

## Your Tough, Growing Bones

By Jennifer Kenny

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Did you know that your leg bones could hold a force of one ton without snapping or bending? Your bones are tough and strong. Bones have to hold you while you run, jump, skip, or even hold something during an emergency. Bones are almost as tough as cast iron, but a lot lighter, of course! That's why it's been so tough to design artificial replacements for bones.

Bones contain **collagen**, a tough protein fiber. Collagen comes from Greek words meaning, "glue forming." Mineral salts are on the collagen making it very strong. Calcium and phosphorus are packed tightly. Seventy percent of an adult's bone is made of minerals. The remaining percentage is made of organic matter, giving the bone flexibility. Babies' bones have reversed proportions.

Your bones are hard and firm, so they don't stretch or bend. So how do bones grow? Your skull grows slowly. Long bones grow more rapidly. The bones of your arms and legs grow faster than the bones of your trunk.

**Cartilage** cells are at the ends of bones. Cartilage forms a baby's skeleton. It remains there even when you are no longer an infant. The cartilage cells continually multiply. Rows and columns of cartilage cells form on the side of the plate at the end of the bone.

On the other side of the plate, blood vessels and bone cells push into the cartilage and replace it with bone. **Osteoblasts** are the bone-building cells that make new bone tissue.

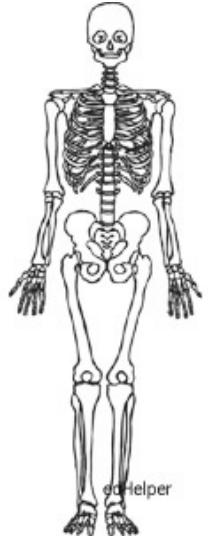
There are also bone cells known as bone breakers. What could they possibly have to do with helping your bones grow? Well, the special name for bone breakers is **osteoclasts**. Osteoclasts eat away channels in the cartilage. While the bone breakers work, the bone builders follow them and coat the channels with collagen. Calcium phosphate is placed onto the collagen fibers. New bone is formed. The shafts of bones grow longer. This process is called **ossification**. Ossification is the replacement of soft cartilage with bone. This process begins before birth and continues until the end of puberty.

When you stop growing in height, the cartilage cells in your growth plate stop growing. The cartilage is replaced by bone. The growth plate disappears.

Bones are living tissues so even after you reach your full height, parts of the bone are built up and broken down. Ten percent of an adult's skeleton is actually replaced each year.

After age 50, the breakdown of the bone might be faster than the buildup of new bone. **Osteoporosis** is the thinning of the bones with age. Very old people may have bones that break easily. It is not uncommon to know an elderly person who has broken a hip. Very often we say the person fell and broke his or her hip. It may actually be more correct to say the bone had weakened, broke, and then the person fell down.

Doctors do know that it is important to exercise and work those bones. Bones become thicker when they are worked. So stay active!



Name \_\_\_\_\_

Tuesday, April 29



Date \_\_\_\_\_

Your Tough, Growing Bones

## Questions

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- \_\_\_\_\_ 1. Bones are almost as tough as cast iron.
- A. True
  - B. False
- \_\_\_\_\_ 2. Bones contain a tough protein fiber called \_\_\_\_\_.
- A. osteoclast
  - B. cartilage
  - C. collagen
  - D. osteoblast
- \_\_\_\_\_ 3. \_\_\_\_\_ are the bone-building cells that make new bone tissue.
- A. Osteoclasts
  - B. Osteoblasts
- \_\_\_\_\_ 4. Your bones can bend.
- A. True
  - B. False
- \_\_\_\_\_ 5. \_\_\_\_\_ is the process of the replacement of soft cartilage with bone.
- A. Osteoclast
  - B. Osteoblast
  - C. Osteoporosis
  - D. Ossification
- \_\_\_\_\_ 6. An elderly person who easily breaks bones often has a condition called \_\_\_\_\_.
- A. Ossification
  - B. Osteoporosis
  - C. Collagen replacement
  - D. Osteoblast withdrawal
- \_\_\_\_\_ 7. Ossification begins before birth.
- A. False
  - B. True

# The Spine

By Jennifer Kenny

Your spine consists of many vertebrae. There are 33 vertebrae in kids and 26 vertebrae in adults, to be exact. These vertebrae fit on top of each other, interlocking to form your spine.

A vertebra is round in front. It has bony spikes on the sides and back. Attached to the spikes are muscles and ligaments. The spine is held together by the ligaments. The muscles support the spine and allow it to move.

Below each vertebra you will find cartilage. Cartilage actually makes up about 25% of the spine's length. The cushion of cartilage acts as a shock absorber. Don't forget that your spine takes a lot of strain as you move, sit, and stand. In fact, due to the pounding your cartilage takes all day, it actually compresses during the day like a sponge coming under pressure. Therefore, you are a tiny bit smaller at bedtime than when you get up in the morning. Overnight, the cartilage recovers its thickness while you sleep. The same can't be said when we age, though. It gets harder for the cartilage to recover as you get older. That's why adults do get shorter as they significantly age!



Now let's get back to the vertebrae. Each one has a hole in it. This forms the **spinal canal**. The spinal cord runs through the spinal canal starting at the bottom of the brain. One of the spine's most important jobs is to protect the spinal cord. The nerves, which branch off from the spinal cord help control our movements and senses.

The **cervical vertebrae** are the top seven vertebrae in the neck, which support the skull. If you didn't have them, your head would droop. The very first vertebra is called **atlas**. This is a great name for this particular vertebra. Do you remember any Greek myths? Atlas is the giant from the Greek myths who held the world on his shoulder. It's a little different from other vertebrae because it's more like a bony ring. The next vertebra is called the **axis**. It, too, is a little different than the others. It has a large, tooth like structure to connect it to the atlas. The other cervical vertebrae are more typical.

The next 12 vertebrae are the **thoracic vertebrae**. They are in the chest area and are attached to the ribs. Each one is larger than the one above it.

The next 5 vertebrae are the **lumbar vertebrae** in the lower back. They support the back muscles. They are the largest and strongest of all the vertebrae. They take the weight of the entire upper body when we stand.

The next five vertebrae are called the **sacrum**. They are in the hip area and are part of the pelvis. These are five separate vertebrae in children but are fused into a single bone in adults.

The last four vertebrae are called the **coccyx**. They are the tailbones at the end of your spine. These fuse together as well as we age.

Finally, did you know that you were born with a C-shaped spine? As a baby learns to hold his head up, sit, and stand, the S-curve develops. Your vertebral column is a long double S-curve so it is easier to bend.

Name \_\_\_\_\_

Wednesday, April 30



Date \_\_\_\_\_

## The Spine

### Questions

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- \_\_\_\_\_ 1. There are \_\_\_\_\_ vertebrae in adults.
  - A. 33
  - B. 16
  - C. 26
  - D. 13
  
- \_\_\_\_\_ 2. There are 33 vertebrae in children.
  - A. True
  - B. False
  
- \_\_\_\_\_ 3. The spine is held together by the \_\_\_\_\_.
  - A. muscles
  - B. ligaments
  - C. cartilage
  - D. none of the above
  
- \_\_\_\_\_ 4. The cushion of \_\_\_\_\_ acts as a shock absorber.
  - A. cartilage
  - B. ligaments
  - C. muscles
  
- \_\_\_\_\_ 5. You are a tiny bit smaller at bedtime than when you get up in the morning.
  - A. False
  - B. True
  
- \_\_\_\_\_ 6. The \_\_\_\_\_ are the top seven vertebrae in the neck.
  - A. sacrum
  - B. cervical vertebrae
  - C. thoracic vertebrae
  - D. lumbar vertebrae
  
- \_\_\_\_\_ 7. The very first vertebra, named after a giant in the Greek myths, is the \_\_\_\_\_.
  - A. axis
  - B. sacrum
  - C. atlas
  - D. coccyx
  
- \_\_\_\_\_ 8. The tailbones are the \_\_\_\_\_.
  - A. axis
  - B. sacrum
  - C. atlas
  - D. coccyx

## How Does a Cast Work to Heal a Broken Bone?

By Sharon Fabian

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If you've ever broken your arm or your leg, you probably already know more about a cast than you ever wanted to. You know that a cast can be itchy and even smelly. It stays on for weeks, and it's not much fun. But if you are lucky enough to never have needed a cast, or even if you have, you might be wondering - how does a cast work?

A cast doesn't heal a broken bone as much as it allows the broken bone to heal itself. Taking good care of the broken bone at every step of the way can help the process to go smoothly. To begin with, if you suspect that someone has broken a bone, get medical care as quickly as possible. In the meantime, try not to move the arm or leg with the broken bone any more than absolutely necessary.

At the doctor's office, the doctor will examine the injured area. He or she will probably take an x-ray to see what it looks like inside the arm or leg. If the bone has broken through the skin, the wound will be cleaned and cared for. The doctor will make sure that the parts of the broken bone are lined up properly so that the bone will heal straight. If the parts of the bone are not lined up right, it is called a displaced fracture. The doctor will have to line them up the way they should be before a cast is put on. This is called setting the bone. If the break is very bad, an operation may be done to put in metal pins to hold everything in the right place. Thankfully, for most breaks, this is not necessary.



When everything is ready, the doctor will put on the cast. The first step is to wrap the arm or leg with layers of soft cotton. Next, the main part of the cast, made of plaster or fiberglass, is fitted to the arm or leg. Plaster is a thick white paste that can be molded for an exact fit. Fiberglass is a plastic material that is lighter and stronger than plaster but cannot be molded to the exact shape as well as plaster can. The doctor decides which type of cast is right for each situation.

The cast holds the broken bone still so that it can heal on its own. For little kids, this may take only a few weeks. For older kids, it may take up to two months.

Once the cast is on, the arm or leg usually feels better than it did before. Still, there may be some pain for the first few days, so the doctor may also prescribe medicine to help the patient feel better. He will also explain how to take care of the cast. One of the most important things is not to get the cast wet, especially if it is a plaster cast. Water can ruin a plaster cast and keep it from holding the broken bone securely. If the inside of the cast stays wet, it can cause an unhealthy infection on the skin. To keep the cast dry, it must be wrapped in a plastic bag and taped shut before taking a shower. Another way to keep it dry is to use a waterproof sleeve made just for this purpose.

In addition to a cast, a patient with a broken arm may also have a sling. The sling keeps the arm in the right location and also helps to keep it comfortable. A patient with a broken leg may also have crutches to help him walk. A patient might get a walking cast on his foot. This is a special cast that the patient can walk on once the plaster or fiberglass has hardened.

Sometimes a cast can become uncomfortably itchy inside, and many people are tempted to poke something down inside the cast to scratch with. This is not a good idea because it may damage the person's skin, cause an infection, or damage the cast. One suggestion for relieving the itch is to use a blow dryer set on a cool setting. The cool air will often make the itchiness go away.

After a long wait, the day will finally come to have the cast removed. The doctor will use a saw to remove the cast, but the saw is perfectly safe. It has a dull, round blade that cuts through plaster but doesn't hurt people at all. In fact, some people say that it tickles.

And one final thing - before you get your cast sawed off, you might want to get all of your friends to sign it. Then you can ask your doctor if you can keep the cast for a souvenir.



How Does a Cast Work to Heal a Broken Bone?

## Questions

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- \_\_\_\_\_ 1. A person with a broken bone should see a doctor \_\_\_\_\_.
- A. the next day
  - B. within two days
  - C. as soon as possible
  - D. none of the above
- \_\_\_\_\_ 2. If you go to the doctor for a broken bone, the doctor will probably take an x-ray.
- A. false
  - B. true
- \_\_\_\_\_ 3. In a displaced fracture \_\_\_\_\_.
- A. the bones line up perfectly
  - B. the bone is cracked but not broken through
  - C. the bone is broken in two or more places
  - D. the broken parts of the bone do not line up properly
- \_\_\_\_\_ 4. You must be especially careful to keep a \_\_\_\_\_ cast dry.
- A. fiberglass
  - B. walking
  - C. plaster
  - D. waterproof
- \_\_\_\_\_ 5. If you get a cast on your leg, you are most likely to also get \_\_\_\_\_.
- A. a waterproof sleeve
  - B. a sling
  - C. a cast on your arm
  - D. a pair of crutches
- \_\_\_\_\_ 6. A blow dryer can be used to \_\_\_\_\_.
- A. relieve an itch caused by a cast
  - B. dry a cast
  - C. heal a broken leg
  - D. heal a broken arm

7. Why is it important to keep a cast dry?

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8. Why do you think many kids like to get their casts signed?

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## Broken Bones

By Jennifer Kenny

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Imagine you are outside trying on your new skates for the first time. You lose your balance and fall down. When you land, you hear a terrible cracking sound and your arm looks crooked. Ouch! You broke a bone!

Bones are hard and tough. They are really not that easy to break, but they do break. A broken bone is serious and painful. The most commonly broken bones are the fingers, wrist, arm, and elbow. Why? It's human nature to try to break the fall! Did you know that more than 50% of Americans break a bone before they turn 18 years old? It's true!

Broken bones hurt, but there are actually no pain nerves inside your bones. So why do you feel pain? Well, the hard, white covering of the bone, which is called the **periosteum**, is damaged when you break a bone. There are nerves and blood vessels inside the periosteum. They send the message to the brain and then you feel pain.

A broken bone is called a **fracture**. Most fractures are simple fractures. This is the kind of break where the bone doesn't go through skin. A compound fracture is the kind where a broken bone sticks through the skin. Sometimes children have incomplete fractures where the bone cracks and ends, but doesn't break completely. An impact fracture occurs when the broken ends of the bone are jammed together due to the force of the accident. A comminuted fracture is one in which the bone shatters. Finally, a person can have a single, double, or multiple fracture if there are one, two, or many breaks in the same bone.

The minute you break a bone, your body starts to fix it. Platelets come across damaged blood vessels, stick to them, and start trapping red blood cells. A clot forms and fills in the gap of the broken bone. This becomes the framework to form new bone and heal the fracture. Meanwhile, the tissue around the broken bone can become inflamed and the skin will become red. White blood cells take care of the dead cells and germs. Bone cells remove dead parts of the bone and lay new material called a **callus**. It will form the true bone.

How can you tell if you have a broken bone? You may hear it break. You may notice that the bone or joint is not shaped the same way anymore. The bone may stick out through the skin. You may even see incredible swelling and you wouldn't be able to move a joint like your knee. That's how you know.

Don't move if you think you have a fracture. A splint might be helpful if an adult knows how to do that. Go to the hospital. An X-ray at the hospital can help the doctor decide if the hurt bone is really broken.

If the bone is really broken, an X-ray will help a doctor line it up just right so it can heal properly. If it is a simple fracture, the doctor may use his or her hands to line it up. If it is a more serious fracture, it may require surgery and pins to hold the bone together.

When the bone is set, a **cast** made of plaster, fiberglass, or plastic will be placed to keep the bone from moving while healing. When the bone is finished healing, the doctor will cut off the cast. Children tend to heal more quickly than adults. For example, an adult with a wrist fracture might take eight weeks to heal. A child with the same wrist fracture might only need three weeks to heal.

When the person has the cast removed and can finally move again, he or she may experience some **atrophy**. That means that the muscles have gotten weaker because they haven't been used. The person might need to exercise or do some physical therapy to get strength back.

It's wonderful that broken bones heal, but it can be a long process. So stay safe! Wear protective gear, avoid accidents, and eat well.



Name \_\_\_\_\_

Friday, May 2



Date \_\_\_\_\_

## Broken Bones

### Questions

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- \_\_\_\_\_ 1. It is easy to break a bone.
- A. True
  - B. False
- \_\_\_\_\_ 2. What is the hard, white covering of the bone?
- A. periosteum
  - B. fracture
  - C. calcium
  - D. cast
- \_\_\_\_\_ 3. What is the name for a broken bone?
- A. compound
  - B. periosteum
  - C. fraction
  - D. fracture
- \_\_\_\_\_ 4. Melanie broke a leg in a skiing accident. The broken bone did not go through the skin. What kind of fracture was this?
- A. simple fracture
  - B. compound fracture
  - C. incomplete fracture
- \_\_\_\_\_ 5. To heal a broken bone, the doctor will place it in a \_\_\_\_\_.
- A. cast
  - B. periosteum
  - C. fracture
  - D. callus
- \_\_\_\_\_ 6. After a cast has been removed, a person might experience some weakness.
- A. True
  - B. False
7. Why do people tend to break more fingers, arms, and wrists than legs?

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# Human Shoulders, Arms, and Hands

By Jennifer Kenny

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An adult's skeletal system is made of 206 bones. Some of those, of course, are part of the shoulders, arms, and hands.

The **shoulders** are actually made of bones, muscles, and connective-tissue straps. Your arms are suspended from these hangers called shoulders.

The **scapulae**, or shoulder blades, are actually two large, flat triangular bones. They look like wings on the back of a skinny person. They are held in place by many ligaments and muscles. They are connected to the top portion of the ribs by the **clavicles**, or collarbones. You can see and feel the collarbones on the upper part of the chest below the neck. The collarbones are connected to the breastbone and shoulder blade. Together, the collarbones and shoulder blades form a crossbar called a **shoulder girdle** so the arms can hang.

The arms are attached to the shoulders at the ball-and-socket joint. This kind of joint lets you twist and swing your arms. Strong muscles, which cover the back and shoulder, also play an important part in letting you move your arm, lift heavy objects, and provide support for your head and neck. To keep such an important part of the body safe from injury, different kinds of special gear have been created for soldiers and athletes.

Running down the length of your upper arm is a thick bone called the **humerus**. Its upper end, which is rounded like a ball, fits into the socket of the shoulder blade. Your arm can move in a full circle because of the ball-and-socket joint.

There are two separate, thinner, long bones in your forearm. Hold your arm out with your palm facing up. You can feel the **radius** on the thumb side from your wrist to your elbow. You can feel the **ulna** on the other side. These two forearm bones are connected to the humerus by a hinge joint at the elbow.

Did you know that wristwatches are actually worn on your forearm and not your wrist? It's true. Anyway, your wrist is made of knobby **carpal bones**. You have no carpals when you are born. When you are an adult, you have eight carpals in each hand.

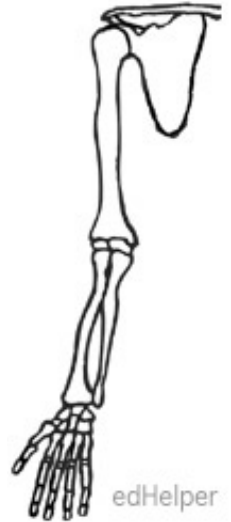
The palm of your hand is formed by five long bones called **metacarpals**. Connected to your metacarpals are the **phalanges**, or bones of your fingers. You have three bones in each finger, but only two in the thumb. Each finger has a scientific name that came from a Latin word with a certain meaning. For example, the word for thumb is "pollex" which means "strong." The pinky is called "minimus" which means "least." The ring finger is called "annular" which means "ring." The middle finger is called "medius" which means "middle." Finally, the index finger comes from "index" which means "pointer."

Unlike some of our animal friends who walk on four legs, humans walk on two and can use their hands for other things. Our hands are capable of doing amazing things such as karate chops or surgery!

Three hinge joints in each finger allow us to hold things. The saddle joint in the thumb allows it to move in two directions. This is called an **opposable thumb** and it lets us do special things like thread a needle.

Muscles below the elbow help move the lower arm and wrist. Muscles above the elbow help you to move your arm up and down.

As you can see, your shoulders, arms, and hands are made up of a complex set of bones. They are essential to so much in your life.



Name \_\_\_\_\_

Monday, May 5



Date \_\_\_\_\_

## Human Shoulders, Arms, and Hands

### Questions

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- \_\_\_\_\_ 1. Which is another word for your shoulder blade?
  - A. humerus
  - B. opposable
  - C. clavicle
  - D. scapulae
  
- \_\_\_\_\_ 2. Which best describes where your clavicles can be found?
  - A. chest
  - B. hands
  - C. wrist
  - D. elbow
  
- \_\_\_\_\_ 3. Which kind of joint best describes where your arm meets your shoulder?
  - A. hinge joint
  - B. ball-and-socket joint
  
- \_\_\_\_\_ 4. Running down the length of your upper arm is a thick bone called the \_\_\_\_\_.
  - A. radius
  - B. scapulae
  - C. clavicle
  - D. humerus
  
- \_\_\_\_\_ 5. An adult has \_\_\_\_\_ carpals in each hand.
  - A. 2
  - B. 8
  - C. 5
  - D. 3
  
- \_\_\_\_\_ 6. What is the scientific name for the thumb?
  - A. annulary
  - B. minimus
  - C. pollex
  - D. medius
  
- \_\_\_\_\_ 7. Humans have opposable thumbs.
  - A. True
  - B. False