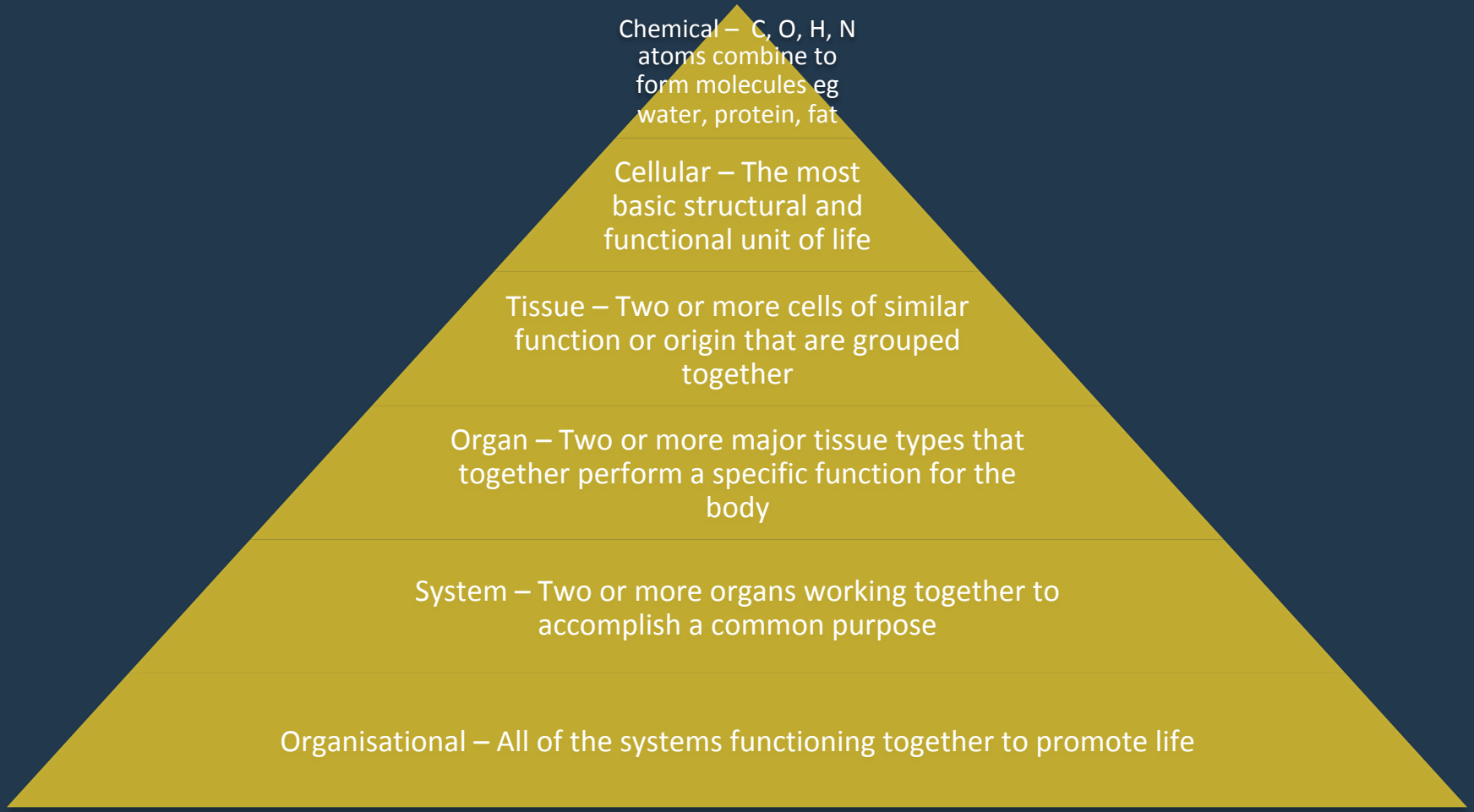
Fit4Training

Sports Massage

Anatomy and Physiology

Organisation of the human body



Tissue types

Tissue type	Structure			Function
Epithelial tissue	Closely packed cells arranged in 1 or more layers			Covers the body surface, lines most cavities and forms glands
Glandular tissue	Composed of epithelial cells			Secretes bodily fluids such as sebum or hormones such as insulin
Membranes	Lines the interior of various bodily structures			Serous membranes cover organs and line body cavities
				Synovial membranes line freely moveable joint cavities
				Meninges cover the brain and spinal cord
Lymphoid tissue	Bone marrow	White blood cells	Lymphocytes	Functions as part of the immune system to help protect body from infection and foreign bodies
	Thymus (primary lymphoid organ that matures T-cells)	Spleen	Lymph nodes	

Tissue types cont.

Tissue type	Structure		Function
Connective tissue	Bones	Contains protein fibres eg; elastin, collagen, reticular	Binds structures together, provides support and protection, fills spaces and stores fat
	Cartilage		
	Blood		
Nervous tissue	Nerves	See specific slides	Initiates and or conducts nerve impulses
	Brain		
	Spinal Cord		
Muscle tissue	Cardiac	See specific slides	Provides movements
	Smooth		
	Skeletal		

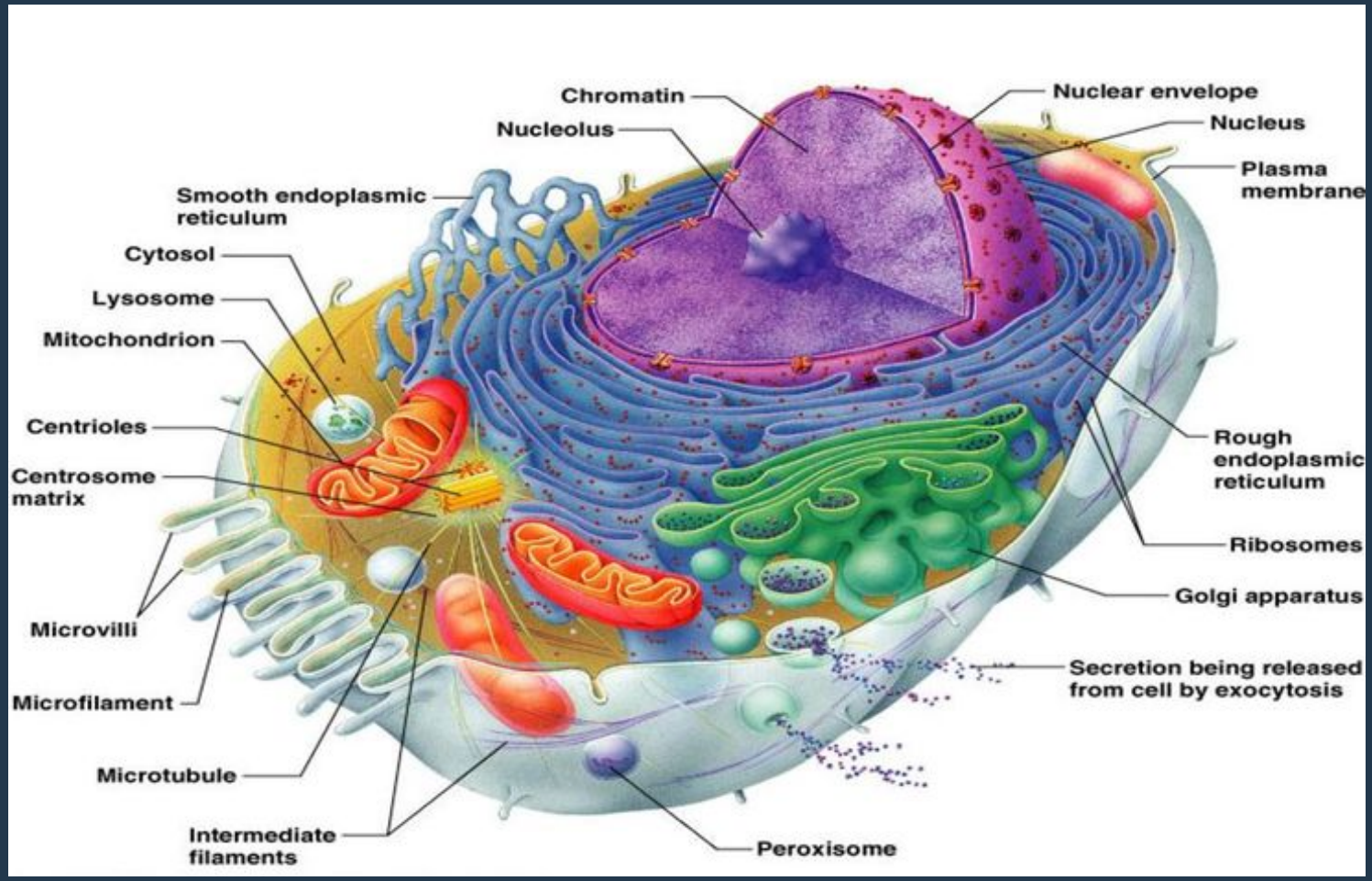
Structure of a human cell

Cellular structure	Functions
Nucleus	Control of the cell Genetic material
Membrane	Seperates the interior of cells from the outside environment
Nucleolus	To make ribosomes
Ribosomes	Combine amino acids to make proteins
Vacuoles	Storage of food, nutrients and cellular waste products
Centrosome	Regulates cell division
Golgi apparatus	Modifies, sorts and packages proteins for secretion
Mitochondria	Energy conversion / production of ATP

Structure of a human cell cont.

Cellular structure	Functions
Lysosomes	Digestions of material taken up from outside of the cell and obsolete components of the cell itself
Vesicles	Transportation of materials into, out of, or within the cell
Cytoplasm	Fluid that fills a cell
Endoplasmic reticulum	Provides a surface area for chemical reactions and permits transport of cellular materials – produces proteins and lipids

Structure of a human cell cont.



The Skeletal System

Storage

- Calcium and other key minerals

Production

- Blood cells, platelets (within marrow)

Shape/structure

- Provides a framework

Protection

- Eg, Cranium, vertebra, ribs

Movement

- Attachment site for muscles
- Long levers for locomotion

Bone growth – key words

Osteoblast

- Cell that builds bone tissue

Osteoclast

- Cell that resorbs bone in order to give it correct shape

Osteocyte

- Mature bone cell

Ossification

- The process of creating new bone

Bone growth

- Occurs at the epiphyseal growth plates
- Influence of growth hormones together with availability of calcium and Vitamin D triggers osteoblasts to transform the cartilage/ fibrous tissue found at growth plate into osteocytes
- More cartilage is then added to the proximal end of the growth plate and the process repeats itself until the end of adolescence

Bone repair

1. Damage to periosteum triggers osteoblast activity
2. Osteoblasts migrate to the blood clot found at the injury site
3. The blood clot calcifies via ossification and begins to turn into bone
4. As the clot is bigger than the original bone, osteoclasts are released to remodel the bone before cells reach full maturity

Bone tissue types

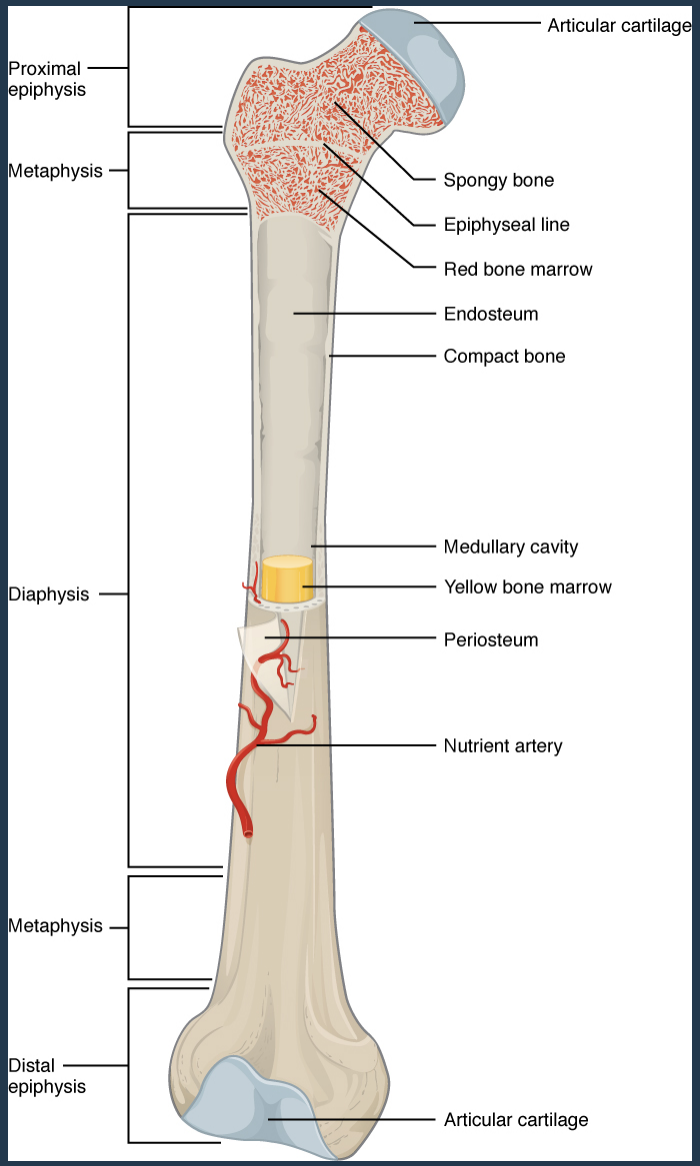
Compact bone tissue

- Closely packed network of bone cells
- Forms the hard exterior
- Adds strength

Cancellous bone tissue

- Fills the interior/cavity of bones
- Arranged in a honeycomb ‘latticework’
- Help to minimise weight and allow space for blood vessels and bone marrow

Structure of a long bone



Diaphysis
- Shaft of the bone

Epiphysis
- The heads of the bone

Articular cartilage (hyaline)
- Protects ends of bone

Epiphyseal growth plate
- Site of bone growth

Medullary cavity
- Cavity where bone marrow can produce blood cells

Periosteum
- Outer membrane surrounding bone except for ends

Bone classification

Long

- Eg; femur, humerus, tibia
- Tubular shaft usually with an epiphyseal growth plate and hyaline (articular) cartilage found at the ends

Short

- Eg; carpals, tarsals
- Cuboidal in shape

Flat

- Eg; scapula, sternum, cranium, pelvis
- Thin layers of compact bone with a thin layer of cancellous bone between

Irregular

- Eg; vertebra

Sesamoid

- Eg; patella, scaphoid, navicular

Divisions of the skeleton

Axial Skeleton (80 bones)

- Lies on the long axis or midline of the body and includes the skull, vertebrae, sternum and rib
- This part of the skeleton provides protection

Appendicular Skeleton (126 bones)

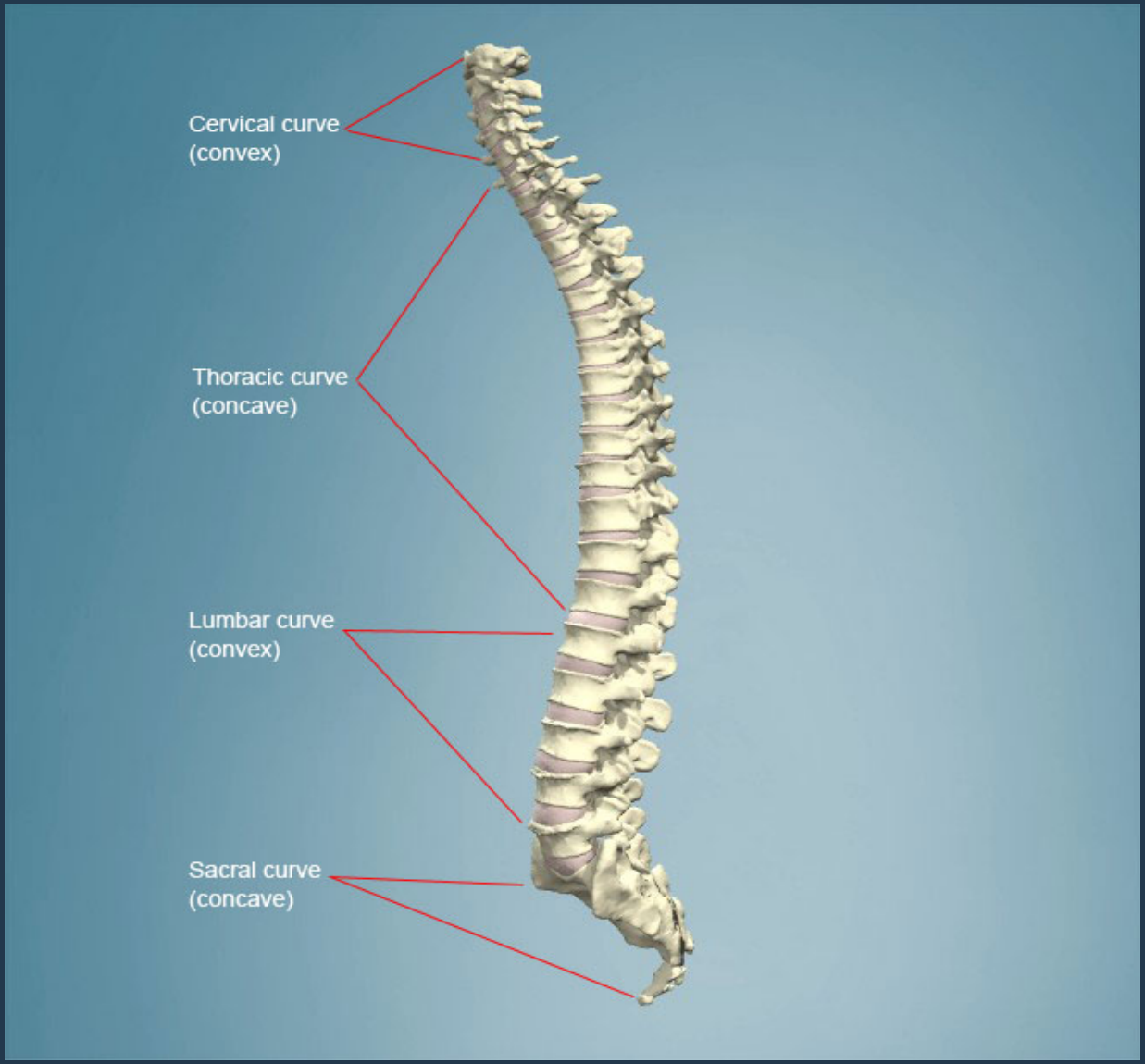
- Includes bones of the shoulder girdle, arms and hands and the pelvic girdle, legs and feet
- This part of the skeleton provides movement


Clavicle
Sternum
Humerus
Ilium
Sacrum
Ischium
Pubis
Patella
Tibia
Tarsals
Metatarsal
Phalanges
Cranium
Scapula
Cervical vertebrae
Ribs
Thoracic vertebrae
Radius
Ulna
Carpals
Lumbar vertabrae
Metacarpals
Phalanges
Coccyx
Femur
Fibula

Axial skeleton

Appendicular skeleton

Vertebral column



There are 33 individual bones in total:

7 Cervical vertebrae

- 1st is called the ATLAS which supports the skull and forms a pivot with the AXIS (2nd cervical vertebrae)

12 Thoracic vertebrae

- Form joints with the ribs to form the ribcage

5 Lumbar vertebrae

- The largest and strongest vertebrae

5 Sacral

- Fused to form the sacrum

4 Coccygeal

- Fused to form the coccyx

All the vertebrae join to one another to form a flexible column that:

- Supports the trunk and head
- Encloses and protects the spinal cord

In between each vertebrae there are intervertebral discs (fibrous cartilage) which act as shock absorbers between each of the vertebrae

Curves of the spine

4 ‘natural’ curves named after the vertebrae that form them:

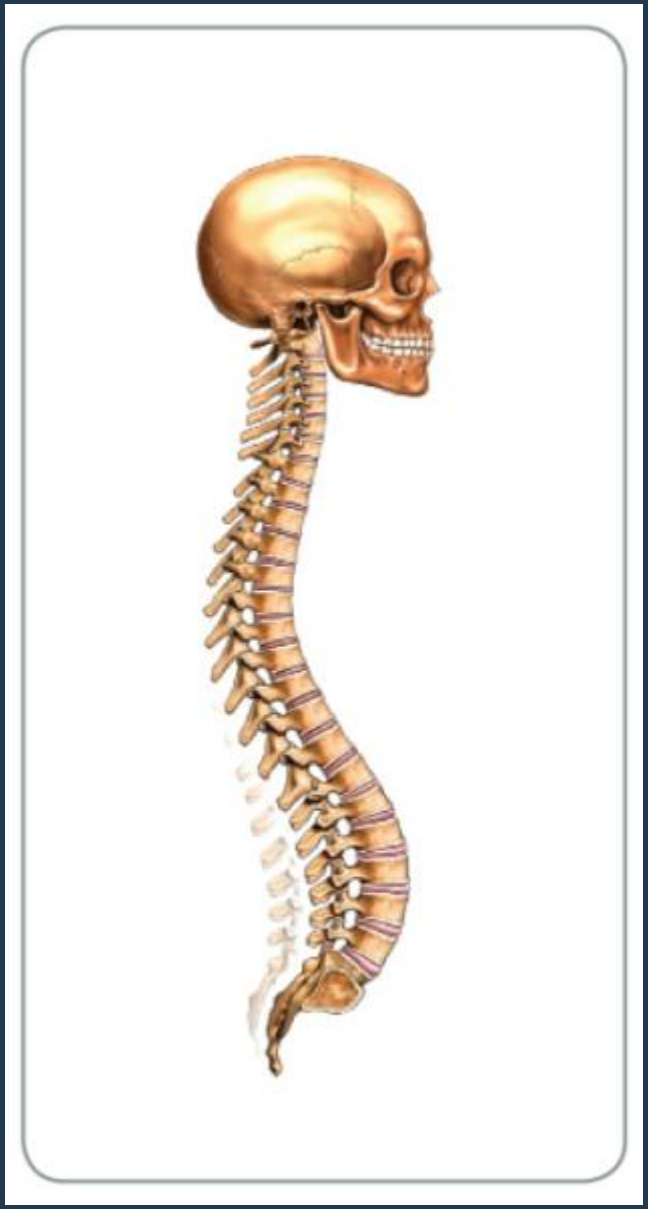
- Cervical
- Thoracic
- Lumbar
- Sacral

These curves centre the head above the body and make walking and maintaining an upright posture more easy

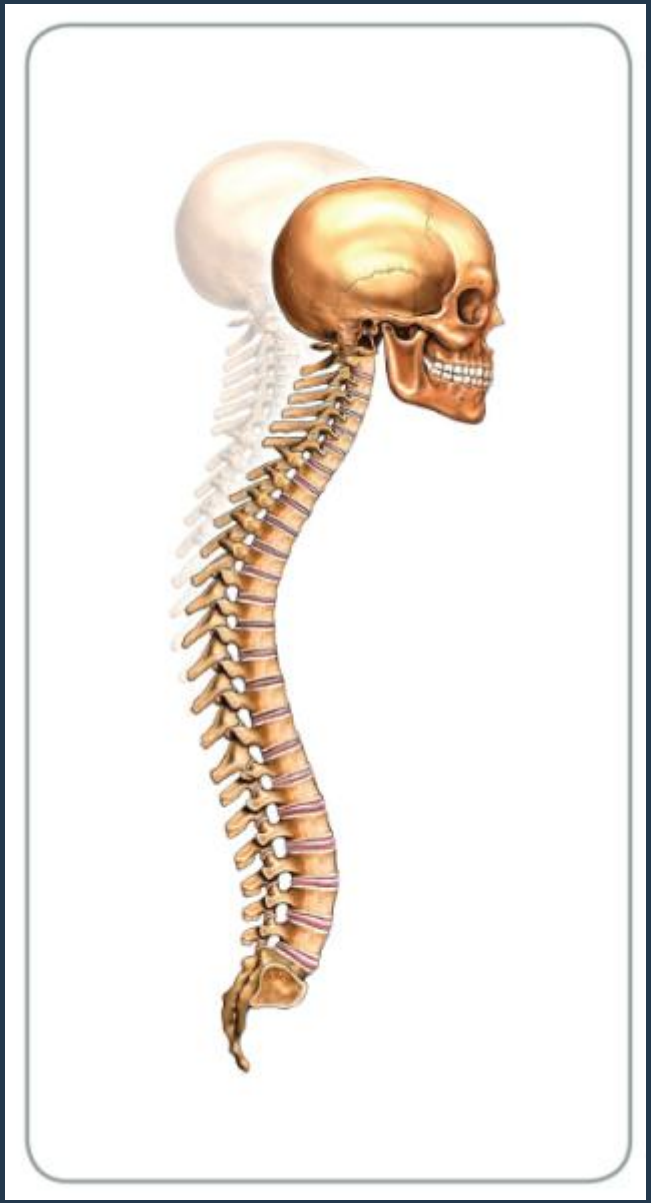
Genetic and lifestyle factors can cause curvature of the spinal to become exaggerated or excessive which gives a distorted appearance to an individuals posture

- Fashion
- Work/school
- Emotional state
- Sport
- Hereditary
- Injuries
- Age
- Pregnancy
- Disability
- Obesity

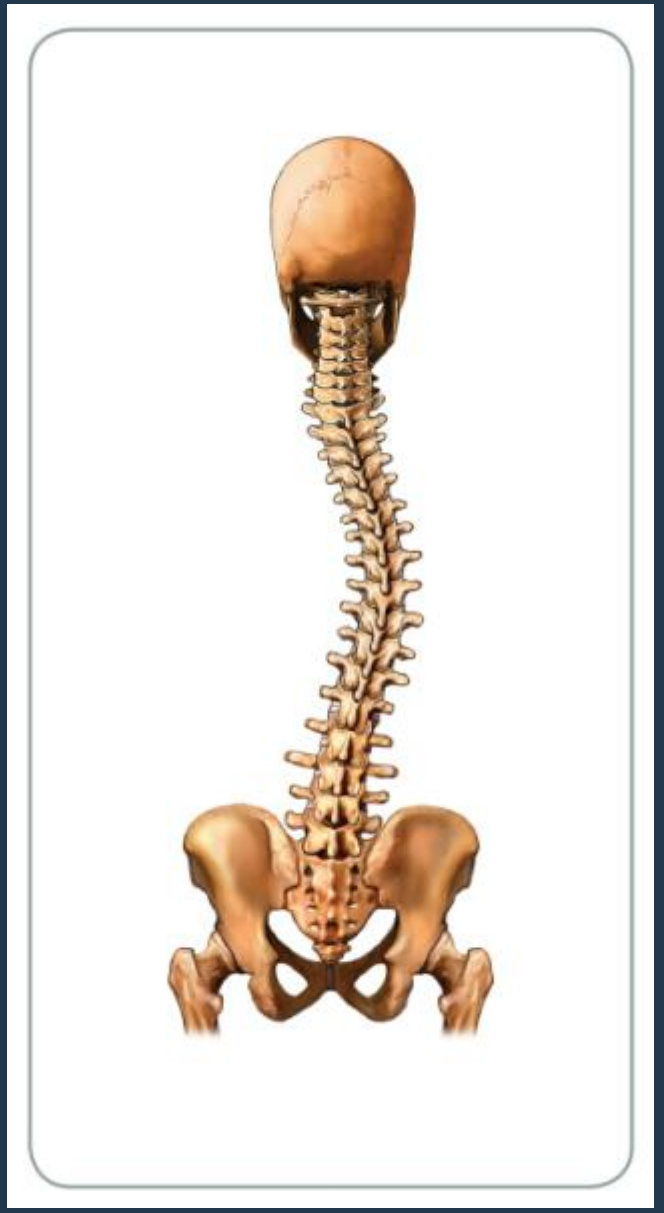
Lordosis



Kyphosis



Scoliosis



The shoulder girdle

- The shoulder, or pectoral, girdle is composed of a double set of two bones on each side of the body.
- The clavicles are slender and doubly curved long bones that run horizontally across the upper chest and can be felt just below the neck.
- Each clavicle articulates at the top of the shoulder with the acromion process of the scapula (acromioclavicular joint or AC joint) in a gliding synovial joint and with the top end of the sternum (the sternoclavicular joint) at the shoulder's front.

Scapula

Shoulder Girdle

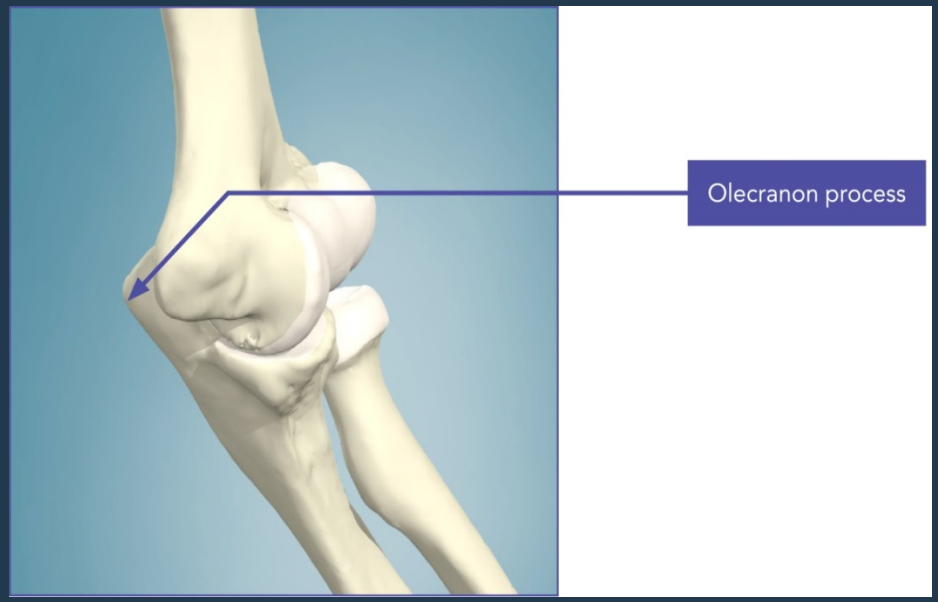
AC Joint

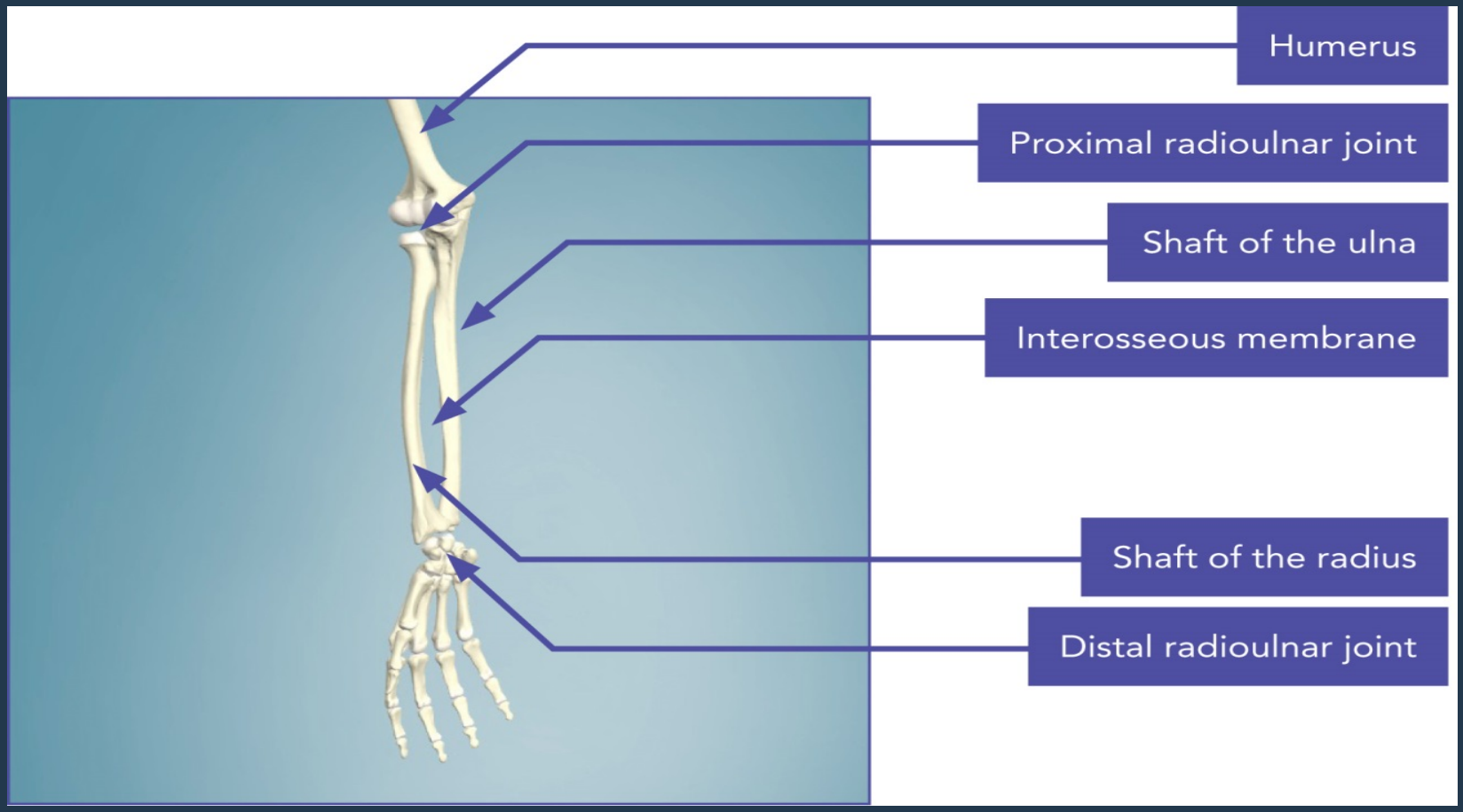
The upper arm and shoulder joint

- The only bone in the upper arm is the humerus.
- It fits into the glenoid cavity of the shoulder girdle.
- The shoulder joint is quite shallow, giving a large range of movement
- The stability of the shoulder joint comes primarily from a small group of muscles called the rotator cuff.

The lower arm elbow and wrist

- There are two long bones in the lower arm – the radius and the ulna.
- The ulna is slightly longer than the radius and has a much more prominent proximal head called the olecranon process that can be felt at the elbow joint.




Humerus
Proximal radioulnar joint
Shaft of the ulna
Interosseous membrane
Shaft of the radius
Distal radioulnar joint

The lower arm elbow and wrist

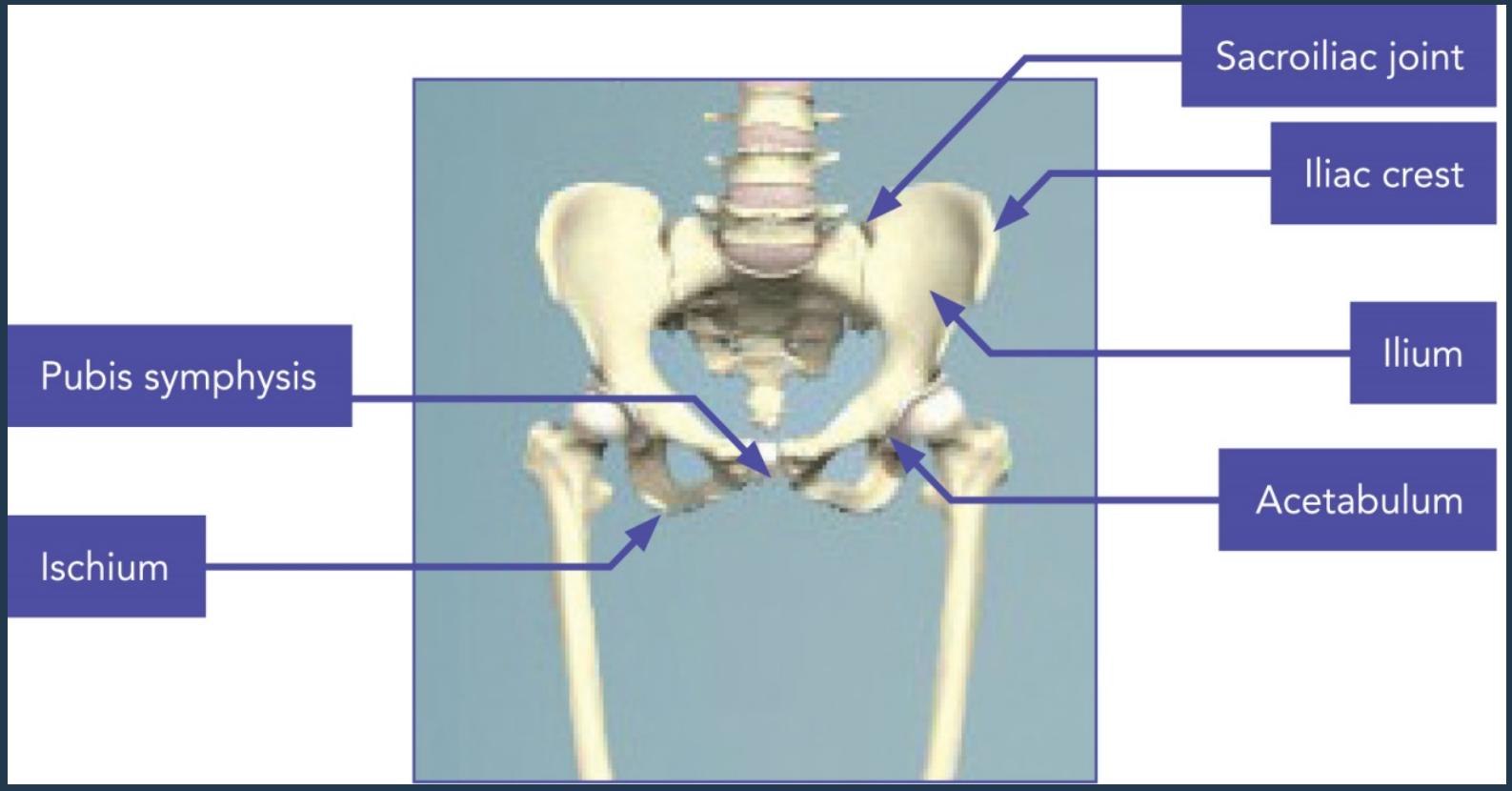
- The radius and the ulna are connected to each other by a synovial pivot joint, both at their proximal and distal ends, called the radioulnar joints.
- In contrast, it is the radius that is far more prominent at the wrist.

The wrist and hand

- The hand is composed of 27 small bones. The true wrist is composed of eight cuboid bones, the carpals, which form gliding synovial joints, giving a large degree of flexibility to the whole hand.
- The carpals are roughly arranged in two rows and the two biggest bones of the first row form the synovial joint with the radius. The second row articulates with the five metacarpals that radiate out to form the palm.
- The four fingers (or phalanges) are composed of three bony segments, articulating with each other via synovial hinge joints.
- The thumb, however, has only two segments. The articulation between the thumb and the first metacarpal is a synovial saddle joint

The pelvic girdle

The pelvic girdle transmits the whole weight of the upper body down through the legs to the ground. It also plays a major role in ensuring the correct alignment of the spine (the neutral spine position). Unlike the pectoral girdle, it needs to be strong, stable and resistant to large ranges of movement. It is composed of two bones on each side. These bones are themselves made from three separate bones: the ilium, ischium and pubic bones, which fuse together indistinguishably, in adulthood.


Sacroiliac joint
Iliac crest
Ilium
Acetabulum
Pubis symphysis
Ischium

- The pubic bones are joined together anteriorly by a cartilaginous disc, the pubis symphysis, which completes the pelvic bowl. This pad of cartilage between the two joint surfaces plays an important role in the stability of the pelvis. Stability is also dependent on ligaments, which are affected by the correct alignment of the Sacroiliac (SI) joints. The pubis symphysis has a normal separation of 3–4mm, which can increase up to as much as 9mm in pregnancy due to the hormone relaxin.
- The effect of relaxin on the SI joints and pubis symphysis often leads them to become a source of discomfort. Any movement or pain is often diagnosed as pubis symphysis disorder (PSD). However, extreme separation is called diastasis symphysis pubis and needs to be specifically diagnosed by a medical practitioner. The general term given to pain in either area is pelvic girdle pain (PGP).

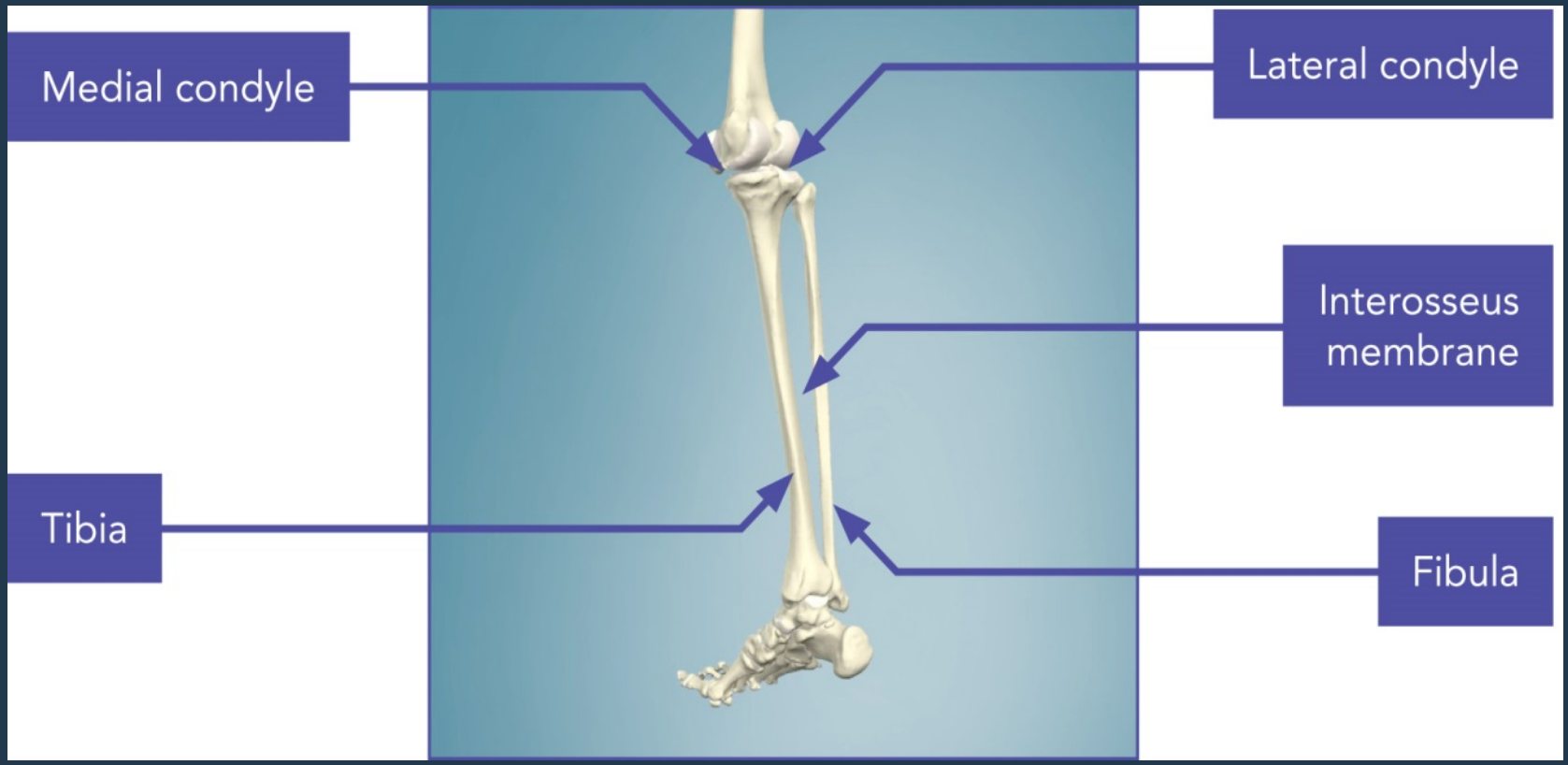
Male

Female

The knee joint and lower leg

- The larger of the two bones (second largest in the body) is the tibia. Its size reflects its role in weight transmission of the upper body from the femur down through the foot.
- The fibula is far weaker. It is completely non-weight-bearing and appears stick-like. However, it does have a role in bracing the tibia and giving the lower leg a stout, rectangular profile rather than a curved cylinder, thus improving its strength.
- The fibula also provides attachment points for muscles.

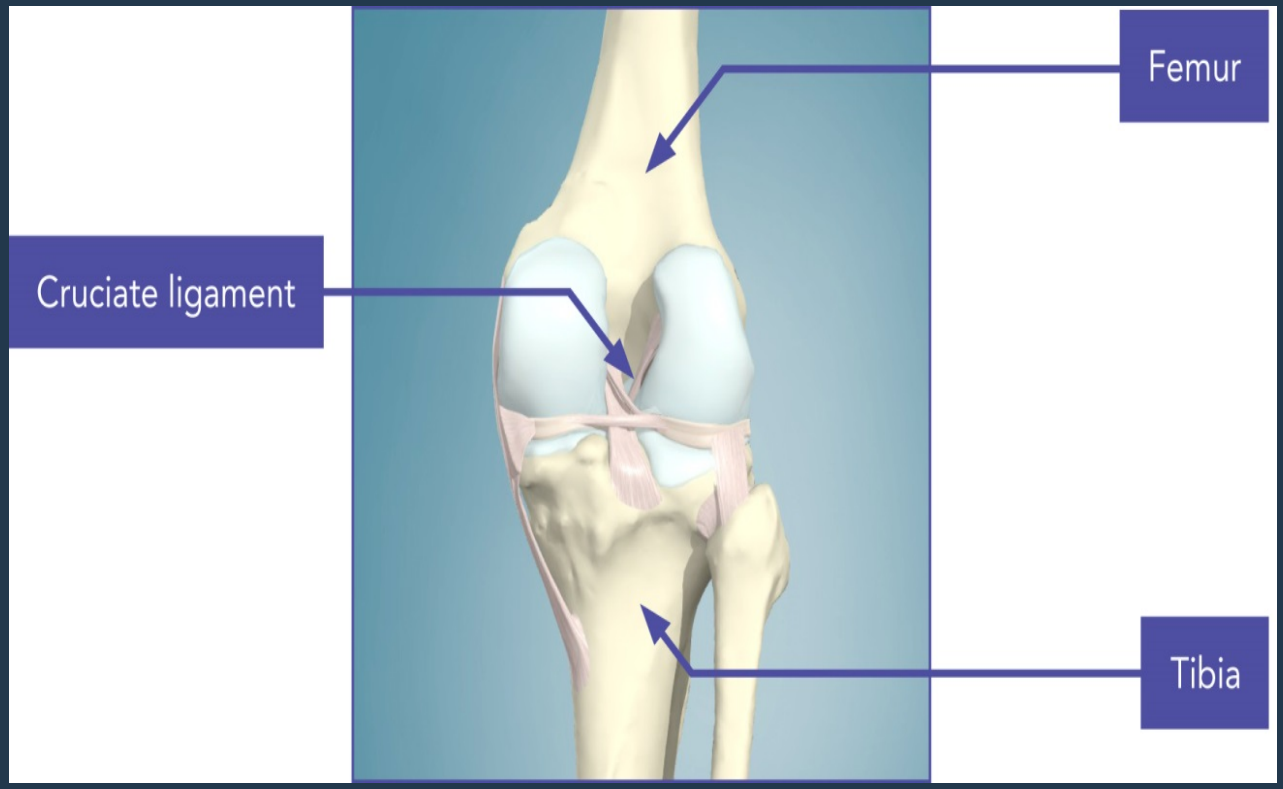
The lower leg



The Knee

- The tibia alone articulates with the femur at the knee and it has large smooth depression that accepts the femoral condyles to form the knee joint – the most complex joint in the body
- It is a hinge joint allowing movements of flexion and extension in the sagittal plane
- The synovial joint cavity has many pouch-like projections called bursa. These bursae help to prevent friction between bone and a ligament or tendon and between the skin and the patella
- The articular cartilage is reinforced with lateral and medial cartilaginous C-shaped wedges called menisci. The menisci help to stabilise the joint by preventing lateral displacement of the bones

The knee



The knee

- The joint is held together internally by two sets of cruciate ligaments at both the front and back of the joint (forming a cross).
- The cruciate ligaments help to add further stability to the knee joint.
- The patella (not shown in the image), a sesamoid shaped bone that has developed inside the tendon of one of the main thigh muscles, crosses the front of the joint and protects the knee.
- It is held in place by strong ligaments that ensure smooth tracking over the surface of the knee joint during movement.
- The patellar ligament is technically an extension of the muscle tendon.

The ankle joint and foot

The foot follows the same principles as the hand. The tarsal bones – like the carpals of the hand – are roughly cuboid and articulate with each other via gliding synovial joints. There are seven tarsals, but the two largest ones, nearest to the lower leg, mainly carry body weight. These are:

- the talus bone that articulates with the tibia and fibula
- the large calcaneus, or heel bone, on which the talus sits

The ankle joint and foot

The ankle joint and foot

- The synovial joint between the talus and the tibia and fibula is a pure hinge joint: its movement is restricted to plantar and dorsiflexion in the sagittal plane.
- It is the gliding joints between the talus (subtalar joint), the calcaneus and all of the other tarsal bones that give the whole foot the flexibility to walk or run on uneven surfaces by allowing inversion and eversion movement.
- The metatarsals are five bony cylinders.
- The first and fifth metatarsals make contact with the ground and are strong weight bearers. The remaining three, however, form a transverse arch and are susceptible to fracture.
- The phalanges complete the pattern. Again like the fingers, they have three segments (apart from the big toe, which has two), but they are much smaller than in the fingers and therefore do not exhibit the same range of movement.

The skin's structure

Dermis

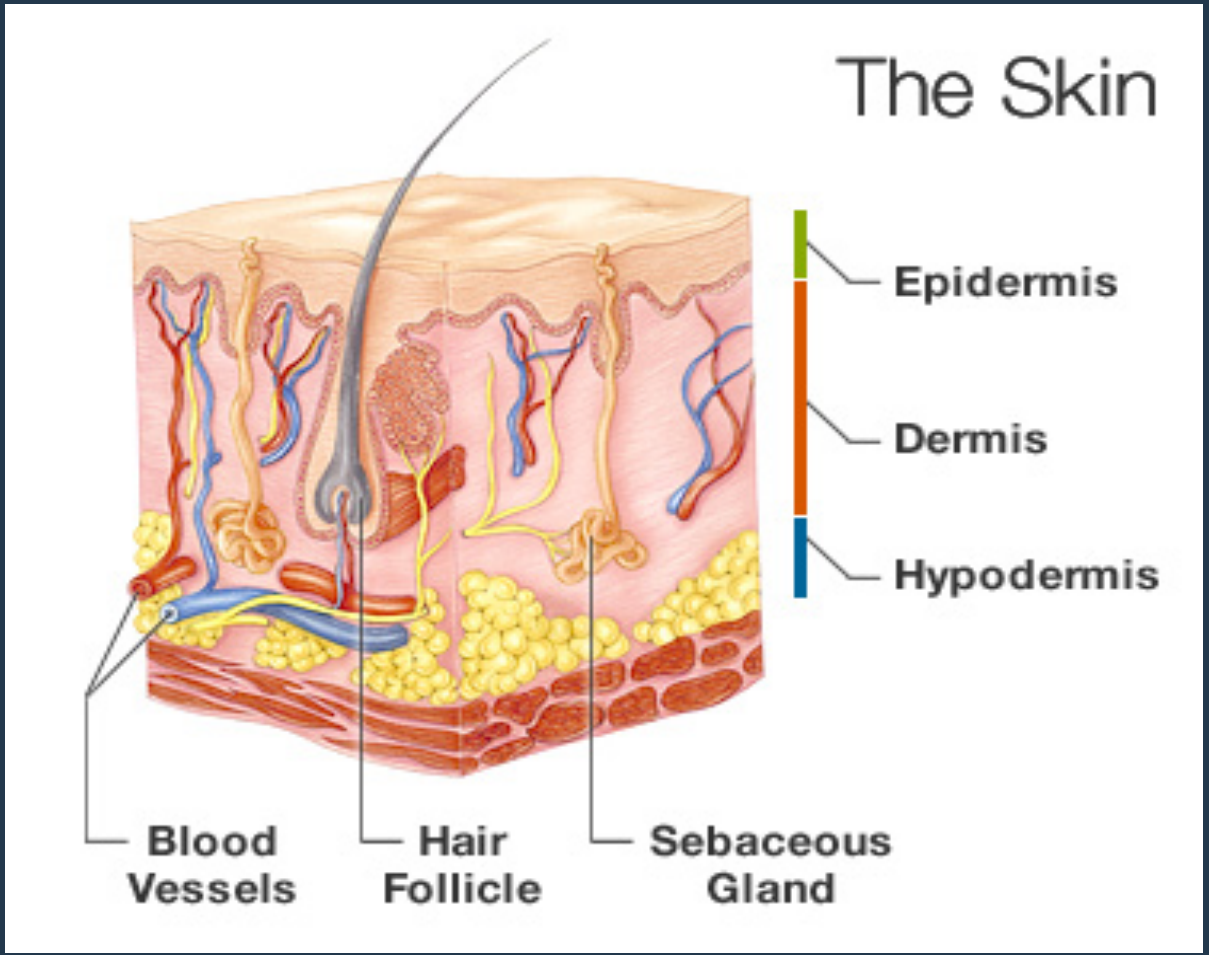
- Much thicker than epidermis
- Formed of collagen fibres, connective tissue and elastin
- Contains structures such as; hair follicles, sweat and sebaceous glands, fat cells, nerves, blood and lymphatic vessels

The skin's structure cont.

Epidermis

- 5 layers (horny, clear, granular, prickle cell, basal)
- Makes up the outer layer of skin and protects the dermis
- Contains no blood or lymphatic vessels
- Pierced by hairs (which allow sebum to reach the surface of the skin) and sweat ducts
- Production of skin cells begins in the deepest layer, pushing the cells up towards the surface; as the cells move away from the base layers they die and fill with the protein keratin, causing the cells to toughen as they reach the surface

The skin's structure cont.



Functions of the skin

- Protection form infection and injury
- Regulation of temperature due to sweat glands and vasodilation/constriction of blood vessels
- Excretion of sweat (99% water 1% salt)
- Sensation (temperature, pressure, touch and pain)
- Secretion of sebum to lubricate the skin and protect it by making it acidic
- Formation of chemicals including vitamin D and melanin

Joints

Synovial joint	Type	Movement available
Shoulder joint (humerus/ scapula)	Ball and socket	Flexion, extension, horizontal flexion, horizontal extension, adduction, abduction, medial rotation, lateral rotation
Shoulder girdle (sternum/ clavicle/scapula	Gliding	Elevation, depression, protraction, retraction
Elbow (humerus/ulna)	Hinge	Flexion, extension
Elbow (radius/ulna	Pivot	Pronation, supination
Wrist (carpals)	Condyloid	Flexion, extension, abduction, adduction
Thumb	Saddle	Flexion, extension, abduction, adduction

Joints cont.

Synovial joint	Type	Movement available
Fingers (phalanges)	Hinge	Flexion, extension
Hip (pelvis/femur)	Ball and socket	Flexion, extension, horizontal flexion, horizontal extension, abduction, adduction, medial rotation, lateral rotation
Knee (femur/tibia)	Modified hinge	Flexion extension, slight rotation when flexed
Ankle (tibia/talus)	Hinge	Flexion, extension
Ankle (talus/calcaneus)	Condyloid	Inversion, eversion
Toes (phalanges)	Hinge	Flexion, extension

Joint categories

Fibrous
- Immovable
- Held together by a thin layer of strong connective tissue
- No movement between bones
- Eg; skull, pelvis

Cartilaginous
- Slightly moveable
- Bones attached to each other by fibrocartilage, or fibro-cartilaginous discs
- Limited degree of movement between bones
- Eg; between vertebra, pubis symphysis

Synovial
- Freely moveable
- Allow a free range of movement between articulating surfaces
- Types include;
  - Gliding
  - Hinge
  - Pivot
  - Ball and socket
  - Saddle
  - Condyloid

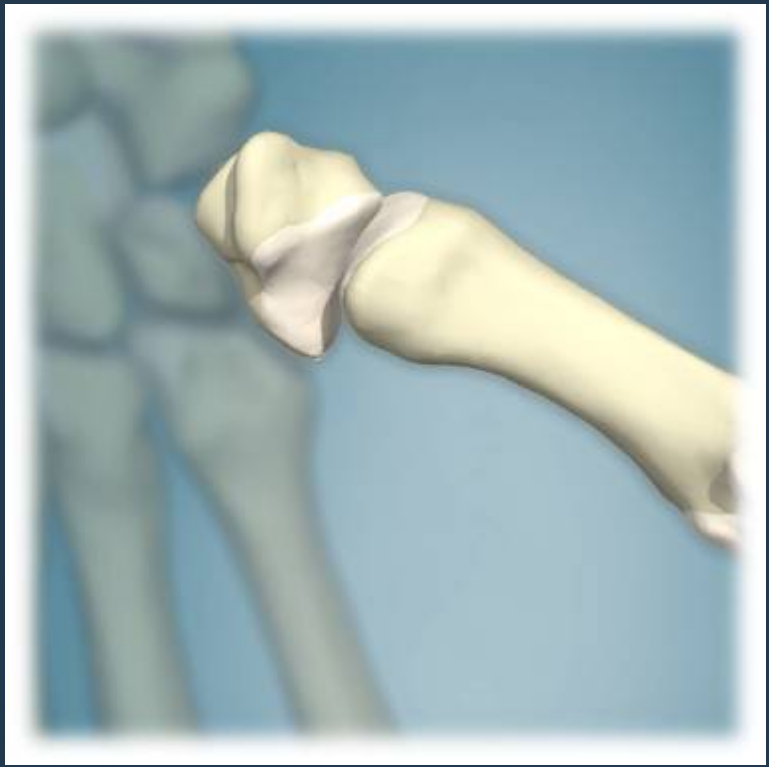
Gliding Joint

Hinge Joint

Pivot Joint

Ball and Socket Joint

Saddle Joint



Condyloid Joint

Synovial Joints – Structure

Articular cartilage

- Lines the ends of bone for smooth movement
- Shock absorption

Joint capsule

- Sleeve-like fibrous capsule that encloses the joint cavity

Synovial membrane

- Secretes synovial fluid into the joint in response to movement

Synovial fluid

- Lubricates the joint

Synovial Joints – Structure

Bones

- Reciprocally shaped so that they fit together

Bursae

- Fluid filled sacs with an inner capillary layer of viscous fluid
- Located between bones and tendons/muscles around a joint

Reduce friction

Ligaments

- Links bone to bone and adds stability

Tendons

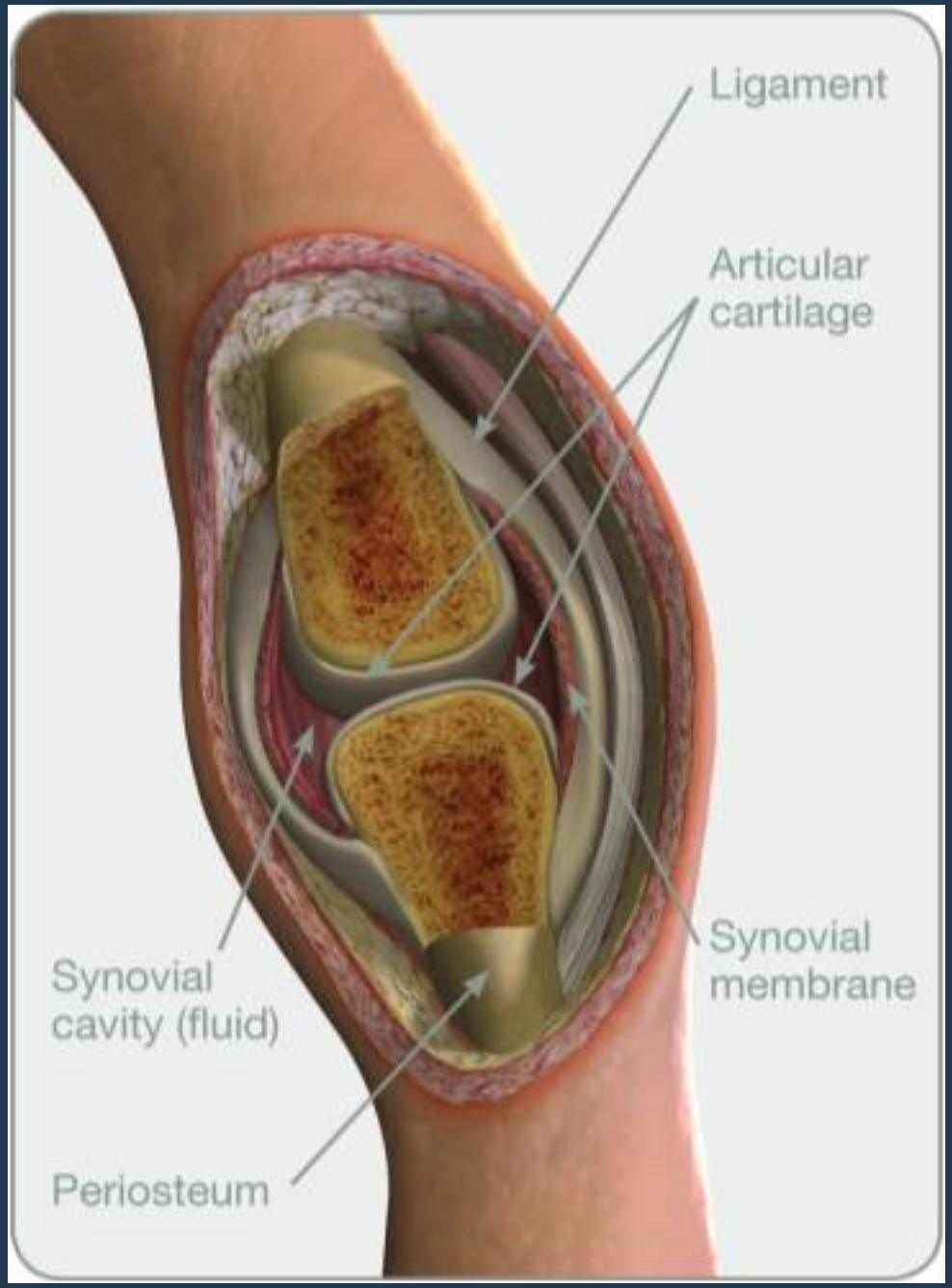
- Tendons attach muscle to bone

Synovial fluid

- Lubricates the joint

Synovial membrane

- Keeps the synovial fluid contained


Ligament
Articular cartilage
Synovial cavity (fluid)
Synovial membrane
Periosteum

Joint movements

Flexion – Reduction of joint angle

Extension – Increasing of joint angle

Abduction – Taking limb away from the midline

Adduction – Bringing limb in toward midline

Rotation – Rotating around a fixed axis

Circumduction – Taking a ball and socket joint through its fullest ranges of motion

Horizontal flexion – Reduction of joint angle in a horizontal plane (Eg, taking arms forwards)

Horizontal extension – Increasing of joint angle in a horizontal plane (Eg, lifting knee and taking leg to the side

Elevation – Lifting up of shoulder girdle

Depression – Drawing down of shoulder girdle

Joint movements

Lateral extension/flexion – Flexion/extension of spine to the side

Dorsi flexion – Lifting foot up

Plantar flexion – Pushing foot downward

Protraction – Pushing shoulders forward

Retraction – Squeezing shoulders backward

Lateral (external) rotation – Rotating around a fixed axis away from the midline

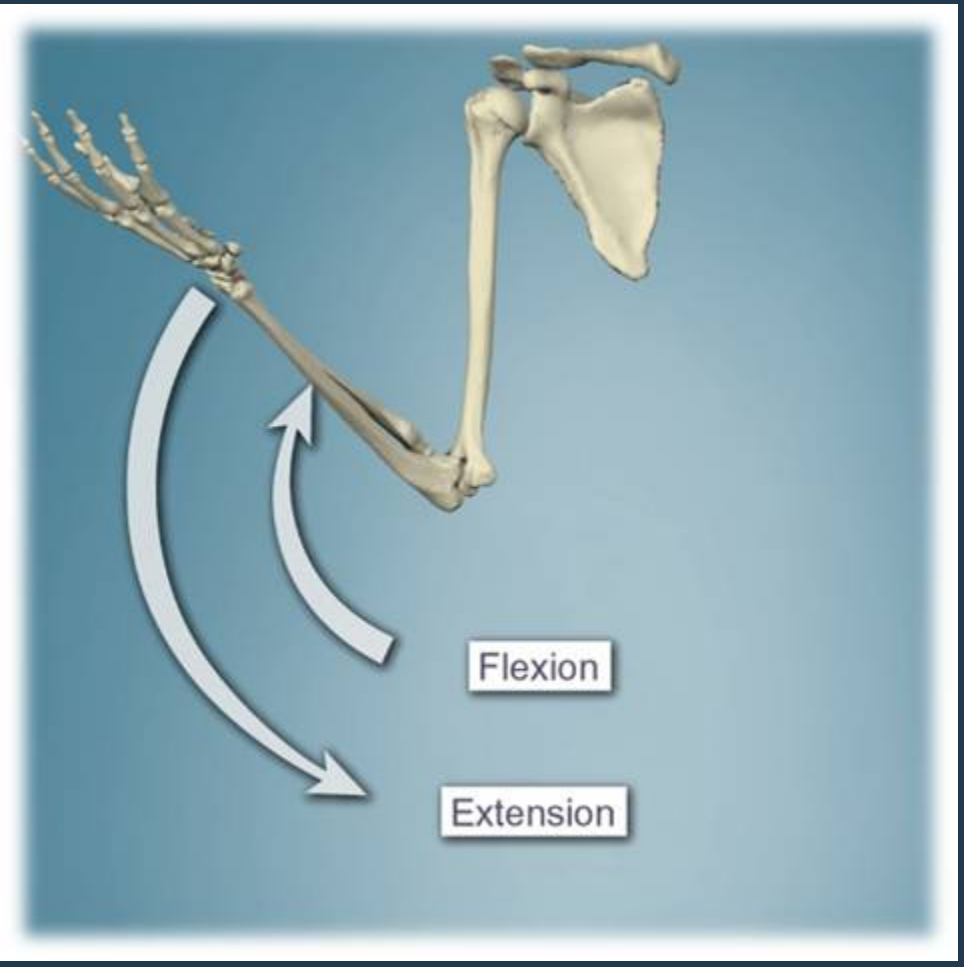
Internal rotation – rotating around a fixed axis toward the midline

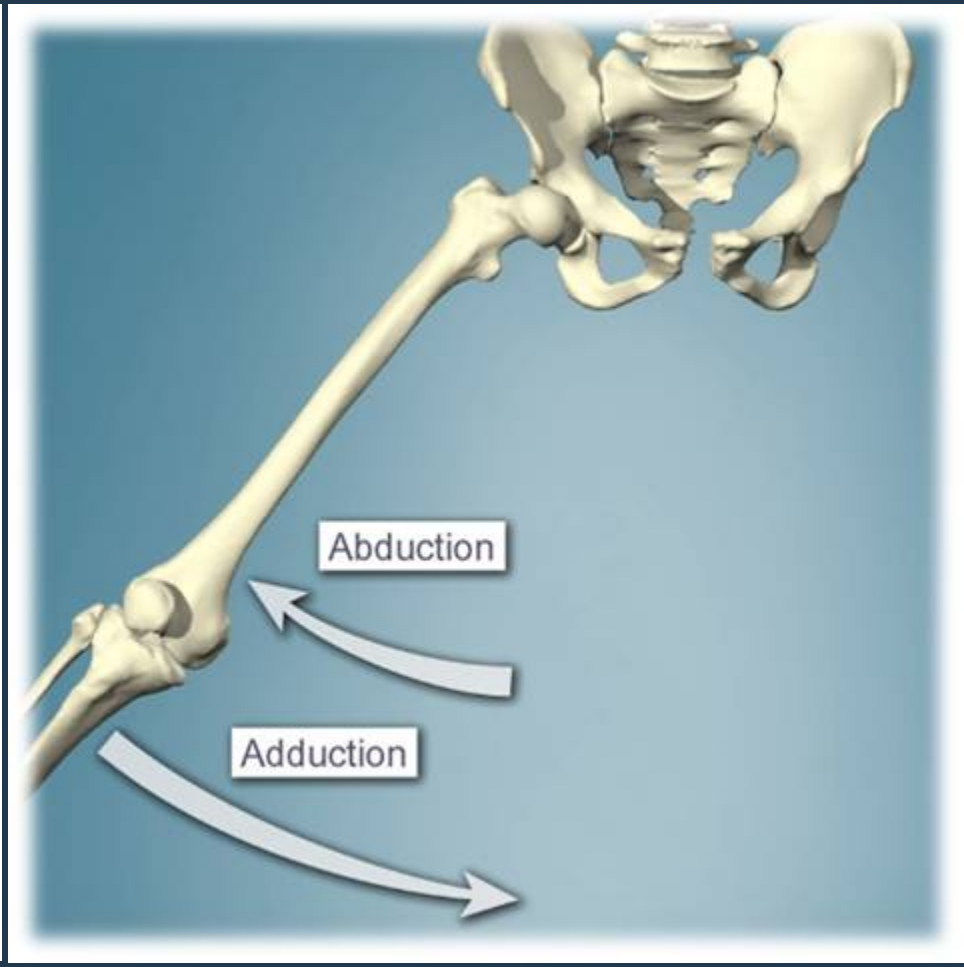
Supination – Palms facing up

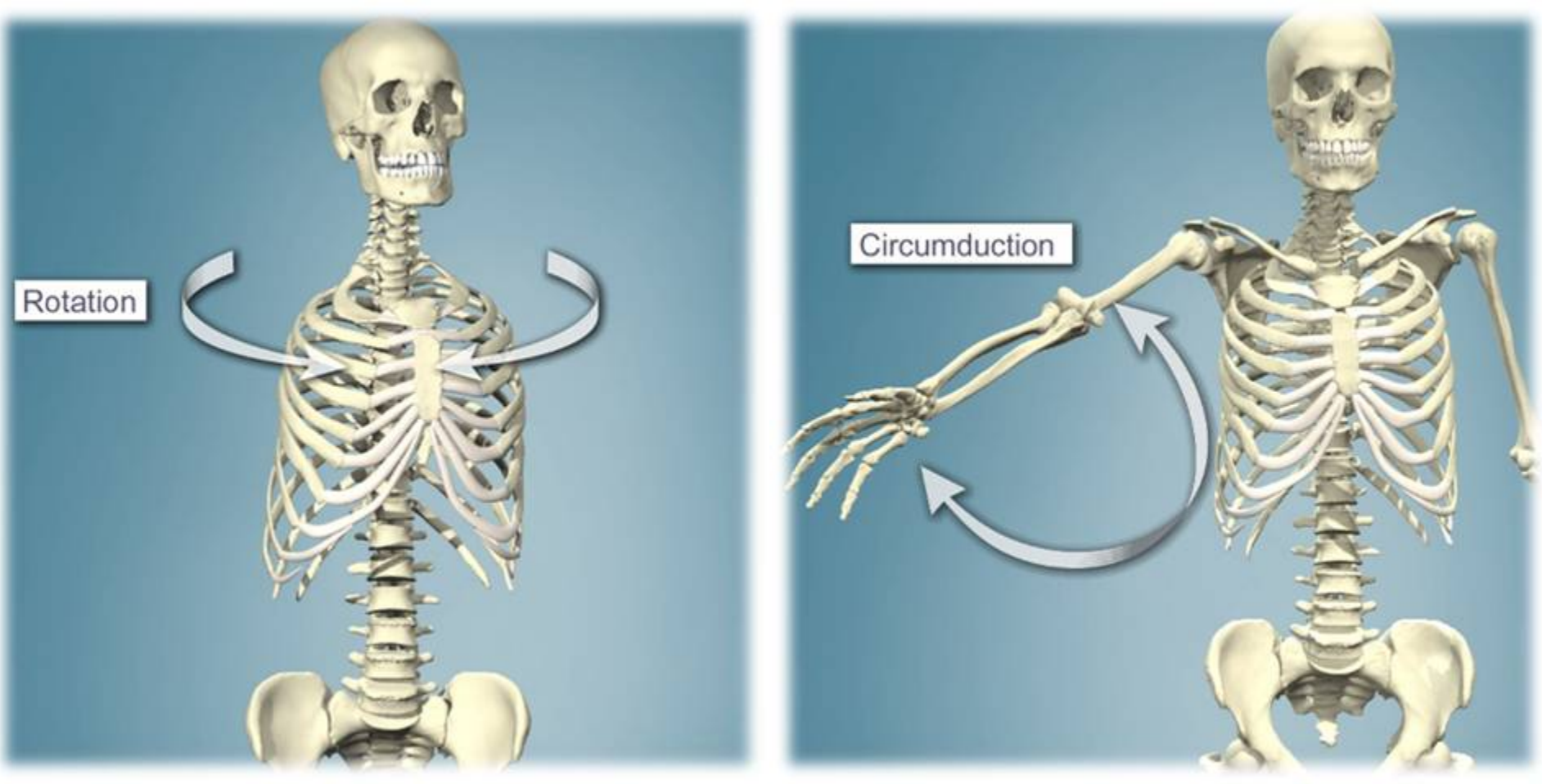
Pronation – Palms facing down

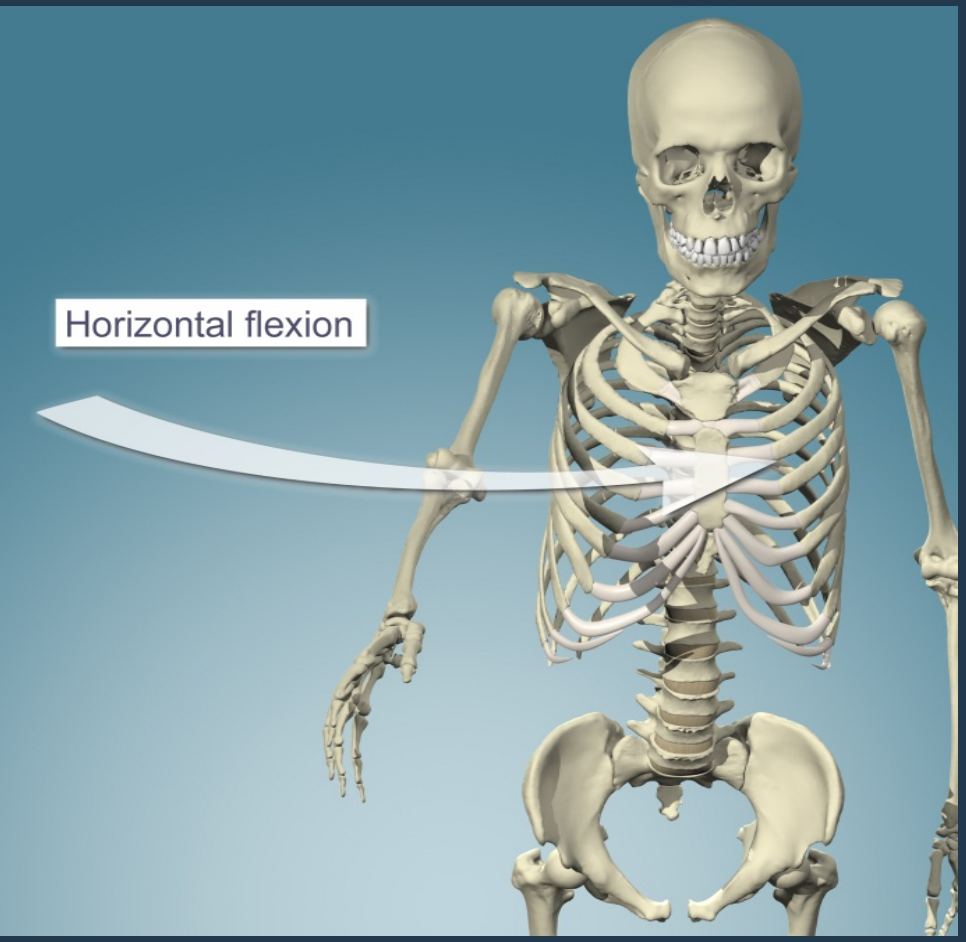
Inversion – Soles of feet up towards the midline

Eversion – Soles of feet down toward the midline


Flexion
Extension

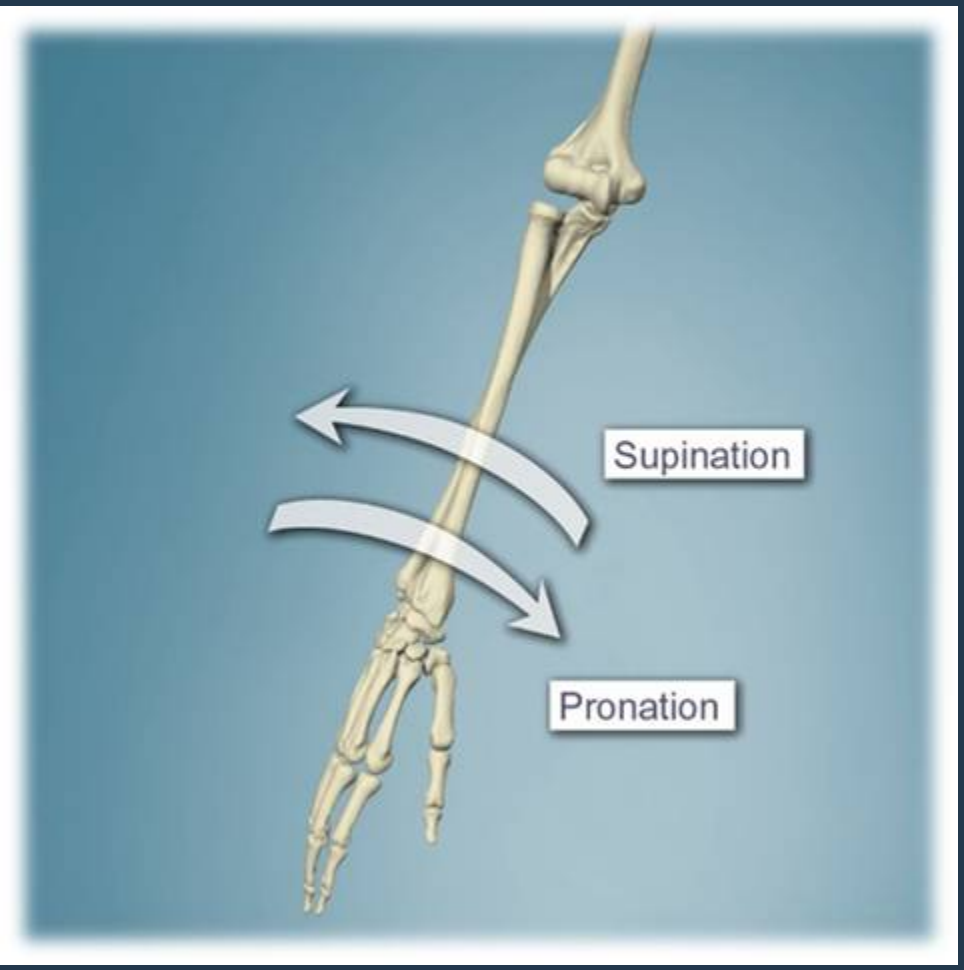

Abduction
Adduction


Rotation
Circumduction

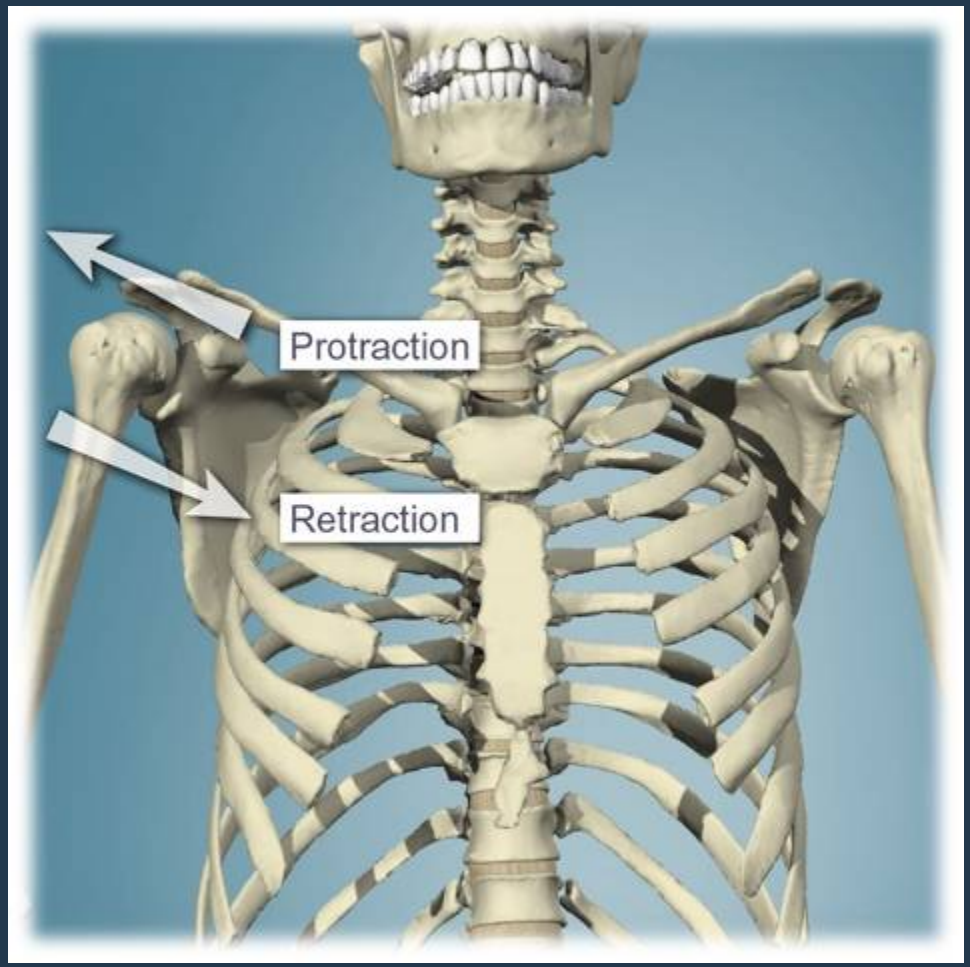

Horizontal flexion


Horizontal extension


Elevation
Depression
Lateral flexion


Supination
Pronation


Dorsiflexion
Plantar flexion


Protraction
Retraction

Anatomical terms

Anterior – Front facing
Posterior – Rear facing
Superior – Above
Inferior – Below
Medial – Closest to the midline
Lateral – Away from the midline
Proximal – End closest to the trunk
Distal – End furthest from the trunk
Midline – Vertical line from top to bottom
Sagital – Plane that if moved along, would take you forwards and backwards
Frontal – Plane which if moved along, would take you up and down
Transverse – Plane which if moved across, would rotate you around
Medial lateral axis – Axis passing through body from side to side
Longitudinal axis – Axis passing through body from top to bottom
Anterior posterior axis – Axis passing through body from front to back

Type of muscle tissue

Cardiac muscle tissue

- Located in the walls of the heart (myocardium)
- Appear striated (muscle fibres aligned)
- Involuntary (under unconscious control)

Smooth muscle

- Located in walls of hollow visceral organs
- Appear spindle-shaped
- Involuntary (under unconscious control)
- Contract with a peristaltic ‘wave’ action

Skeletal muscle

- Located in skeletal muscle
- Striated in appearance
- Voluntary (under conscious control)
- Contract by shortening in length

Muscle structure

Epimysium
- Outer sheath protecting muscle

Perimysium
- Sheath protecting bundle of muscle fibres

Bundle of muscle fibres

Endomysium
- Sheath protecting individual muscle fibre

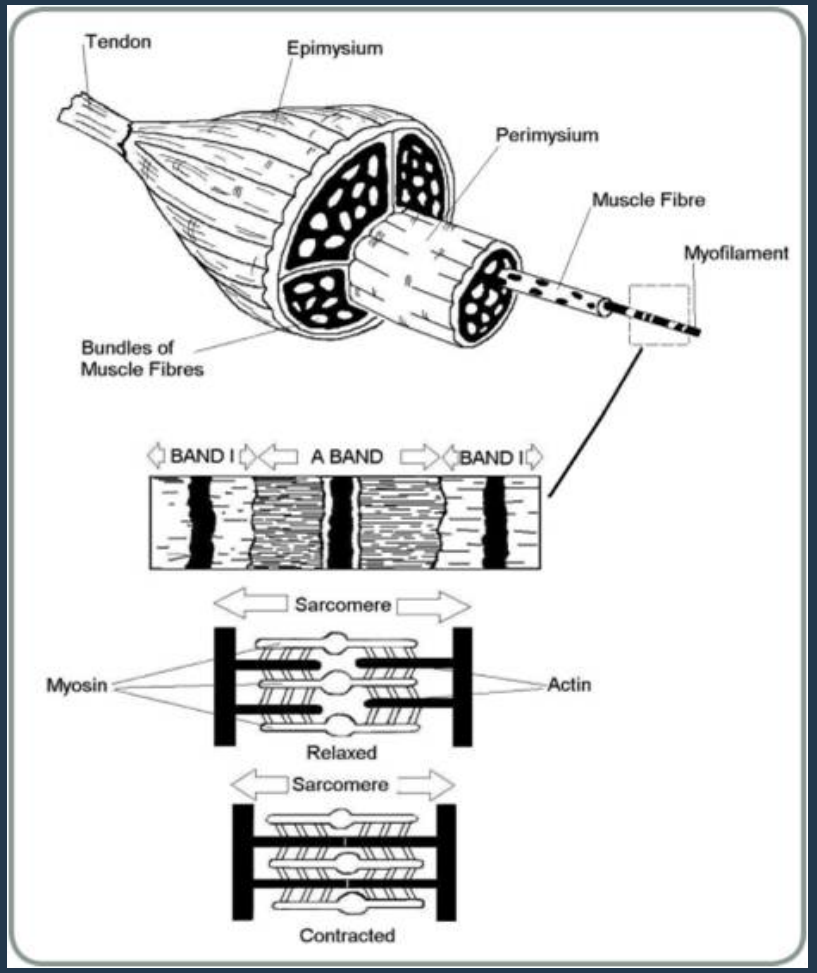
Muscle fibre

Myofibril
- A cylindrical organelle running the length of the muscle fibre

Sarcomere
- The functional unit of the myofibril

Actin
- A thin protein filament

Myosin
- A thick protein filament



Sliding filament theory

1. A nervous impulse arrives at the neuromuscular junction, which causes the release of calcium ions from the sarcoplasmic reticulum
2. Calcium binds to troponin/tropomyosin which then allows myosin to bind with actin (crossbridges are formed)
3. The breakdown of ATP releases energy which enables the myosin to pull the actin inwards, shortening the muscle. This occurs along the entire length of the myofibril in the muscle cell
4. Myosin then detaches from the actin
5. This process can last for as long as there are adequate stores of calcium and ATP
6. Once the nervous impulse stops, the calcium is pumped back into the sarcoplasmic reticulum and the actin returns to its resting position, lengthening the muscle

Muscle actions

Concentric

- Muscle shortens as it contracts

Eccentric

- Muscle lengthens under tension

Isometric

- Muscle is contracted with no change in length

Role of muscles

Agonist (prime mover)

- Provides the major force to move a joint

Antagonist

- Acts in an opposite manner to the agonist
- Can be used to slow down a movement

Synergist

- Muscle or group of muscles that work with the agonist to move a joint

Fixator

- Muscle or group of muscles that act to stabilise the origin of the agonist during movement

Anterior and posterior muscles

Muscle	Origin	Insertion	Primary action
Erector spinae	Length of vertebral column, ribs and pelvis	Vertebral column and ribs	Extension of spine
Quadratus lumburum	Iliac crest	12^{th} ribs and L1-4	Lateral flexion of spine. Bilateraly extends spine
Internal obliques	Iliac crest	8^{th}, 9^{th} 10^{th} ribs and linea alba	Rotation and lateral flexion of spine
External obliques	Lower 8 ribs	Iliac crest and linea alba	Rotation and lateral flexion of spine
Sternocleidomastoid	Sternum and medial clavicle	Mastoid process	Flexion, lateral flexion and rotation of neck

Muscle	Origin	Insertion	Primary action
Scalenes	C1-8	1st and 2nd ribs	neck
Transversus abdominus	Iliac crest, lower 6 ribs, lumbar fascia	Linea alba and pubis	Drawing abdomen inwards
Rectus abdominus	Pubis symphysis, pubic crest	Xiphoid process and 5th, 6th and 7th ribs	Flexion of spine
Intercostals	Ribs	Ribs	Inhalation (external) Expiration (internal)
Gluteus maximus	Iliac crest, sacrum and coccyx	Upper posterior femur and ITB	Extension and lateral rotation of hip
Gluteus medius	Lateral and posterior ilium	Posterior and lateral surface of upper femur	Abduction and medial rotation of hip
Gluteus minimus	Lateral ilium	Anterior surface of upper femur	Abduction and medial rotation of hip

Muscle	Origin	Insertion	Primary action
Piriformis	Anterior sacrum	Upper surface of upper femur	Abduction and lateral rotation of hip
Iliopsoas	Lumbar spine an pelvis	Lesser trochanter of femur	Flexion of hip and spine
Pectineus	Anterior pubis	Upper femur	Adduction and flexion of hip
Abductor brevis	Anterior pubis	Medial femur	Adduction of hip
Abductor longus			
Abductor magnus			
Gracilis	Ischiopubic ramus	Medial tibia	Adduction of hip and flexion of knee
Sartorius	Anterior superior iliac spine (ASIS)	Medial condyle of tibia	Flexion, abduction and lateral rotation of hip. Flexion and medial rotation of knee
Tensor Fascia Latae	Anterior iliac crest	Lateral tibia via iliotibial band (ITB)	Flexion and abduction of hip. Medial rotation as hip flexes

Muscle	Origin	Insertion	Primary action
Rectus Femoris	Anterior inferior iliac spine (ASIS)	Tibial tuberosity via patella	Flexion of hip and extension of knee
Vastus Lateralis	Lateral/upper femur		Extension of knee
Vastus Intermedius	Anterior femur		Extension of knee
Vastus Medialis	Medial femur		Extension of knee (esp. last 20 degrees of movement)
Biceps Femoris	Ischial tuberosity and posterior femur (2 origins)	Head of fibula and lateral condyle of tibia	Extension of hip and flexion of knee
Semimembranosus	Ischial tuberosity	Medial condyle of tibia	
Semitendinosis			
Popliteus	Lateral upper femur	Posterior upper tibia	Flexion and medial rotation of knee
Plantaris	Lateral upper femur	Calcaneus	Plantarflexion of ankle

Muscle	Origin	Insertion	Primary action
Gastrocnemius	Posterior medial/ lateral upper femur	Calcaneus	Plantarflexion of ankle Flexion of knee
Soleus	Upper posterior tibia and fibular	Calcaneus	Plantarflexion of ankle
Tibialis anterior	Lateral tibia	Plantar surface of foot	Dorsiflexion and inversion of ankle
Tibialis posterior	Posterior surfaces of tibia and fibula	Plantar surface of foot	Plantarflexion and inversion of ankle
Peroneus longus	Upper lateral surface of fibula	Plantar surface of foot	Plantarflexion and eversion of ankle
Peroneus brevis	Lower lateral surface of fibula	Plantar surface of foot	Plantarflexion and eversion of ankle
Peroneus tertius	Lower anterior surface of fibula	Dorsal surface of foot	Dorsiflexion and eversion of ankle

Muscle	Origin	Insertion	Primary action
Infraspinatus	Posterior surface of scapula	Superior posterior humerus	Adduction and lateral rotation of shoulder joint
Teres minor	Lateral border of scapula	Superior posterior humerus	Adduction and lateral rotation of shoulder joint
Subscapularis	Anterior surface of scapula	Superior anterior humerus	Medial rotation of shoulder joint
Teres major	Inferior angle of scapula	Superior anterior humerus	Extenson, adduction and medial rotation of shoulder joint
Triceps brachii	Long head: superior scapula Lateral head: lateral posterior humerus Medial head: posterior humerus	Superior ulna (Olecranon)	Extension of shoulder joint and elbow
Biceps brachii	Long head: superior scapula Short head: anterior scapula	Radius	Flexion of shoulder joint and elbow Supination of forearm

Muscle	Origin	Insertion	Primary action
Coracobrachialis	Superior scapula	Medial humerus	Flexion and adduction of humerus
Brachialis	mid humerus	Superior ulna	Flexion of forearm
Brachioradialis	Distal humerus	Distal radius	Flexion and supination of forearm
Common wrist flexors	Medial humerus	Palm of hand	Flexion of wrist
Common wrist extensors	Lateral humerus	Back of hand (dorsum)	Extension of wrist

Ligaments

Structure

- Band of tough, fibrous, dense connective tissue (collagen)

Function

- Stabilise joint and prevent unwanted movement

Properties

- Avascular (poor blood supply)
- Non elastic (but may lengthen under stress)
  - Lengthened ligaments may de-stabilise joints)
- Non contractile (but may shorten through disuse)

Tendons

Structure

- Band of tough, fibrous, dense connective tissue contained within a sheath

Function

- Connect muscle to bone

Properties

- Avascular (poor blood supply)
- Primarily non elastic, however the Achilles tendon may act as a ‘spring’ storing tension during gait.
- Non contractile (but may shorten through disuse)

The nervous system

Central Nervous System (CNS)

- Brain and spinal cord
  - Receiving and storing information
  - Collating info and decision making
  - Initiating instructions for bodily activities

Peripheral nervous system (PNS)

- Somatic (SNS) and Autonomic (ANS) nervous systems
  - Sensory neurons (afferent)
  - Motor neurons (efferent)

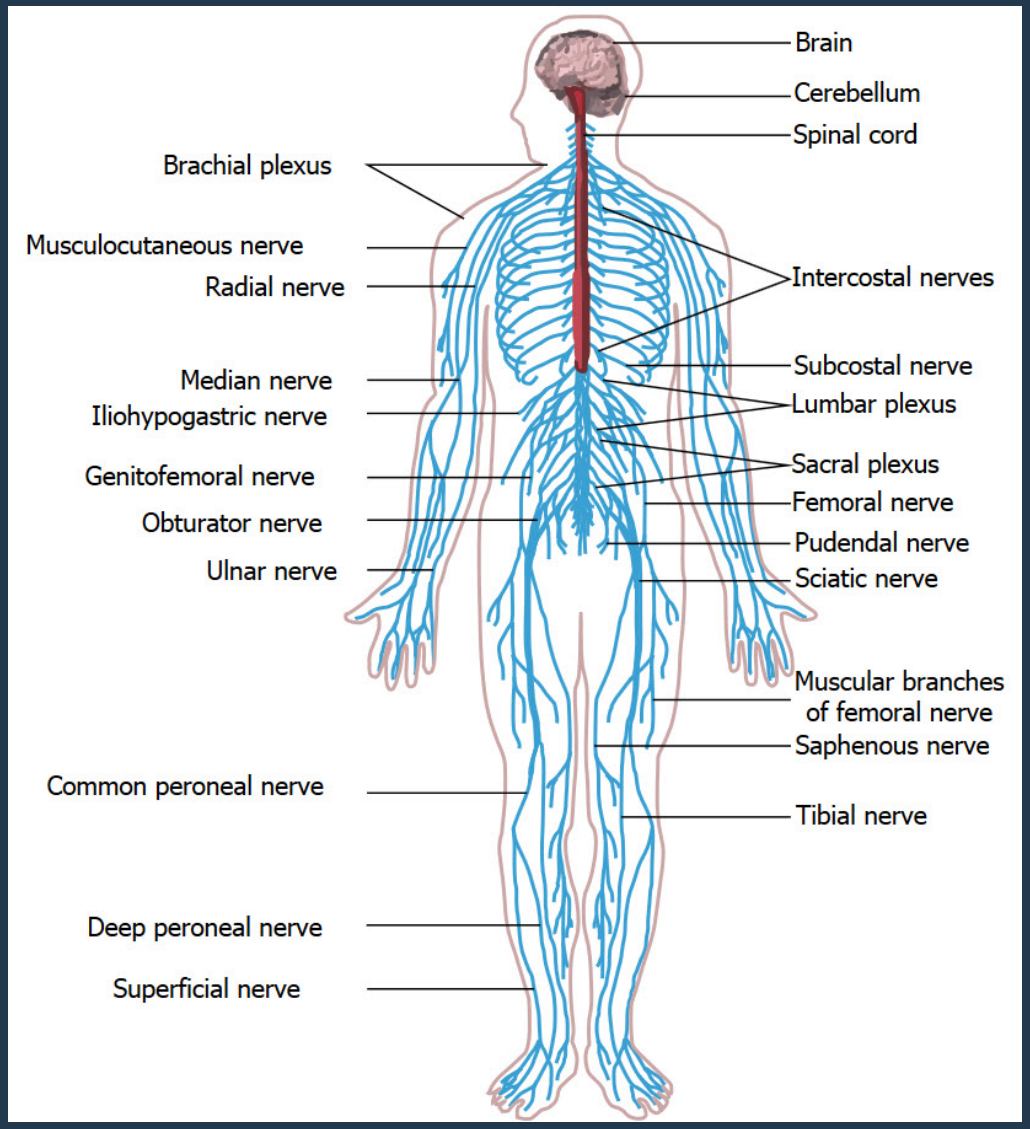
SNS

- External sensors

ANS

- Internal sensor
- Helps maintain homeostasis
  - Sympathetc responses
  - Parasympathetic responses

The nervous system



The nerve cell

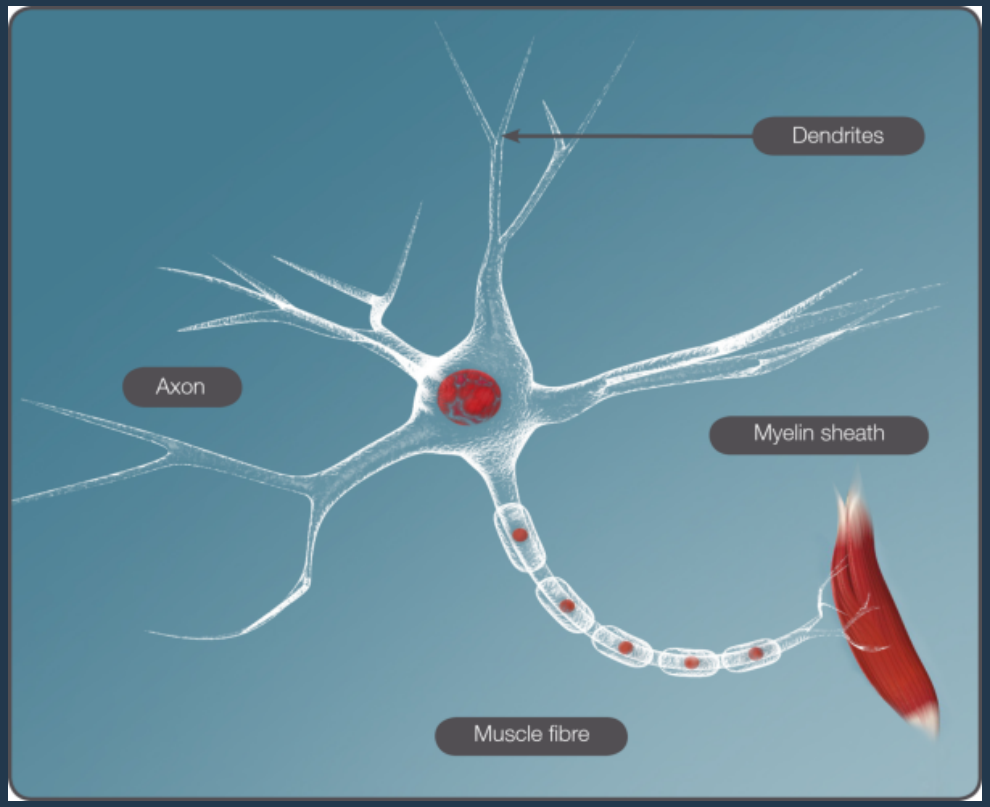
Cell Body
- Contains nucleus and all associated specialised organelles

Dendrites
- Receive signals from other nerve cells

Axon
- Conducting unit of the cell

Myelin sheath
- Protects the axon and prevents ‘short circuits’

Synapse
- At the end of an axon and transmits impulse

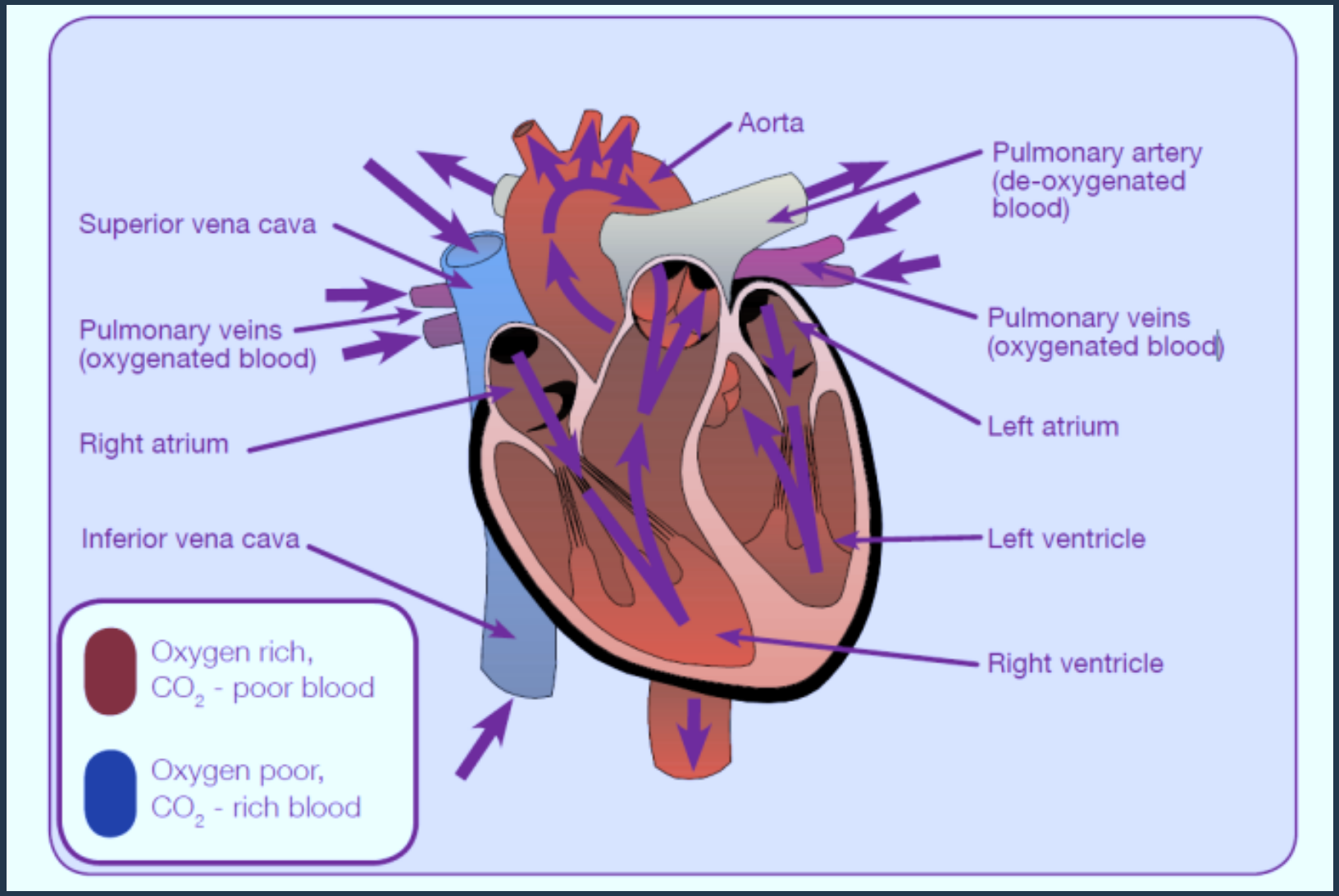


The Cardiovascular System

The heart pumps blood around the body

- Myocardium contraction excited by a single nerve impulse
- Sinoatrial node acts as ‘pacemaker’ and ‘splits’ the single impulse and delivers to each chamber
- 4 chambers divided by septum and separated by valves

The Cardiovascular System



The Cardiovascular System

The function of the CV system is to: transport material, warm the body, and protect the body from infection

Arteries

- Lined by smooth muscle
- Coronary artery supplies oxygen to the myocardium
- Transport blood away from the heart
- Smaller branches are called arterioles

Capillaries

- One cell thick
- Allow nutrients, O_2 and fluids to pass into tissue, and CO_2, waste materials and fluid to pass out via diffusion

Veins

- Lined by thin smooth muscle
- Non return valves
- Smaller veins are called venules

Blood flow

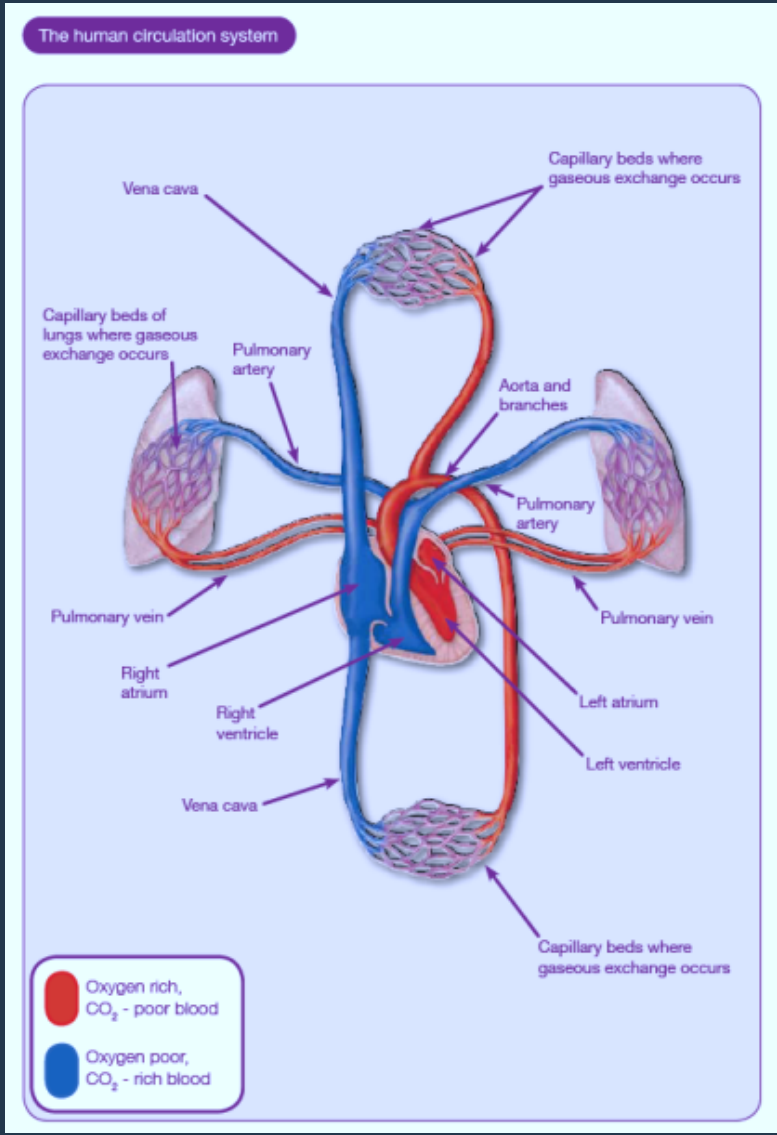
Pulmonary circulation

- Deoxygenated blood from heart to lungs
- Oxygenated blood from lungs to heart

Systemic circulation

- Oxygenated blood from heart to tissue
- Deoxygenated blood from tissue to heart

Blood flow


The human circulation system
Capillary beds where gaseous exchange occurs
Vena cava
Capillary beds of lungs where gaseous exchange occurs
Pulmonary artery
Aorta and branches
Pulmonary artery
Pulmonary vein
Pulmonary vein
Right atrium
Right ventricle
Left atrium
Left ventricle
Vena cava
Capillary beds where gaseous exchange occurs
Oxygen rich, CO_2 - poor blood
Oxygen poor, CO_2 - rich blood

Composition of blood

Plasma (approx 60%)

- Proteins
- Enzymes
- Nutrients
- Haemoglobin
- Wastes
- Hormones
- Gases

Red Blood Cells (RBCs)

- Transport Oxygen

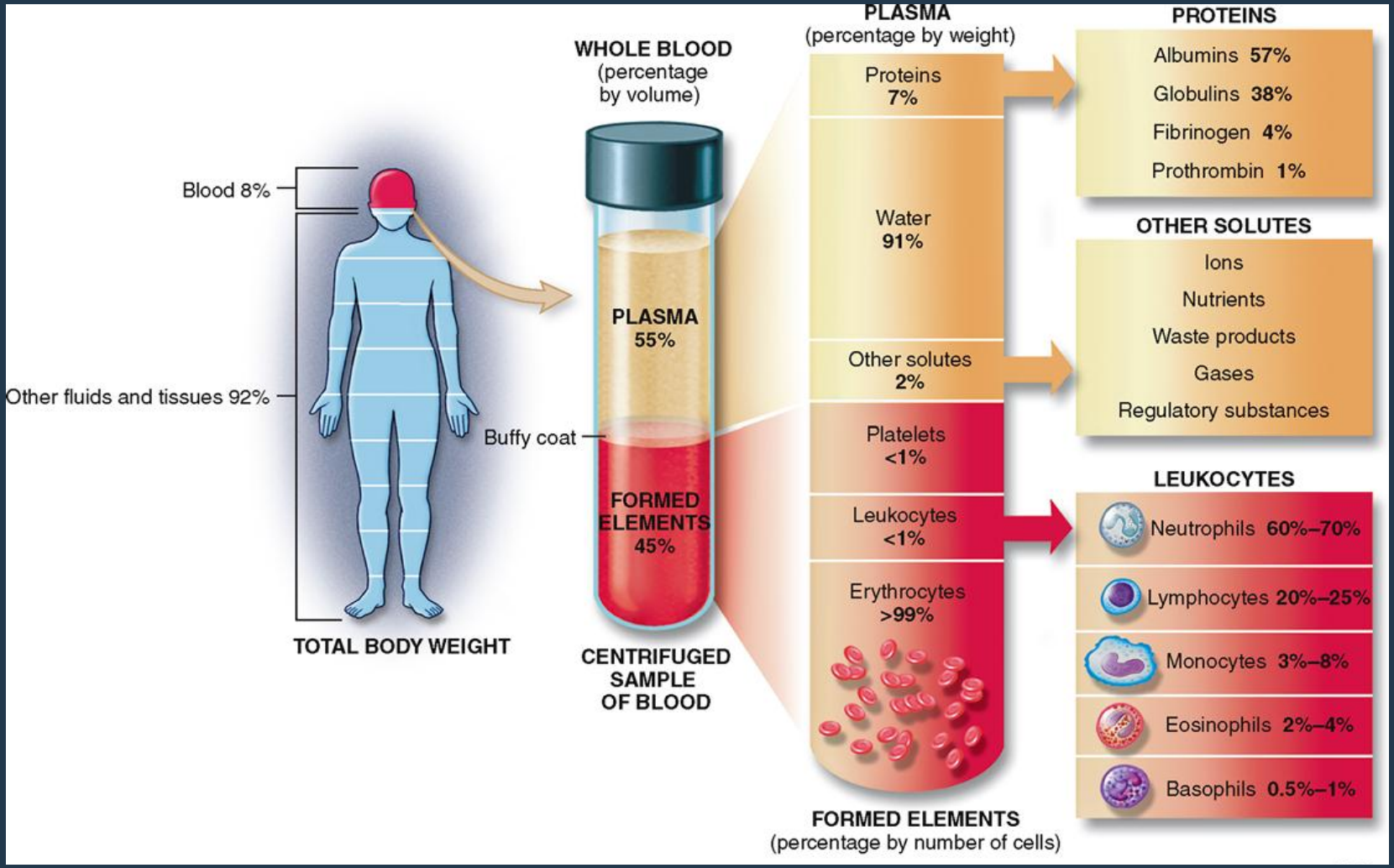
White Blood Cells

- Fight / Digest infection

Platelets

- Coagulation
- Secrete chemicals which aid in inflammatory response

Composition of blood



Blood pressure

The pressure exerted by circulating blood upon the walls of blood vessels

- Greatest during heart contraction (Systole)
- Lowest between heart contractions (Diastole)

Factors affecting blood pressure:

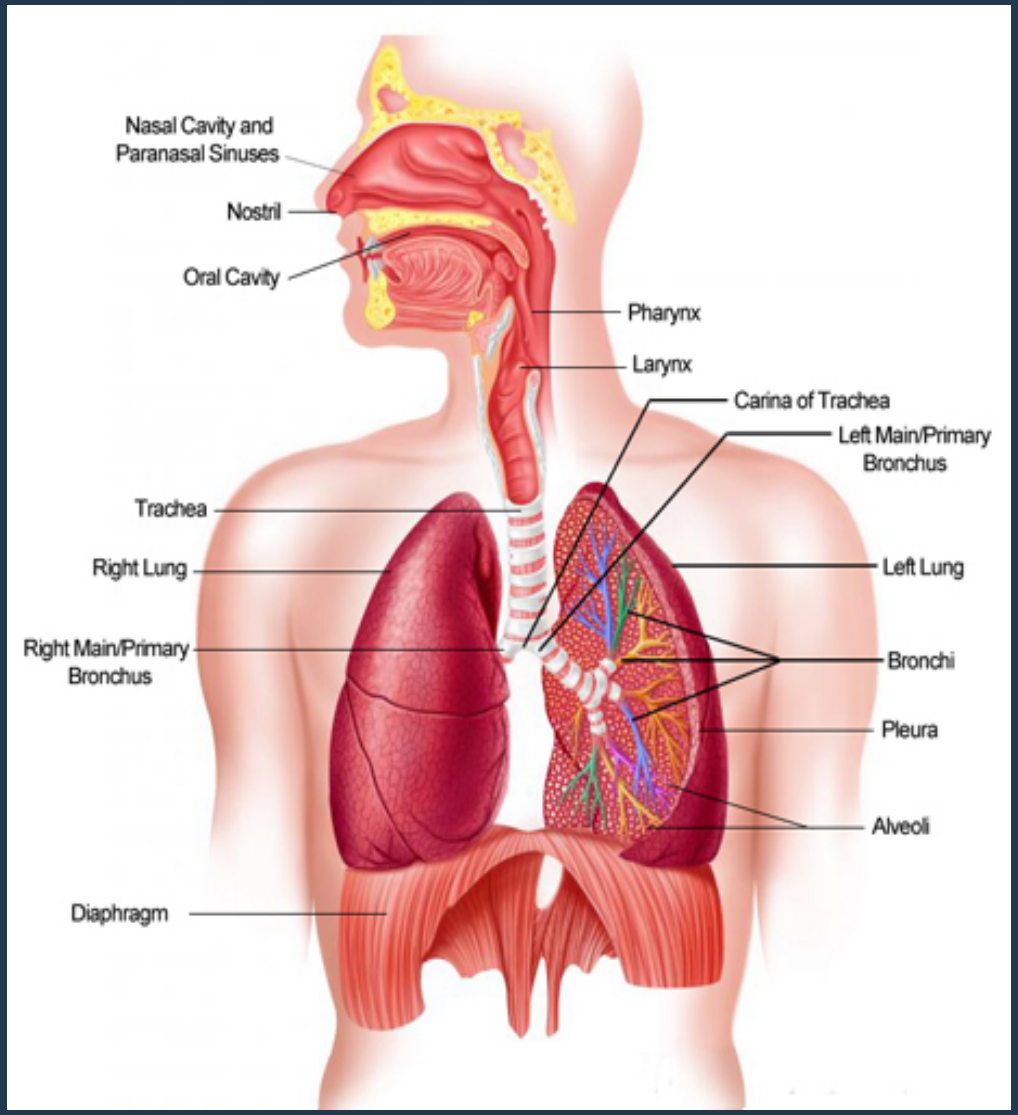
- Exercise (short term increase bp / long term decrease bp)
- Obesity (increase bp)
- Stress (increase bp)
- Nutrition (low salt and saturated fat decrease bp)
- Smoking (vasoconstriction and artery narrowing increase bp)
- Age (older increase bp)
- Family history
- Excessive sweating (increase bp)

Respiratory system

1. Pharynx
2. Larynx
3. Trachea
4. Bronchi
5. Bronchioles
6. Alveoli

Gaseus exchange (diffusion) occurs between the capillaries and the alveoli

Respiratory system



Respiratory system

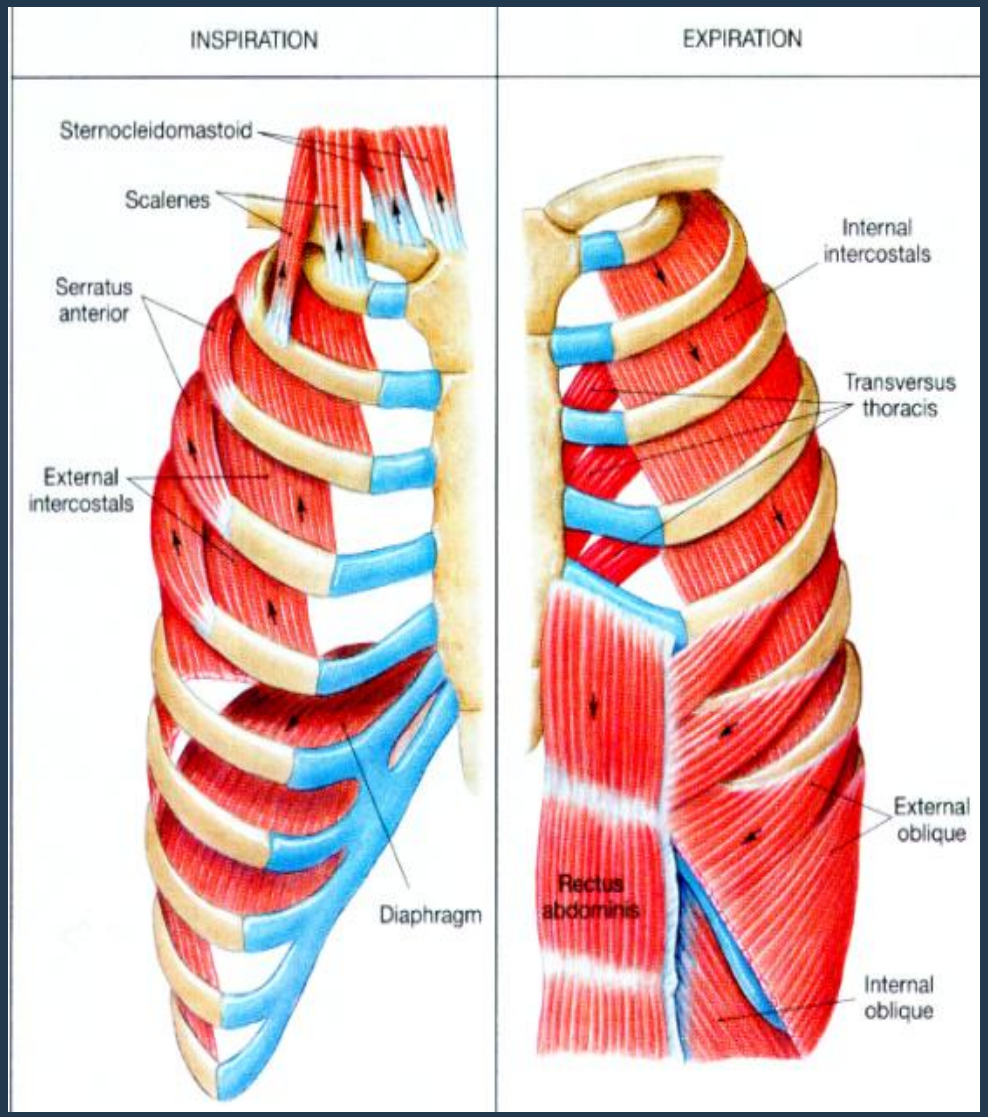
Inspiratory muscles

- External intercostal muscles
- Diaphragm
- Scalenes
- Sternocleidomastoid

Exhalation muscles

- Internal intercostal muscles
- External/internal obliques
- Rectus abdominus

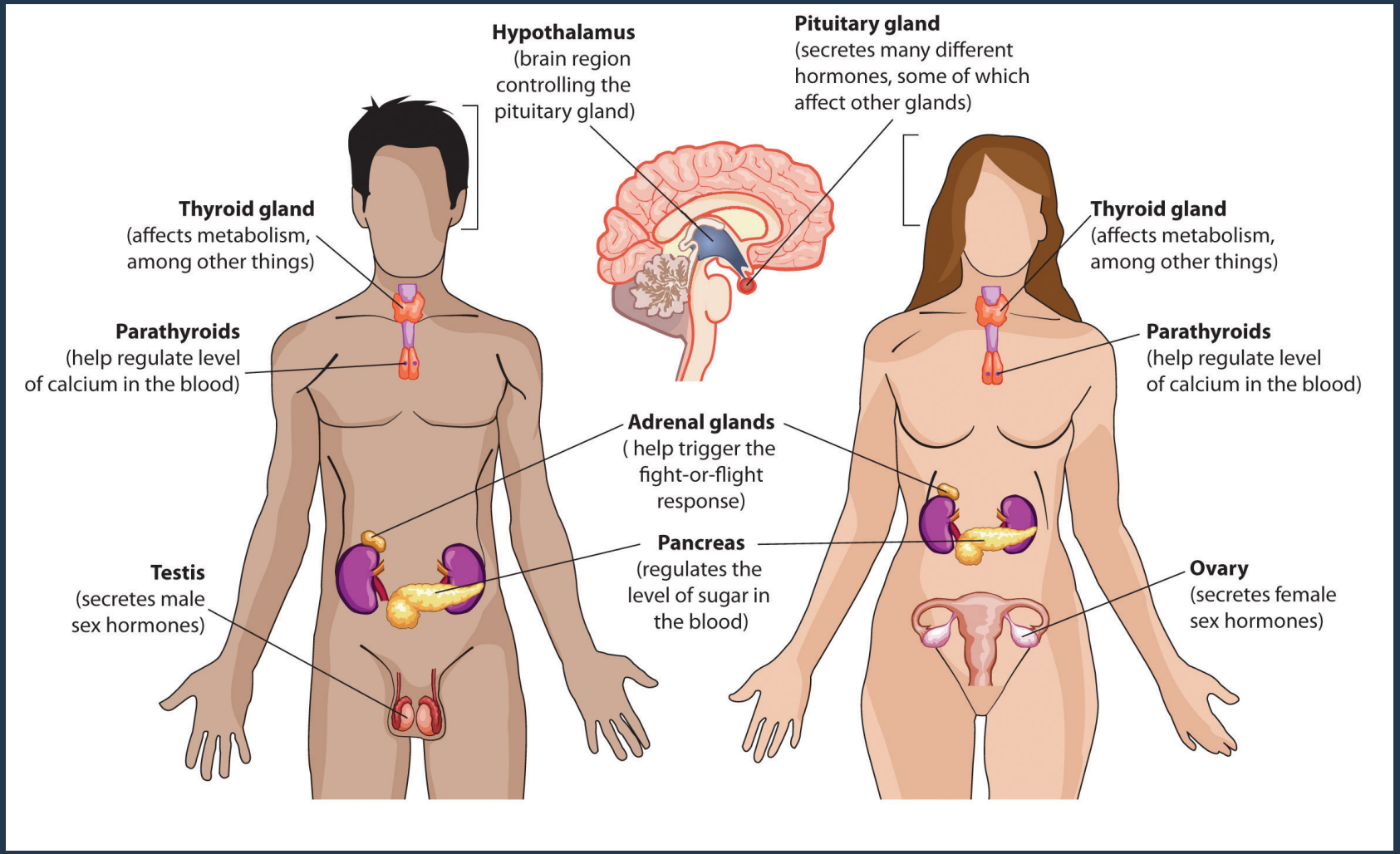
Respiratory system



The Endocrine System

- Contains a number of glands that secrete hormones
- Hypothalamus is the ‘master’ gland that controls most of the other glands in the body
- Endocrine system delivers messages to the body’s systems via chemical – therefore slower response than nervous system

The Endocrine System



Gland	Hormone	Action / Role
Thyroid	Thyroxine	Regulate metabolism of all cells in body
Parathyroid	Parathyroid hormone (PTH)	Control blood calcium levels
Pituitary	Human Growth Hormone (HGH)	Regulate body composition, body fluids, muscle and bone growth
Pineal	Melatonin	Maintain normal sleep
Adrenal	Epinephrine (adrenalin) Norepinephrine Cortisol	Initiate sympathetic responses to stress Regulate conversion of macronutrients to energy
Pancreas	Insulin Glucagon	Blood sugar control
Ovaries	Oestrogen Progesterone	Primary sex hormone Promote fat storage
Testes	Testosterone	Primary sex hormone Promote muscle growth

Lymphatic system

Lymphatic vessels
- Lymphatic duct
- Right lymphatic duct

Lymphatic capillaries

Lymph
- Fluid within the system

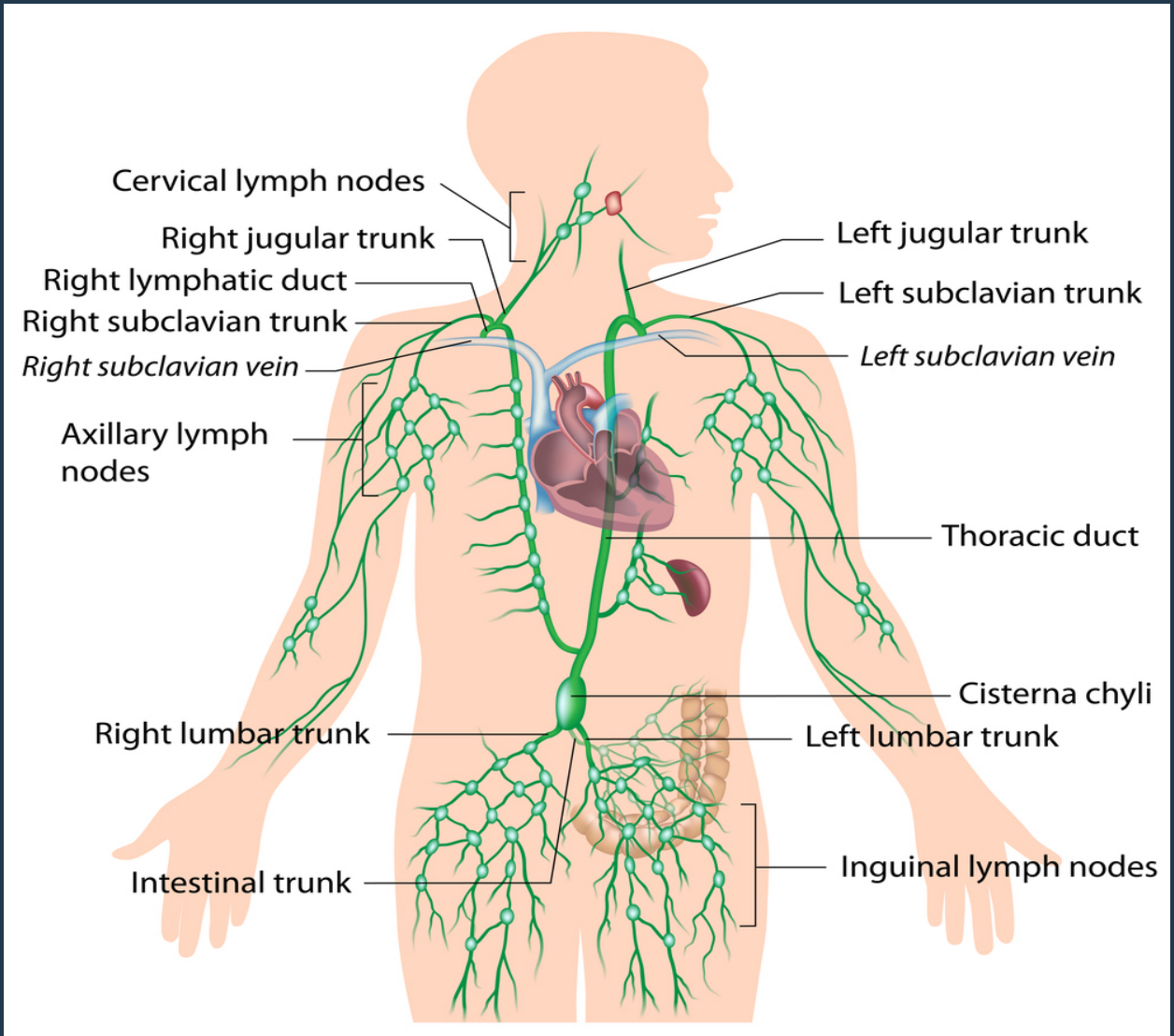
Lymphocytes
- Remove pathogens

Lymphatic nodes
- Filter lymph and produce and store lymphocytes
  - Occipital (nape (back) of neck)
  - Popliteal (behind knee)
  - Inguinal (groin)
  - Axillary (armpit)
  - Cubital (crook of elbow)

Spleen* (left side of abdomen inferior to rib cage)

*Important to know that a ruptured spleen can prove fatal!

Lymphatic system



Lymphatic system

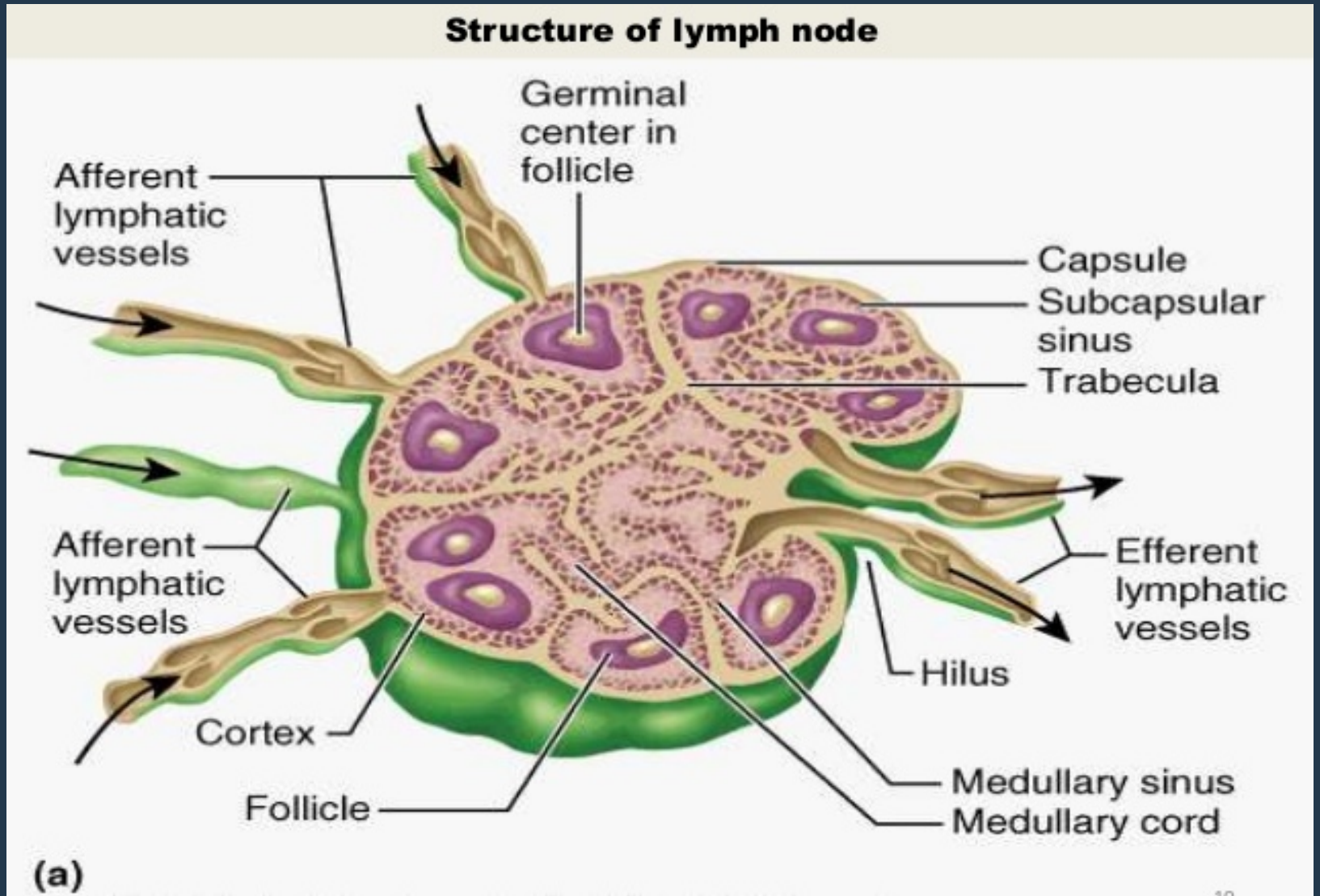
Lymphatic functions

- Removal of tissue fluid (oedema) and return it to bloodstream
- Filter fluid to help prevent infection of the blood and tissue
- Aid digestion via the absorbsion of lipids from the small intestine

Lymph node structure

- Been or oval shaped
- Divided into compartments
- More vessels entering (afferent) than leaving (efferent) – this slows the flow to aid lymphocytes in removing pathogens

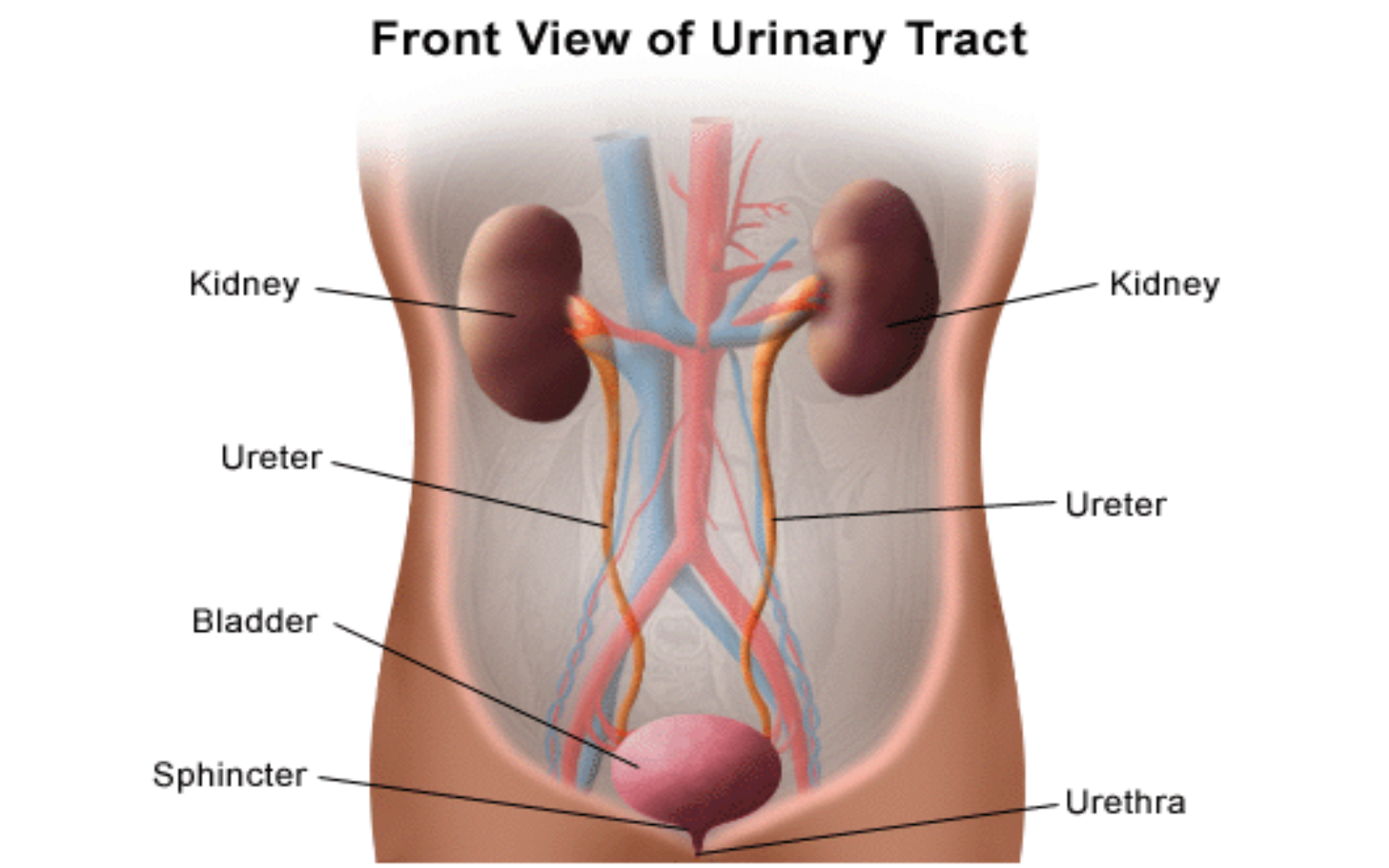
Lymphatic system



Urinary system

Structure	Function
Kidneys	Filters waste from the blood and produces urine
Ureter	Tubes through which urine leaves the kidneys and travels to the bladder
Bladder	Stores urine until it is excreted
Urethra	Carries urine from the bladder out of the body

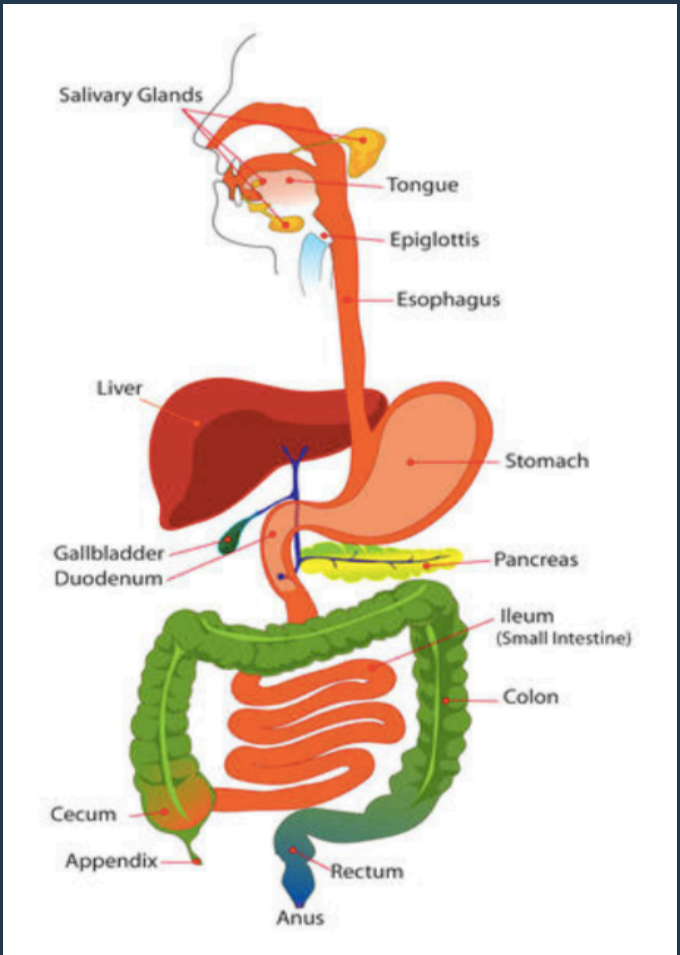
Urinary system



Digestive system

Structure	Function
Mouth	Mechanical breakdown of food by chewing Chemical breakdown of food by slaivary amylase
Oesophagus	Carries food into the stomach (via peristalsis)
Stomach	Churns food and bathes it in acid (kills bacteria) and pepsin (digests bacteria)
Small intestine	Main site for absorption of nutrients into the bloodstream using enzymes produced by the liver, gall bladder and pancreas
Large intestine	Waste passes through the large intestine – localised bacteria help with the extraction of vitamins, minerals and elctrolytes
Rectum	Elimination of waste

Digestive system



Effects of sports massage

Physical effects

- Mechanical pumping and squeezing assists in the flow of blood and lymph
- Longitudanal and transverse stretching of soft tissue assists in mobility
- Helps to influence the formation of collagen fibres
- Specific techniques assist in the removal/reduction of soft tissue adhesions and aid free movement

Physiological and neurological

- Generally elicits a parasympathetic relaxation response
  - Vasodilation of blood and lymphatic vessels
  - Reduction in neural stimulation of muscles (contraction)
  - Reduction in production of sympathetic ‘stress’ hormones
- Varying method of application can cause the opposite to occur. Ie, a sympathetic response

Effects of sports massage cont.

Psychological effects

- Sympathetic response
  - Increases mental alertness
  - Stimulation
  - Adrenaline and endorphin release
- Parasympathetic response
  - Reduction in physical tension
  - Feeling of wellbeing and relaxation
  - Lowering of anxiety

Assessment

Assessment element 1 – Assessment workbook

- Homework

Assessment element 2 – A&P theory assessment

- 30 multiple choice questions (A-D)
- 45 minutes
- 70% pass mark (21/30)