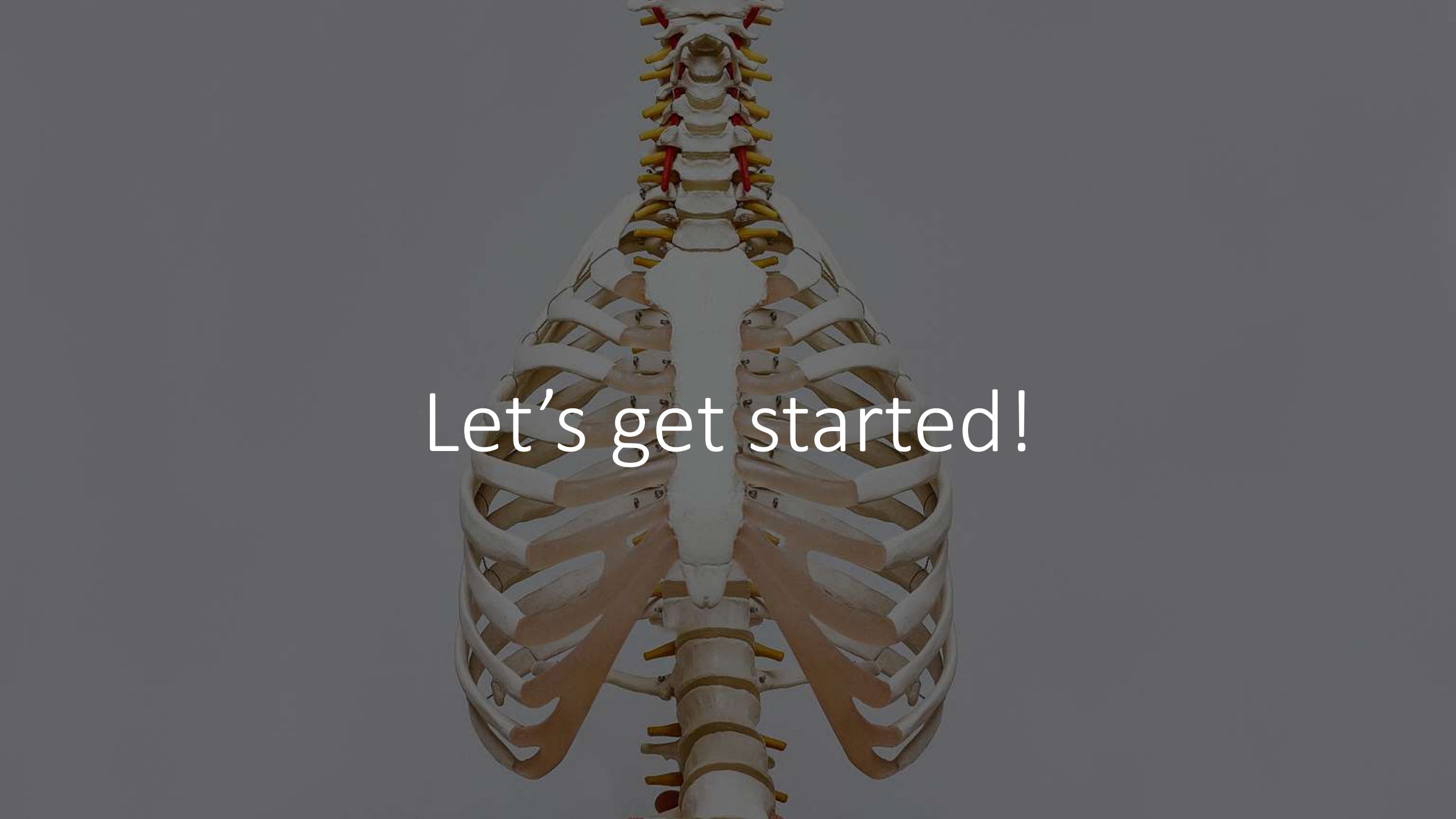
Bones, Muscles & Movement

July 2020

About Me

- Youth leader and leadership advisor
- Lifelong sports fan
- Worked for the British Olympic and Paralympic Teams
- Master’s degree in Sport Psychology
- Bachelor’s degree in Sport & Exercise Science from Loughborough University
- Gym fanatic
- Pathfinder to Guide level – attended Oshkosh Camporee in 2009


Let’s get started!

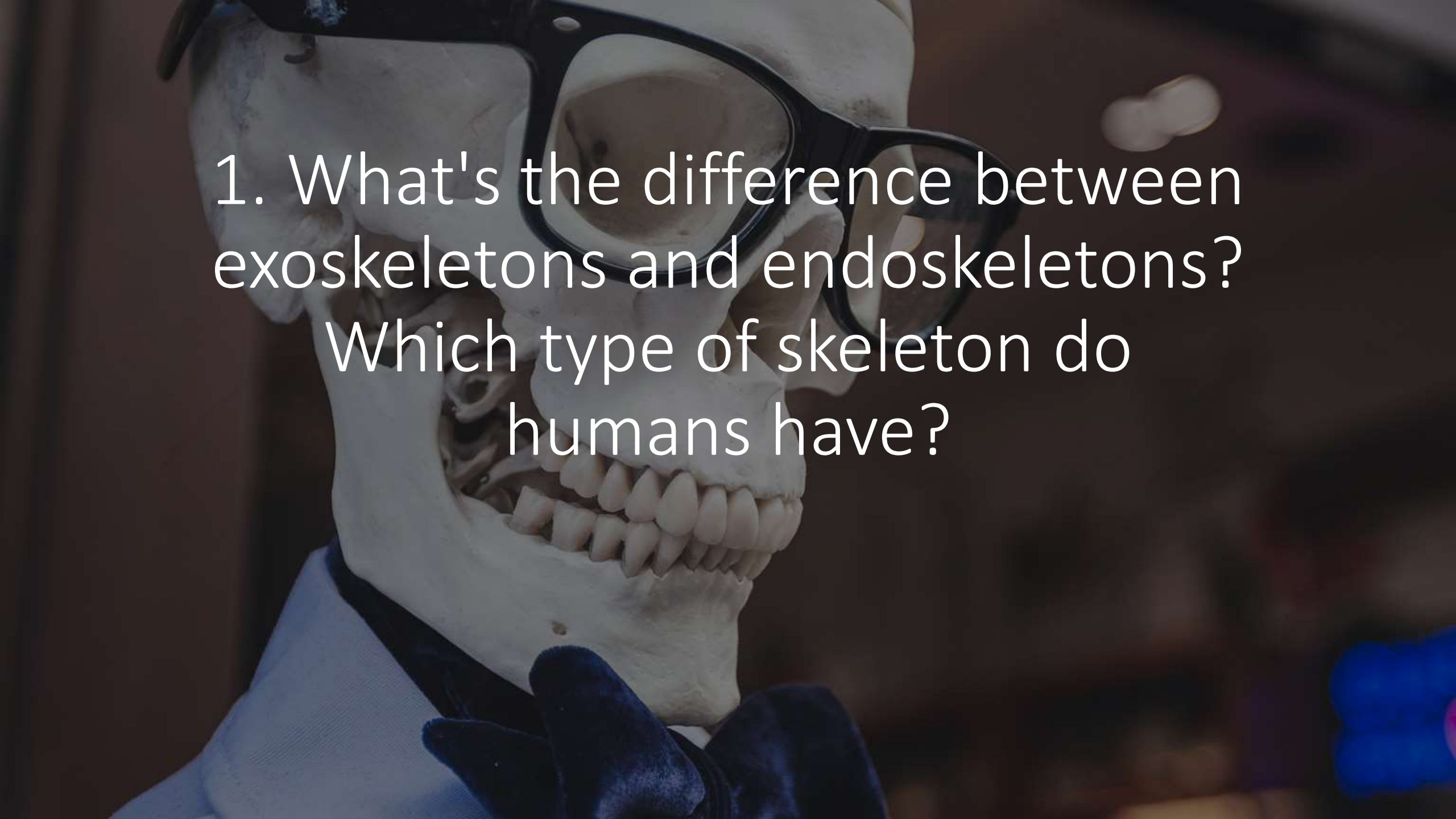
Worksheets at the ready…

Bones, Muscles & Movement Pathfinder Honour

Participant Worksheet

Honour Requirements (available here)

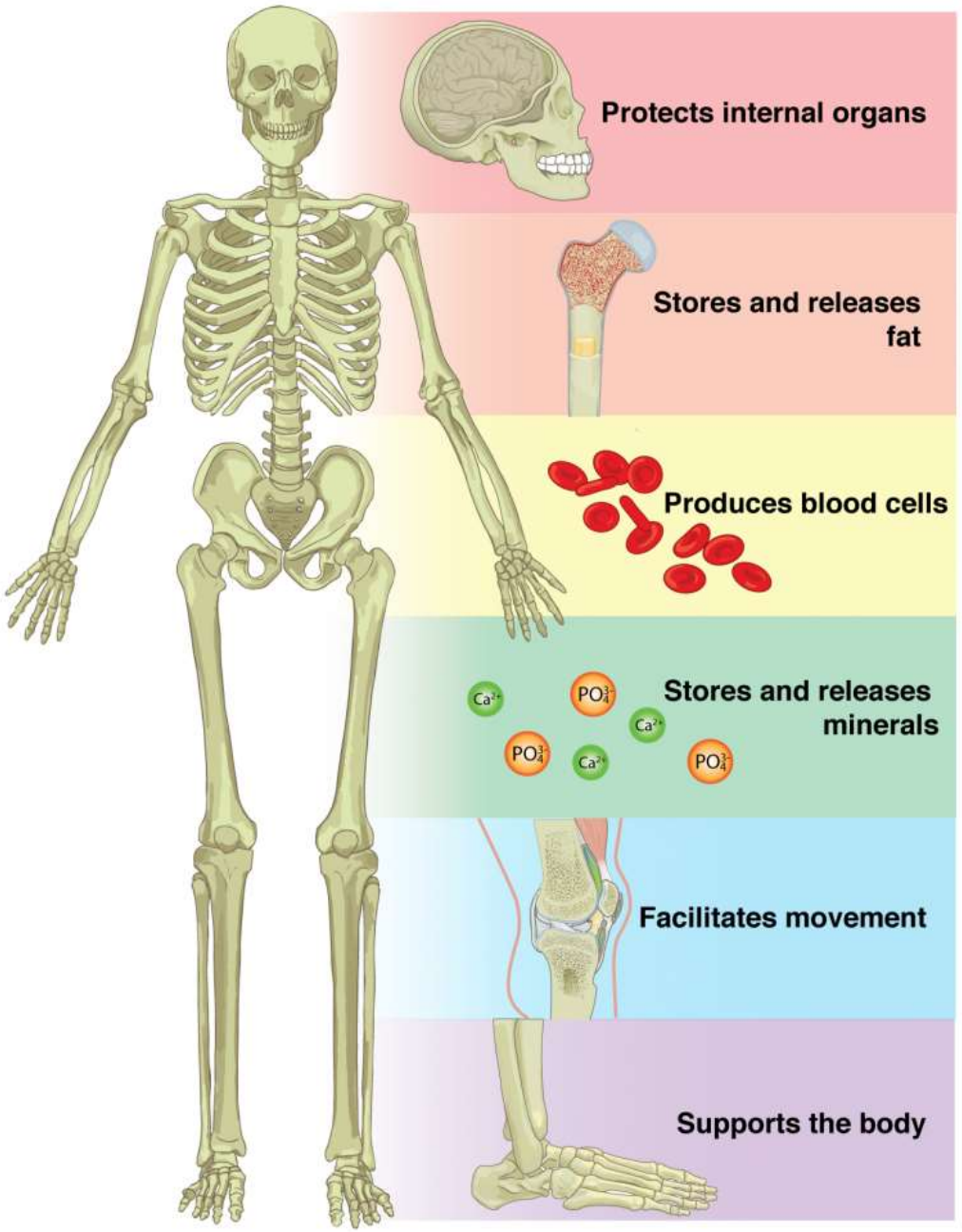
1. What's the difference between exoskeletons and endoskeletons? Which type of skeleton do humans have?
2. List three functions of the skeletal system
3. Is bone a living tissue? Explain why or why not.
4. Describe the structure and development of bone.
5. Identify the following bones of the skeletal system: Carpals, clavicle (collarbone), cranium, femur, fibula, humerus, mandible, maxillary bones, metacarpals, metatarsals, patella, pelvis, phalanges, radius, ribs, scapula (shoulder blade), coccyx (tailbone), sternum (breastbone), tarsals, tibia, ulna, and vertebrae.
6. What is a joint?
7. List the three types of joints found between bones.
8. Name and describe six types of freely moveable joints. Be able to locate an example of each of these in your body.
9. Be creative and construct a model of one of the six freely moveable joints.
10. What is another name for a broken bone? List 3 types of breaks that can occur in bones. Describe how bones heal and how doctors can help this process.
11. What is osteoporosis? Who can get it? List at least 5 health habits that deal with maintaining healthy bones and muscles.
12. What is the function of the muscular system?
13. Name and describe three types of muscle tissue. Give one example of each.
14. Be able to identify the following muscles on your body: Masseter, Trapezius, Deltoid, Pectoralis, Biceps, Abdominal, Quadriceps, Triceps, Latissimus dorsi, Gluteus maximus, Hamstrings, Gastrocnemius, and Soleus.
15. Describe the process that causes a muscle to contract.
16. Describe the difference between voluntary and involuntary muscles.
17. Using your model in # 9, show how muscles, bones, and joints work together to produce movement.
18. Find 3 texts in the Bible that mention bones and/or muscles. Tell about each one in your own words.



1. What's the difference between exoskeletons and endoskeletons? Which type of skeleton do humans have?

An exoskeleton is a hard shell on the outside of a creature (such as an insect or a lobster). An endoskeleton is the system of bones on the inside of a creature (such as a human, dog, cat or a bird).

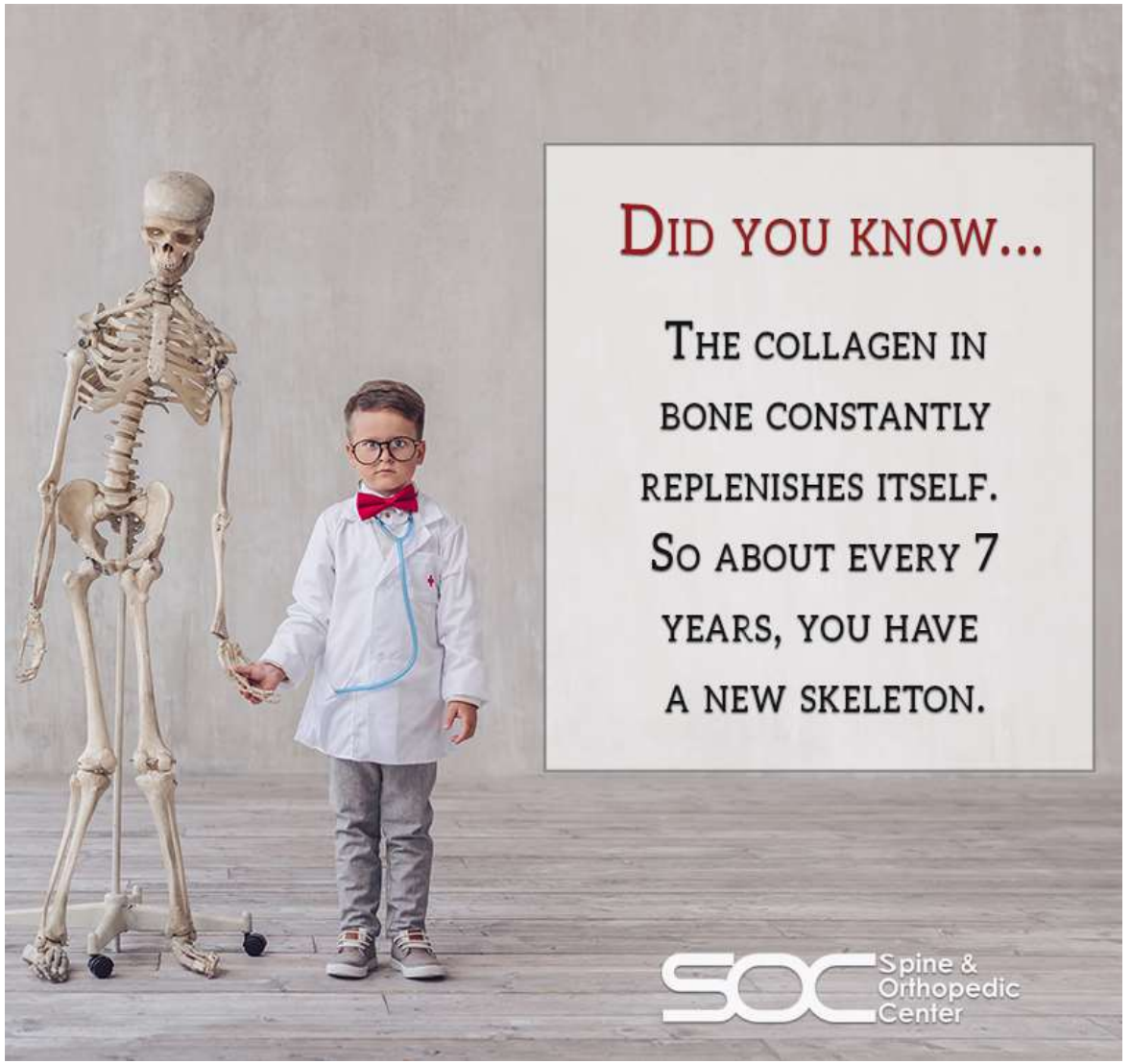
2. List three functions of the skeletal system

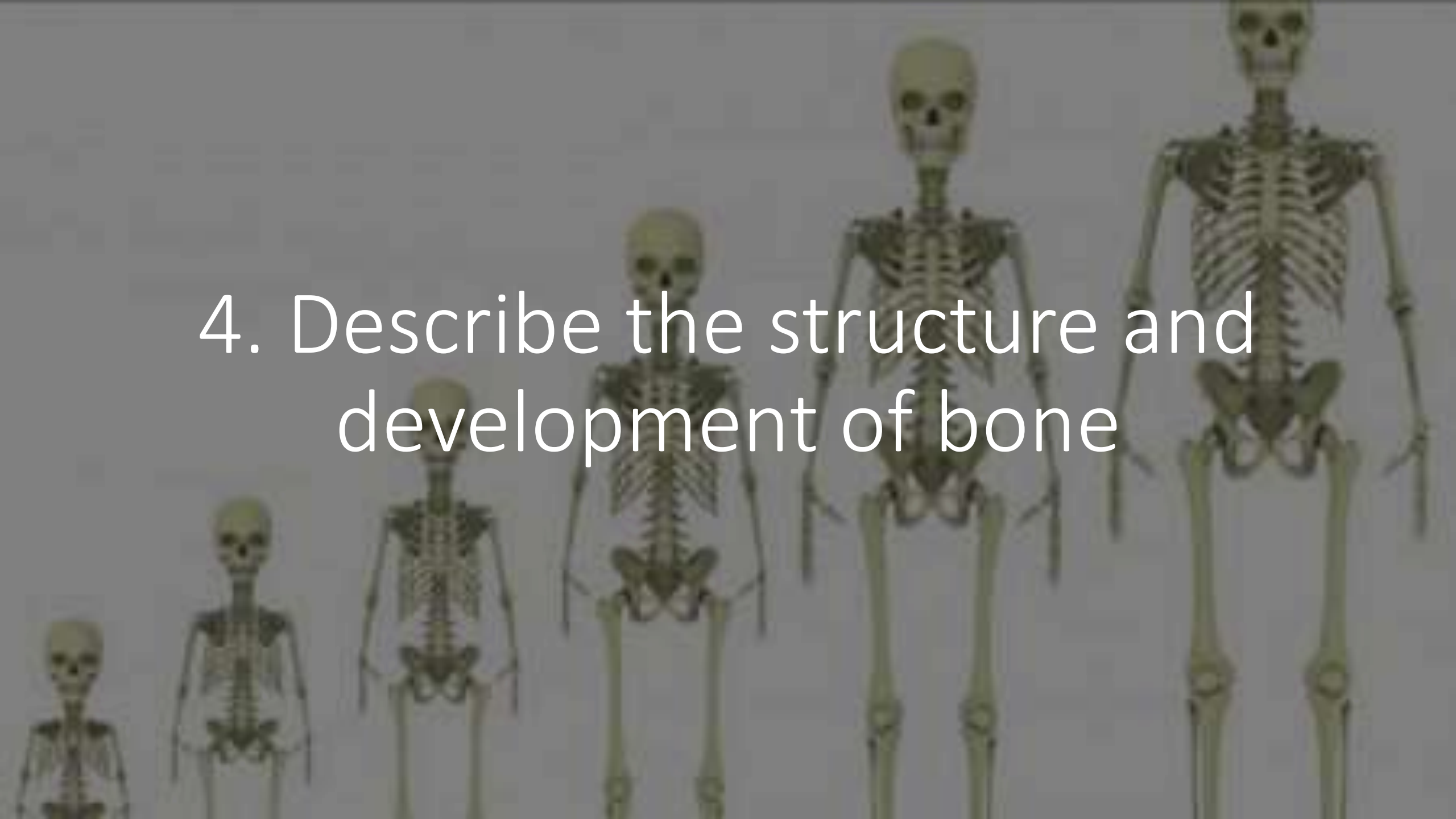

Protects internal organs
Stores and releases fat
Produces blood cells
Stores and releases minerals
Facilitates movement
Supports the body

3. Is bone a living tissue? Explain why/why not

Bone is a living tissue

- Bones produce blood cells
- Bones heal after being broken
- Bone cells continually regenerate themselves





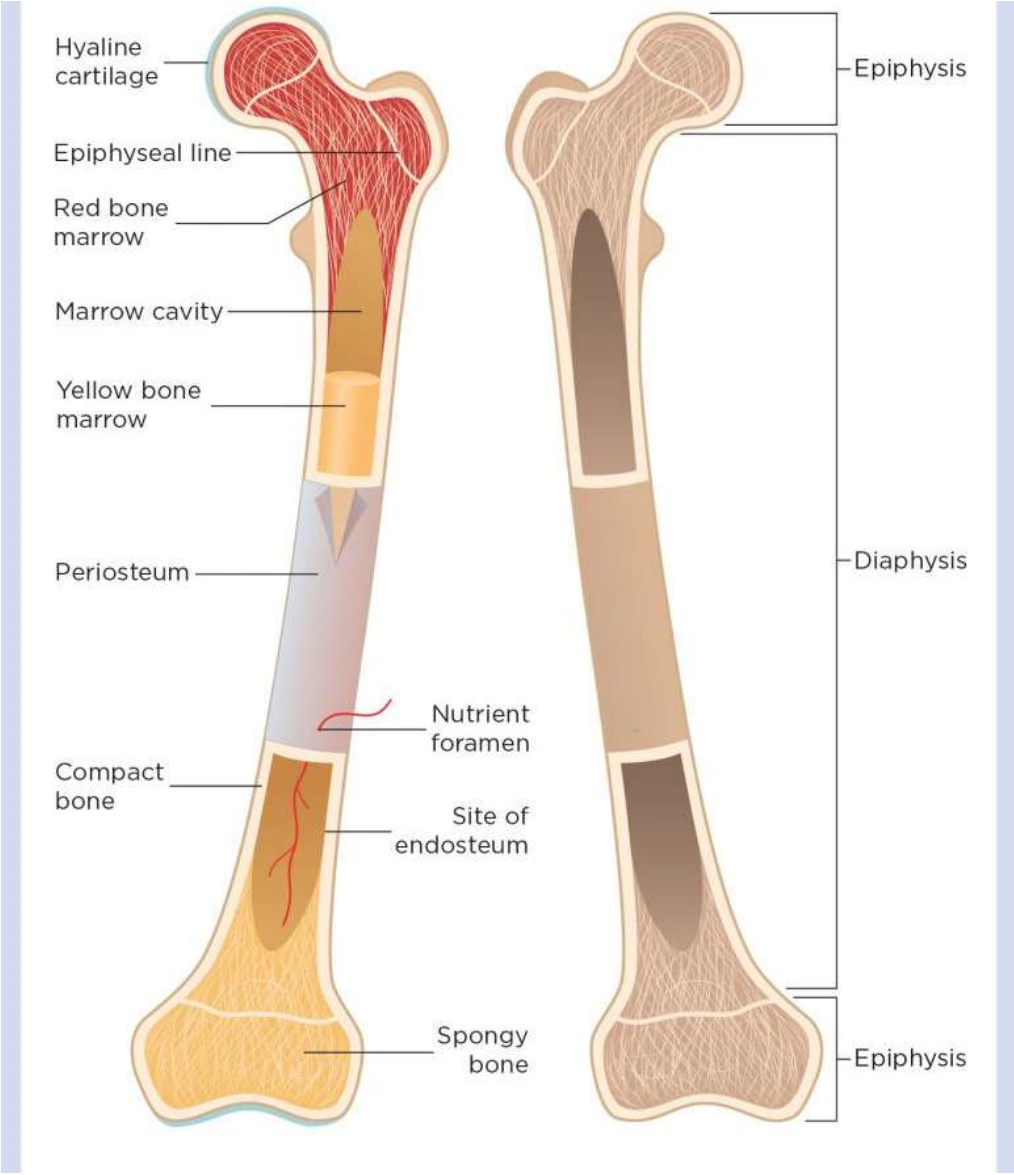
4. Describe the structure and development of bone

Fun Fact!

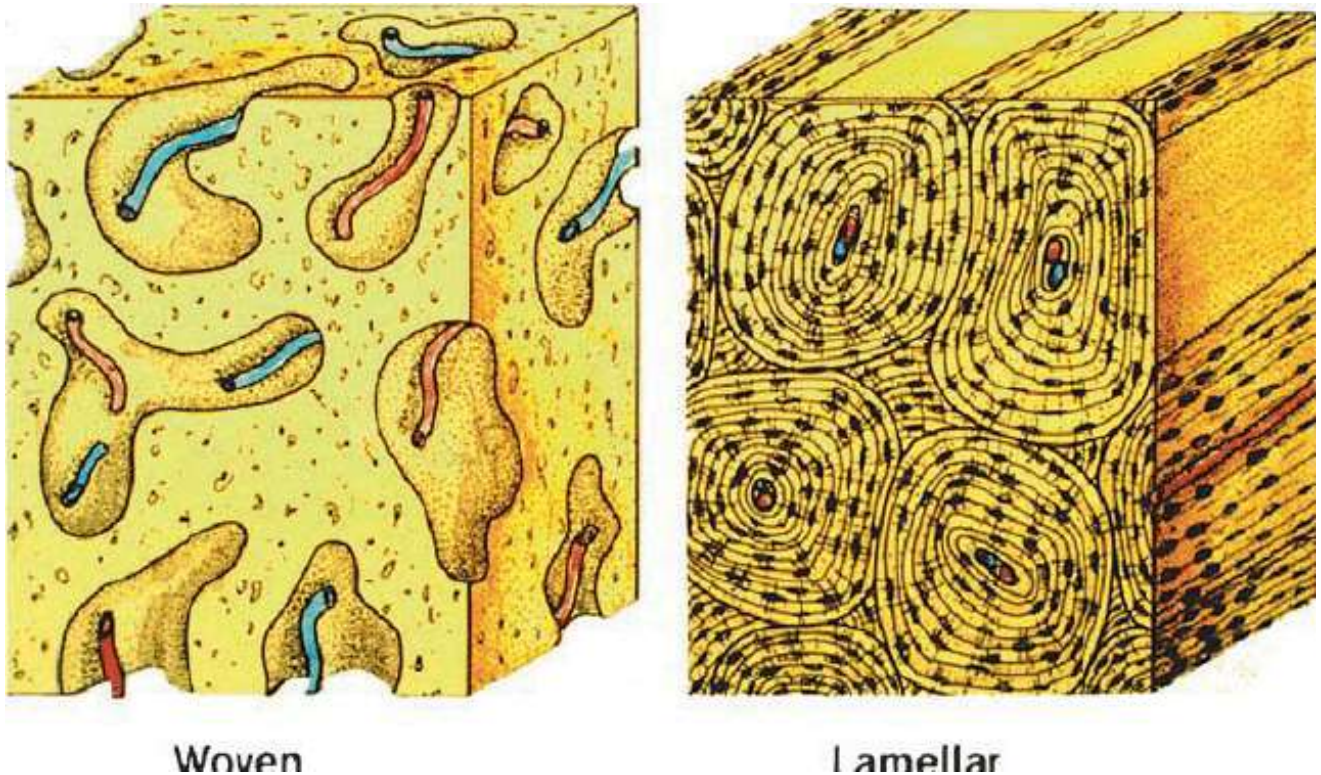
- Babies have 300 bones when they are born.
- Adults have 206 bones.
- The number of our bones actually decreases as we mature!

Bone Structure

- Bone is hard, but lightweight
- Bone is primarily formed of calcium phosphate
- It has high compression strength
- It has poor tensile strength (the resistance of a material to breaking under tension)
- Bone is somewhat elastic due to its collagen
- The density of bone varies at different points



Woven versus Lamellar Bone

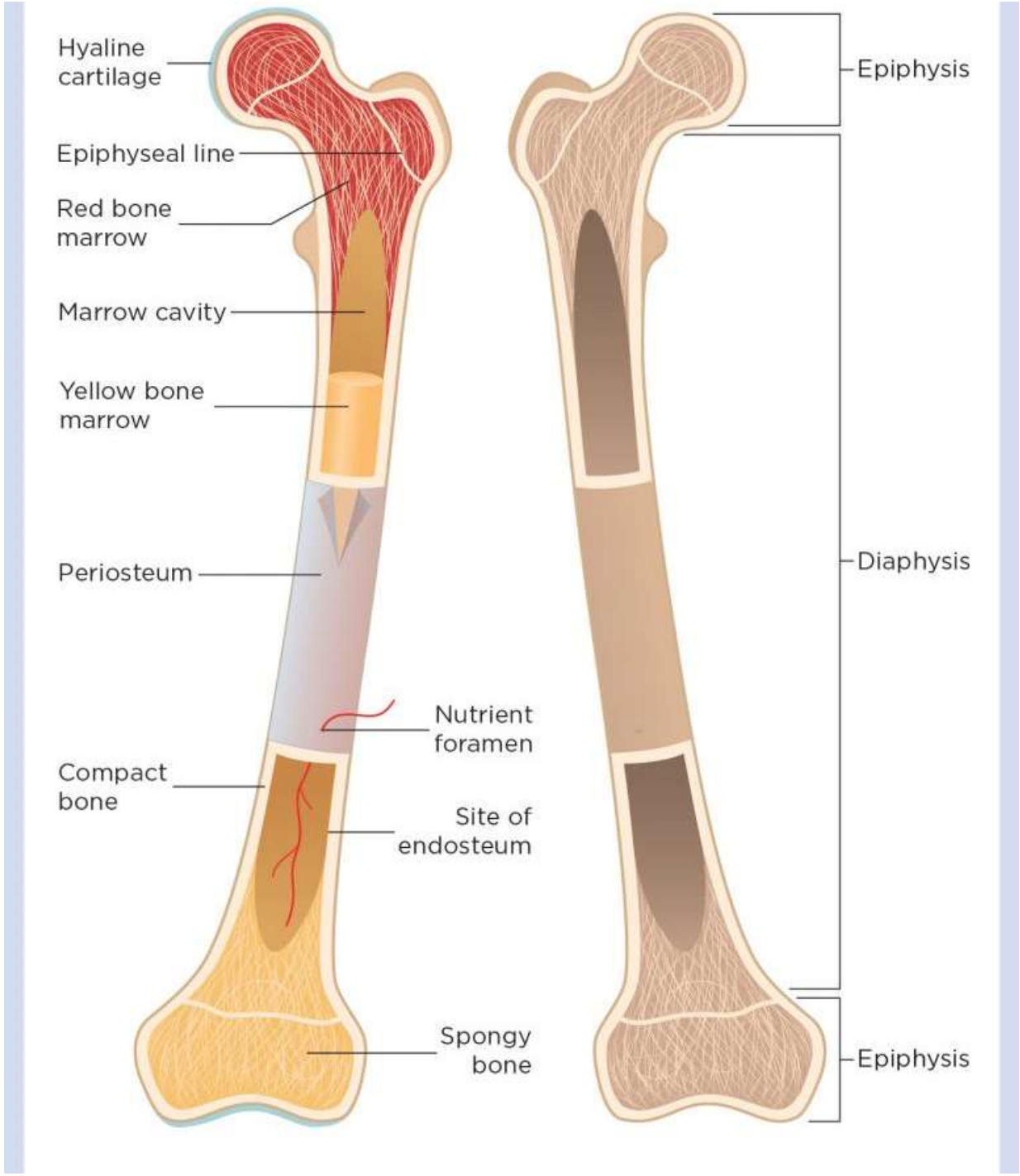


Woven Lamellar

- There are 2 types of bone: woven or lamellar
- Woven bone is used for growth or repair. Its fibres are aligned at random, so has low strength
- Lamellar bone has parallel fibres and is therefore much stronger
- Lamellar bone replaces woven bone during growth/repair processes

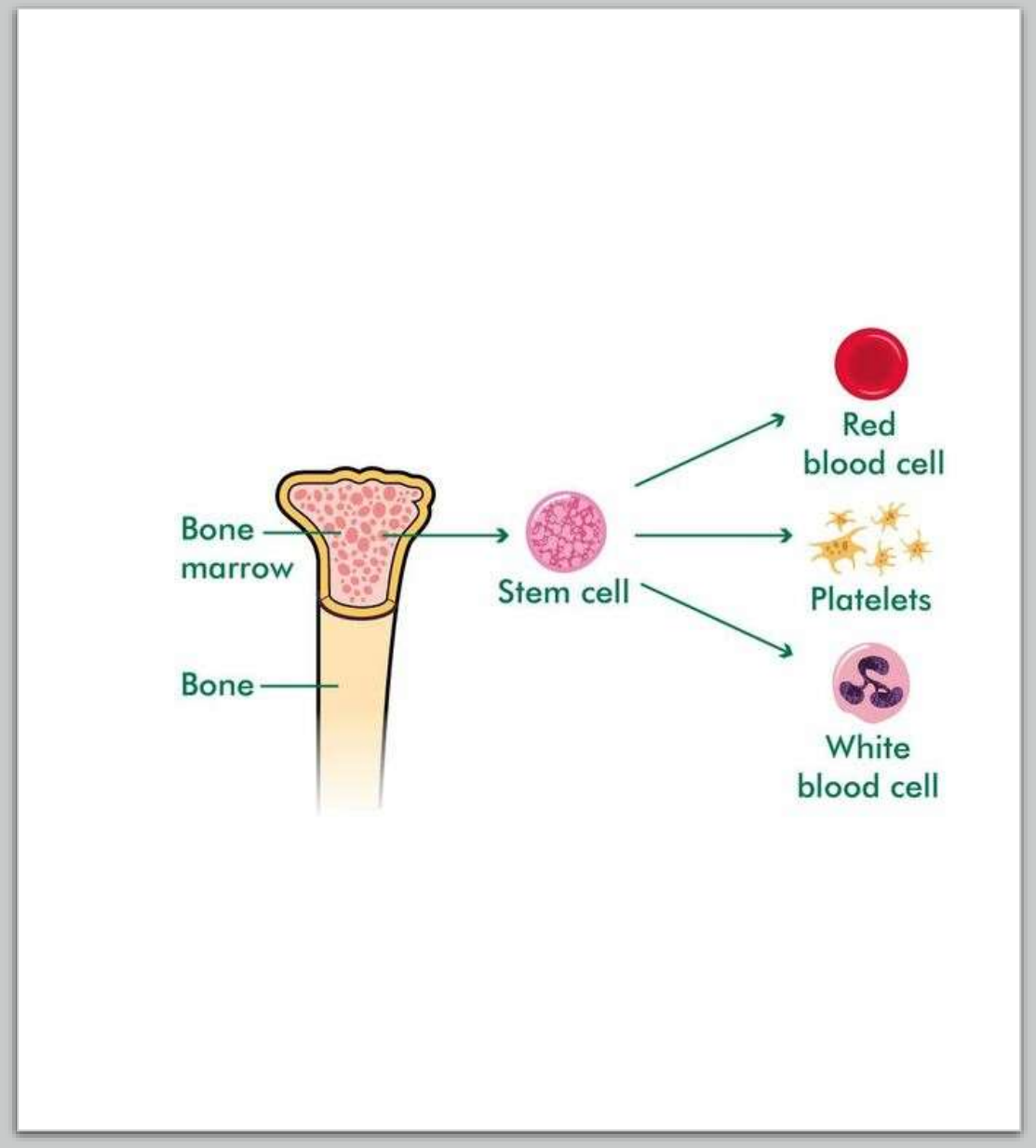
Bone Development

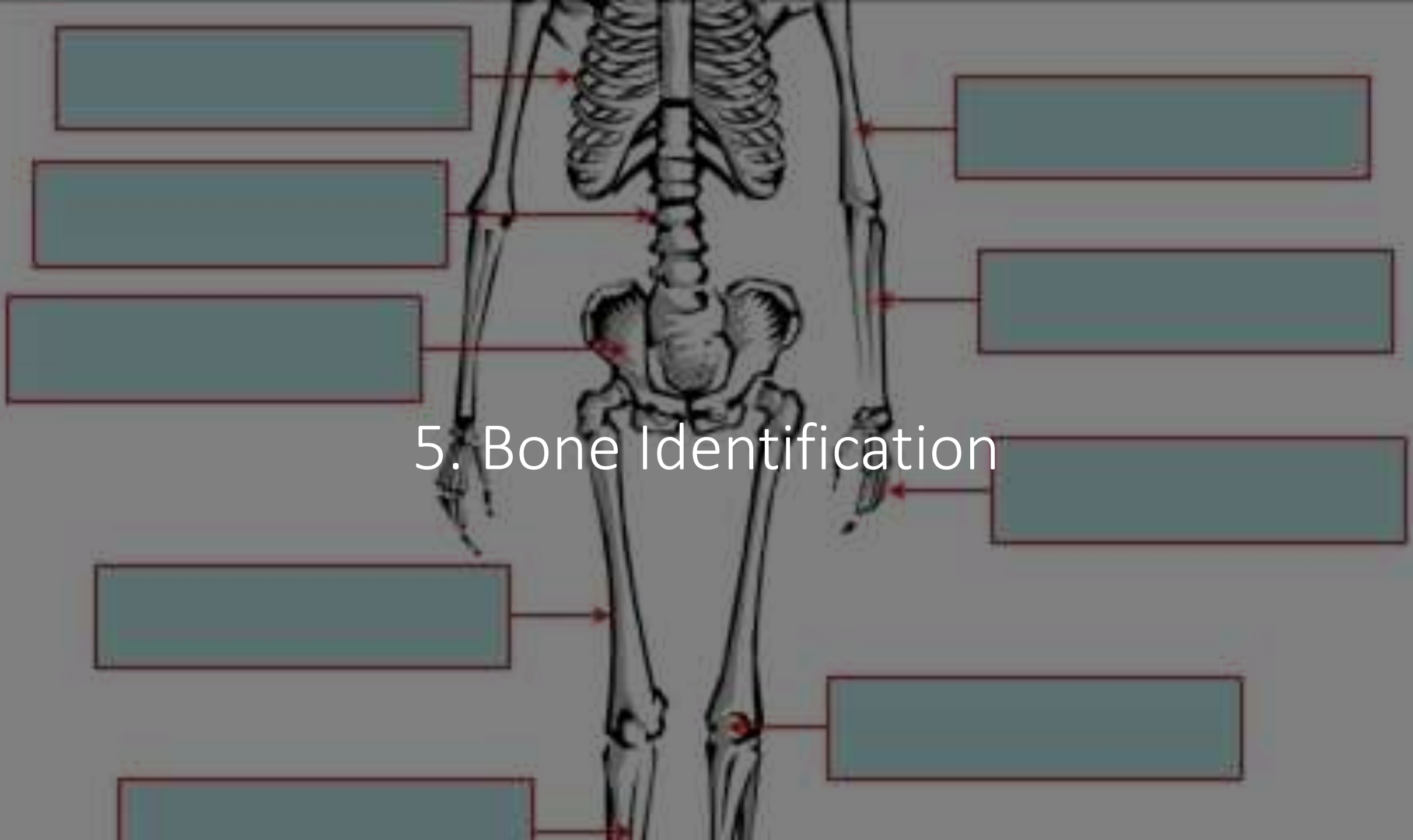
- Most bone development occurs in the womb, but some bones do fuse after birth (“ossification”)
- Bone growth starts in the cartilage
- Long bones ossify and get longer as they grow and develop. These bones grow from their ends, known as the epiphysis
- If a bone has a growth plate on the end of it (the ”epiphyseal line”), then that signifies that the bone is still growing
- In late teens/early twenties, a person stops growing – all of their cartilage has been replaced by bone, so no further growth in bone length is possible. However, bones can still increase in thickness. This may occur in response to increased muscle activity, such as weight training


Hyaline cartilage
Epiphyseal line
Red bone marrow
Marrow cavity
Yellow bone marrow
Periosteum
Nutrient foramen
Compact bone
Site of endosteum
Spongy bone
Epiphysis
Diaphysis
Epiphysis

Bone Marrow

- Bone marrow is a spongy substance found in the center of the bones
- Bone marrow makes It blood cells.
- Each type of blood cell made by the bone marrow has an important job
  - Red blood cells carry oxygen to tissues in the body
  - White blood cells fight infections
- Over time, red marrow is mostly replaced by yellow marrow in large bones. Most red marrow in adults is found in flat bones, not long bones (e.g. in the skull, ribs, vertebrae and pelvis)



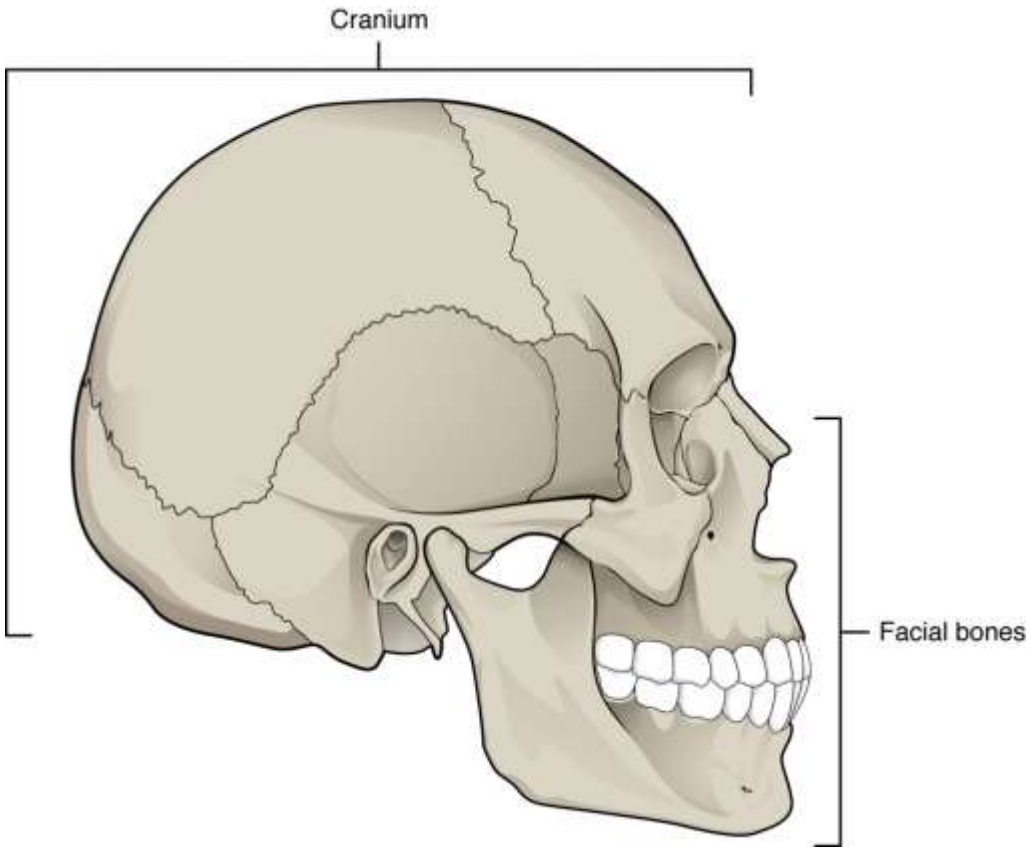


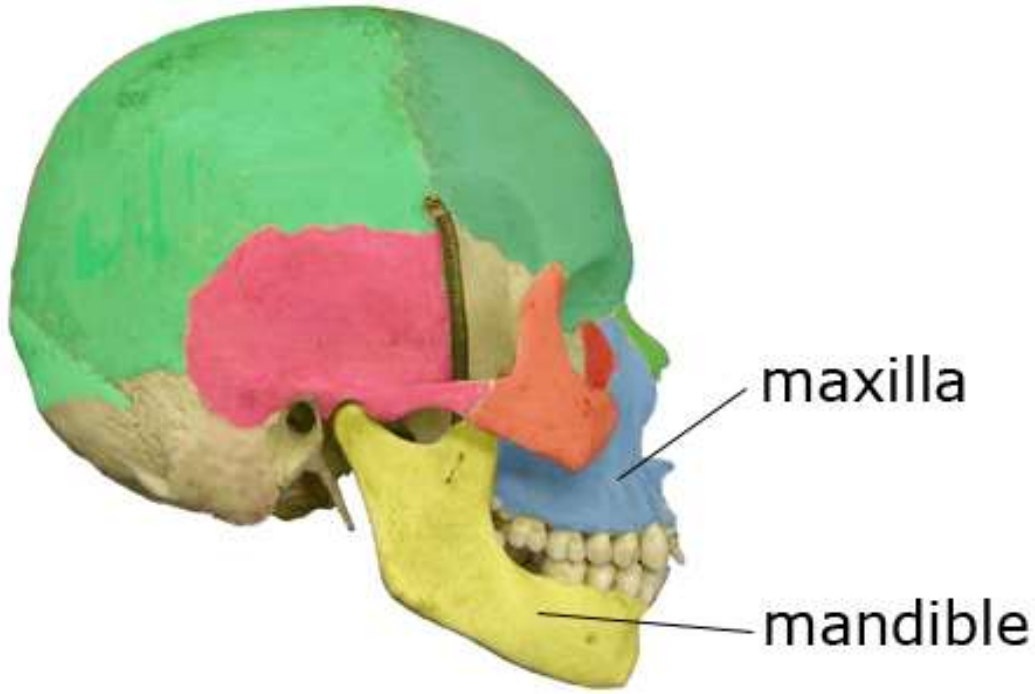
5. Bone Identification

The Bones we must Identify

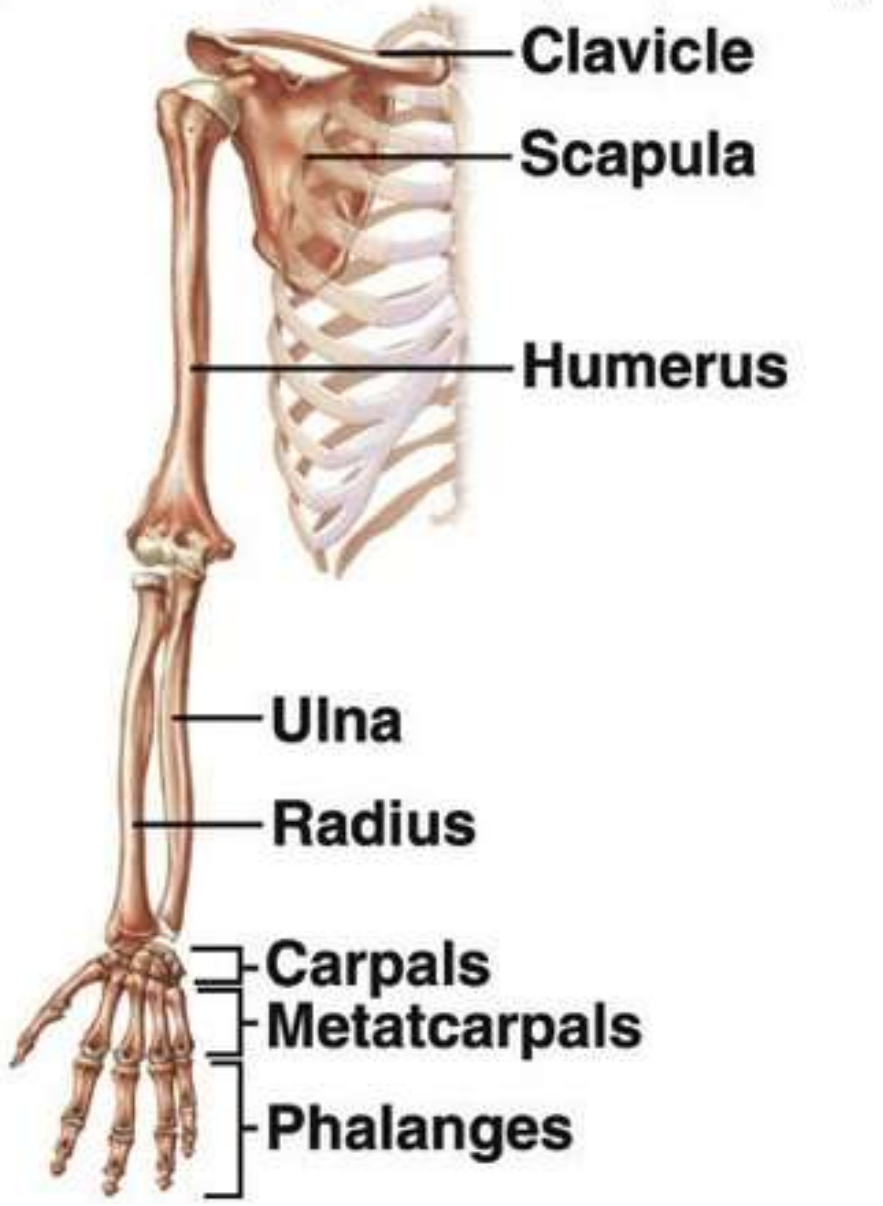
Carpals	Mandible	Radius
Clavicle (collar bone)	Maxilla	Ribs
Coccyx (tail bone)	Metacarpals	Scapula and Sternum
Cranium	Metatarsals	Tarsals
Femur	Patella	Tibia
Fibula	Pelvis	Ulna
Humerus	Phalanges	Vertebrae

Head

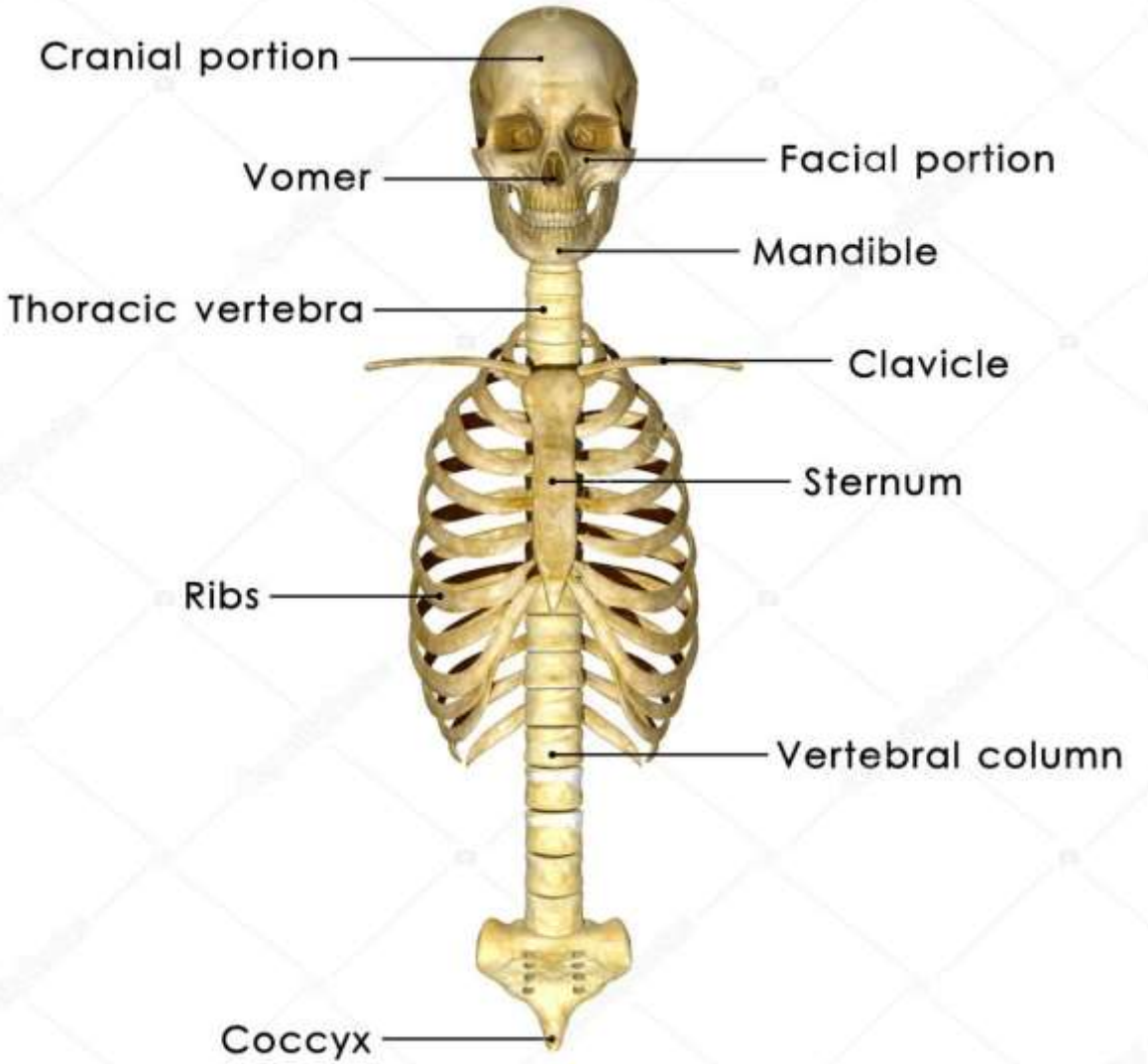




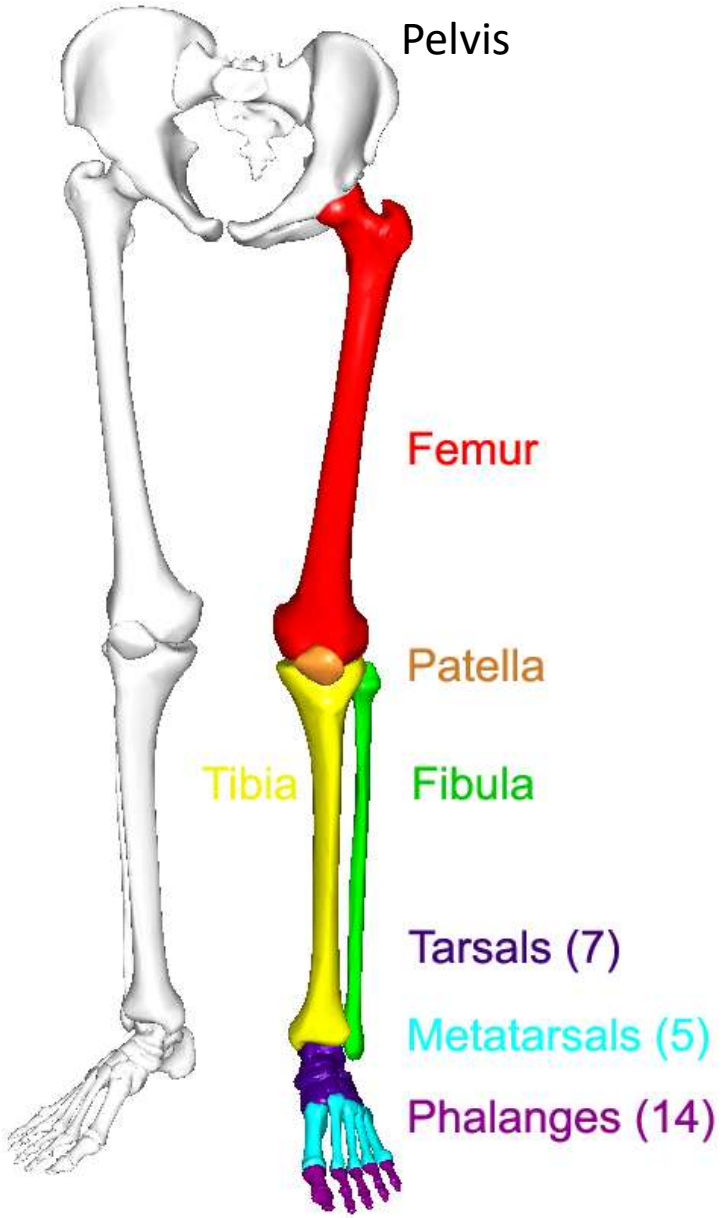
Arms



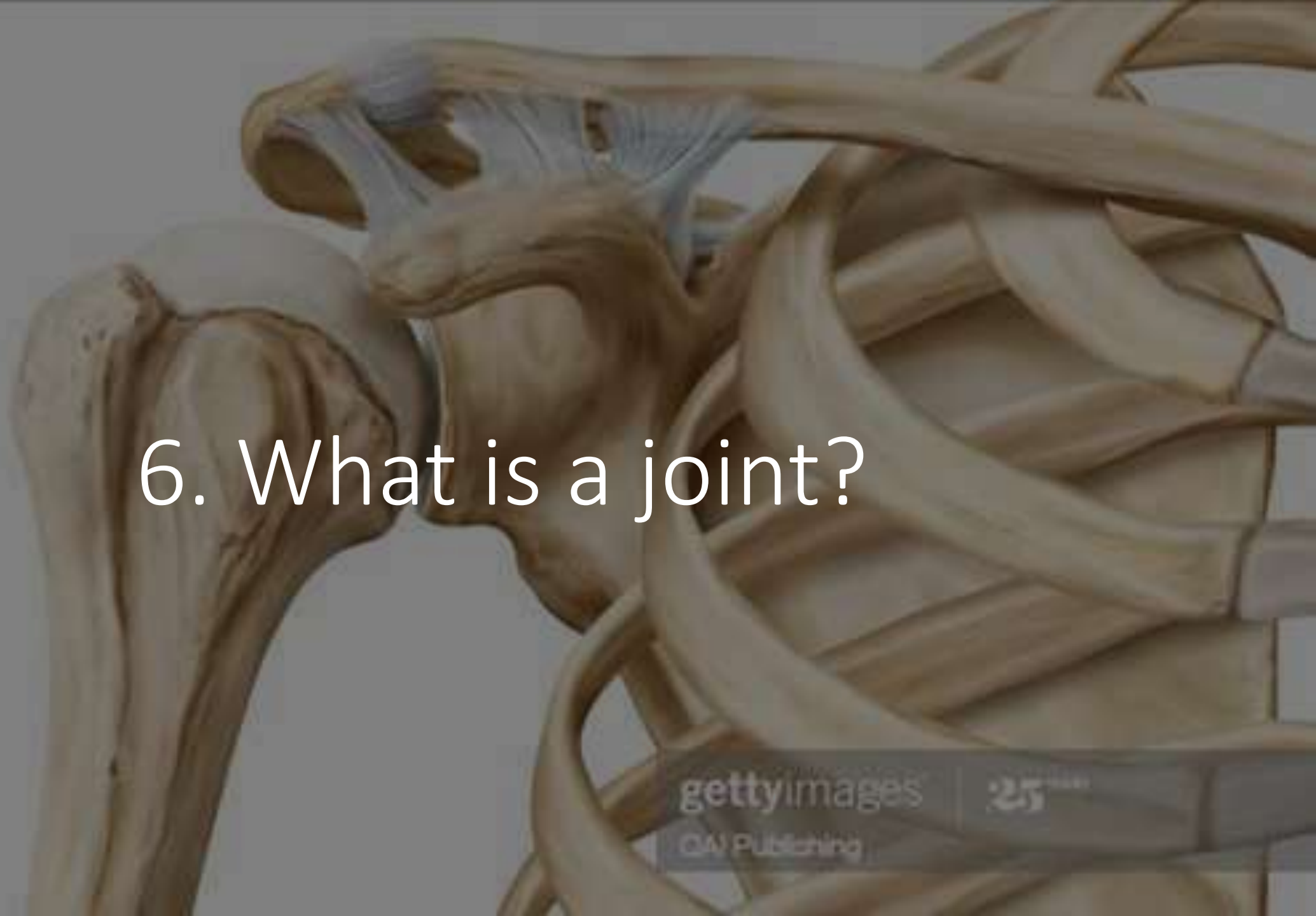
Upper Body


Cranial portion
Vomer
Facial portion
Mandible
Thoracic vertebra
Clavicle
Sternum
Ribs
Vertebral column
Coccyx

Legs


Pelvis
Femur
Patella
Tibia
Fibula
Tarsals (7)
Metatarsals (5)
Phalanges (14)

6. What is a joint?



Joints

- A joint is the place where two or more bones meet
- What examples can you think of, of joints within the body?

7. List the three types of joints found between bones

Fibrous
(Immoveable)

Cartilagenous
(Semi moveable)

Synovial
(freely moveable)

Fibrous

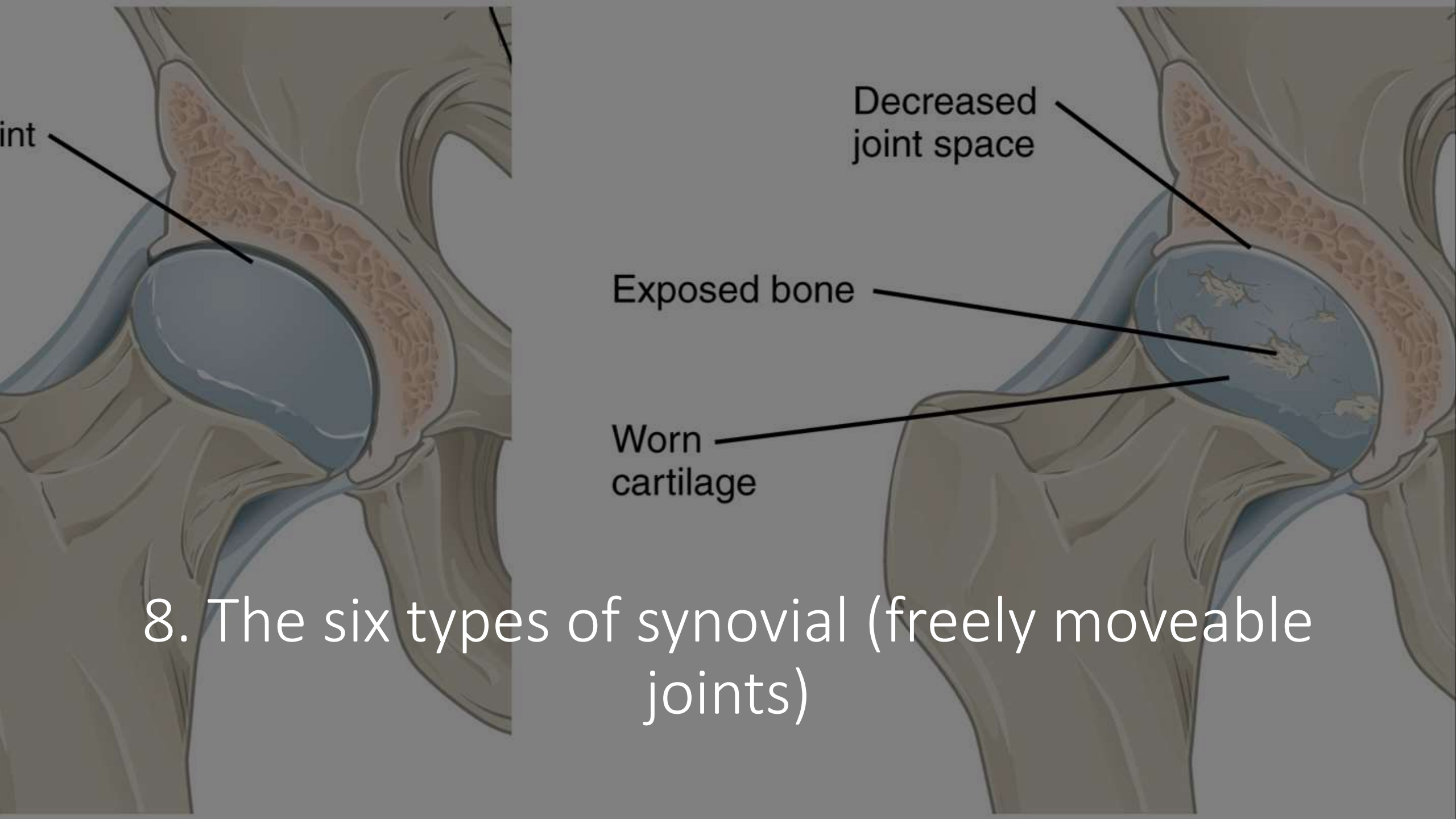
(Immoveable)

Cartilagenous

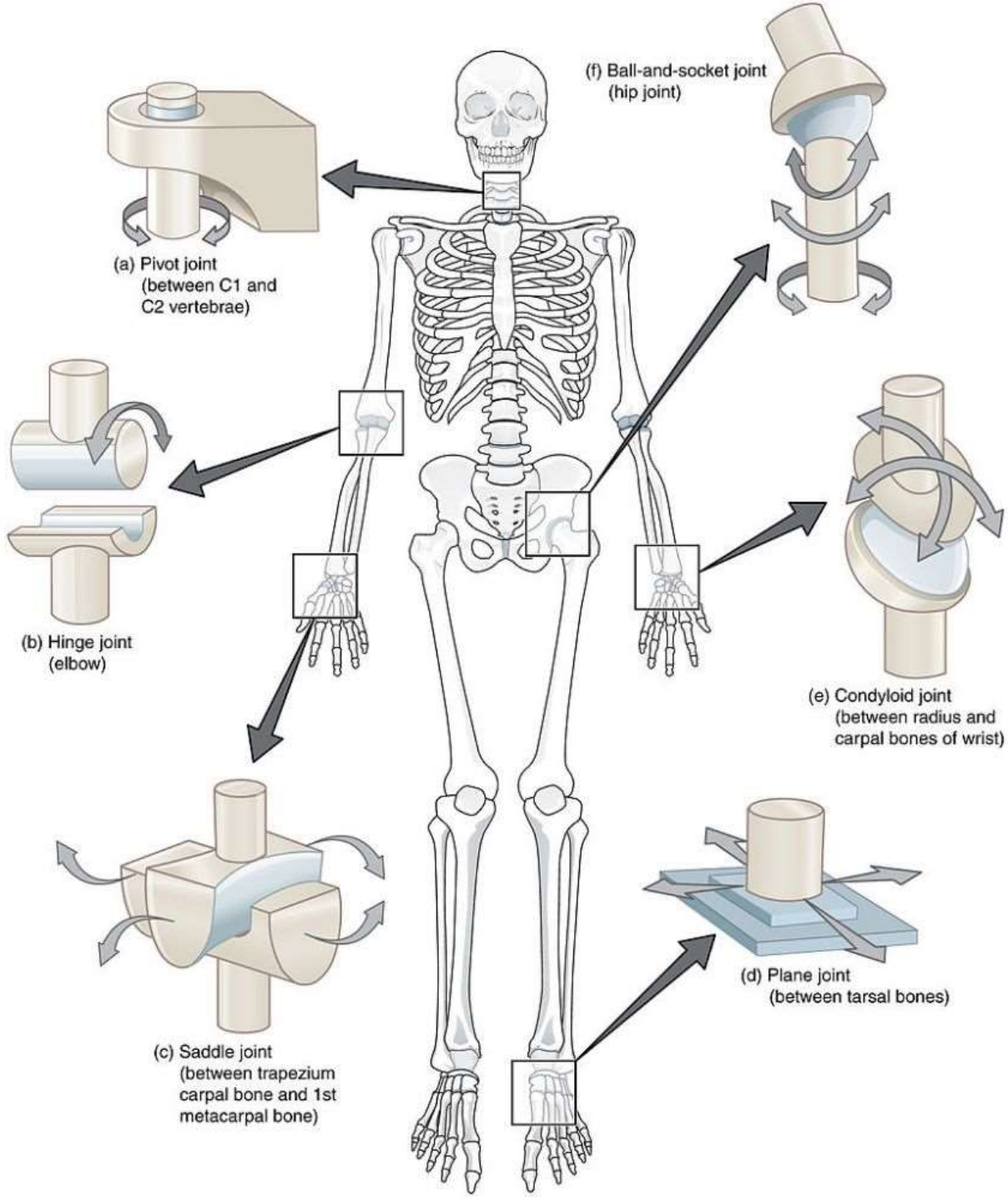
(Semi moveable)

Synovial

(freely moveable)



8. The six types of synovial (freely moveable joints)

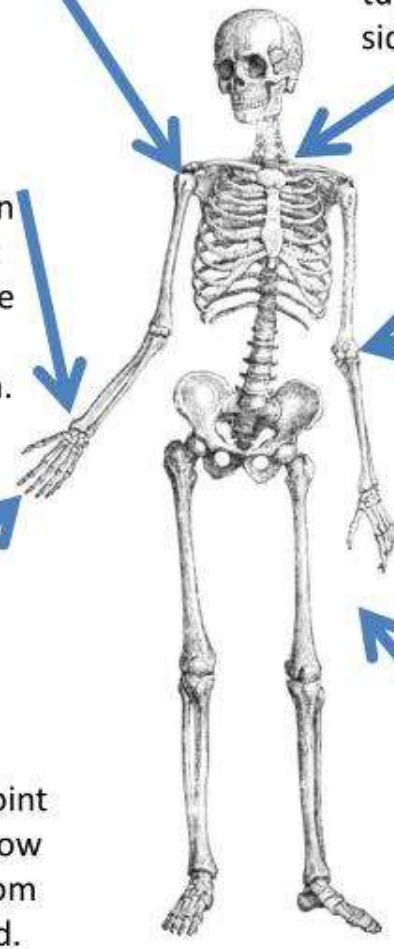

(a) Pivot joint
(between C1 and
C2 vertebrae)
(b) Hinge joint
(elbow)
(c) Saddle joint
(between trapezium
carpal bone and 1st
metacarpal bone)
(d) Plane joint
(between tarsal bones)
(e) Condyloid joint
(between radius and
carpal bones of wrist)
(f) Ball-and-socket joint
(hip joint)

Types of Joints

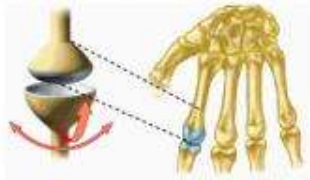
1. _____ joint (Like in your neck) allows you to turn your head from side to side.

2. _____ joints, like in your knee and elbow, enable movement similar to the opening and closing of a hinged door.

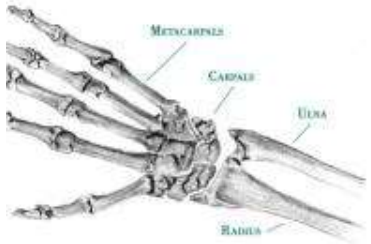
3. _____ joints (in your thumbs) The bones in a these joints can rock back and forth and from side to side, but they have limited rotation.



4. _____ joints, such as the joint at the base of your index finger, allow bending and extending, rocking from side to side, but rotation is limited.



5. _____joints occur between the surfaces of two short bones that are held together by ligaments. (Some of the bones in your wrists and ankles); have limited range of motion.

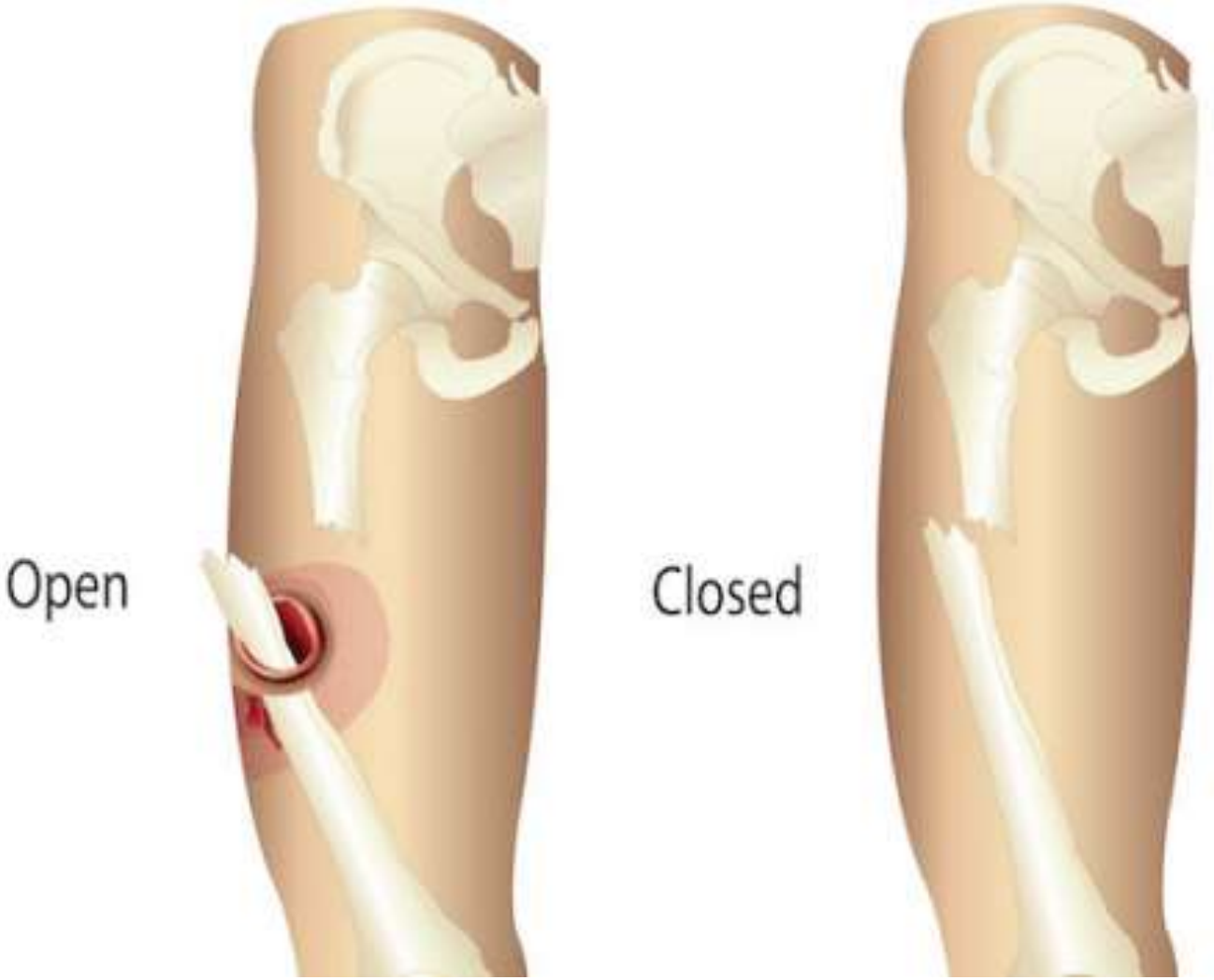


6. _____and _____ joints, (like your hip and shoulder joints) are the most mobile type of joint in the human body. They allow you to swing or rotate your arms and legs in many different directions

The shoulder joint

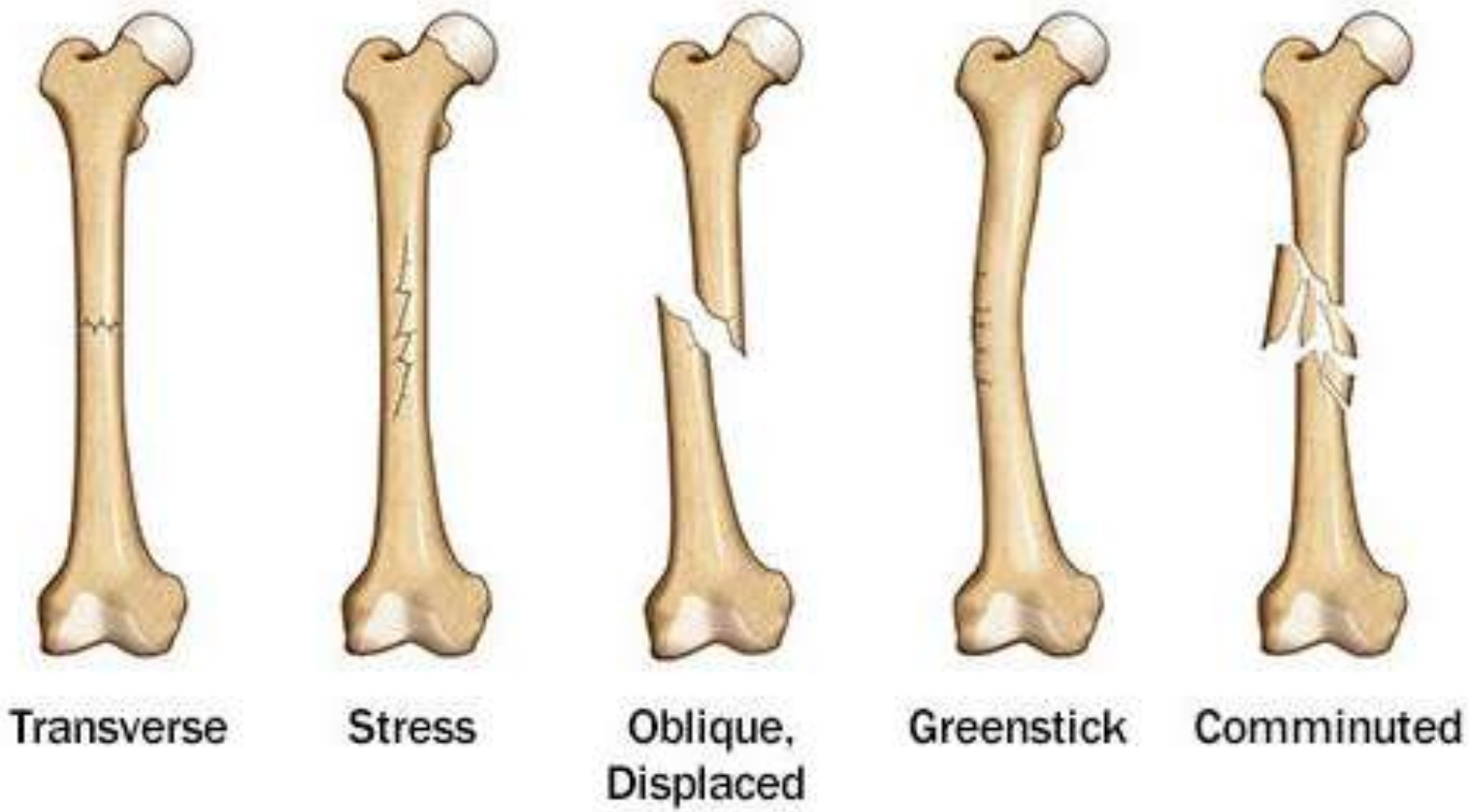
9. Be creative and construct a model of one of the six freely moveable joints

10. Broken bones



Broken bones are otherwise known as fractures. There are 2 main types of fracture

1. Open fractures
2. Closed fractures



Sub-Categories of Fractures

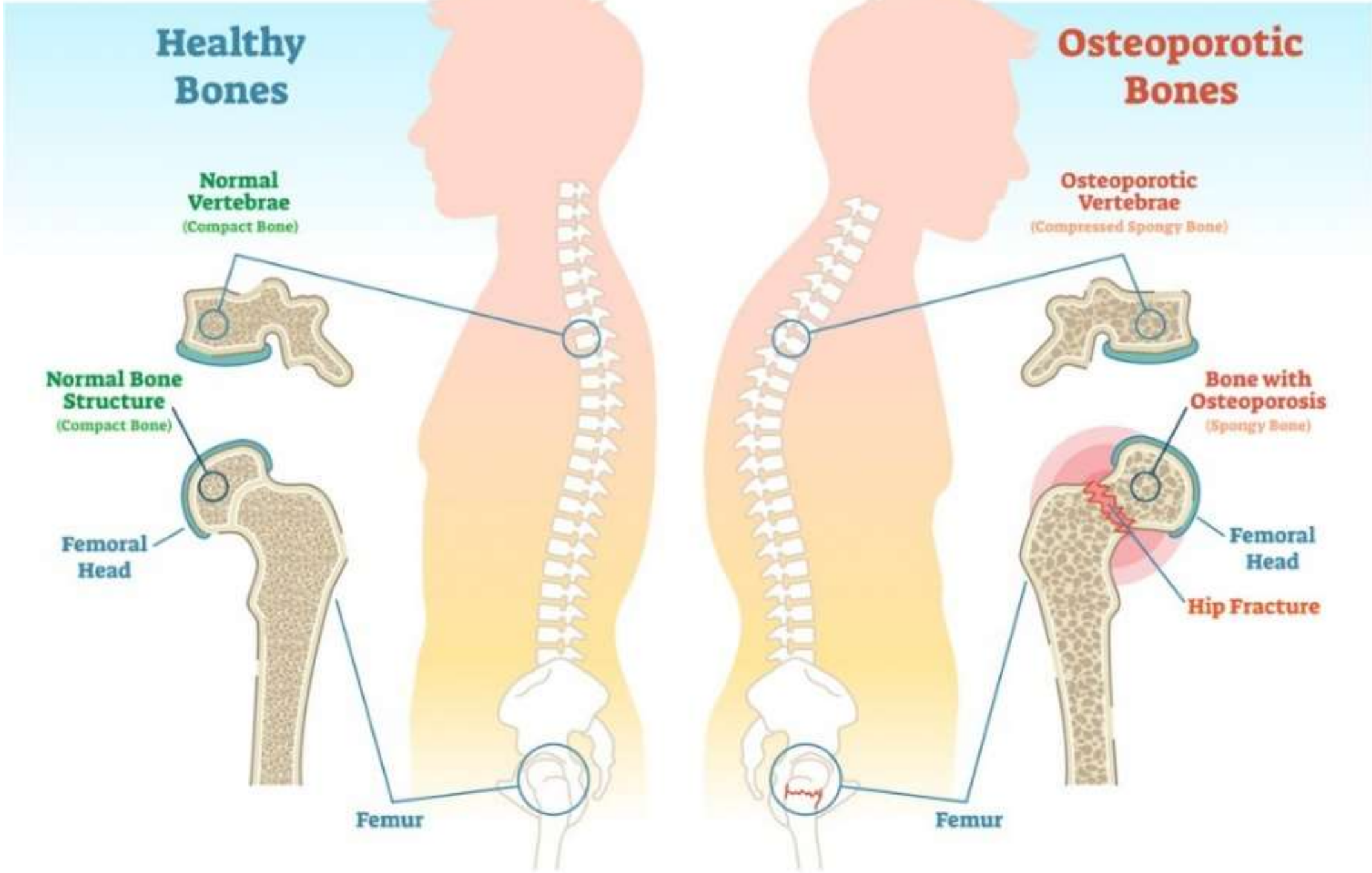
How do bones heal and how can doctors help?

- Living bones are in constant change. Cells die and are replaced on a regular basis. Because of this, a bone will heal all by itself if allowed to.
- Doctors can help this process in two ways:
    1. They can **set** the bone. This is done by making sure the pieces of the bone are aligned properly. In a comminuted fracture this may involve surgery
    2. They can **immobilise** the bone - that is, keeping it from moving around. This can be done by surrounding the broken limb with a cast or by embedding pins inside the body. Some bones do not need to be immobilised when broken (e.g. the nose)

11. Osteoporosis

What is osteoporosis and who can get it?

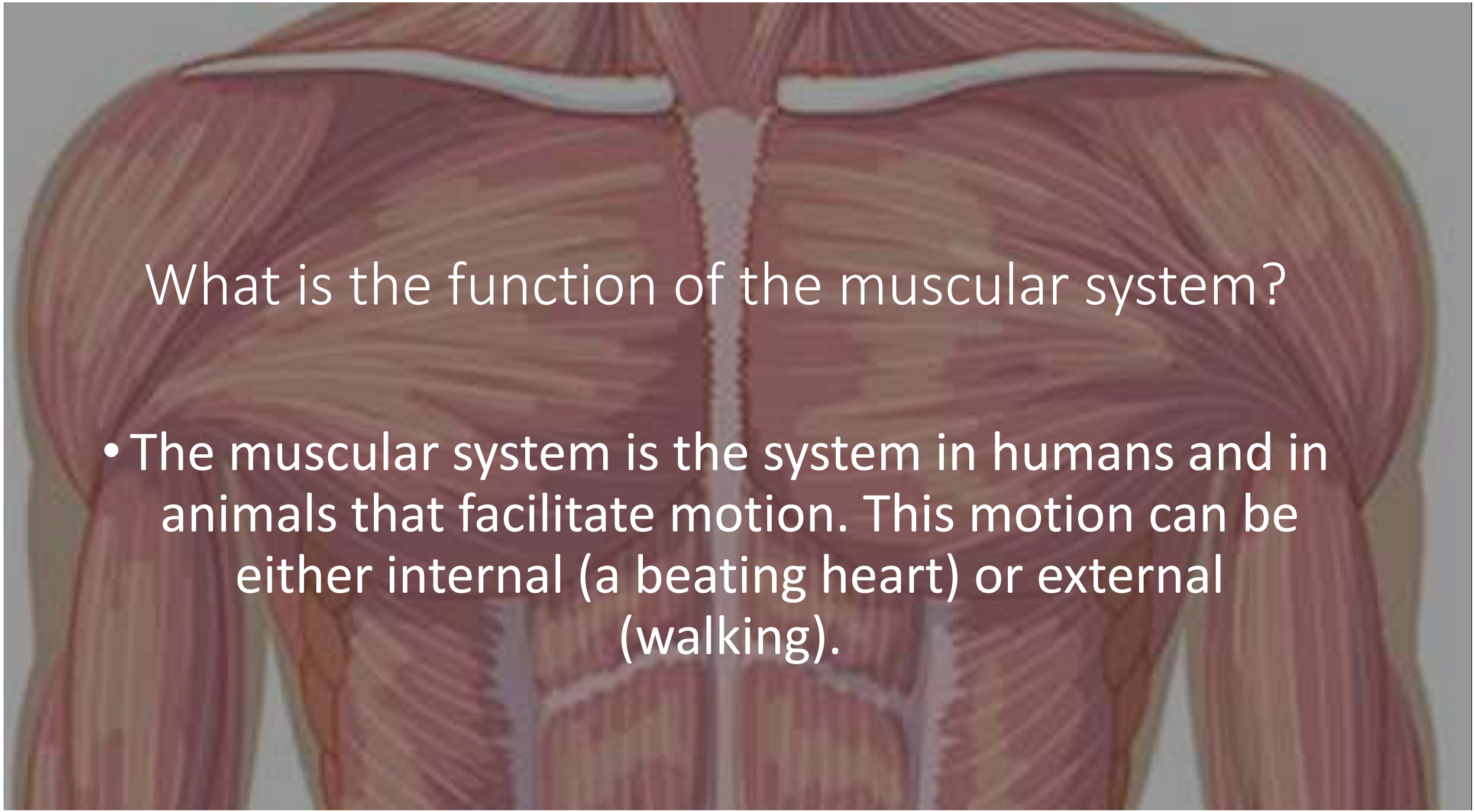
- Osteoporosis is the depletion of minerals from the bone
- Minerals in bones give them their strength, so a bone with a low **b**one **m**ineral **d**ensity (or BMD) is more susceptible to breakage, even when stressed only lightly
- Anyone can get osteoporosis, but it is more common in older women
- Some of the risk factors of getting osteoporosis cannot be reduced by modifying behaviour (e.g. being a woman, having dementia, having a history of weak bones/fractures and/or being of European descent), but other factors can be avoided by healthful living


Healthy Bones
Normal Vertebrae
(Compact Bone)
Normal Bone Structure
(Compact Bone)
Femoral Head
Femur
Osteoporotic Bones
Osteoporotic Vertebrae
(Compressed Spongy Bone)
Bone with Osteoporosis
(Spongy Bone)
Femoral Head
Hip Fracture
Femur

List at least 5 healthy habits that deal with maintaining healthy bones and muscles

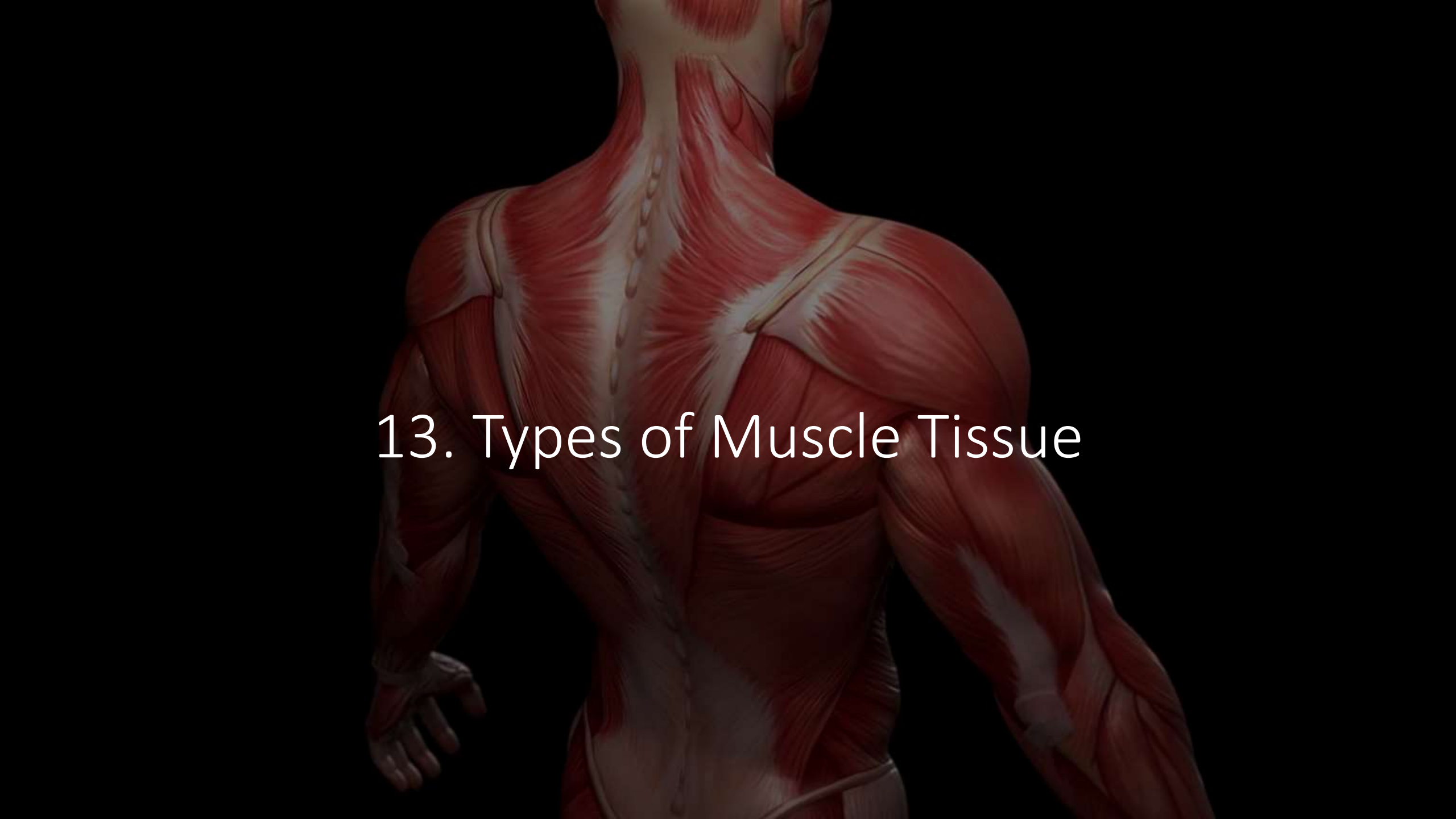
1. Avoid soft drinks
2. Avoid alcohol
3. Avoid tobacco
4. Maintain a healthy body weight. Those with abnormally low body weight are more susceptible to osteoporosis
5. Make sure your diet has plenty of calcium
6. Make sure your diet has plenty of vitamin D
7. Get plenty of exercise, especially weight-training

12. The muscular system



What is the function of the muscular system?

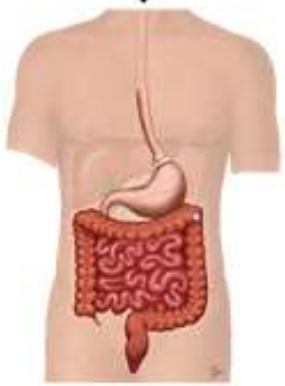
- The muscular system is the system in humans and in animals that facilitate motion. This motion can be either internal (a beating heart) or external (walking).



13. Types of Muscle Tissue

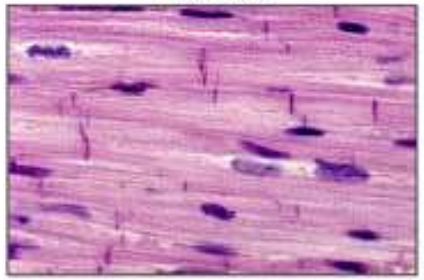
13. Name and describe three types of muscle tissue. Give one example of each

Smooth Muscle Tissue



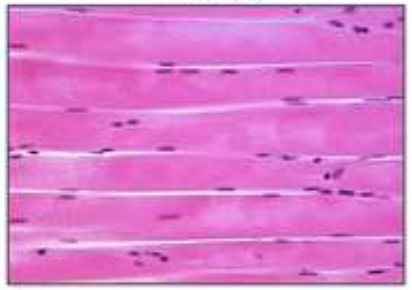
Involuntary Control

Cardiac Muscle Tissue

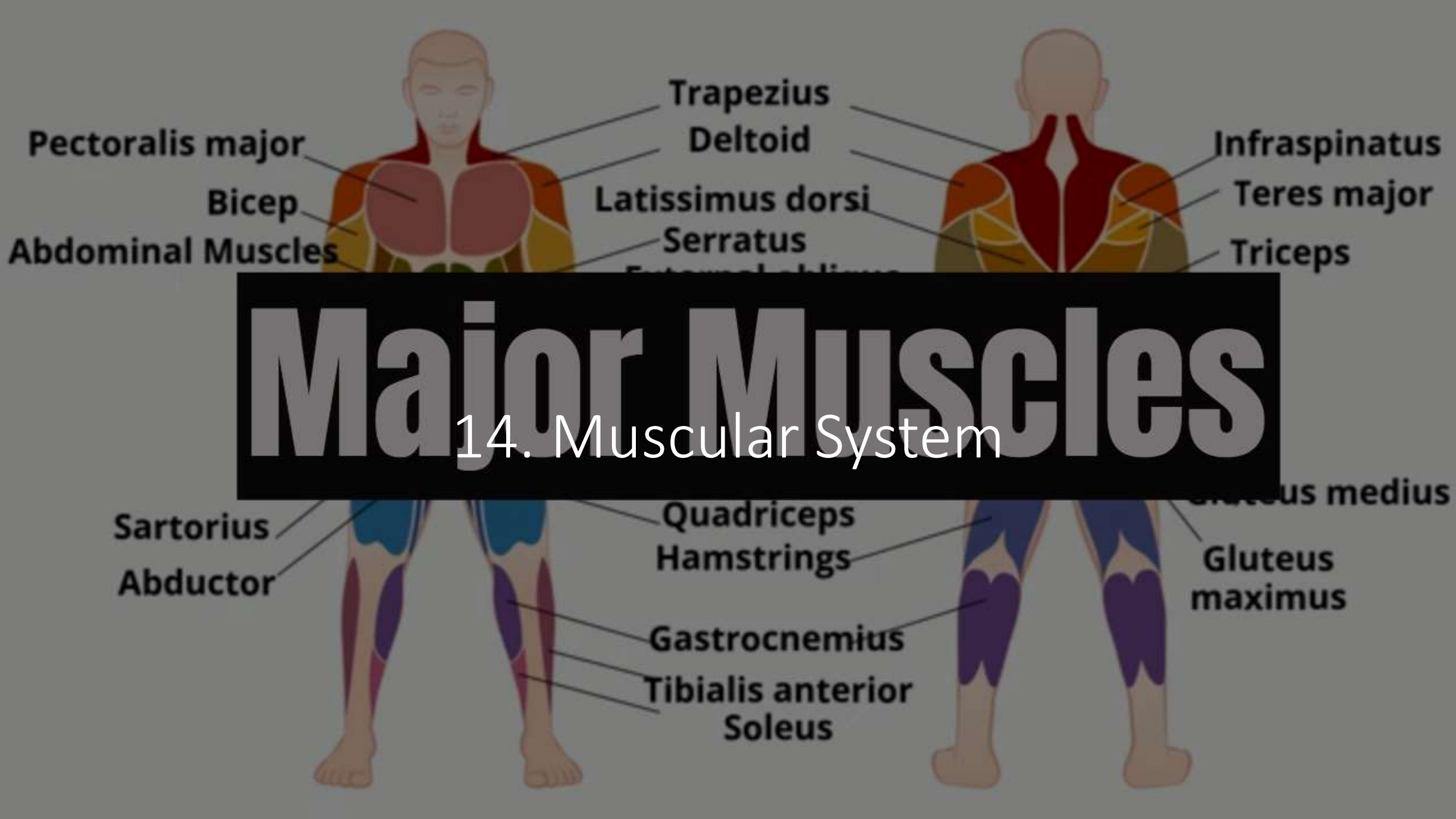


Involuntary Control

Skeletal Muscle Tissue



Voluntary Control

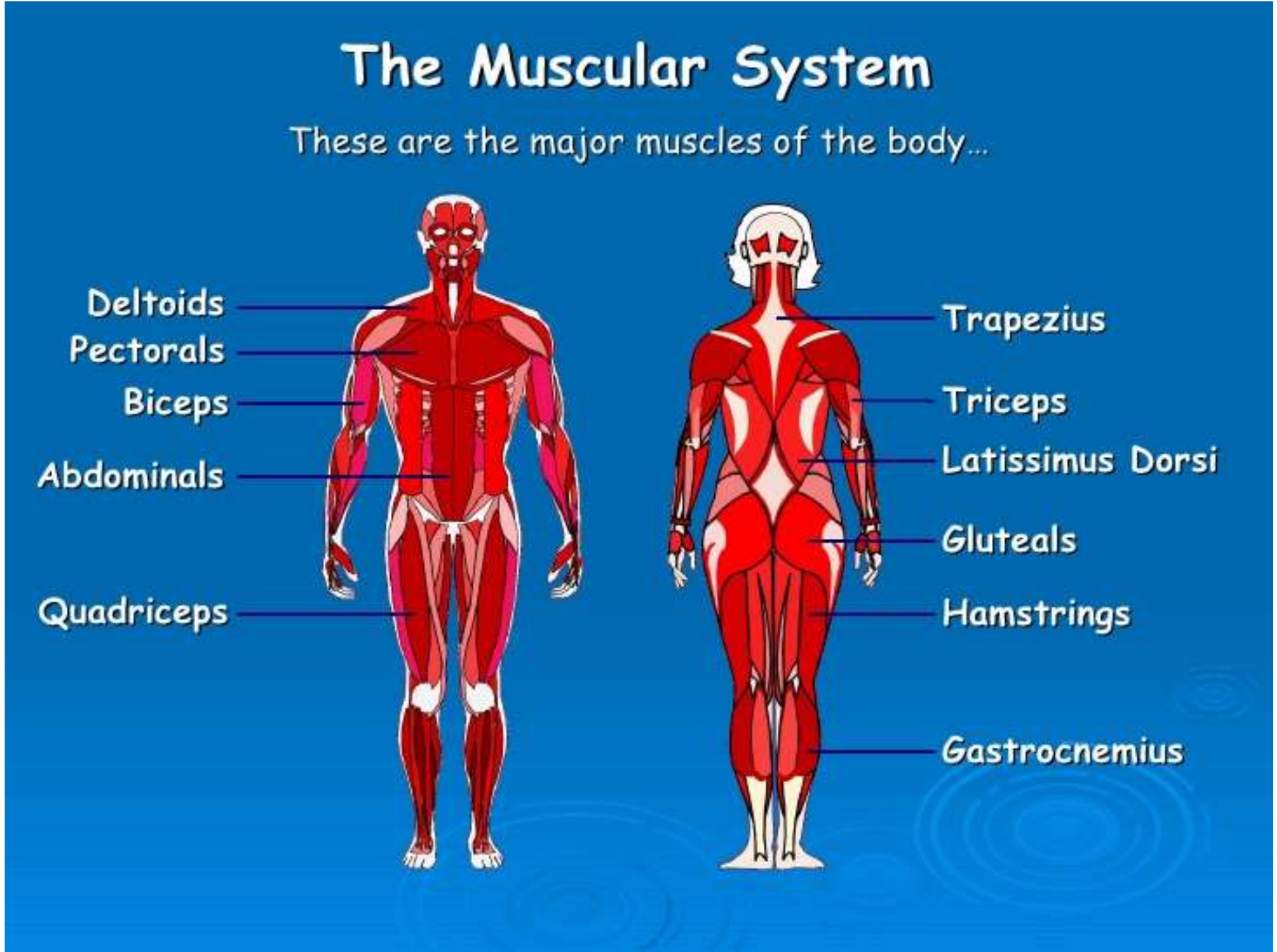

Trapezius
Deltoid
Pectoralis major
Bicep
Abdominal Muscles
Latissimus dorsi
Serratus
Infraspinatus
Teres major
Triceps
Major Muscles
14. Muscular System
Sartorius
Abductor
Quadriceps
Hamstrings
Gastrocnemius
Tibialis anterior
Soleus
Gluteus maximus

The Muscles we must Identify

Abdominal	Masseter
Biceps	Quadriceps
Deltoid	Pectoralis
Gastrocnemius	Soleus
Gluteus maximus	Trapezius
Hamstrings	Triceps
Latissimus dorsi	

The Muscular System

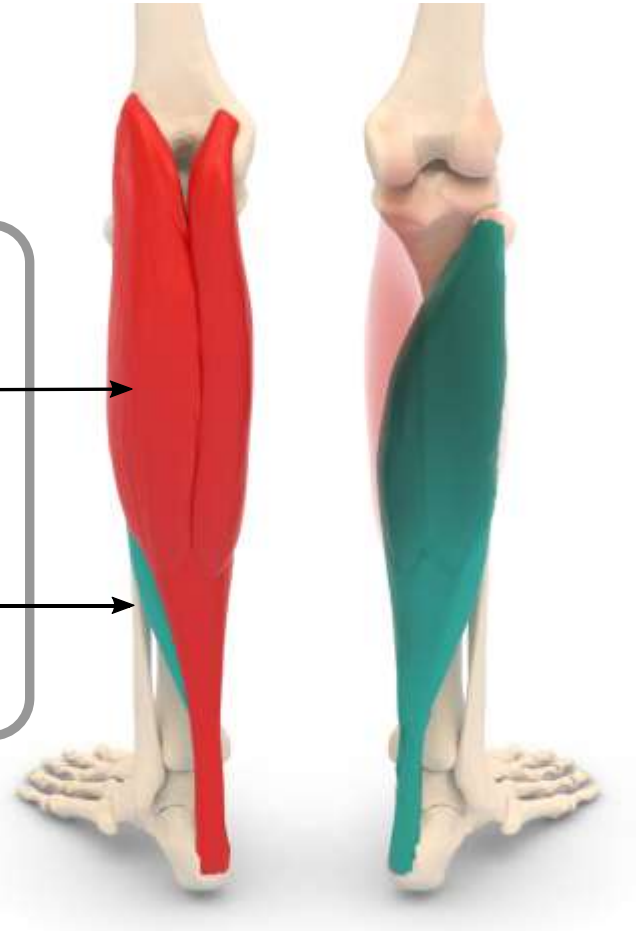
These are the major muscles of the body…

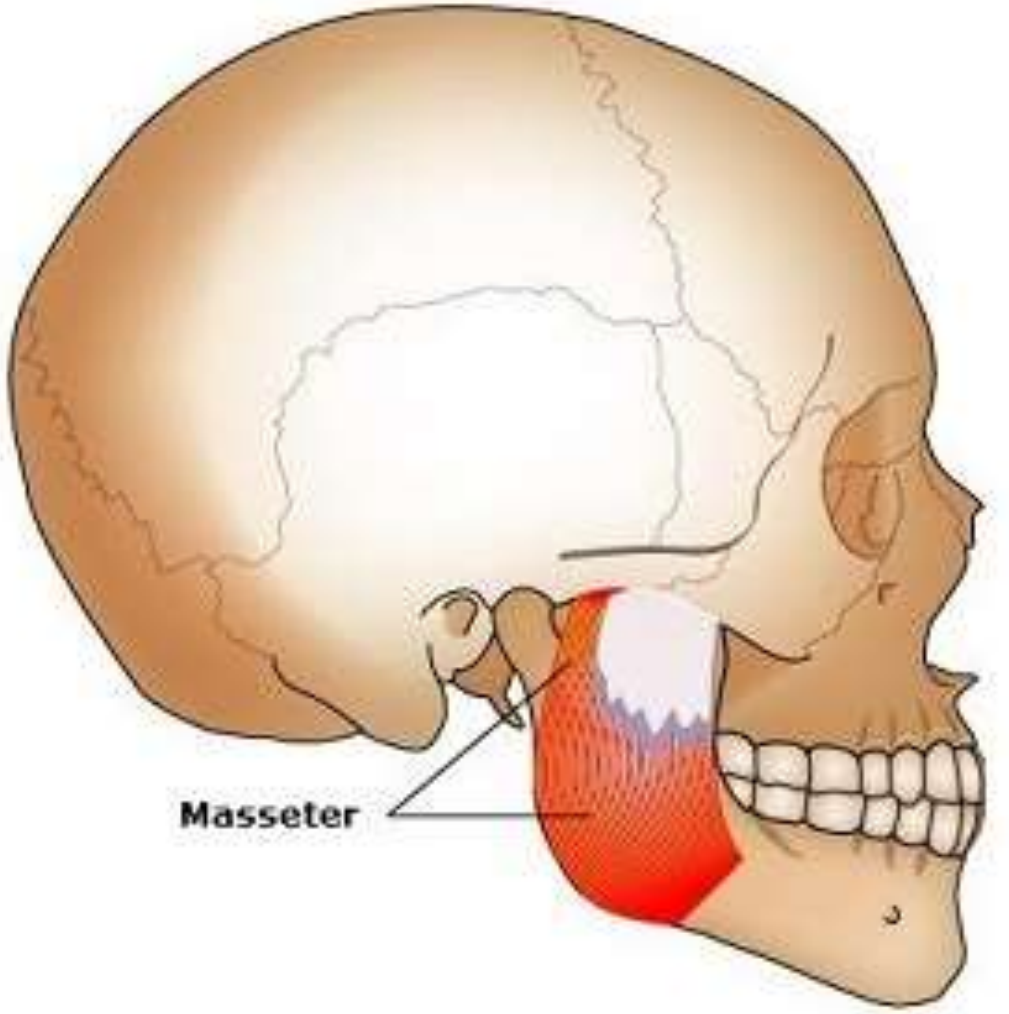


Triceps surae

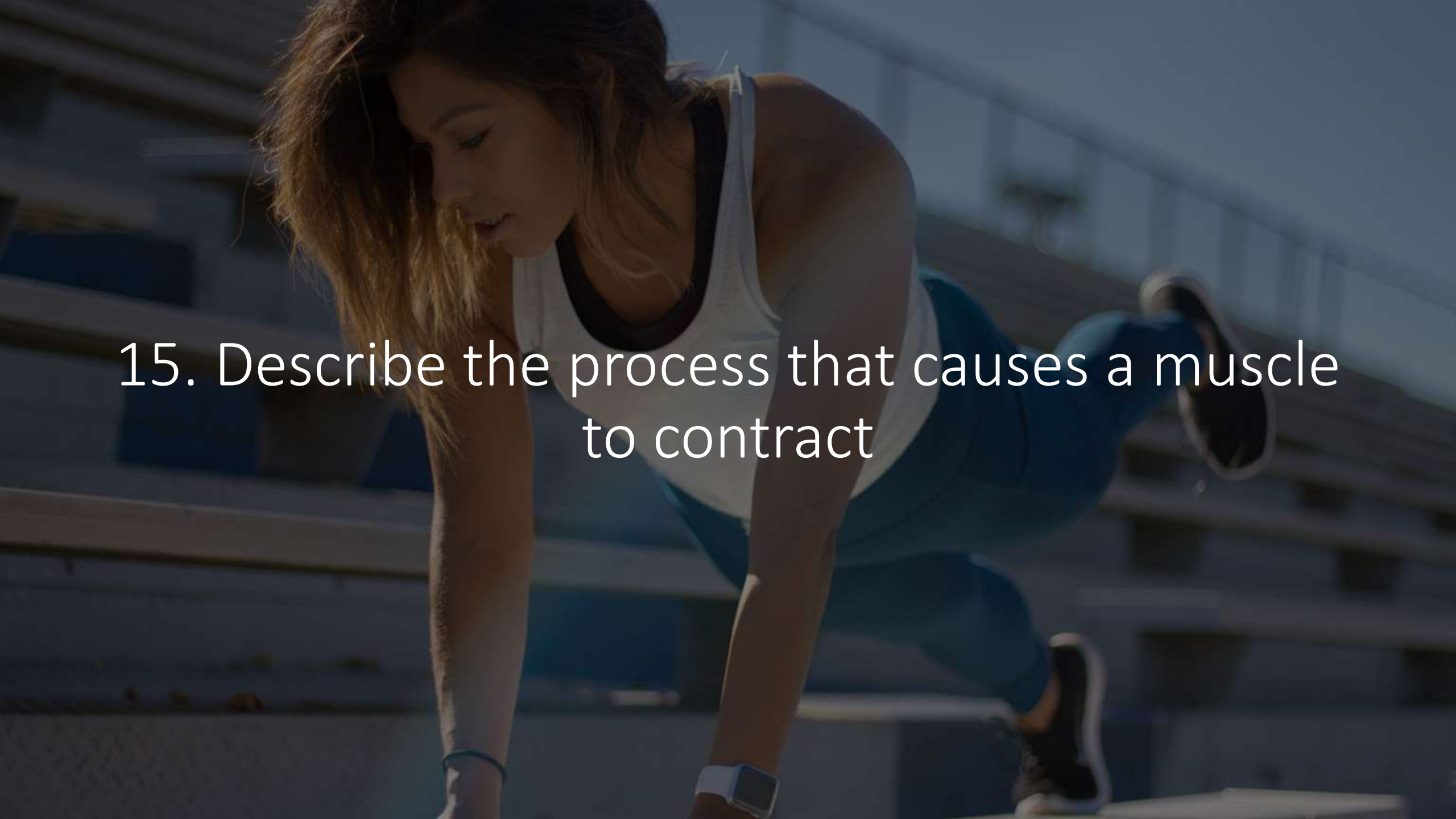
Gastrocnemius muscle

Soleus muscle

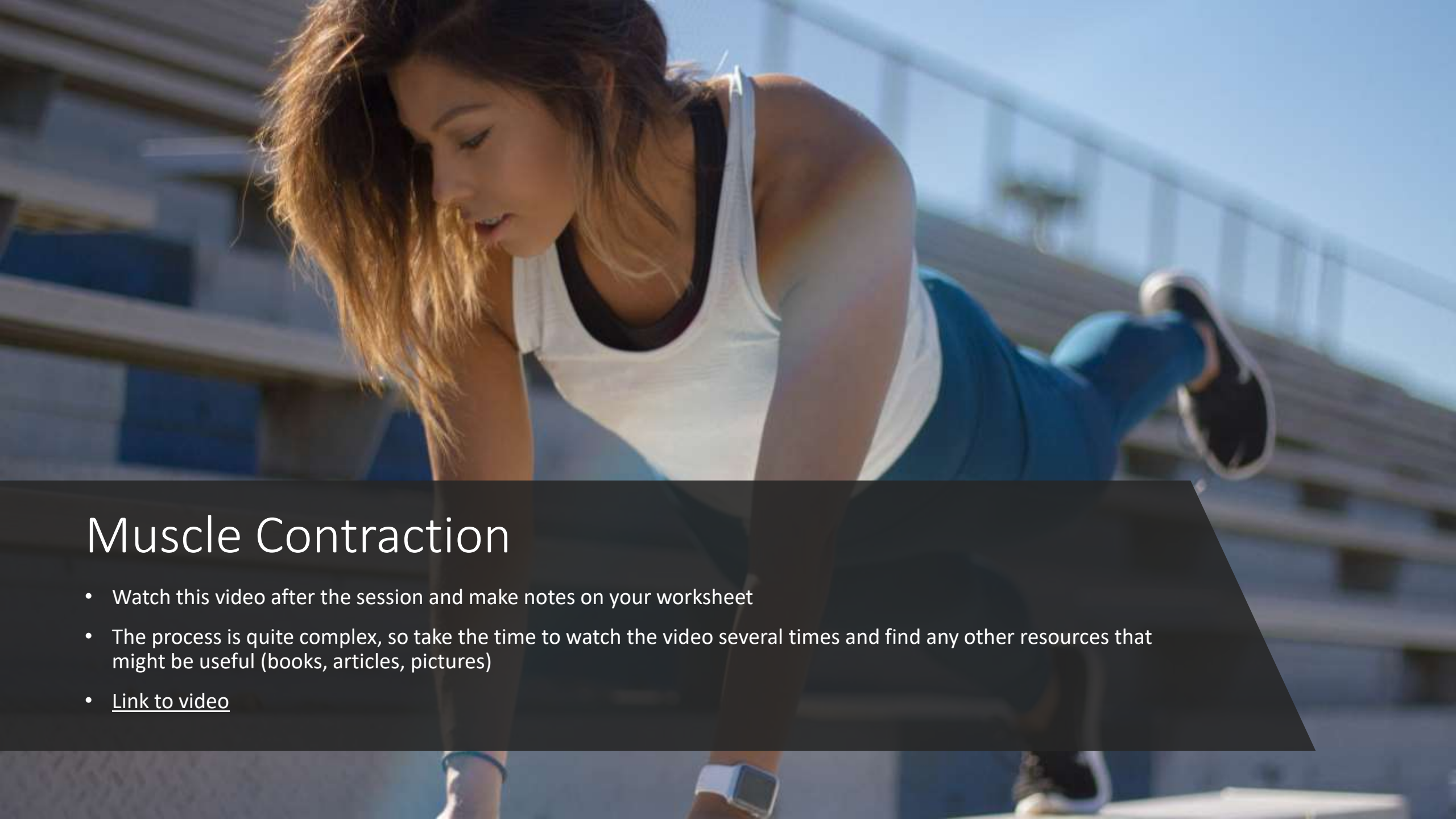




15. Muscle contractions



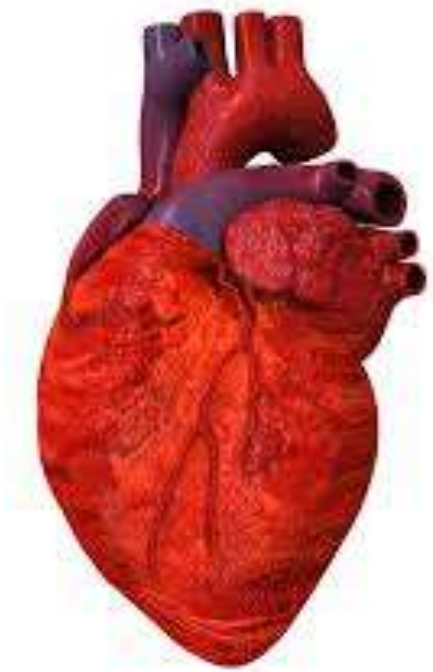
15. Describe the process that causes a muscle to contract



Muscle Contraction

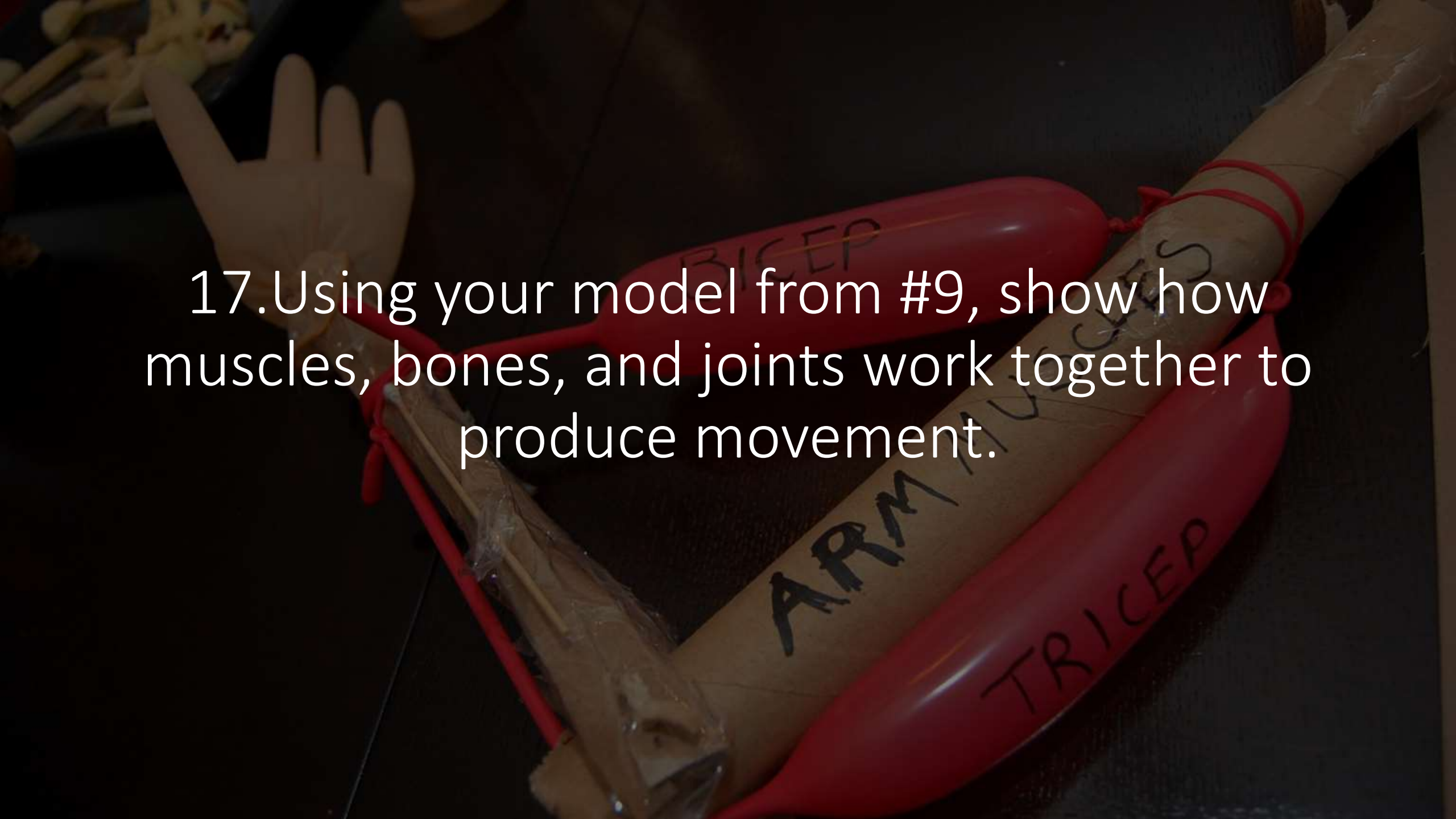
- Watch this video after the session and make notes on your worksheet
- The process is quite complex, so take the time to watch the video several times and find any other resources that might be useful (books, articles, pictures)
- Link to video

16. Voluntary & involuntary muscles

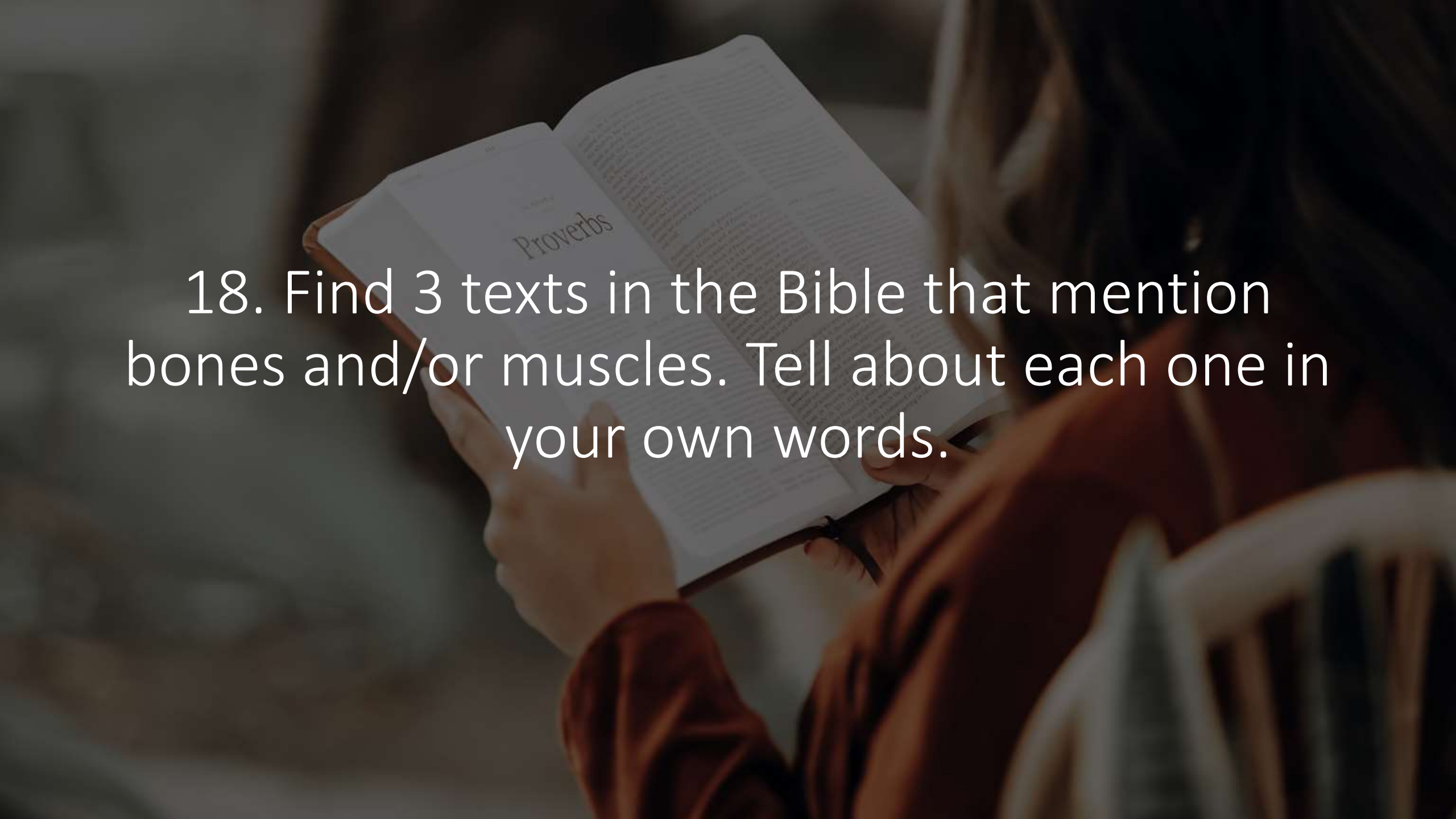


Voluntary v Involuntary Muscles

	Voluntary Muscles	Involuntary Muscles
Anatomy	Attached to the skeletal frame	Most are organs
Control	Generally under the control of the person to whom they belong	Controlled by the autonomic system without the conscious control of the individual
Examples	Arms Legs	Heart Digestive system



17.Using your model from #9, show how muscles, bones, and joints work together to produce movement.



18. Find 3 texts in the Bible that mention bones and/or muscles. Tell about each one in your own words.


Questions