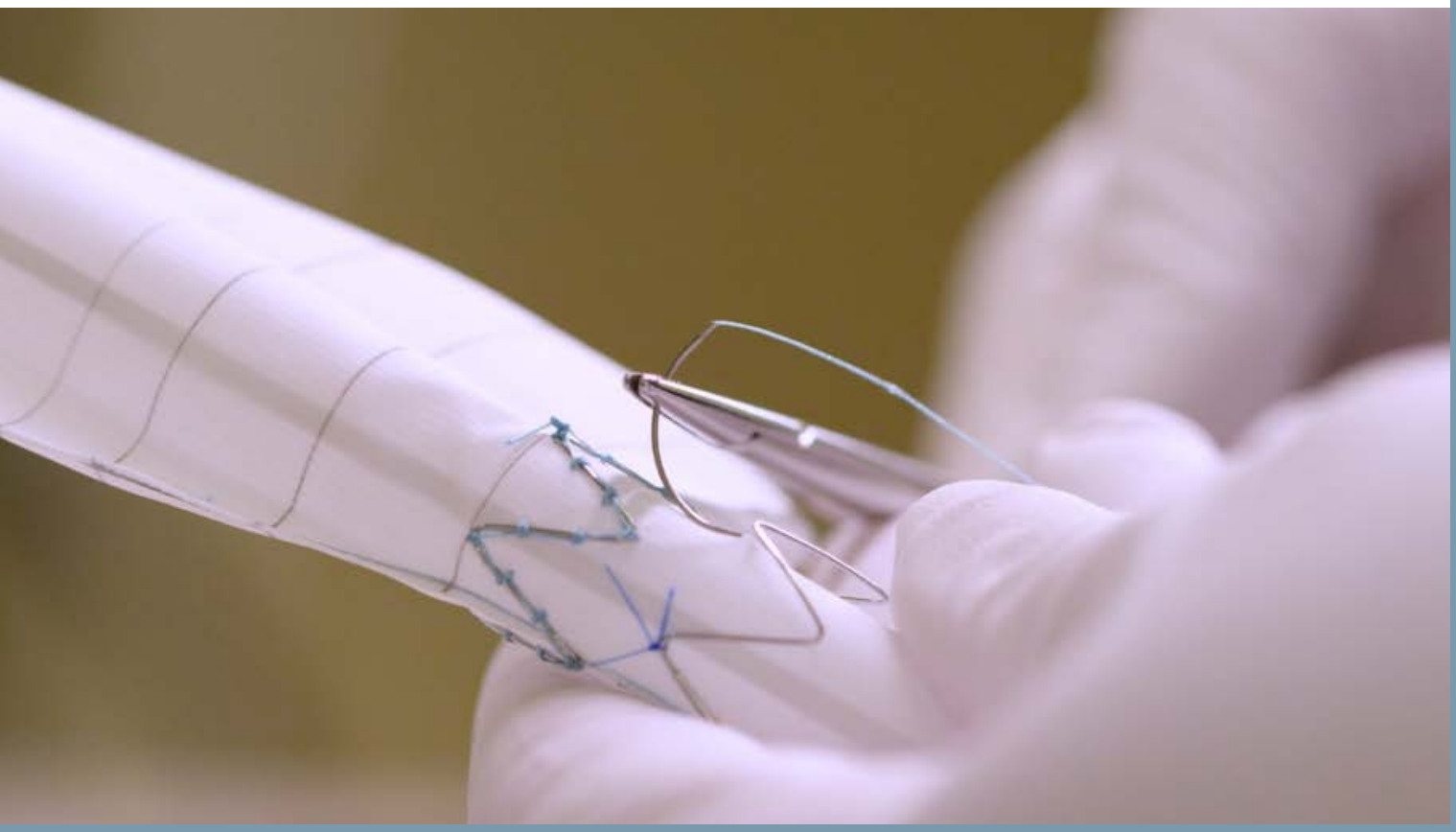
INDIANA UPLANDS | PROUD PARTNER

Grade 3-5 STEM Challenge

Sewing Saves Lives

Inspired by Sarah, a Production Technician in the Indiana Uplands.



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GRADE 3-5 STEM CHALLENGE

Sewing Saves Lives

Inspired by Sarah, a Production Technician in the Indiana Uplands.

Students will explore the circulatory system through a model heart and learn about devices to repair blood vessels.

CAREER CONNECTION AND LESSON OVERVIEW

Sarah is a production technician and assembler for COOK Medical in Bloomington, Indiana. Sarah hand-makes stents for patients who have a potentially life-threatening weakening of large arteries. She also trains the next generation of production technicians, teaching them how to carefully stitch and assemble these life-saving devices. COOK depends on production technicians like Sarah to ensure that the products they manufacture are free of defects and safe for use in people.
In this investigation, students will create a simple model of the human heart. They will then practice making the same kinds of knots Sarah uses to assemble the life-saving stents at COOK.

LESSON TIMELINE

DAY 1 60 Minutes
- Show the inspiration video, "Sarah - Team Assembler Trainer"
- Build a model heart

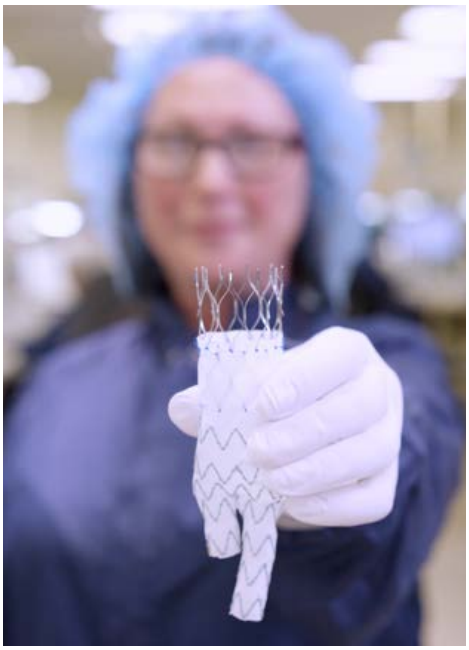
DAY 2 60 Minutes
- Explore scenarios
- Sew a model stent

DAY 3 60 Minutes
- Create a presentation
- Present to the class

Recommended Supplies

Day 1, per group
- Balloon
- Scissors
- Cup or glass jar (strong enough to stretch balloon over the top opening)
- Water (colored with food coloring, optional)
- Two bendable straws
- Toothpick or kebab skewer (something with a sharp point)

Day 2, per student
- 6-8” square of chicken wire (or similar mesh material)
- Yarn
- 1 pair of gloves
- 1 balloon for demonstration



IN THIS CHALLENGE, STUDENTS WILL:

- Build a model heart and circulatory system.
- Learn about how stents and small medical devices save lives.
- Design a model stent.
- Create a presentation.

Standards

Science & Engineering Process Standards

SEPS.1 Posing Questions (for science) and defining problems (for engineering)

SEPS.2 Developing and using models and tools

SEPS.6 Constructing explanations (for science) and designing solutions (for engineering)

SEPS.8 Obtaining, evaluating, and communicating information

Engineering Standards

3-5.E.1 Identify a simple problem with the design of an object that reflects a need or a want. Include criteria for success and constraints on materials, time, or cost.

3-5.E.3 Construct and perform fair investigations in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

Computer Science Standards

3-5.NC.2 Use productivity technology tools for individual and collaborative writing, communication and publishing activities.

English/Language Arts

3.SL.3.1 Retell, paraphrase, and explain the main ideas and supporting details of a text read aloud or information presented in diverse media and formats, including visually, quantitatively, and orally.

4.SL.3.1 Summarize major ideas and supportive evidence from text read aloud or information presented in diverse media and formats, including visually, quantitatively, and orally.

5.SL.3.1 Orally summarize or respond to a written text read aloud or information presented in diverse media and formats, including visually, quantitatively, and orally.

Science Standards

3.LS.2 Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.

4.LS.2 Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction in different ecosystems.

Employability Skills Standards

3-5.WE.4 Complete tasks or activities with prompting and guidance from adult educators.

3-5.WE.5 Demonstrate perseverance to complete tasks and activities.

3-5.LS.2 Communicate with others by applying a variety of speaking skills.

3-5.LS.3 Communicate with others using a variety of technology.

3-5.LS.4 Relate personal interests, abilities, and leisure time activities to possible occupational choices without stereotyping.

3-5.LS.13 Utilize effective questioning and brainstorming techniques.

Planning and Implementation

SEWING SAVES LIVES

Essential Vocabulary

- STENT: a tubular support placed temporarily inside a blood vessel, canal, or duct to aid healing or relieve an obstruction.
- CIRCULATORY SYSTEM: the system that moves blood, oxygen and nutrients through the body. The circulatory system includes the functioning of the human heart, blood and blood vessels.
- ARTERY: A vessel that carries blood high in oxygen content away from the heart to the farthest reaches of the body.
- VEIN: A vessel that carries oxygen-depleted blood toward the heart.
- CAPILLARY: The smallest of blood vessels. The capillaries distribute oxygenated blood from arteries to the tissues of the body and to feed deoxygenated blood from the tissues back into the veins.

In this challenge, students will:

- View the job shadow video Sarah-Production Technician
- Build a model heart to simulate blood circulation
- Learn about stents and how small medical devices save lives
- Design a model stent
- Create a presentation

Before Class:

- Read the activity outline sheet and leader notes to become familiar with the activity.
- Gather necessary materials. Be sure that you have enough materials and space for each student to create their models.

Day 1

Introduction (20 Minutes)

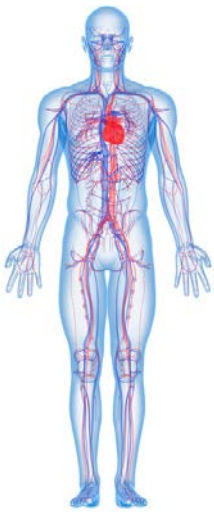
Introduce the career of team assembly trainer in the field of life sciences to the students.

> *"When most people think about a career in life sciences, they most often think about careers in the medical field, likes doctors and nurses. Others may be familiar with companies that develop and manufacture medicines and other substances that people need. The career we will look at today is related to these but involves manufacturing small medical devices that doctors use to help their patients. One example of a small medical device is a stent. A stent is a tubular support placed inside a blood vessel, canal, or duct to aid healing or relieve an obstruction."*

"This means that if a patient's blood cannot flow normally for some reason, a surgeon can insert a stent to help. Sarah, the team assembler trainer in the video we will watch very carefully sews stents. Sarah is also responsible for training new team members how to do this job."

Show Sarah's career shadow video, "Sarah - Team Assembler Trainer," available at http://www.regionalopportunityinc.org/sarah/, and either project Sarah's Career Profile or provide printed copies to each student. Here they can read more about Sarah's work, the education jobs like hers require, and similar jobs in the field.

Prompt students to reflect on the article by asking what they think is interesting about Sarah's job and if they have any questions.



The Circulatory System (10 Minutes)

Explain that the human body has many systems that help it function every day. The circulatory system is the system that moves blood, oxygen and nutrients through the body. The circulatory system includes the functioning of the heart, blood and blood vessels.

Before students explore Sarah's job by creating model stents on Day 2, they will first learn more about how the circulatory system works

Complete the 'Know' and 'Wonder' sections of the Know, Wonder, Learn (KWL) chart with the class. *(individual student KWL chart included if preferred)

- "What do you know about the circulatory system?"
- "What do you wonder about the circulatory system?"

Share with students this brief overview of the circulatory system, available at https://www.youtube.com/watch?v=aUOQqoPsaBg (1:34)

Students will revisit the KWL chart at the conclusion of the model heart activity to reflect on what they have learned.

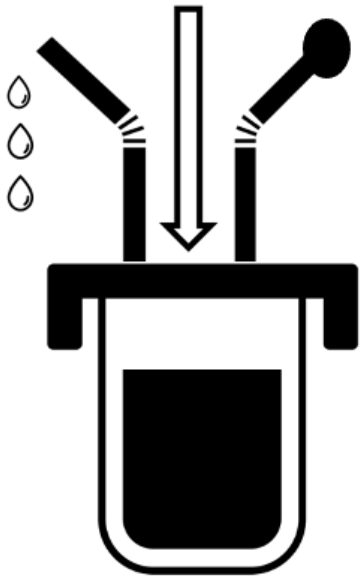
Create (20 Minutes)

In this activity:

- Students will build a model heart to simulate how blood is pumped through the circulatory system.
- Students will work in groups of 2-3.

Explain to students that each group will be building a model heart to explore the way that blood is pumped, by the heart, through the veins and arteries. Each group should collect the recommended materials and an instruction sheet.

Student Instructions



1. Cut the straight neck off of the balloon.
2. Fill the cup about 3/4 full with water.
3. Stretch the round end of the balloon over the top of the cup. The flatter you get the top, the better.
4. Using the toothpick (or sharp object) carefully punch two small holes in the top of the balloon.
5. Place the two straws into the holes.
6. Place the cut off end (the neck) of the balloon over the bendy end of one of the straws and tape to secure.
7. Bend the straws and take the model outside or place it in a bowl or basin (it can get messy!)

Test (20 Minutes)

Once the students have completed the construction of their model, they will use it to pump "blood" through the system. Pushing down on the balloon in between the straws will cause the water to squirt out of the straw, in the same way that the blood is pushed by the heart through our veins and arteries.

Students will need to experiment with how frequently to pump the balloon in order to cause the water to pump out. Remind students to handle the model carefully. If the balloon is not taut over the cup or if the balloon rips around the straw openings, air leaking in will affect the function of the model. Prompt students to problem solve and persevere through these challenges. You can also offer replacement balloons or tape if the problem persists.

Allow students a few minutes to explore their models before prompting them to consider the questions on the student handout. Have the students complete the questions in the TEST section of the student handout. Reflect on these questions as a class.

Some possible connections may include:

- The water pumps through the straw similar to how blood pumps through veins and arteries.
- The straw that is blocked only lets the blood travel one way through the system.
- You can also point out that there are valves in the heart that keep blood from going backward in the system. The blocked straw acts as a valve in this model.

Wrap up the day by completing the LEARN section of the KWL chart with the class.

Day 2

Introduction (20 Minutes)

Take a moment at the start of the lesson to review Day 1.

- Students observed how blood pumps through veins and arteries to keep oxygen flowing to the cells of the body.
- Prompt the class to share what they learned about the circulatory system.
  - Ask "What would have happened if we had blocked the other straw?
    - *The blood wouldn't have been able to flow!*
  - Ask students to think about why that might be a problem in the human body. Students may have had family members who suffered heart attacks or strokes, medical situations caused by having a blocked blood vessel.

Share with students:

> *"On Day 1, you explored how the heart pumps blood. Today you will explore a small medical device called a stent. We'll talk about what they are, why people might need it, and how they are made by people like Sarah."*

Tell students that an aneurysm is a bulge in an artery. Different things can cause them, and they're not common, but they can weaken the blood vessel so doctors repair them with a stent. Demonstrate what an aneurysm looks like with a balloon. Blow up a balloon until it is about halfway full. Point out that the sides fo the balloon are smooth and round. This sort of what your arteries look like: Smooth, strong, and stretchy!

Squeeze the balloon so that one area of the balloon bulges out. Tell the students that if the side of an artery becomes weak, it can "balloon" out and run the risk of breaking open. This is called an ANEURYSM. Usually this happens because the person's blood pressure was too high or there was a blockage or clot somewhere in the blood vessel. Some people are also just prone to them because of their genetics. Every human is different!

Let the balloon go back to normal. Explain that a lot of blood, important to how your whole body functions, runs through the arteries. So, if the side of an artery is weak, it must be repaired. The stents that Sarah makes are like special reinforcements that relieve the pressure on the artery, letting the aneurysm shrink back down and the vessel repair itself. This particular stent is called the "Triple A" stent because it's for:

Abdominal (meaning in the lower trunk of your body-- think belly!)

Aortic (the big, tough artery that carries the blood away from your heart to the rest of the body.)

Aneurysms (Those weak, bulgy areas that can form on arteries.)

So, the AAA stent is used to fix the types of aneurysms that can form in the big artery that runs down from your heart and carries oxygenated blood to the lower half of your body.

Create (40 Minutes)

Students will now have the opportunity to use the materials provided to design their own model stent.

> Safety Note: Remind students that chicken wire can have sharp edges and to wear their gloves. Gloves offer a level of protection from the chicken wire, but also provide an illustration of the kind of safety equipment Sarah is required to wear at work. Because stents are created for use in humans, the production environment must be without dirt and germs.

Before passing out materials, share with students a picture of the stent from the curriculum. Have students make observations about how it is sewed together. Ask them to point out any patterns or strategies they might try. Also, point out that each time the sewing changes directions, they should tie a knot.

Provide each group with materials and time to work through their ideas. When students have completed a model they are satisfied with, have them complete the DESIGN section of the student handout.

Discuss and Report (60 Minutes)

Students will work in their small groups or individually to complete the COMMUNICATE section of their handout. Have students use available technology (or another mode of presentation) to summarize their learning. Presentations should include:

- a summary of what students learned about circulatory system and stents.
- a summary of why they think a job like Sarah's is important.

Career Exploration and Extension

Prompt students to think about and research what a career as a production technician might involve.

- What does a production technician do all day? What does Sarah do?
- What kind of school would a student need to become a production technician? What other types of technicians are there?
- Are jobs like Sarah's in high demand? Will more people be hired to manufacture medical devices by hand in the future?

Name: _____

Sewing Saves Lives

Know, Wonder, Learn Chart

KNOW	
WONDER	
LEARN	

Name: _____

Sewing Saves Lives

Student Data Sheet

CHALLENGE

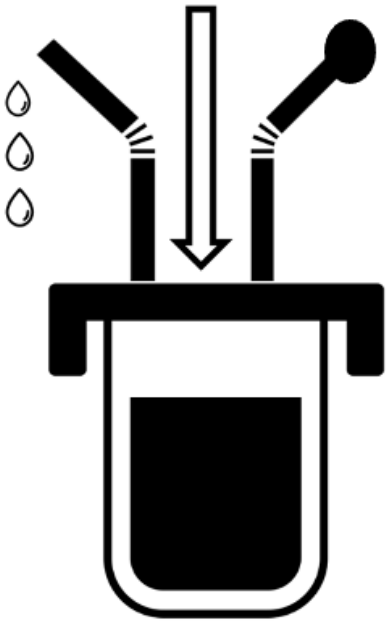
What is the problem we are going to solve?

The circulatory system moves blood, through arteries and veins, to deliver oxygen and nutrients to the body.

Build and explore a model heart to better understand this process.

CREATE

Follow the instructions to create a model of the heart



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5. Place the two straws into the holes.
6. Place the cut off end (the neck) of the balloon over the bendy end of one of the straws and tape to secure.
7. Bend the straws and take the model outside or place it in a bowl or basin (it can get messy!)

Name: _____

TEST

Push down on the balloon between the straws.
This is similar to how your heart pumps!

Describe what it takes to make your model pump water of out of the straw.

What similarities are there between the circulatory system video you saw and the model you created?

Name: _____

DESIGN

You will have _____ minutes to design your stent.

Draw a picture of the stent you and your classmate(s) created.

If you were hiring someone to do this job, what skills would you want them to have?

Name: _____

COMMUNICATE

Share your prototype with the class or another group.

What was the most difficult part of this challenge?

What did you learn about Sarah's job as a medical device assembler? Why is her job important?

ACKNOWLEDGEMENTS

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IMAGE AND CONTENT CREDITS

Images

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water drop by Aybige.

Content

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