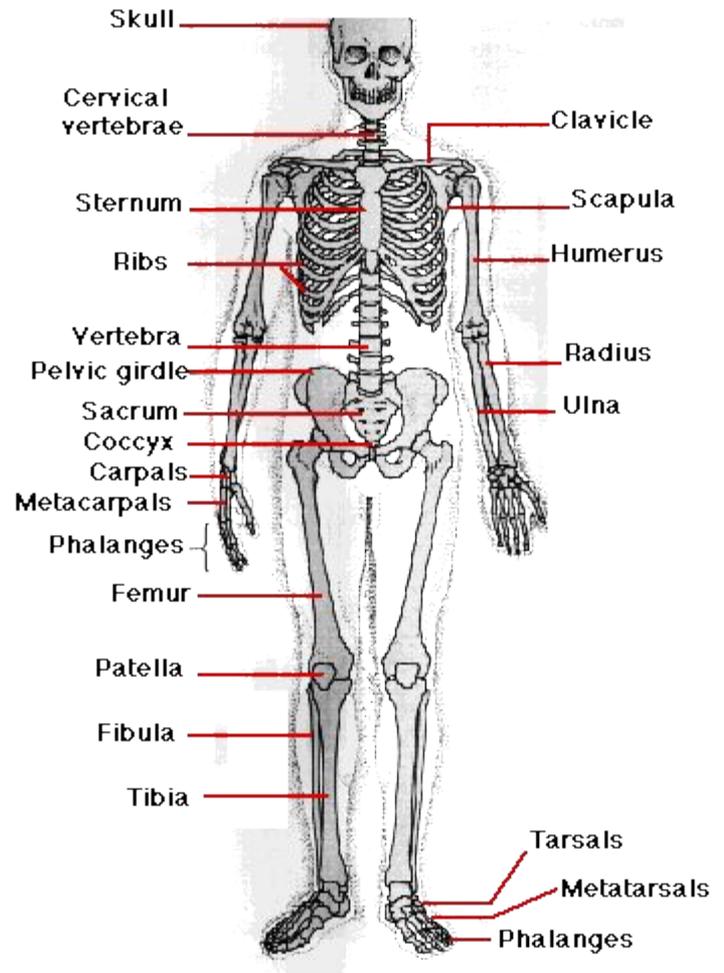

The skeleton and muscles

The skeleton and muscles

-The skeleton and muscles work together in most animals to form the musculoskeletal system and this system is controlled by the nervous system.

-Muscles associated with the skeleton are called skeletal muscle.

-Other types of muscles are found in the heart (cardiac muscle) and in places such as blood vessels, intestine and the uterus (smooth muscle).



Functions of the skeleton

- Support:** the bones of the skeleton provides a rigid framework that holds the body upright. (what part of a plant acts as a skeleton?)
- Protection:** the skull protects the brain, vertebrae protect the nerves of the spinal cord and the ribs protect the heart and lungs.
- Movement:** bones provide a system of rigid levers against which muscles can pull.
- Shape:** the shape of the body is determined to a large extent by the skeleton.
- Manufacture of blood components:** bone marrow makes red and white blood cells and platelets.

Structure of human skeleton

-the human skeleton has 213 bones and is divided into the axial and appendicular skeleton.

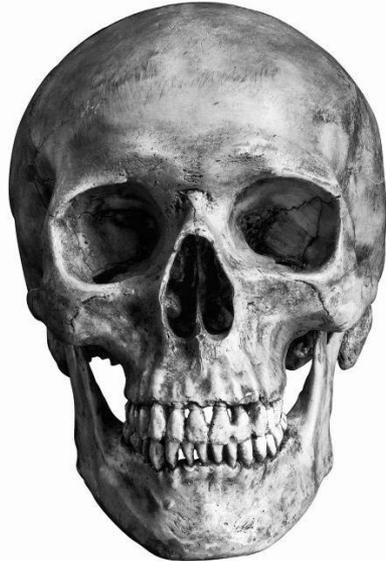
-the axial skeleton consists of the skull, spine, ribs and sternum a.k.a. Breastbone.

-The appendicular skeleton is composed of the limbs, the pectoral girdle and the pelvic girdle.

Parts of the axial skeleton

Skull

-the skull consists of over 20 bones fused together

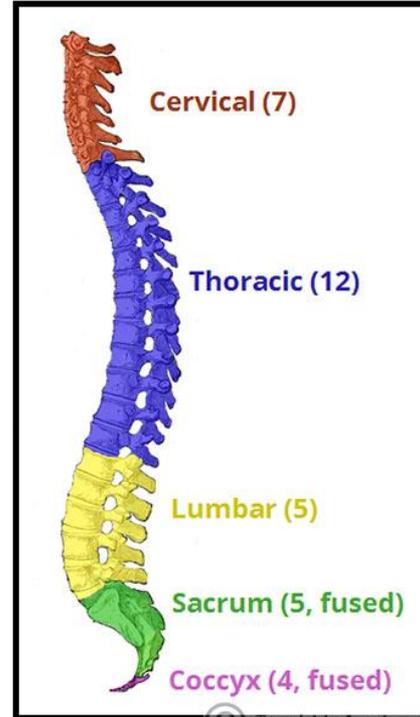
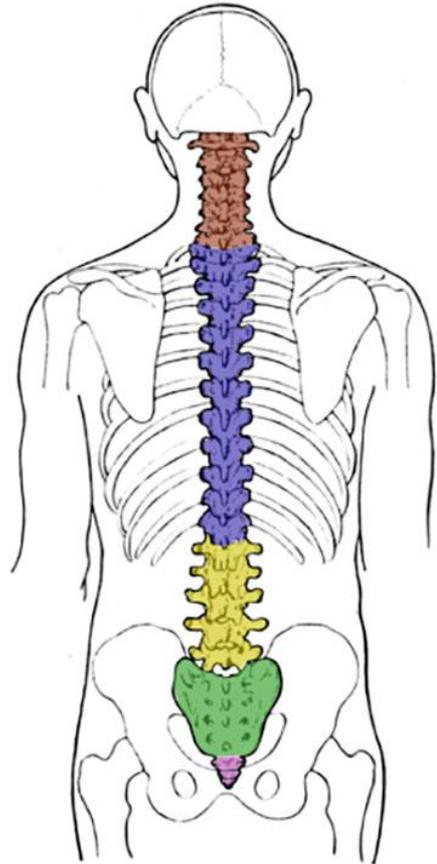


Parts of the axial skeleton

Spine

- the spine consists of 33 bones called the vertebrae
- these are arranged into 5 regions: cervical, thoracic, lumbar, sacrum and coccyx
- the top 24 vertebrae are held together by ligaments and can move slightly relative to one another
- they are separated by discs of cartilage which have a hard outer layer and a soft, jelly like centre. They act as shock absorbers and protect the vertebrae.
- the last 9 are fused together and there are no discs between them. No movement occurs between these vertebrae.

Regions of Spine



Parts of the axial skeleton

Rib cage

- the rib cage consists of the sternum and 12 pairs of ribs.
- all ribs are attached to the vertebrae of the spine
- the top 7 ribs are attached to the breastbone at the front of the body and they are called the *true ribs*
- the next 3 ribs are attached to each other at the front of the chest of cartilage and these are called *false ribs*
- the bottom 2 ribs are only attached to the spine and they are called *floating ribs*

Parts of the appendicular skeleton

Pectoral girdle

- consists of the collarbone and the shoulder blade
- it forms the connection with the vertebral column and with the arms

Pelvic girdle

- composed of 2 halves joined at the front by a band of flexible cartilage. Each half consists of 3 fused bones.
- the pelvic girdle is fused to the spine and it consists of the hip bones and the sacrum. It is connected to the legs.

Parts of the appendicular skeleton

Limbs

- the arms and legs have a similar design pattern and are called *pentadactyl limbs*.
- the phalanges are the individual bones of the fingers and toes
- each finger and toe has 3 phalanges, except the thumb and big toe, these only have 2

Parts of the appendicular skeleton

Cartilage

- contains a firm but flexible fibrous protein called collagen
- cartilage protects the bones (shock absorber) and allows friction-free movement
- it can be found in the pinna of the ear, the nose, trachea and in discs between the vertebrae

Types of bone

Compact bone

- is made of bone cells embedded in a matrix, composed of 70% inorganic salts such as calcium phosphate and 30% protein
- mostly found in the shaft of the bone and is also located as a layer around the ends of bones
- it gives bone its strength, and protein gives bone its flexibility

Types of bone

Spongy bone

- is like compact bone that contains numerous hollows
- consists of a network of thin, bony bars separated by different sized spaces
- these spaces are filled with red bone marrow that produces blood cells
- spongy bone also gives strength and rigidity to the skeleton

Types of bone

Bone Marrow

- bone marrow is a soft fatty substance found in the medullary cavity and within spongy bone
- in young people, bone marrow is full of active, red marrow
- in adults, active marrow is confined to the spongy bone
- the medullary cavity of adults contains inactive, yellow, fat rich marrow

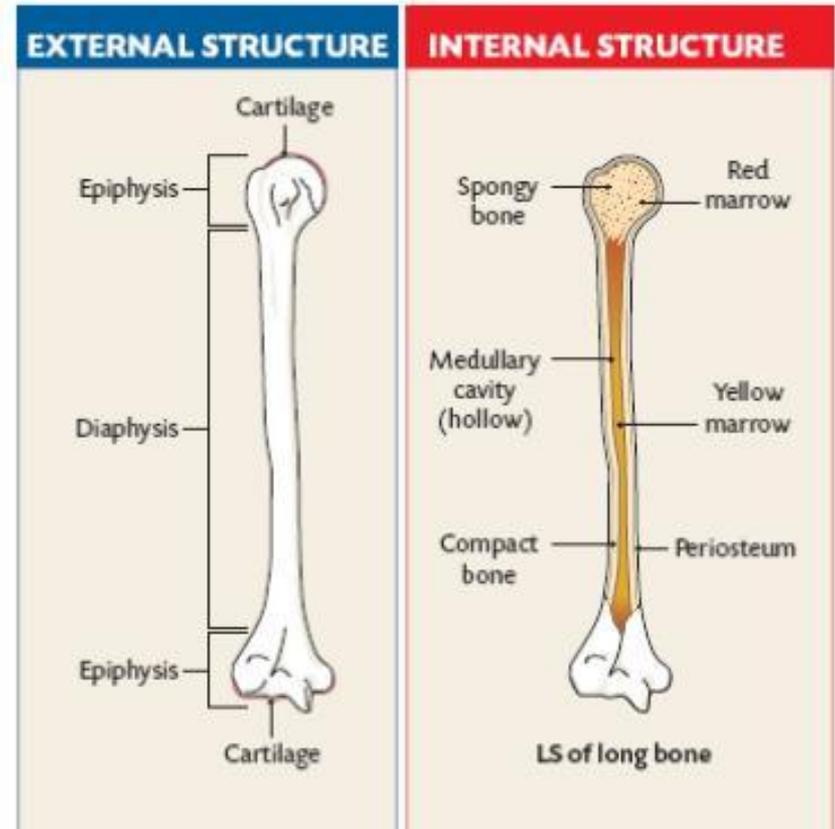
Answer questions 1,2,3,5,6 on page 375 in your book

Structure of long bone

-long bones such as the femur are enclosed by a membrane called the periosteum

-this membrane contains blood vessels and nerves.

-the long shaft of the bone is called the diaphysis and the head of the bone is called the epiphysis



Bone growth (HL)

- Embryonic cartilage begins to be replaced with bone around the 8th week of development in the uterus
- bone forming cells called osteoblasts form the protein collagen
- a hard compound forms around the collagen fibres and the osteoblast become trapped in this hard compound resulting in dormant bone cells
- the increase in length of a bone is due to a growth plate made of cartilage
- in this plate cartilage is continually formed and turned into bone. The growth plate ceases to function when the person becomes an adult
- the inactivation of the growth plate is said to terminate the development of adult height

Bone Development (HL)

- bone is dissolved and replaced during life, roughly 10 times during the life of each bone
- this restructuring of bone involves bone material being removed from the interior medullary cavity and extra bone material being disposed on the outside of the bone
- osteoblasts form new bone to replace the bone that is destroyed
- bone digesting cells and osteoblast work together to enlarge the medullary cavity and thicken the compact bone lining it

Renewal of bone (HL)

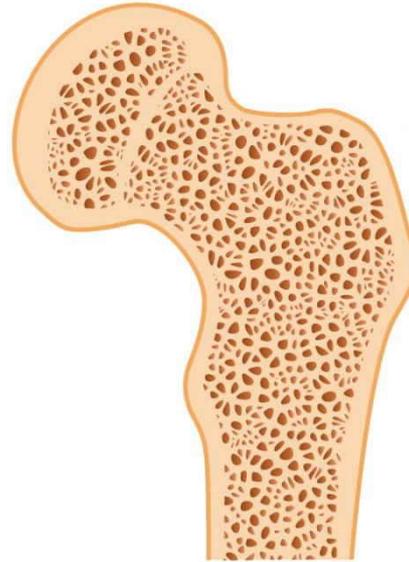
- continual renewal of bone is dependent on physical activity, hormones and diet
- when bones are stressed by physical activity they become thicker and stronger
- the main hormones affecting bone development are growth hormone, sex hormones (which increase bone size) and parathormone (which removes calcium from bone)
- it is essential to have sufficient supplies of calcium in the diet

Osteoporosis

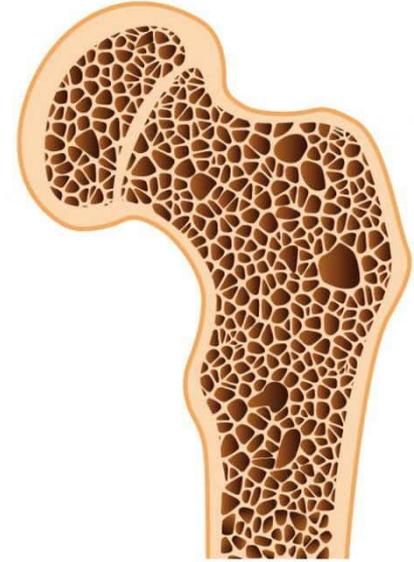
-Osteoporosis is the loss of protein material from the body.

-It causes bones to become brittle and easily broken.

Answer question 7,8,9,12 in your book on page 375



Healthy bone



Osteoporosis

Joints

-a joint is where 2 or bones meet.

-they may be classified according to the degree of movement they allow.

Immovable

-fixed joints that include the skull, and pelvic girdle

-these joints provide strength, support and proection

Joints

Slightly movable

- the joints between the vertebrae in the upper spinal column are slightly movable
- the joints are separated by pads of cartilage
- the vertebrae are separated by discs of cartilage and the bones are held in place by ligaments
- these ligaments limit the amount of movement possible in order to protect the nerves of the spinal cord

Joints

Freely movable (synovial)

- the ends of the bones are covered with cartilage and the bones are separated by a cavity

- these bones are held in place by ligaments, which prevent excess movement of bones at joints

- inside the ligaments the joint is enclosed in synovial membrane which secretes synovial fluid

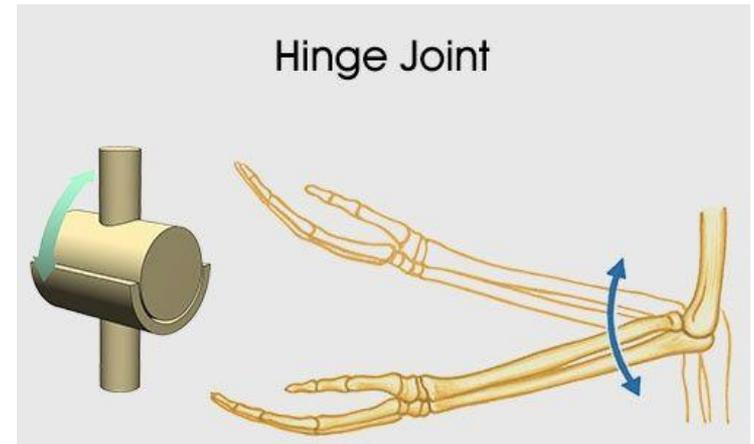
- this fluid lubricates the joint and reduces friction

Joints

Examples of synovial joints include:

-Ball and socket joints: the shoulder and hip. These allow movement in all directions but are unable to support heavy loads

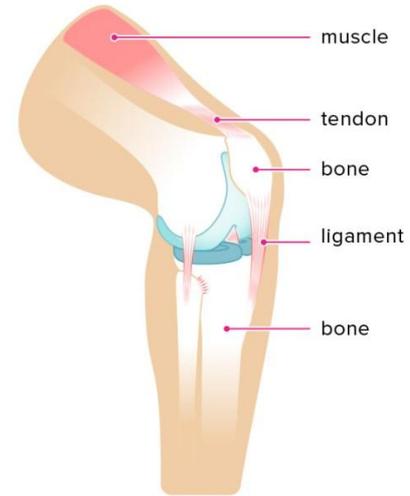
-Hinge joints: the elbow and knee. These allow for movement in one direction only and can support heavy loads



Ligaments and Tendons

Ligaments: are strong, fibrous, slightly elastic tissues that connect bone to bone.

Tendons are strong, flexible, inelastic fibres that connect muscle to bone.



Musculoskeletal Disorder: Arthritis

Cause:

- resulting from inflammation of a joint
- rheumatoid arthritis is the most severe form of joint inflammation. It is caused genetically by the body's immune system turning on itself

Prevention:

- can be prevented by reducing damage to joints e.g. proper footwear when running

Treatment:

- no cure but treatments include rest, weight loss and anti-inflammatory medications

Muscles

Skeletal Muscle

- over 600 skeletal muscles in the body and they make up 50% of body weight
- is concerned with body movements
- it can contract quickly but tires very easily
- it is under voluntary or conscious control

Muscles

Smooth Muscle

- also called unstriated or involuntary muscle
- found in the internal structures such as the digestive system, blood vessels and uterus
- it contracts slowly and is slow to tire
- it is under involuntary control

Muscles

Cardiac Muscle

-found in the heart

-it is involuntary

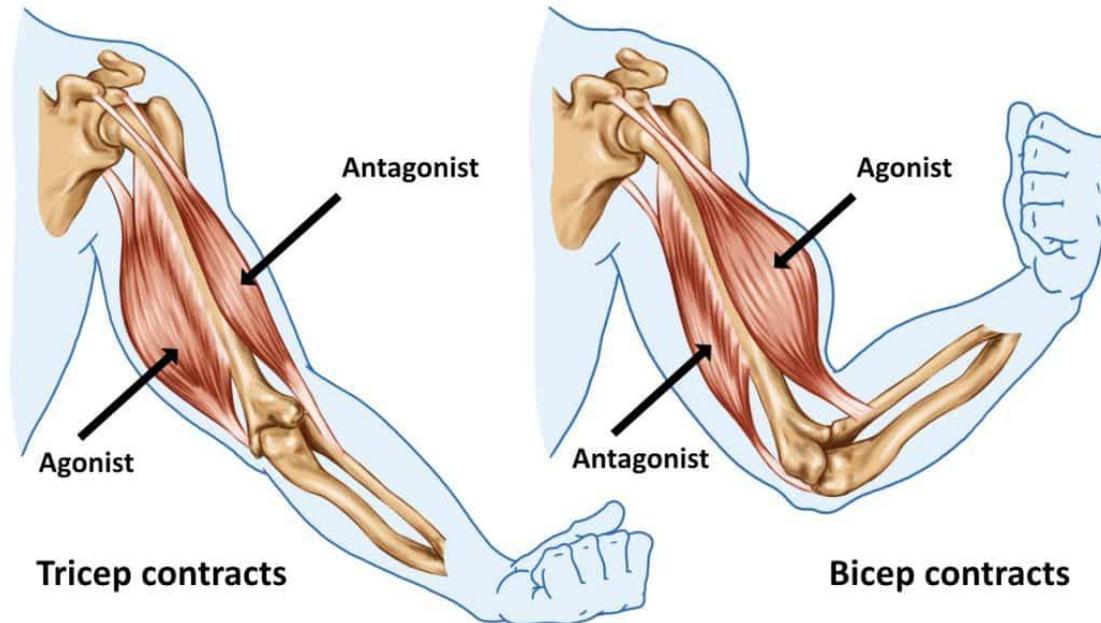
-has many mitochondria, contracts strongly and does not tire as easily as skeletal muscle

Antagonistic Pairs

- muscles are connected to bones by tendons
- when the muscle contracts, the tendon pulls on the bone causing it to move
- muscles can only pull they cannot push
- in the forearm a muscle on top of the humerus called the biceps contracts to pull the lower arm up
- to straighten the lower arm, a second muscle is required. These are the triceps located at the back of the humerus which contract to straighten the arm
- the biceps is a flexor while the tricep is an extensor

Antagonistic Pair

An **antagonistic pair** is two muscles that have opposite effects to each other.



Questions and Summary video

Answer questions 13,14,15,18 and 19 on page 376

<https://www.youtube.com/watch?v=yUllBH9mORU>