

Bones, Muscles, and Joints

PART 1

The Musculoskeletal System

Every time you sprint through the halls because you're late for class, score against your opponents during a game, or shoot pool with friends, you're using your bones, muscles, and joints. Without these important body parts, you'd be seriously sidelined — you'd be unable to sit, stand, walk, or do any of the activities you do every day.

From our head to our toes, our **bones** provide support for our bodies and help form our shape. The skull protects the brain and forms the shape of our face. The spinal cord, a pathway for messages between the brain and the body, is protected by the backbone, or spinal column. The ribs form a cage that shelters the heart, lungs, liver, and spleen, and the pelvis helps protect the bladder, intestines, and in girls, the reproductive organs. Although they're very light, bones are strong enough to support our entire weight.

Joints occur where two bones meet. They make the skeleton flexible — without them, movement would be impossible. **Muscles** are also necessary for movement: They're the masses of tough, elastic tissue that pull our bones when we move.

Together, our bones, muscles, and joints — along with tendons, ligaments, and cartilage — form our musculoskeletal system and enable us to do everyday physical activities.

What Are the Bones and What Do They Do?

The human skeleton has 206 bones. Our bones begin to develop before birth. When the skeleton first forms, it is made of flexible cartilage, but within a few weeks it begins the process of **ossification** (pronounced: ah-suh-fuh-**kay**-shun). Ossification is when the cartilage is replaced by hard deposits of calcium phosphate and stretchy collagen, the two main components of bone. It takes about 20 years for this process to be completed.

The bones of kids and young teens are smaller than those of adults and contain "growing zones" called **growth plates**. These plates consist of columns of multiplying cartilage cells that grow in length, and then change into hard, mineralized bone. These growth plates are easy to spot on an X-ray. Because girls mature at an earlier age than boys, their growth plates change into hard bone at an earlier age.

Bone building continues throughout your life, as your body constantly renews and reshapes the bones' living tissue. Bone contains three types of cells: **osteoblasts** (pronounced: **ahs**-tee-uh-blastz), which

make new bone and help repair damage; **osteocytes** (pronounced: **ahs**-tee-o-sites), which are mature bone cells that help form the new bone; and **osteoclasts** (pronounced: **ahs**-tee-o-klasts), which break down bone and help to sculpt and shape it. Osteoclasts are very active in kids and teens, working on bone as it is remodeled during growth. They also play an important role in the repair of fractures.

Bones are made up of calcium, phosphorus, sodium, and other minerals, as well as the protein collagen. Calcium is needed to make bones hard, which allows them to support your weight. Bones also store calcium and release some into the bloodstream when it's needed by other parts of the body. The amounts of certain vitamins and minerals that you eat, especially vitamin D and calcium, directly affect how much calcium is stored in the bones.

The soft **bone marrow** inside many of our bones is where most of the blood cells flowing through our bodies are made. The bone marrow contains **stem cells**, which produce the body's red blood cells and platelets, and some types of white blood cells. Red blood cells carry oxygen to the body's tissues, and platelets help with blood clotting when someone has a cut or wound. White blood cells help the body fight infection.

Bones are made up of two types of material — compact bone and cancellous bone. **Compact** bone is the solid, hard outside part of the bone. This type of bone makes up most of the human skeleton. It looks like ivory and is extremely strong. Holes and channels run through it, carrying blood vessels and nerves from the **periosteum**, the bone's outer membrane. **Cancellous** (pronounced: **kan**-suh-lus) bone, which looks like a sponge, is inside the compact bone. It is made up of a mesh-like network of tiny pieces of bone called **trabeculae** (pronounced: truh-**beh**-kyoo-lee). This is where red and white blood cells are formed in the marrow.

Bones are fastened to other bones by long, fibrous straps called **ligaments** (pronounced: **lih**-guh-mentz). **Cartilage** (pronounced: **kar**-tul-ij), a flexible, rubbery substance in our joints, supports bones and protects them where they rub against each other.

Reviewed by: Yamini Durani, MD

Date reviewed: October 2012