IGNITE ACTIVITY

MODELING YOUR SPINE

STEM^{2}D Topics:
SCIENCE & ENGINEERING

Target Population:
Students, ages 8-14

MODELING YOUR SPINE is part of the Student Activities Series developed by FHI 360 for Johnson & Johnson's WiSTEM^{2}D initiative (**W**inning in **S**cience, **T**echnology, **E**ngineering, **M**ath, **M**anufacturing, and **D**esign). The series features interactive and fun, hands-on activities for youth.

MODELING YOUR SPINE

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ACTIVITY DESCRIPTION

The human spine serves many purposes, including holding you upright! The spine and spinal cord are parts of the musculoskeletal system and central nervous system, which control every cell in your body. It's important to keep your spine healthy by stretching, staying active, standing when possible, and maintaining a healthy weight. In this activity, students will create a model of the human spine.

ESTIMATED TIME

This session typically takes **10 to 15 minutes** to complete.

STUDENT DISCOVERIES

Students will:

- Learn how STEM^{2}D – science, technology, engineering, mathematics, manufacturing, and design – subjects are connected to the healthcare industry.
- Build important STEM^{2}D skills, such as exploring problems, critical thinking, and collaboration.
- Consider STEM^{2}D concepts including the anatomy and structure of the spine, and how the healthcare industry connects to various STEM^{2}D fields.
- Have fun experiencing STEM^{2}D!

GETTING READY

Materials:

- Pre-Activity Checklist
- Tell My Story Form, *optional*

STEM^{2}D Skills

- Exploring Problems
- Communication
- Collaboration
- Attention to Detail
- Adaptability

- Activity materials, 1 set of the following items per group:
  - 1 Empty egg carton
  - 2 Pipe cleaners
  - Colored foam sheets or construction paper
  - Markers
  - Scissors
  - 3 Straws
  - Stapler

Estimated Cost:
Activity leaders can expect to incur $15 in materials costs per 20 students.

ACTIVITY LEADER PREPARATION

1. Read **Spark WiSTEM²D**. This is essential reading for all volunteers interested in working with youth, as it provides important background knowledge about STEM²D, strategies for engaging students, and tips for working with groups of students.
2. See the **STEM²D Student Activities Overview** for additional information.
3. Review the **Pre-Activity Checklist** (at the end of this document) for details and specific steps for planning, preparing, and implementing this activity.
4. If you have limited access to supplies or time scheduled with students is shorter than 10 minutes, consider providing a volunteer demonstration of how to build a spine model to the entire group.

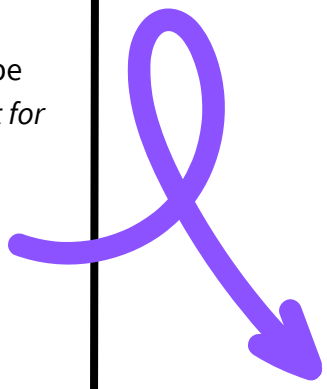
STEP-BY-STEP INSTRUCTIONS

1. **Welcome & Introductions (3 minutes)**
   - Greet the students as they arrive.
   - Tell the students your name, title, and organization/company.
   - Explain why you love STEM²D, and how your work is connected to various STEM²D areas.

Engaging Students

- Circulate and answer questions during the building process.
- Check frequently for understanding by asking open-ended, topic-specific, or process questions.
- Encourage students to ask questions to gain deeper understanding.

2. **Learning Activity: Modeling Your Spine (10 minutes)**
   - Explain that today students will create a model of the human spine. Show the students the materials they will be using to create the spine model. *See Pre-Activity Checklist for more details.* Ask:
     - Which of the 11 human body systems does the spine belong to?
     - What is the primary purpose of the spine?
     - What are the different parts of the spine?
     - What are the 5 different regions of the spine?
     - What can you do to keep your spine healthy?
   - Consider playing the following video that walks the students step-by-step through the construction of the spine model. Pause the video after each step to allow students time to perform each task within their group.
     - bit.ly/STEM2Dspinedesign
   - If you do not have access to technology during this session, walk students through the steps of building the spine model.
     - Using the bottom half of the egg carton, cut the individual egg cups apart. This will result in 12 individual cups representing the vertebrae.
     - Cut your foam board into 12 small circles approximately the same diameter as the individual egg carton cups. These will be the intervertebral disks.
     - Use the scissors to poke a small hole through the center of each of the individual foam circles. This will allow space for your pipe cleaner. The pipe cleaner will represent the spinal cord.
     - Use the scissors to poke a small hole through one side of your egg carton cup. Then poke a second hole on the opposite side of your egg carton cup. Repeat this process for each egg carton cup.
     - Thread your pipe cleaner through one egg carton cup. Then add one of your foam circles.
     - Repeat this pattern until all egg carton cups and foam disks are used.
     - Twist the ends of two pipe cleaners together to elongate the spinal cord and provide more room for the egg carton cups and foam disks.
     - Label the different parts of your spine model using the marker, straws, stapler, and extra foam sheets.



Helpful Hints

- The spine belongs to the musculoskeletal system while the spinal cord belongs to the central nervous system.
- The spine gives the body structure, supports the body, protects the spinal cord, and gives you the ability to move and be flexible.
- The different parts of the spine include the vertebrae, facet joints, intervertebral disks, ligaments, spinal cord, and nerves.
- 33 vertebrae make up 5 distinct spine segments: cervical, thoracic, lumbar, sacrum and coccyx.
- You can keep your spine healthy by maintaining good posture, exercising regularly, maintaining a healthy weight, taking breaks from extended periods of sitting, and staying hydrated.

See pages 7 & 8 for visual representations of the different parts and sections of the spine.

3. **Student Reflection (2 minutes)**

- Wrap up the activity by asking the following reflection questions:
  - How does the health of your spine impact the entire body?
  - What can you do to keep your spine healthy?
  - How did your understanding of the spine change today?
- Ask students to consider what kind of careers people with an interest/degree in this area would have. Examples include:
  - Spine Specific Careers: Orthopedic Spine Surgeon, Neurosurgeon
  - Engineering: Biomechanical Engineer, Ergonomist
  - Education & Rehabilitation: Physical Therapist, Chiropractor, Spine Rehabilitation Specialist, Physical Education Teacher, Fitness Trainer
- Thank students for joining you today and encourage them to continue exploring careers in STEM²D.
  - Direct students to the Exploring Nursing Pathways eBook to learn more about careers in healthcare.
    - https://www.stem2d.org/navigating-nursing
  - Encourage students to take the STEM Career quiz and explore how a career in STEM²D can help to shape their future.
    - https://www.stem2d.org/stem2d-at-home

EXTENDED LEARNING

You can extend student learning by having students (or teams):

- If working with older students, **watch** the following video that illustrates the structure of the spine. Spine Anatomy | Know Your Spine (youtube.com)
- If working with younger students, **watch** the following video that describes the different segments of the spine. Fun facts for kids about human spine (easyscienceforkids.com)
- If you have extra supplies, **challenge** students to use the correct number of vertebrae (33) in their model and include labels for the different parts and segments of the spine.
- **Explain** that the spinal cord is a vital link to and from the brain, and is also responsible for the body's reflexes, such as removing your hand from a hot object.

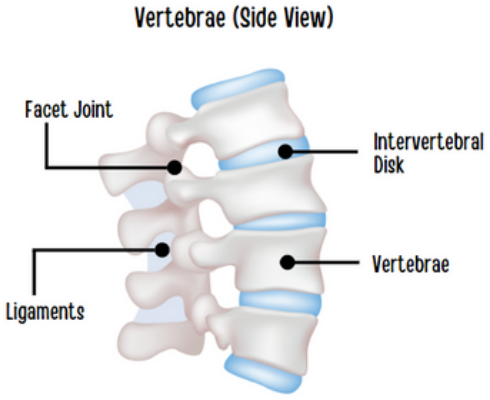
STEM²D Connections

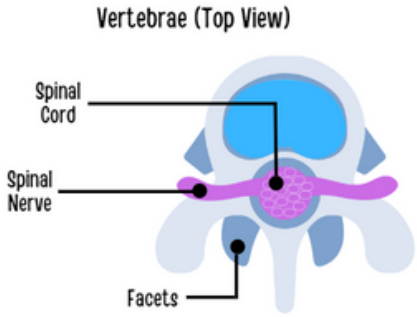
- *Anatomy and Physiology:* understanding the structure and function of the vertebral column.
- *Biomechanics:* studying the curvatures, movements, and load-bearing capacity of the spine.
- *Engineering and Design:* developing medical devices like spinal implants, prosthetics, and orthotics.
- *Mathematics and Science:* analyzing spinal curvatures, calculating angles, assessing patient data, and analyzing statistics to help evaluate treatment outcomes and predict risks.

- **Experiment** with different health conditions.
  - What would happen if a nerve connection broke?
  - What kinds of things could break connections?
- Encourage students to **explore** some diseases, disorders, or injuries that could affect the nervous system.

KEY WORDS

- **Cervical spine:** The first 7 vertebrae at the top of the spine, commonly referred to as the neck, which allows the neck to move in all directions. This region controls arm, hand, and breathing functions.
- **Coccyx:** Commonly referred to as the tailbone, the coccyx is a tiny triangular-shaped bone that consists of 4-5 small vertebrae that are fused together. The tailbone serves as an attachment point for various muscles, tendons, and ligaments in the pelvic region and helps distribute body weight while sitting.
- **Facet joints:** Small joints that connect the vertebrae and allow for the movement and stability of the spinal column.
- **Intervertebral disks:** Soft, cushion-like structures between vertebrae that function as shock absorbers and provide flexibility and support for the spinal column.
- **Ligaments:** Strong bands of connective tissue that help stabilize and support the vertebrae.
- **Lumbar spine:** The five vertebrae in the lower back responsible for housing nerve roots that supply motor function to the lower extremities, including the legs and feet.
- **Nerves:** Spinal nerves contain sensory and motor nerve fibers that relay movement, sensation, and involuntary functions between the spinal cord and other parts of the body.
- **Sacrum:** A single bone at the base of the spine that carries all the weight of the body and helps with standing, walking, and other weight-bearing activities.





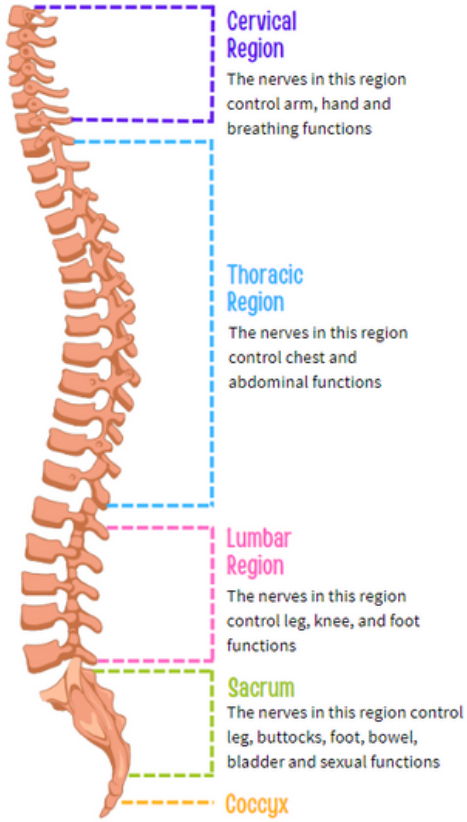
- **Spinal cord:** A long, tubular bundle of nerves that extends from the brainstem down the vertebral column. The spinal cord serves as the central pathway for transmitting sensory and motor signals between the brain and the body through specific nerves.
- **Thoracic spine:** The twelve vertebrae of the mid-back that are attached to your ribs. The primary function of this region of the spine is to protect the spinal cord and control the chest and abdominal areas.
- **Vertebrae:** The bones of the spine that have a space in the center, forming a hollow tube when stacked on top of each other so they can wrap around and protect the spinal canal.

RESOURCES AND REFERENCES

Activity concepts and real-life connections adapted from:

- Team Cartwright, How to Make a Model Spine: Anatomy STEM for Kids
  How To Make a Model Spine: Anatomy STEM for Kids - Team Cartwright (team-cartwright.com)
- National Spine Health Foundation, The Spine: Anatomy and Function
  The Spine: Anatomy and Function (spinehealth.org)
- My Cleveland Clinic, Spine Structure and Function
  Spine: Anatomy, Function, Parts, Segments & Disorders (clevelandclinic.org)

Spine Regions



PRE-ACTIVITY CHECKLIST

MODELING YOUR SPINE

The following checklist helps activity leaders plan and prepare to conduct the ***Modeling Your Spine*** *activity with students.*

DID YOU . . .

- ☐ Read Spark WiSTEM^{2}D? This is essential reading for all volunteers interested in working with youth. It defines the STEM^{2}D principles and philosophy and provides research-based strategies and tips for engaging and interacting with students.
- ☐ Visit the event venue (optional) and/or finalize logistics with the organizer? Ask:
  - ☐ What is the date, time, and location of the event?
  - ☐ How will the room be arranged? Do I have access to tables? How big are they?
  - ☐ How many students do you expect? How will the students be organized/participate in the event? Knowing this will help you determine the quantity of materials to purchase.
- ☐ Recruit additional volunteers, if needed?
- ☐ Prepare for the activity? Did you:
  - ☐ Read the entire activity text prior to implementation?
  - ☐ Customize the activity, if desired, to reflect your background and experiences, as well as the cultural norms and language of the students in your community?
  - ☐ Complete the **Tell My Story Form**, which will prepare you to talk about your educational and career path with the students? *(optional)*
- ☐ Obtain the required materials? See the Materials and Estimated Materials Costs sections.
- ☐ Set up the site appropriately for the activity?
- ☐ Practice your presentation? *Make sure you can explain the concepts to students, if needed, and that you know the correct answers.*
- ☐ Bring a camera, if desired, to take photographs?
- ☐ Obtain and collect permission slips and photo release forms for conducting the activity, if applicable?
- ☐ Have fun!

TELL MY STORY FORM

This form will help activity leaders and other volunteers 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 will get out of this activity?

_____

_____

FUN FACT

Share a little about your background. Ideas:

- Share a memory from childhood when you first had your "spark" or "interest" in STEM²D.
- Detail your journey, highlighting 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. _____

_____

_____

What does your current position entail? Be sure to include how you use STEM²D during a typical work day. _____

_____

_____