ABOUT BROKEN BONES

Essential Question: How Do Bones Heal?

Learning Targets:

Students will:

- Explain the role of bones in the functioning of the human body.
- Summarize the stages of how bones heal.
- Use a variety of media to develop and deepen understanding of a topic or idea.

Lesson Overview

This lesson introduces the fields of EMT, x-ray technician, and radiologist. It also highlights the hidden functions of bones. After learning how bones heal and key new vocabulary through a quick charades activity, the young professionals will face a splinting design challenge.
Lesson Agenda

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Materials

- Young Allied Health Professional student packet
- <How Does a Bone Heal> video to project

FACILITATION NOTES

The Narrative Arc. The more each <Emergency Scenario> can be presented as if telling a story, the more engaged the audience will be. Work to avoid a stale reading and lean towards bringing the information to life as in a conversation or a “reveal” of the next chapter. Think of creative ways to make the story your own.

IN ADVANCE

- Preview How Does a Bone Heal: [http://askabiologist.asu.edu/bone-healing](http://askabiologist.asu.edu/bone-healing). This video is a computer graphic that illustrates the healing process. The video can give students ideas about how to take notes on the steps of bone healing on the <How Bones Heal Graphic Organizer>.
- Preview the videos on splinting: [https://www.youtube.com/watch?v=Ot7c3syPtr4](https://www.youtube.com/watch?v=Ot7c3syPtr4) and [https://www.youtube.com/watch?v=0dzk5ROSSxI](https://www.youtube.com/watch?v=0dzk5ROSSxI) cover how to properly splint an extremity arm fracture. Please review these BEFORE assisting students. One video models using stabilizers other than SAM splints ([http://www.sammedical.com/products/sam-splint/](http://www.sammedical.com/products/sam-splint/)).
## Vocabulary

<table>
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<th>Content</th>
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<tbody>
<tr>
<td>x-ray technician, closed fracture, open fracture, comminuted fracture, splint, joint, forearm, blood clot, callus, extremity, pulse, sensation, movement</td>
<td>immobilize, stabilization, secure, protected, supported</td>
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## Opening (5 min)

### Emergency Scenario: Broken Forearm

1. **Invite** the young professionals to turn to a colleague and share any personal stories they have about broken bones.
2. **Ask:** “What might you do to help someone with a broken bone?”
3. **Invite** volunteers to answer the question. **Listen for:** Splinting, calling 911, going for help.
4. **Share** the *Emergency Scenario: Broken Forearm* in a conversational, engaging manner.

**Say:** The skateboard patient’s arm was splinted in the field by the first responder. First, let’s learn about how bones heal and how to do first aid in the field if someone breaks a forearm.

## Work Time

### How Bones Heal (10 min)

When a bone breaks, what happens? Are all breaks the same? How do bones heal? These are questions that are important for both the patient and for the health care team helping them heal.

Unlike machines, our bodies can repair themselves. The next video will help us learn how bones heal. **Focus on the function** of each stage if some of the vocabulary is new. As you watch the video, be sure to record the functions of each in the *How Bones Heal Graphic Organizer*.

1. **Project:** [http://askabiologist.asu.edu/bone-healing](http://askabiologist.asu.edu/bone-healing).
2. **Stop** the video at each stage so students can fill out their graphic organizers:

- Day 1: Blood Clot (0:35)
- Day 7: Soft Callus (1:15)
- Day 28: Hard Callus (1:37)
- Month 3: Remodeling (1:39)

3. **Ask**: *Now that you know how bones heal, why would we splint broken bones? Cast them?*

**Splinting Vocabulary Preview (5 min)**

1. **Say**: *Let’s take a moment to learn some new words.*
2. **Project** the new vocabulary words.
3. **Invite** volunteers to act the words out. Have other YPs guess them like charades.

- splint
- immobilize
- joint
- extremity
- stabilization
- secure (i.e. hold still)

*Now we are going to learn about a process that first responders use in the field. Has anyone here ever had a splint? The splint is a temporary way to immobilize an extremity—an arm, leg, wrist, finger, etc. Why do you think we would want to immobilize a broken limb on the way to a hospital?*

*While an EMT or paramedic often work in professionally stocked ambulances, many first responders have to improvise until help arrives. At other times, more advanced medical equipment may be far away, or in cases of wilderness settings or natural disasters, a well-stocked ambulance is not always available. In this case, first responders must improvise using specific principles to help guide their work.*

*Imagine you came upon someone with a broken arm and help was far away—what would you do? What are important things to think about?*

**Listen for**: *Reduce pain, immobilize the break so the patient can be moved, reduce swelling, keep the bone from breaking through the skin, support the injury.*
Splinting Design Challenge (20 min)

Ask: If you were far from help and came across a hiker with a fractured forearm, how would you respond? (Invite a few students to share their responses.) In the next activity, we will explore how to splint this type of injury.

1. Pair the students for the <Splinting Design Challenge>.
2. Ask the pairs to take three minutes to 1) look through the <Splinting Design Challenge> and 2) discuss a plan.
3. Have one person in each pair raise their hand. This arm becomes the broken arm, and they are now the patient.

   o The “non-injured” partner has 10 minutes to create a splint that meets the design constraints below (write on the board or project):
     • Protect the injury.
     • Immobilize the joint above and below the break.
     • Make sure the patient has pulse, sensation, and movement in the fingers (this shows you have not cut off circulation, which would damage the nerves and flesh).
     • Support the injury.

Design Challenge Feedback: Specific, Helpful, Kind (10 min)

1. After the allotted time, ask the patients to critique their first responder’s splint.
2. Patients should offer specific, helpful, and kind feedback on how well the first responder’s design met (or did not meet) the criteria.

Closure (5 min)

2 Stars, 1 Step

In the next lesson, you will learn a standard approach to splinting. EMTs who work in the front country have access to standardized equipment and are expected to follow a standard procedure. In many scenarios, a first responder may not have access to medical equipment, especially if an emergency occurs in the wilderness. A first responder must meet the constraints presented in today’s design challenge even if they do not have access to the best materials. During these moments, it is important to use a growth mindset to learn from each experience in the field.
What did you learn from your experience today?

Based on the feedback you received during the splinting design challenge, use your growth mindset to identify **two stars** (things you did well) and **one step** (something you would change or improve the next time).

In their training, allied health professionals spend hours in practicums, labs, and hands-on trainings. Do not expect your first splint to be perfect—but do expect to use feedback to think through how to make it better!
ABOUT BROKEN BONES: How Do Bones Heal?

Today’s Learning Objectives:

I can:

- Explain the role of bones in the functioning of the human body.
- Summarize the stages of how bones heal.
- Use a variety of media to develop and deepen understanding of a topic or idea.

This lesson introduces the fields of EMT, x-ray technician, and radiologist, as well as the big picture of the hidden functions of bones. After learning how bones heal and key new vocabulary through a quick charades activity, I will face a splinting design challenge.

Today’s Activities:

- How Bones Heal
- Vocabulary Preview
- Splinting Design Challenge
- 2 Stars, 1 Step
Emergency Scenario: Broken Radius and Ulna

As the emergency room x-ray technician, the person who administers and reads x-rays, you are very familiar with your patient's diagnosis: a broken radius and ulna in the forearm. Broken forearms are often caused by an impact injury, such as from a fall (when a child uses their outstretched arm to break a fall) or a direct blow. They are the most common fractures in children, especially if they're active.

You have already taken the X-ray of the adolescent male's broken forearm. While he is sedated for suturing his facial laceration, the doctor works to set his broken bones. His fracture is a closed fracture, one of the least complicated to set. This type of fracture means that the bones are broken but no bone has broken through the skin, an open fracture. And, luckily, the bones did not fragment into smaller pieces as we see in a comminuted fracture.

In this case, the bones are set in alignment and then splinted so they will be immobilized, or unable to move. The patient is later supplied with a sling to further minimize movement. He will receive physical therapy to help reduce the stiffness he will feel in his shoulder and to help restore muscle strength. The treatment plan states that his arm will be X-rayed again in 5-7 days, and the splint may be replaced with a cast.
# How Bones Heal Graphic Organizer

<table>
<thead>
<tr>
<th>Stages</th>
<th>Functions</th>
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<tbody>
<tr>
<td>List the four stages of the regenerative process in order.</td>
<td>Describe the function of each stage. (In other words, what is the body doing at each stage?)</td>
</tr>
</tbody>
</table>

1. 
2. 
3. 
4. 

### Word Bank
- Soft Callus
- Blood Clot
- Hard Callus
- Remodeling
Splinting Design Challenge!

**Scenario:** You are a first responder who has come across an injured hiker with a fractured forearm. You are far from help, so you must splint the forearm in order to prevent further injury. Follow the directions below.

**Directions:** You will have 7-8 minutes to create a splint that meets all of the design constraints below. Take some time to discuss a plan with your partner now.

**Design Constraints:**

1. The injury must be **protected**.
2. The joint above and below the break must be **immobilized**.
3. Make sure the hiker has **pulse, sensation, and movement** in the fingers (this shows you have not cut off circulation, which would damage the nerves and flesh).
4. The injury must be **supported**.
2 Stars, 1 Step: Use Your Growth Mindset!

Take a moment to reflect on today and think of two strengths (stars) and one thing you would work to improve the next time (step).

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