

# Spine Fixers

Primary Curriculum	Grade 4
Supplemental Curriculum	Grades 3–5+
Notes	Standard unit/refill kit comes with enough materials for 30 students.

## Description

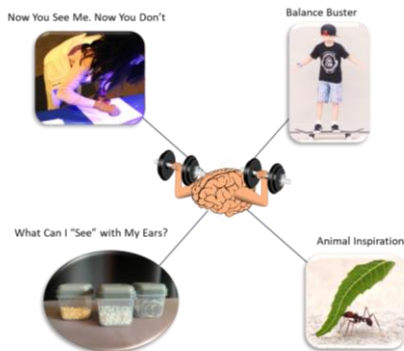
### How does your body do what it does?

Have you ever thought about how difficult it would be if you couldn't move your spine? How about what it might take to develop an artificial limb? Join entrepreneurs and pioneers like Glenn, Emily, and others who are developing new technologies and prostheses as they talk about the challenges of designing technology for the human body and the passion they have for what they are doing.

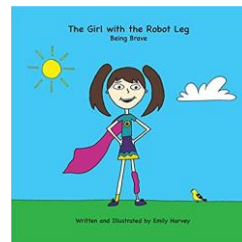
Using the spine and Glenn's newly developed spinal implant as the overarching phenomenon, students will explore how living organisms process information and develop physical structures as they ask themselves: *"What can nature teach us about developing improved artificial limbs and prostheses in general?"*

## Main Investigations

### The Brain: Commander of Your Universe



### Bionic Buddies



## Number of Lessons\*

Full unit – 22 lessons

Supplemental program – minimum 5 lessons

*\*Lesson = 30–40 min. block, 50% of full unit lessons can be delivered in non-science classes*

## Best Suited For

- Classroom science instruction
- Afterschool programs

## Overarching Enduring Understanding

"What can nature teach us about developing improved artificial limbs and prostheses in general?"

### Number of Lessons\*

Full unit – 22 lessons

Supplemental program – minimum 5 lessons

\*Lesson = 30 – 40 min block, 50% of full unit lessons can be delivered in non-science classes

## FLOW OF INSTRUCTION

### Introductory Investigation: How You Move (hands-on investigation, occurs during week 1)

Groups will build a "pipe cleaner" person – arms, legs, head, and spine. In the first version they will have a solid piece of straw over their pipe cleaner person and must examine how their person can or cannot move. They will then be challenged to make modifications to their person to see if they can improve how the person moves. An example modification is to take the pipe cleaner person apart and cut pieces out of the back straw to let it bend.

### Investigation: Why Am I Special? (mini research investigation, occurs during weeks 1 and 2)

In this multipart investigation students will create the foundation and framework that will help them organize information and their thoughts around physical challenges and prosthetic limbs.

Part 1: This investigation begins with students identifying unique traits and characteristics in plants & animals and discussing their form, function, and benefit.

Part 2: Students create a framework that they will use to help make connections between challenges humans face and strategies they can use to look for and develop solutions. This is accomplished through at least two series of brainstorming, research, and reflection sessions guided by the framework provided by the following three categories: Types of Physical Challenges, Tasks that Are Difficult for People with these Physical Challenges, Where & What Can I Learn About to Help Make These Tasks Easier?

### Investigation: The Brain: Commander of The Universe (hands-on investigations, occurs during weeks 2, 3, 4)

In this series of shorter investigations, students examine how our senses process various types of information. They also have an opportunity to experience firsthand some of the challenges that might face should they lose one of their senses.

Now You See Me. Now You Don't. In this investigation students explore what it takes to see features of a picture created with different types of paint (Regular paint, UV sensitive paint, glow-in-the-dark paint). At the end students must create a model that describes how they see the picture under different conditions.

What Can I "See" with My Ears? In this investigation students will try to describe the properties of and identify objects based on the sound they make when shaken in a plastic container.

Balance Buster: In this investigation students will attempt a series of balance poses under four different conditions (regular, eyes closed, ears plugged, eyes closed and ears plugged). They will compare the challenges of performing the balancing poses under the different conditions.

Animal Inspiration: Students must pick an animal that processes information differently than humans and compare and contrast the two styles of information processing. For example, humans use their eyes to see and bats rely on echolocation. As a reflection exercise, students will propose how this difference could be used to help humans with a related physical challenge.

### Investigation: The Girl with the Robot Leg (case study, occurs during week 5)

Students will learn about Emily Harvey through her video, biography, and story book *The Girl with the Robot Leg*. As practice for the summative challenge, students will evaluate the forces Emily must deal with on her stand-up paddle board or surfboard and what that means for her prosthetic leg.

### Investigation: Bionic Buddies (summative challenge, occurs during weeks 6 and 7)

In this summative challenge students revisit their brainstorming list created in *Why Am I Special?* and develop a new bio-inspired prosthetic body part or assistance device to help someone with a physical challenge.

## Overarching Enduring Understanding

### "What can nature teach us about developing improved artificial limbs and prostheses in general?"

#### Number of Lessons\*

Full unit – 22 lessons

Supplemental program – minimum 5 lessons

\*Lesson = 30 – 40 min block, 50% of full unit lessons can be delivered in non-science classes

## FLOW OF INSTRUCTION

#### 4-LS1-1

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

#### 4-LS1-2

Use a model to describe that animals receive different types of information through their senses, process the information in their brain, and respond to the information in different ways.

#### 4-PS4-1

Develop a model of waves to describe patterns in terms of amplitude and wavelength and that waves can cause objects to move.

#### 4-PS4-2

Develop a model to describe that light reflecting from objects and entering the eye allows objects to be seen.

#### Introductory Investigation: How You Move (hands-on investigation, occurs during week 1)

Groups will build a "pipe cleaner" person – arms, legs, head, and spine. In the first version they will have a solid piece of straw over their pipe cleaner person and must examine how their person can or cannot move. They will then be challenged to make modifications to their person to see if they can improve how the person moves. An example modification is to take the pipe cleaner person apart and cut pieces out of the back straw to let it bend.

#### Investigation: Why Am I Special? (mini research investigation, occurs during weeks 1 and 2)

In this multipart investigation students will create the foundation and framework that will help them organize information and their thoughts around physical challenges and prosthetic limbs.

**Part 1:** This investigation begins with students identifying unique traits and characteristics in plants & animals and discussing their form, function, and benefit. (4-LS1-1)

**Part 2:** Students create a framework that they will use to help make connections between challenges humans face and strategies they can use to look for an develop solutions. This is accomplished through at least two series brainstorming, research, and reflection sessions guided by the framework provided by the following three categories: Types of Physical Challenges, Tasks that Are Difficult for People with these Physical Challenges, Where & What Can I Learn About to Help Make These Tasks Easier? (4-LS1-1)

#### Investigation: The Brain: Commander of The Universe (hands-on investigations, occurs during weeks 2, 3, 4)

In this series of shorter investigations, students examine how our senses process various types of information. They also have an opportunity to experience firsthand some of the challenges that might face should they lose one of their senses.

**Now You See Me. Now You Don't.** In this investigation students explore what it takes to see features of a picture created with different types of paint (Regular paint, UV sensitive paint, glow-in-the-dark paint). At the end students must create a model that describes how they see the picture under different conditions. (4-PS4-2, 4-LS1-2)

**What Can I "See" with My Ears?** In this investigation students will try to describe the properties of and identify objects based on the sound they make when shaken in a plastic container. (4-LS1-2)

**Balance Buster:** In this investigation students will attempt a series of balance poses under four different conditions (regular, eyes closed, ears plugged, eyes closed and ears plugged). They will compare the challenges of performing the balancing poses under the different conditions. (4-LS1-2)

**Animal Inspiration:** Students must pick an animal that processes information differently than humans and compare and contrast the two styles of information processing. For example, humans use their eyes to see and bats rely on echolocation. As a reflection exercise, students will propose how this difference could be used to help humans with a related physical challenge.

#### Investigation: The Girl with the Robot Leg (case study, occurs during week 5)

Students will learn about Emily Harvey through her video, biography, and story book *The Girl with the Robot Leg*. As practice for the summative challenge, students will evaluate the forces Emily must deal with on her stand-up paddle board or surfboard and what that means for her prosthetic leg. (4-PS4-1)

#### Investigation: Bionic Buddies (summative challenge, occurs during weeks 6 and 7)

In this summative challenge students revisit their brainstorming list created in *Why Am I Special?* and develop a new bio-inspired prosthetic body part or assistance device to help someone with a physical challenge.