DESCRIPTION

A strong, healthy body moves freely and rapidly in its daily activities, thanks to its team of 206 bones and 600 muscles. Clear graphics and close-up photography of model and actual bones and muscles help illustrate this complex interdependence of human body systems. Couples many scientific and common names of bones and muscles with related visuals. THE HUMAN BODY SERIES.

INSTRUCTIONAL GOALS

• To associate scientific names of some bones and muscles with their locations in the human body.
• To explore the mechanics of human movement.
• To illustrate the relationship of the skeletal and muscular systems.
• To identify the number and arrangement of bones in the hands and feet which allow for dexterity and weight-bearing ability.
• To emphasize that bones and muscles can be strengthened with proper diet and exercise.

BEFORE SHOWING

1. Read the CAPTION SCRIPT to determine unfamiliar vocabulary and language concepts.
2. Review the overall appearance of the human skeleton by showing a model. Discuss the appendicular and axial skeletons.
3. Display a poster of the muscular system for use during and after the video.
4. Pretest viewers in a general discussion of bones and muscles to determine on which facts to focus in the video.
DURING SHOWING

1. View the video more than once, with one showing uninterrupted.
2. Pause after every grouping of bones. Feel those bones for identification and movement. Also refer to the skeletal model.
3. Pause after demonstration of contracting and relaxing muscles. Tighten or contract arm and leg muscles. Discuss.

AFTER SHOWING

Discussion Items and Questions

1. Explain the process of fossilization. Discuss why bones are the last part of the body to decay.
2. What are the scientific names for the bones in the middle ear, commonly called the hammer, anvil, and stirrup?
   a. Research how these bones are related to deafness.
   b. Research if these three bones are components in the ears of other animals.
3. What happens to the body in paralysis? Why are some bones unable to move? What other body systems are involved?
4. The video states that more than half of a human’s bones are in the hands and feet.
   a. Is this true for any other species of animal?
   b. How is the function of human hands different than that of feet?
5. Identify dangers of muscle overuse.
6. What makes teeth different from bones?
7. Name two differences between the skeletons of a man and a woman. Determine if the muscular systems are different between the two.
8. Name a variety of jobs that require strenuous activity of the hands, the feet, or the spine. Discuss some common injuries of each.
9. What are the major organs of the human body?
   a. Which bones protect them?
   b. Is it easier to repair damaged body organs or the bones that protect them?

10. Discuss the variety of muscle types. Guess which muscles in the body are typically used most. Check references to determine accuracy.
   a. What is the difference between a tendon and a ligament? Where are they found on the body? How are they related to joints?
   b. How are the chemicals actin and myosin stimulated? What happens if one or both are deficient? How does aging affect these chemicals?

11. Find the names of the three types of joints. Discuss why each is best suited for its particular location in the body.

12. Compare the frailty and strength of the neck bone.
   a. Describe the role of the nervous system in relation to the spinal cord.
   b. Discuss why breaking the neck causes such rapid death. Name predatory animals that break the necks of their prey.
   c. Explain why an infant is unable to hold up its head. Demonstrate the development and relationship of the axis and atlas.
   d. Describe how the neck assists the skull to rotate.

13. Contrast voluntary and involuntary muscles. Determine why the human body has both.

Applications and Activities

1. Using a tabletop model skeleton, vertically cover one half of it with “muscles” created from oil-based modeling clay.
   a. Refer to texts for accuracy of size and placement.
   b. Make muscles appear striated.
2. Purchase a beef soup bone and a poultry drumstick from a grocery store.
   a. Examine how muscle tissue is connected. Identify and touch cartilage. Compare with pictures of human muscle tissue and bones.
   b. Using an electric knife, make a crosscut and examine the inside and spongy bone under a microscope.
   c. Sketch or photograph a bone, then manually break it. Observe the break and glue it together according to the photograph.
3. Make a fossil using plaster and chicken or beef bones. Carefully place the bones in half-dry plaster and remove later.
4. Write or call a local hospital and ask for several x-rays of broken bones. Ask for descriptions of the breaks and bone names.
   a. For each x-ray, decide what is necessary to set it properly.
   b. Write or call the hospital again, thank them for their help, and share project results.
5. Produce a video on muscle building. Include footage of particular exercises and name the muscles used for each.
6. Create a health poster encouraging proper care of bones and muscles. Mention what improper care or poor posture can cause.
7. Demonstrate the correct position to lift a heavy package. Explain the dangers of lifting and carrying incorrectly.
8. Conduct a morning aerobics class. Analyze how specific exercises contribute to healthy bones and muscles.
9. Conduct an experiment about bones. Using three similar turkey thigh or drumstick bones, set each one in a jar filled with tap water, thick sugar water, or water and dissolved calcium tablets.
   a. Keep the bones immersed in the water and refill when needed.
b. After approximately two weeks, remove the
bones and compare.
c. Test breakage of each and draw conclusions.
d. Discuss results.
10. Invite the track or football coach to speak about
injuries related to strenuous use of muscles. Include
questions about overexertion and first aid.
11. Look at the bone structure of prehistoric humans
and note differences in the modern human skeleton.
Hypothesize what caused these changes.
12. Research the effects of steroids on muscle tissue.
Discuss the controversy of steroid use by athletes.

COMMUNICATION SKILLS

1. Find the meaning of these prefixes: meta-, osteo-, myo-. Give examples of words related to bones
or muscles.
2. Role-play a scene between a hearing doctor and a
patient who is deaf or hard of hearing at a clinic.
Assume the patient is in need of help due to an injury.
Practice speechreading the following sentences:
a. “You have a slight fracture.”
b. “How did you land when you fell?”
c. “Tell me when it hurts.”
d. “You broke your arm.”
e. “You pulled a muscle.”

WEBSITE

Explore the Internet to discover sites related to this
topic. Check the CFV website for related information.
(http://www.cfve.org).
Following are the captions as they appear on the video. Teachers are encouraged to read the script prior to viewing the video for pertinent vocabulary, to discover language patterns within the captions, or to determine content for introduction or review. Enlarged copies may be given to students as a language exercise.

(male narrator)

Like all of us,

Jim and Sharon depend on strong, healthy bodies that enable them to take part in their daily activities.

And, like us, they seldom stop to think about how remarkable, how complex and durable their bodies are.

We owe our strength and flexibility, our very ability to remain upright and move, to our bones and muscles.

The adult human body is made up of 206 bones, which together with more than 600 muscles, support our bodies, give us shape, and enable us to move.

The bones of the skull include the facial bones and a hard covering called the cranium, which encloses the brain.

The spinal column, or backbone, consists of segmented bones called vertebrae.

The spinal column forms the central support for the body and protects the spinal cord and its nerves.

The rib cage, together with the breastbone, or sternum, forms the chest.

Attached to the breastbone by the collarbones, or clavicles, and the shoulder bones, or scapulae, are the arms.

The long bone of the arm is the humerus, which connects at the elbow.
to the *ulna* and *radius* of the forearm.

These bones extend to the wrist, joining the hand.

At the bottom of the spinal column is the *pelvis*, where the legs attach. The body’s longest and strongest bone is the *thigh bone*, or *femur*.

At the knee joint, the femur joins the *tibia*, the larger, stronger bone of the lower leg. The smaller bone—the *fibula*—with the tibia, forms the ankle joint at the foot.

26 bones in each foot, together with the 27 bones in each hand and wrist, make up more than half of the body’s 206 bones.

Every day we use our body’s bones and muscles without even thinking about how they work. Yet the smallest movement depends on the body’s team of bone, muscle, joints, ligaments, and tendons.

There are many parts that have to cooperate. It is perhaps only when they no longer function, as a result of injury or disease, that we start to wonder about how they actually work.

The human skeleton is divided into two principal parts: the *axial skeleton* and the *appendicular skeleton*.

The axial, or central, skeleton is composed of the bones of the skull, spine, and chest. The appendicular skeleton consists of the bones of the shoulder and pelvis girdle and of the upper extremities—the arms and the hands—and the lower extremities—the legs and feet.

The spine is a vertical column composed of 33 vertebrae. Together with soft intervertebral disks that absorb shock and prevent bones from rubbing against each other,
the vertebrae create a powerful but flexible column. When linked together, the arched vertebrae form the channel through which the spinal cord passes. The vertebrae at the bottom form the coccyx and the sacrum. They support the five lumbar vertebrae. The 12 thoracic vertebrae are linked to the ribs, and the 7 cervical vertebrae form the neck. The cervical vertebra at the top of the spine is called the atlas. It supports the skull’s weight and pivots on the second cervical vertebra, called the axis. The axis has a projection that fits into the opening in the atlas vertebra. This enables the atlas to rotate, allowing us to turn our head. The 29 bones of the skull include the cranium, which encloses and protects the brain, the eyes, parts of the ear, and the facial bones. The facial bones create a person’s unique features. Rigid bones are capable of fluid movement because of movable joints... the places where bones are held together by strong connective tissues called ligaments. Here, we see a knee joint, where ligaments connect the femur to the tibia. The ends of the bone at each joint are coated with a smooth surface made of cartilage, seen glistening on this femur. The shoulder girdle consists of two shoulder blades, or scapulae, each of which connects to a collarbone, or clavicle. The scapula joins the humerus-- the long bone of the upper arm-- at the shoulder joint.
the most mobile joint
in the body.
The other end
of the humerus
connects
at the elbow joint
with the bones
of the forearm:
the radius
and the ulna.
At the wrist, the radius
joins the carpal,
or wrist bones
of the hand.
The rest of the hand
consists
of the five metacarpal bones.
Each of these supports
the fingers and thumb.
Fingers have three bones,
or phalanges,
while the thumb
has only two phalanges.
The many joints
and muscles of the hand,
combined
with muscles of the forearm,
enable us to move
this specialized structure
in many different ways.
The foot
is the platform
on which
we stand and land.
It is designed
to support
the weight
of the entire body.

The 26 bones
of the foot
are similar
to those of the hand
but are constructed less
for precise movement
and more for weight-bearing
and locomotion.
The bones of the foot
are arranged
in the shape of an arch--
an effective
weight-bearing construction.
When walking and jumping,
tendons and ligaments
that bind the foot bones
allow a degree of give
and, with the arch,
provide spring and lift
for movement.
The largest joint
in the body
is the knee.
It connects the femur,
or thigh bone,
with the tibia and fibula
of the lower leg.
The knee joint
is a hinge joint,
moving in one plane only.
The pelvis
supports the spine
and joins
the lower extremities
at the hip joints.
The back of the pelvis
is composed of the sacrum and coccyx.

With the two pelvic bones, they form the pelvic girdle, which protects the urinary and reproductive systems.

The female pelvis is broad, creating a larger opening that allows a baby to pass through.

The 12 ribs are attached to the sternum, or breastbone, by cartilage, protecting the heart, lungs, and other chest organs.

The bones of the middle ear—

The hammer, anvil, and the stirrup—are the smallest bones in the body.

The stirrup is 4 millimeters long. The longest bone—

the femur—is about 46 centimeters long and accounts for about one-quarter of a person’s height.

Bone is composed of the living cells that grow and change with time.

Bone tissue also contains inorganic, nonliving material, such as calcium salts, which help make bones hard.

There is a difference between the bone tissue in the inner and outer sections of bones.

Inside is a woven structure called spongy or cancellous bone.

Under greater magnification, we see that spongy bone has a lighter structure—spikes of bone with open spaces between them.

The hard outer shell that appears to be solid is called compact bone.

This architecture combining spongy and compact bone provides maximum strength with minimum weight.

The spaces in the spongy bone are filled.
with bone marrow, which has been removed from this spongy bone.

Marrow produces red and white blood cells.

Our bones, joints, and muscles must be in good working order for us to be able to sit, stand, walk, run, work, and play sports.

Bones cannot move by themselves.

Some 600 skeletal or voluntary muscles attached to the bones by tendons pull on the bones and, by their contractions, create motion.

If we want our muscles to work properly, we must keep them moving.

This means everything from gentle, everyday activities to hard, purposeful training.

Sharon has found that if she trains her muscles, they become stronger.

Skeletal muscles usually work together.

As the bicep or flexor muscles on the front of the arm contract, drawing the forearm toward the shoulder, the opposing tricep or extensor muscles on the back of the arm relax.

As you straighten the arm, the tricep contracts and the bicep relaxes.

Good coordination of muscles working together is necessary for smooth movements.

The skeleton and attached muscles give the body its framework and shape.

Several layers of muscles are hidden under the skin.

The muscles directly beneath the skin can be seen as they contract and relax.

Each muscle consists of bundles of muscle cells, or fibers.

Under the microscope, the cells have a banded appearance; hence the name striated, or striped, muscles.

This appearance is caused by smaller cellular units called myofibrils, which contract,
creating movement.

Our skeletal muscles could not create motion without the nervous system.

The brain sends impulses, or messages, through motor nerve fibers to the appropriate muscle groups.

These motor nerve fibers branch out inside the muscle, ending in nerve endings called motor end plates.

When the impulse reaches the nerve ending, a chemical is released that makes the muscle fibers contract.

The nerve cells can stimulate many muscle fibers, or only a few, to contract. This allows us great precision in our movements.

The myofibrils inside the muscle cells are composed of the chemical proteins actin and myosin.

During muscle contraction, the actin, which is thinner, glides in between the myosin, which is thicker.

When the muscles lengthen during relaxation, the fibers glide apart again to their original length.

This is a process in which chemical energy is transformed into mechanical movement.

One-quarter of the energy our muscles produce is converted into motion.

The rest is released as heat.

Using a thermavision camera that detects heat, we can see how the heat increases locally across the muscles.

Heat generated by muscles functioning is circulated throughout the body by the blood, helping maintain body temperature.

When we get cold, it is the muscular contractions we call "shivering" that help us keep warm.

Our facial muscles enable us to create an enormous range of expressions.

The muscles of the face
allow us to open and close our eyes, chew our food, and to communicate with other people. In addition to the skeletal muscles, the body has two other kinds of muscles that create movement: smooth muscle and cardiac muscle. Smooth, or involuntary muscles, which usually work without conscious control, operate the internal organs, such as those of the digestive system. The muscular walls of the stomach relax and contract to break down food mechanically. The heart is made up of specialized muscle tissue called cardiac muscle and is our body's most important muscle. The cardiac muscle pumps the blood that carries oxygen and nourishment out of the heart to the rest of the body. The heart works automatically. People say that most of the muscles are controlled by the will, but we don't have to tell individual muscles what to do to carry out every movement. The brain deals with movements so we don't have to think about them--from everyday activities to more specialized ones. Muscles and bones are exposed to enormous stresses, even during everyday activities. And the loads are even greater when we exercise. Fortunately, the muscles and the skeleton become more powerful and durable when they are exposed to the right kind of loads. That's why exercise is important. Our bones, muscles, joints, tendons, and ligaments form a complex system--a system so well-designed that we can control it when we want to,
but fully capable of functioning smoothly without ever thinking about it.

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