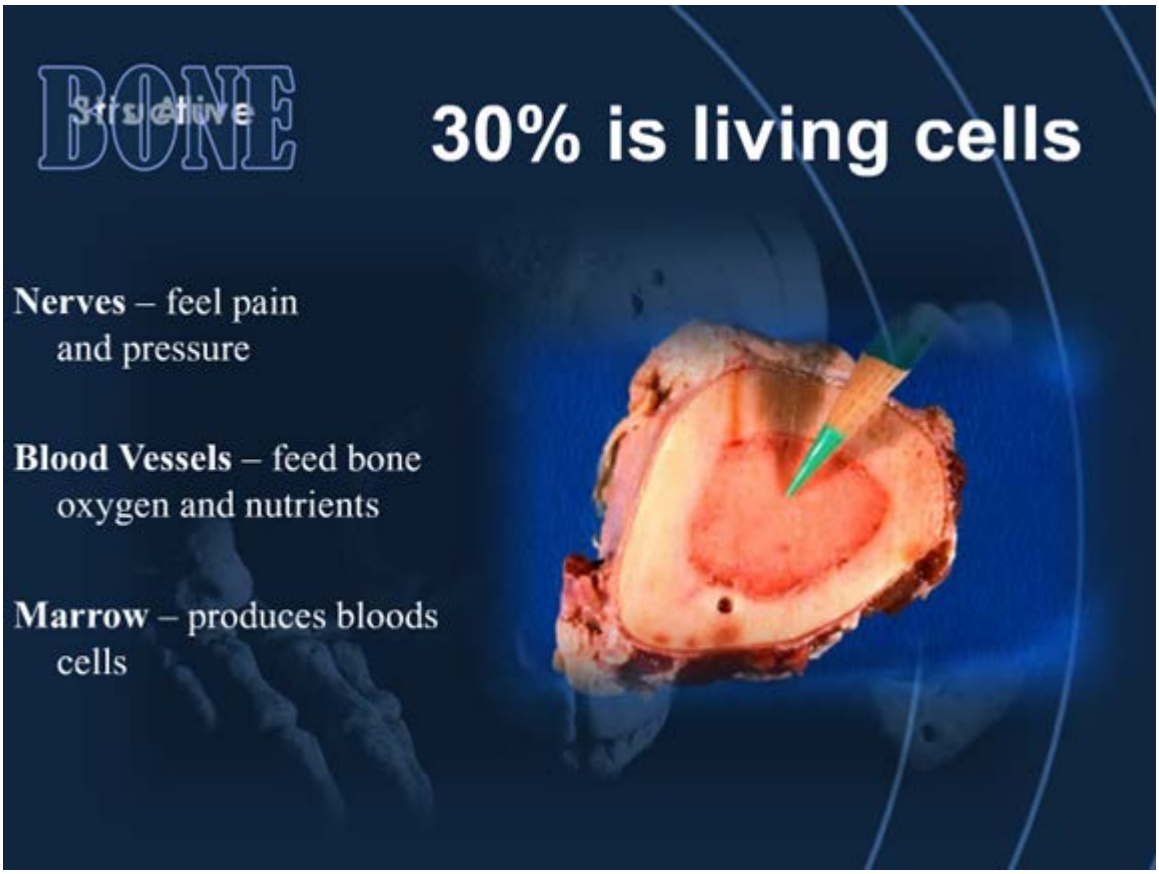
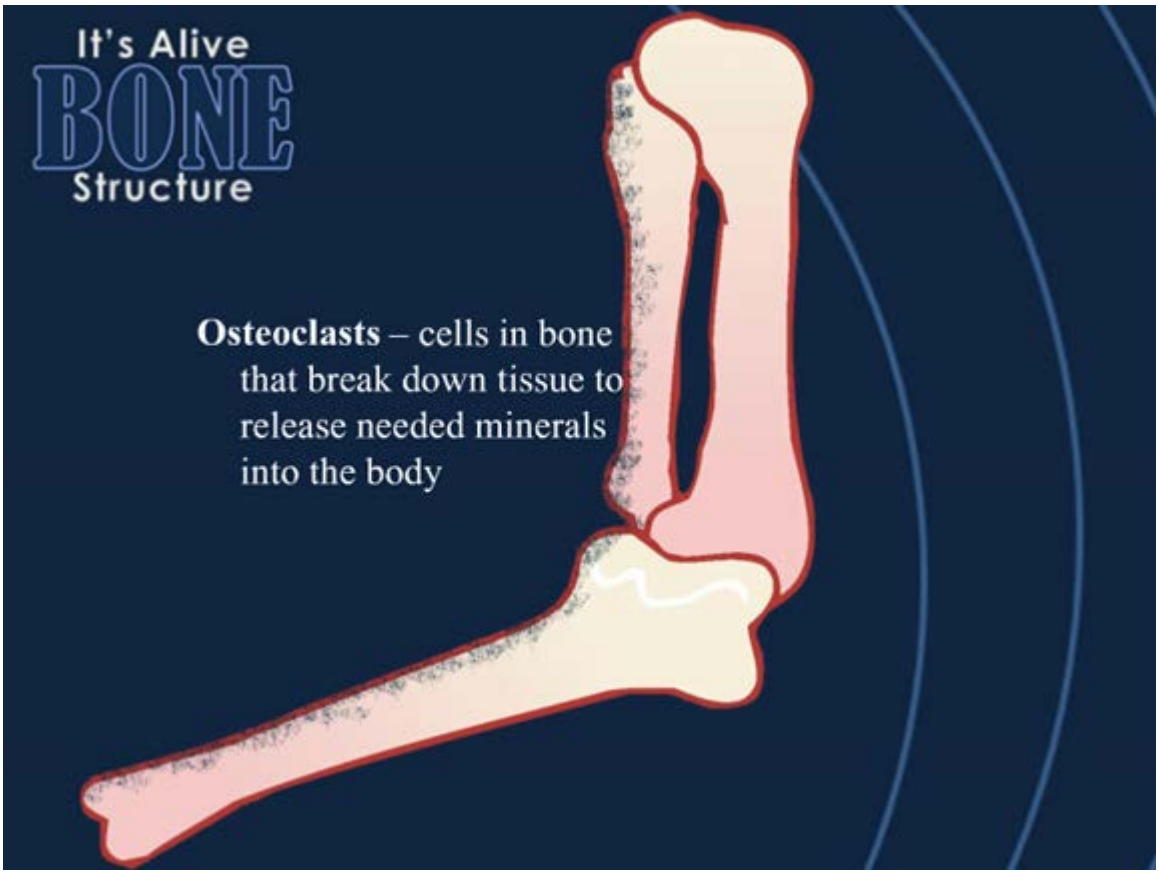
Module 3: High-Performance Machinery
Topic 1 Application: It's Alive: Bones

Structure



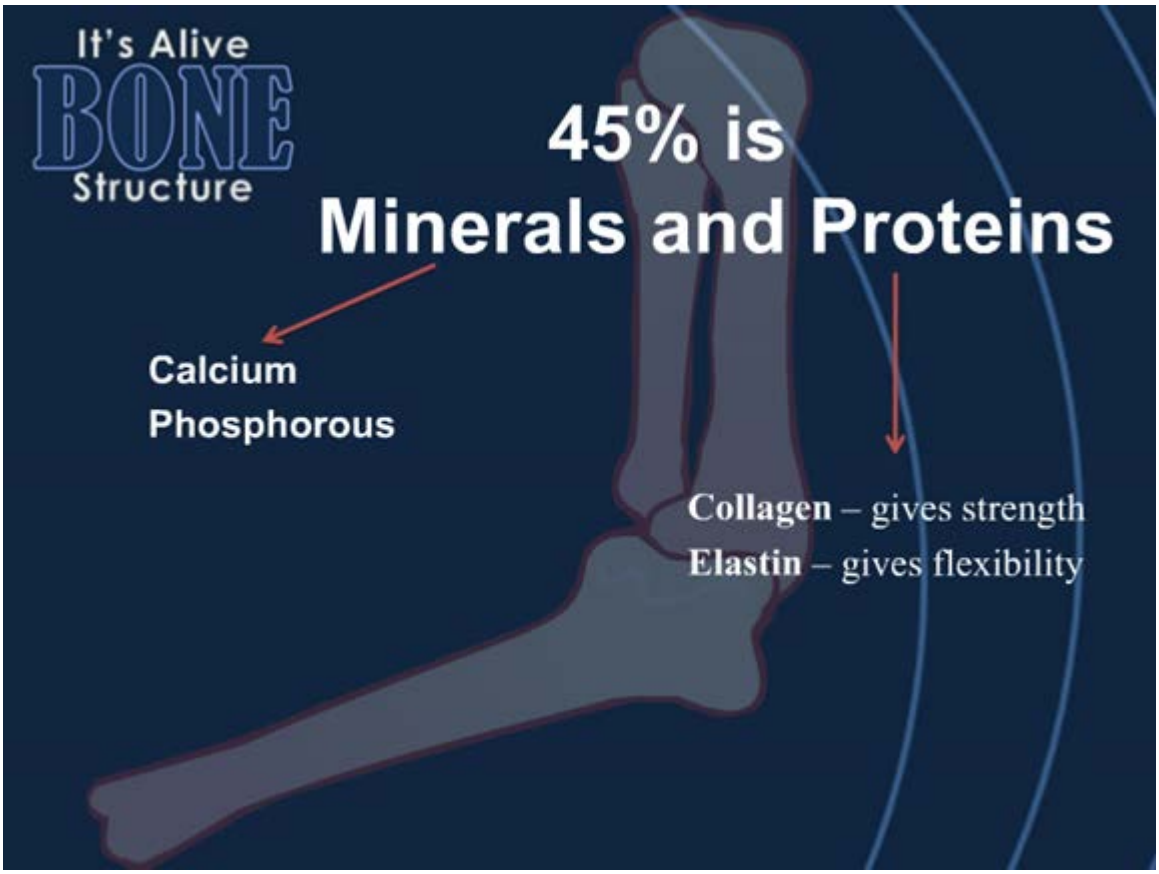
Have you ever broken a bone? Well, it hurts. Why? Bone is not just the fancy white sticks you see on TV and in movies. Thirty percent of bone is living cells that have nerves, blood supply, and marrow (which produces blood cells). Bones support our bodies and are the basis of movement.

Osteoclasts and Osteoblasts



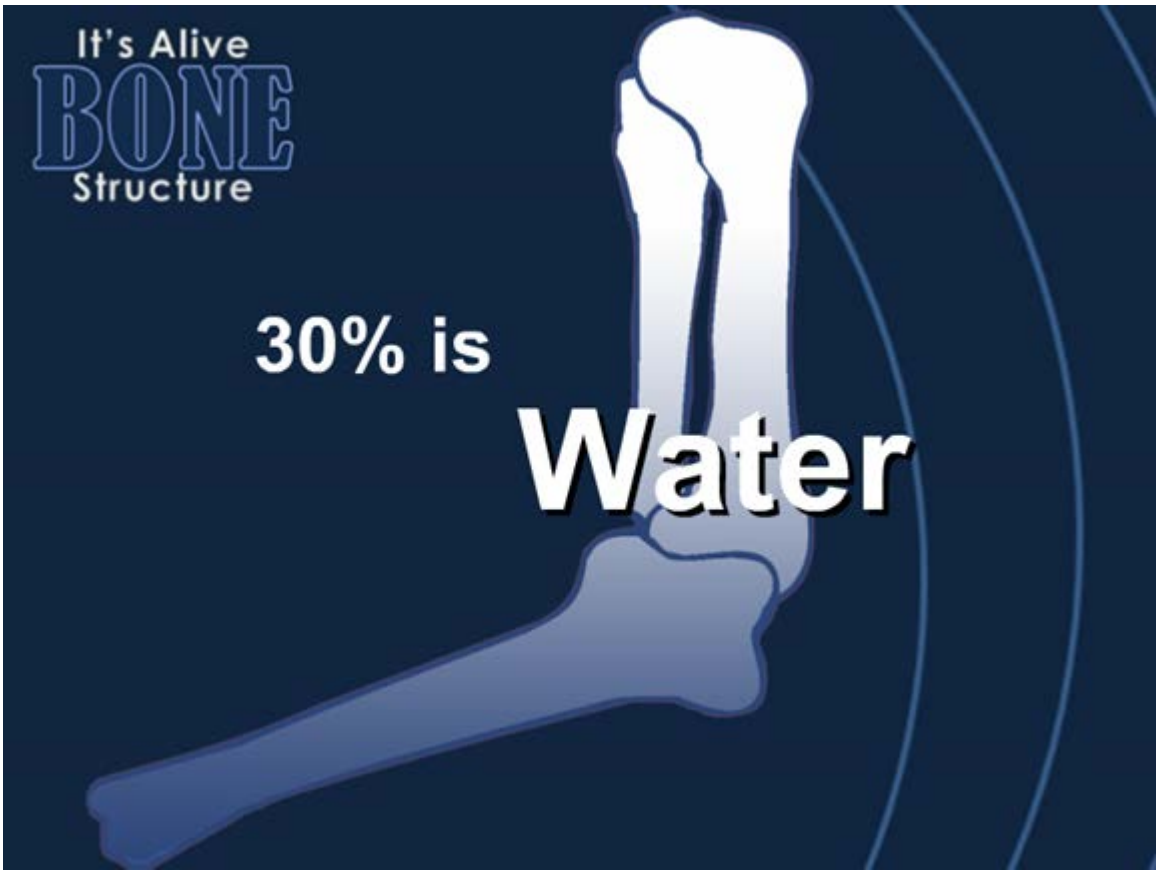
Two other very important cells that make up bone are osteoclasts and osteoblasts. These two cells work closely together to tear down and regenerate bone mass. Osteoclasts' job is to break down bone, so the minerals can be used for other bodily functions, like muscle contraction. Osteoblasts are key in remodeling, or bone building, by hardening proteins with minerals.

Minerals and Proteins



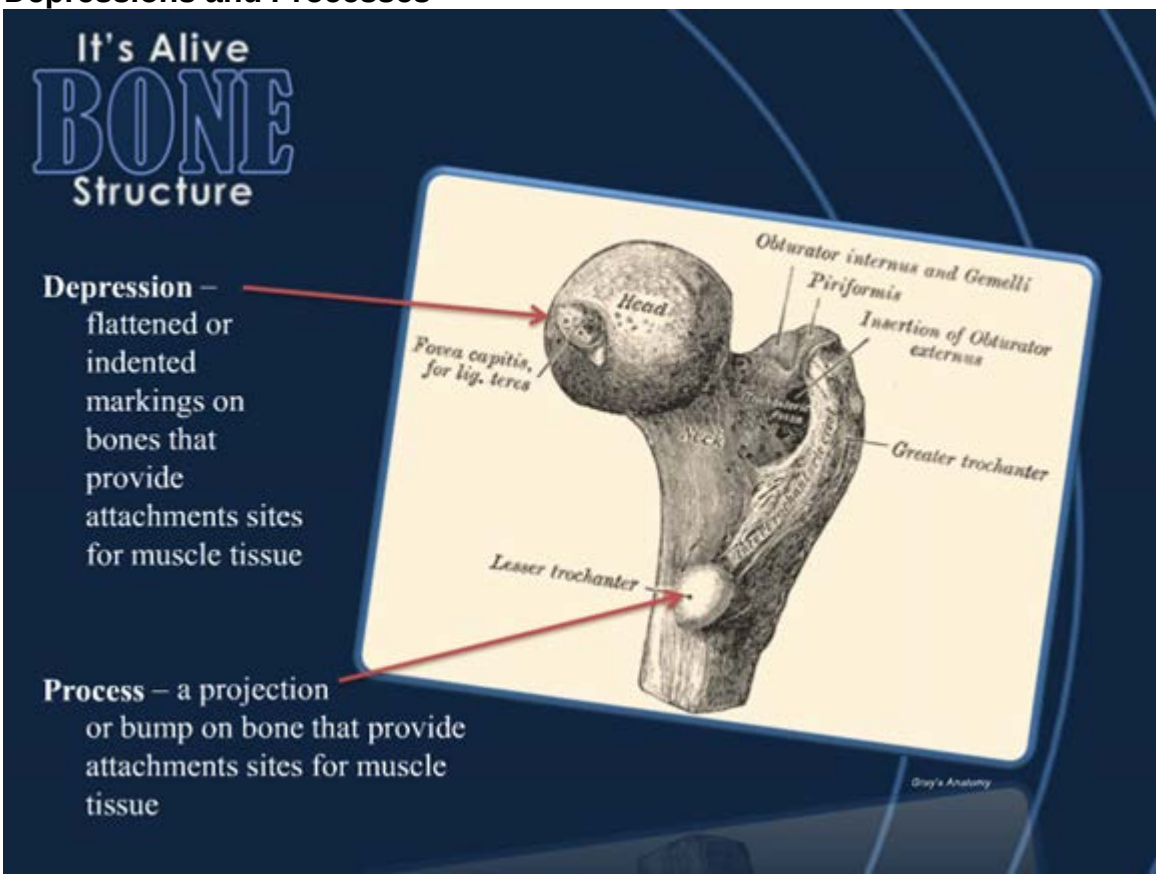
Forty-five percent of bone is made up of minerals, namely calcium and phosphorus. These two minerals combine to make bone strong and ridged. Meanwhile proteins such as collagen and elastin provide additional strength and flexibility.

Water



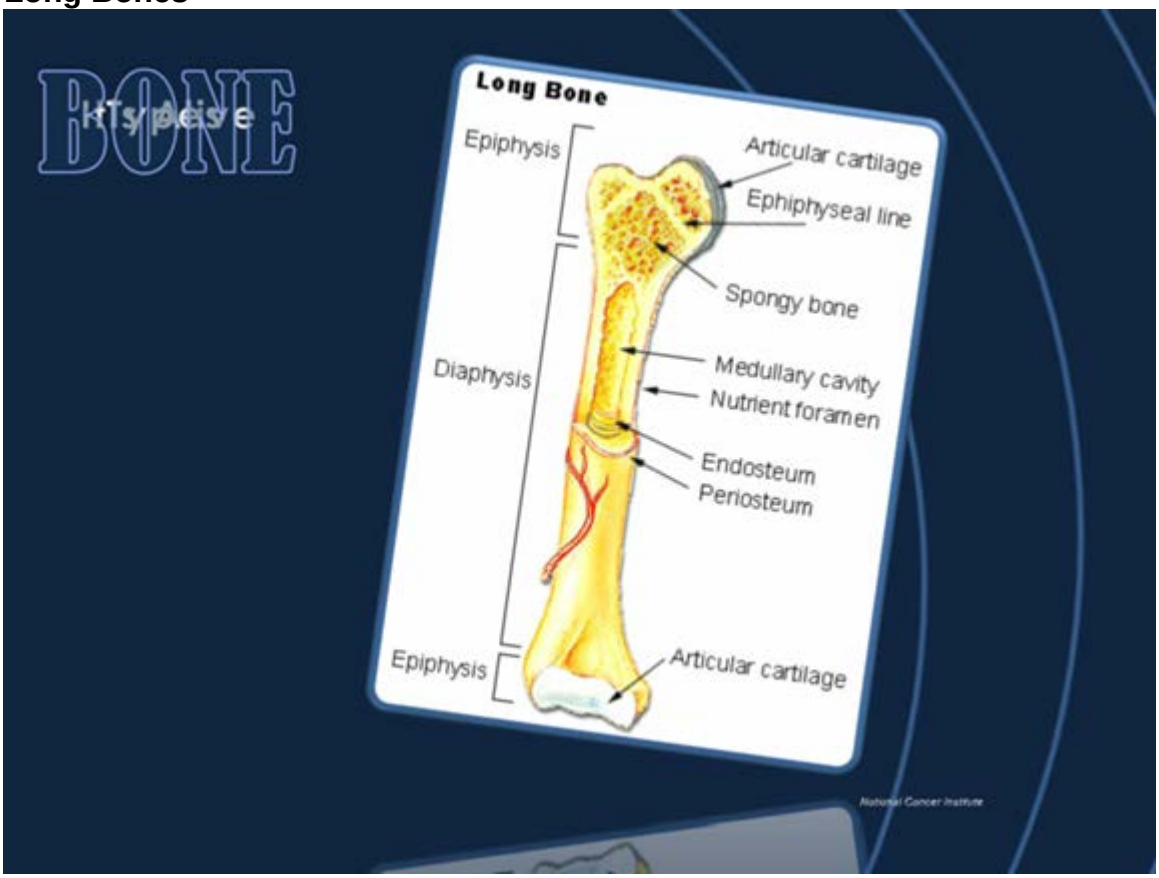
The remaining content of bone is water.

Depressions and Processes



Bone has unique markings on it. Each one is different, but the functions of the markings are the same; they supply an attachment site for muscle and other tissue needed for movement. Depressions are flattened or indented markings, while processes are projections or bumps. For each marking on every bone, the depressions and processes have special names that are derived from the type of marking, bone name, and/or what tissue attaches to it.

Long Bones

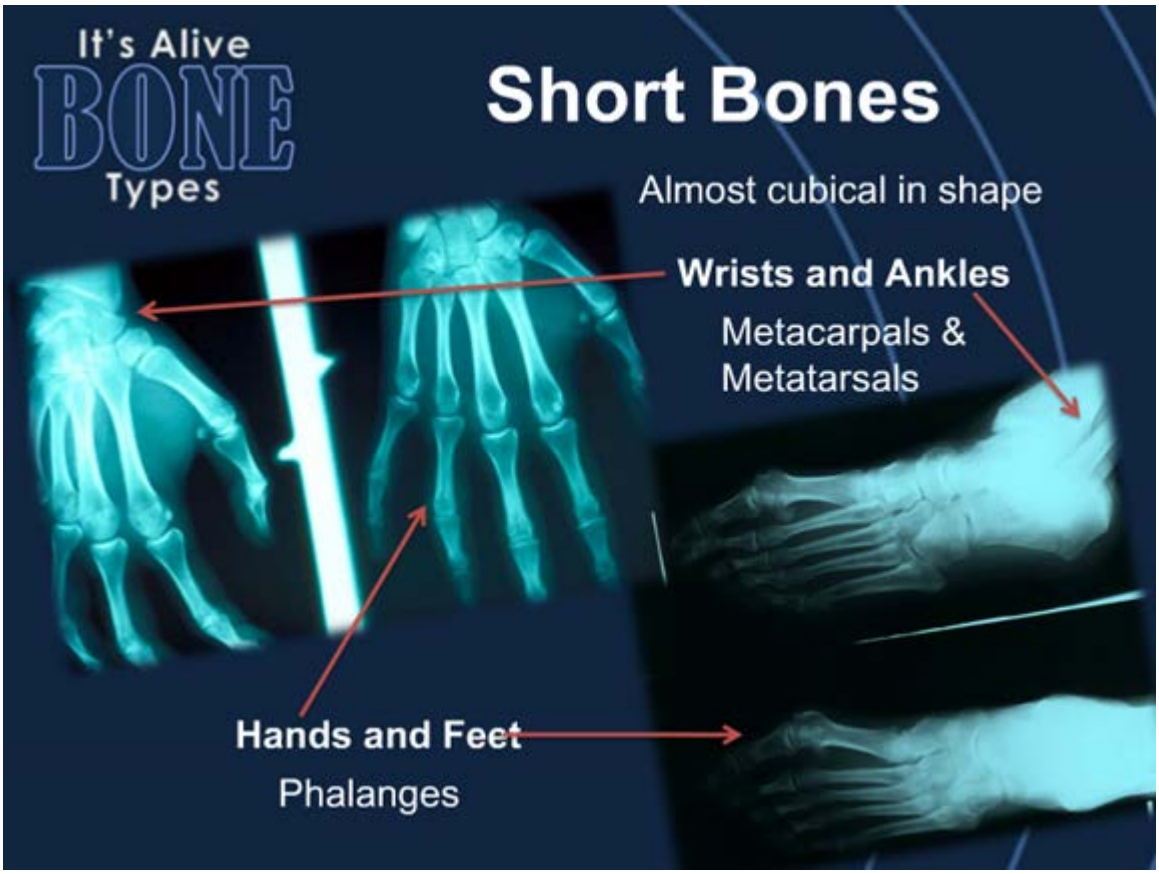


Each long bone has a long narrow shaft called a diaphysis. At each end of a long bone is an epiphysis. The bulgy epiphysis houses marrow and provides stability for joints with other bones.

Irregular Bones

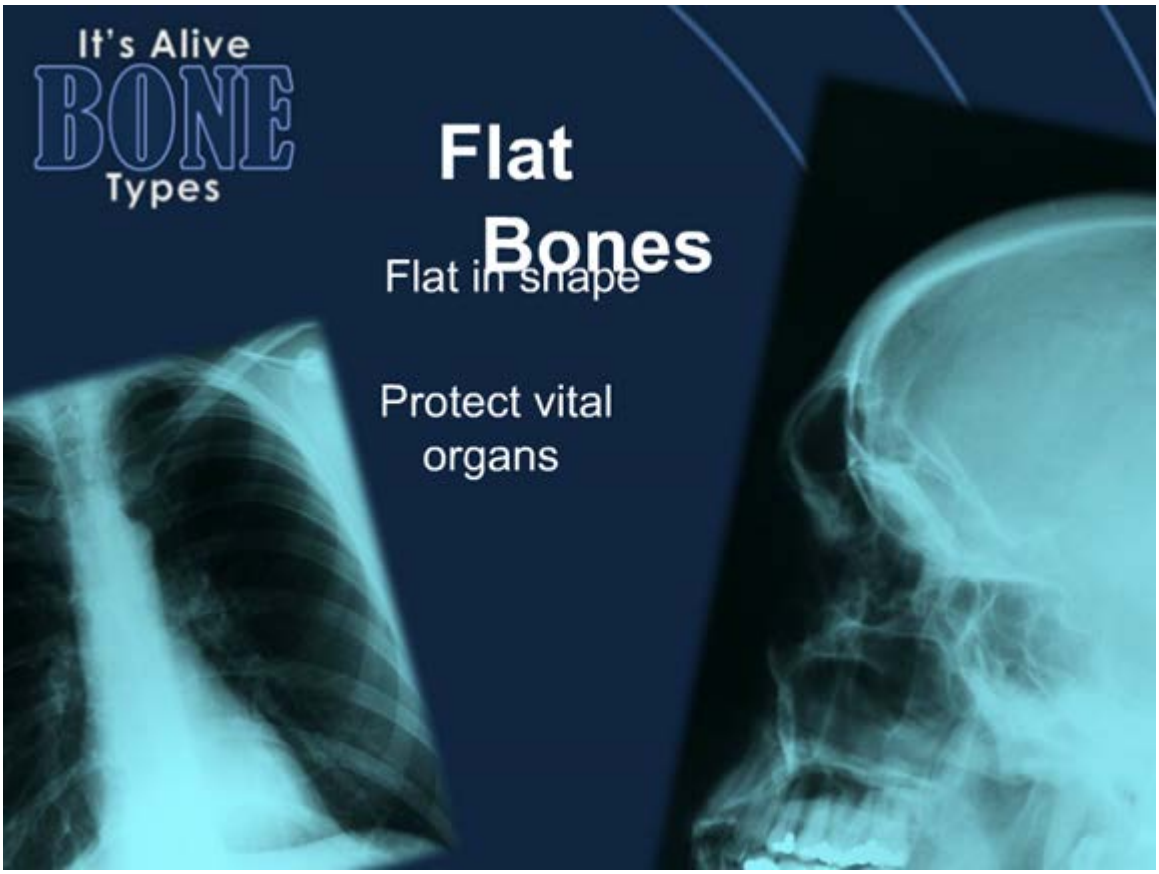
The irregular bones category was created for the bones that did not fit into the other three categories. These bones are basically the vertebral column, sometimes called the spine or backbone. There are a total of thirty-three bones; however, five sacral vertebrae fuse into one sacrum, and four coccygeal vertebrae fuse into one coccyx. Final fusion occurs around the age of twenty, resulting in twenty-six vertebrae.

Short Bones



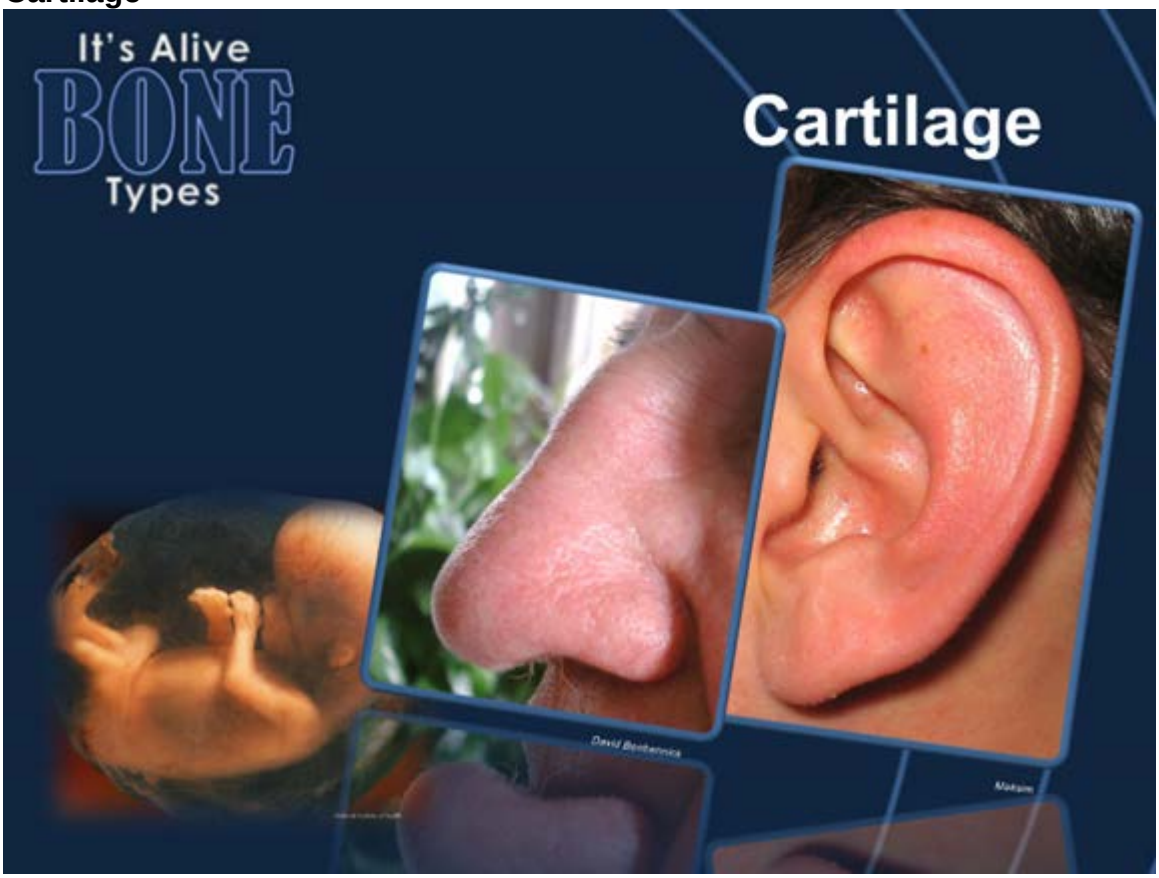
Short bones are structurally almost equal in length and width; that is what gives them a cubical shape. More than half of the 206 bones are short bones and can be found in the wrist, hands, ankles, and feet.

Flat Bones



Some bones are flat. Some are small and paddle-like, while others are big like plates. All flat bones' main job is to protect vital organs such as the brain, heart, and lungs.

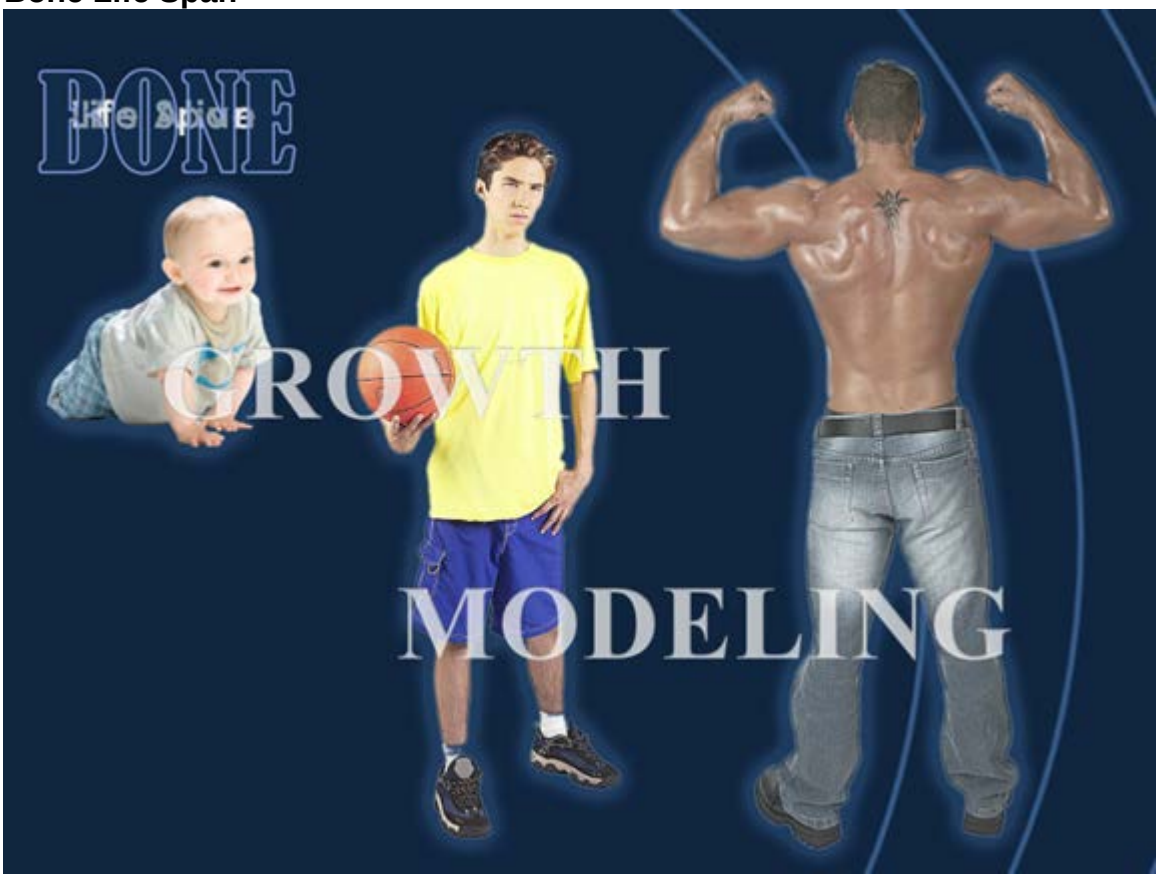
Cartilage



Cartilage is a strong flexible bone-like tissue that forms the skeletal system of a growing fetus. That cartilage eventually develops into bone. Some cartilage remains at the ends of bone for cushion at joints and to form the bridge of the nose and define the folds of your ears. Believe it or not, cartilage does not have blood vessels or nerve endings.

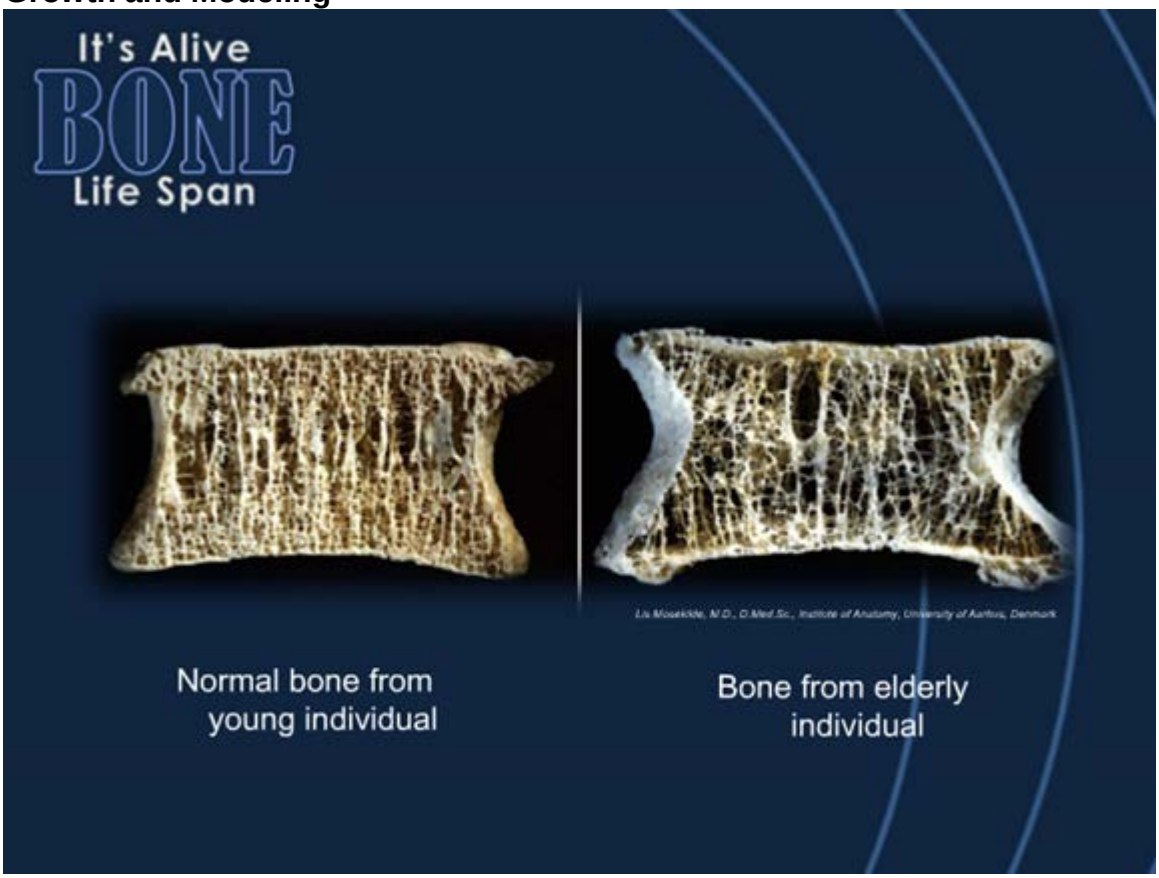
Why, then, does it hurt when you break your nose or get your ear pierced? It hurts because you still have nerves surrounding the area of the cartilage.

Bone Life Span



Bone has a lifespan, which means it grows and develops. During childhood, bone development and size are obtained through what is called growth and modeling. These two processes work independently, but together, and with the help of hormones and physical activity, they produce a very strong ridged support system.

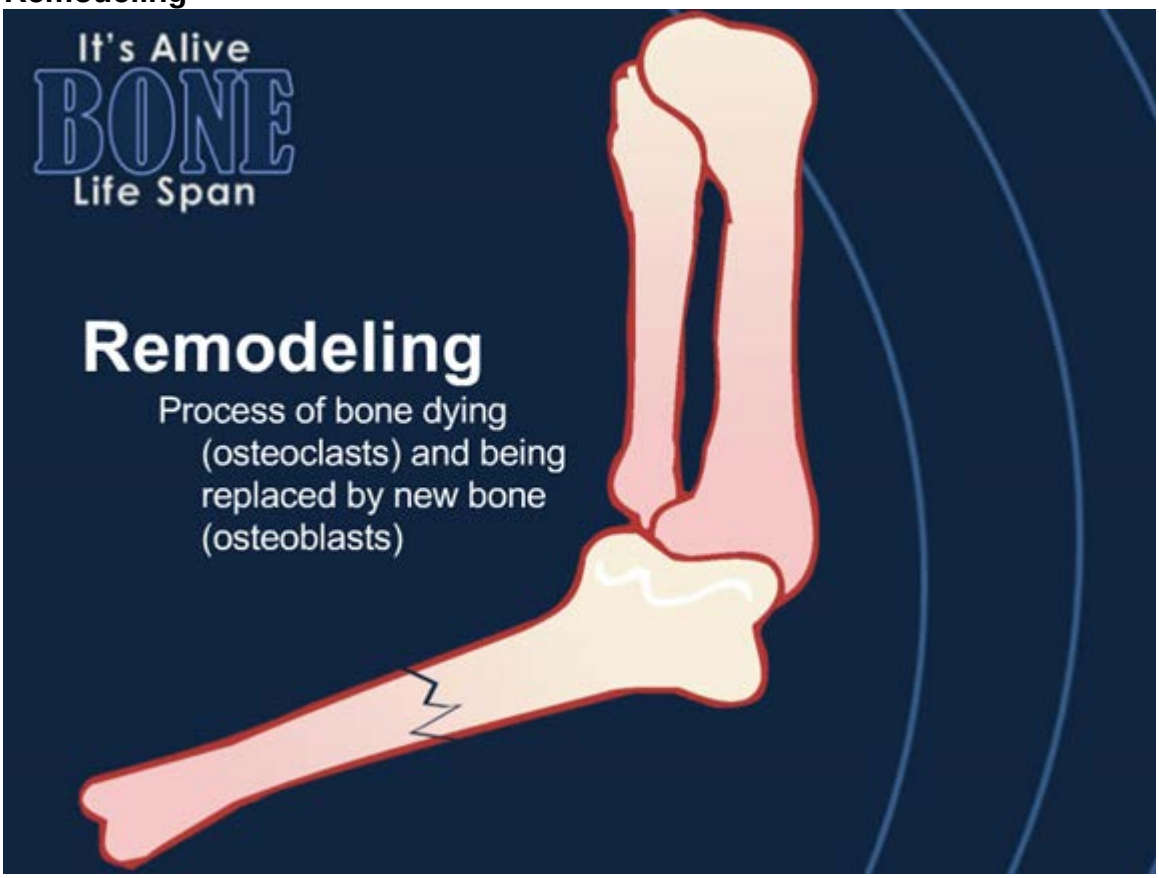
Growth and Modeling



By your early twenties, bone growth and modeling stop, resulting in peak bone mass. Once growth and modeling stop, bone mass is lost. The body takes minerals from bone for other body functions. It is a natural part of the life cycle. We cannot stop the deterioration process, but we can slow it with continued physical activity and proper nutrition.

During this youthful phase of your life, it is highly important for you to do what you can to optimize bone development. This can be done through good nutrition and physical activity.

Remodeling



After the age of twenty, bone dies and regenerates through a process called remodeling. This naturally occurs as we age and is helpful in healing when we fracture a bone.