

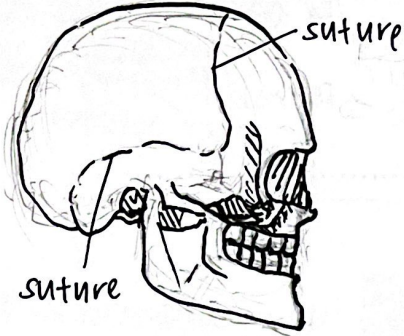
skeletons

exoskeleton endoskeleton hydrostatic skeleton

Human

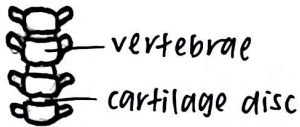
Joints

① Immovable

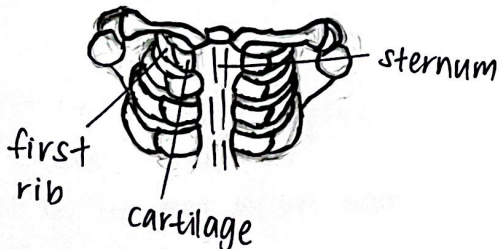


② Slightly movable

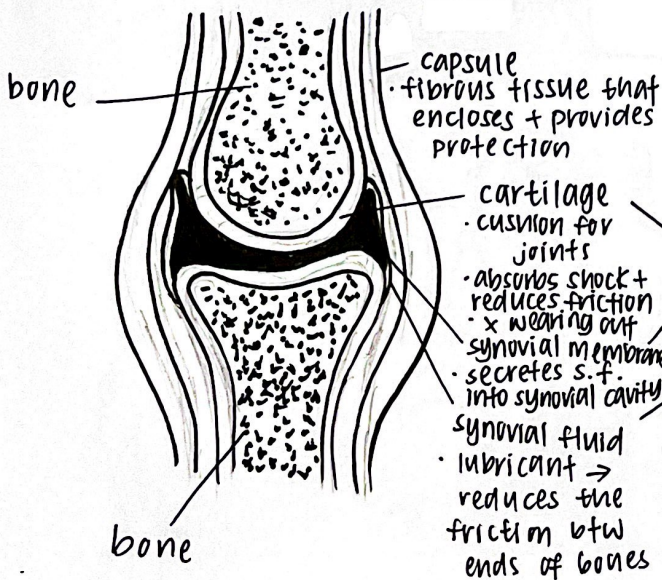
(a) cartilage disc btw vertebrae



(b) cartilage btw 1st rib + sternum

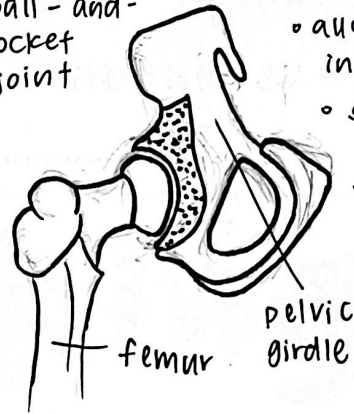


structure of freely movable joint



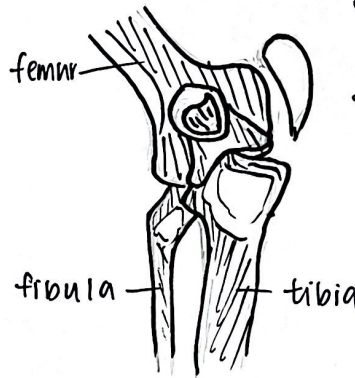
③ Freely moveable

(a) ball-and-socket joint

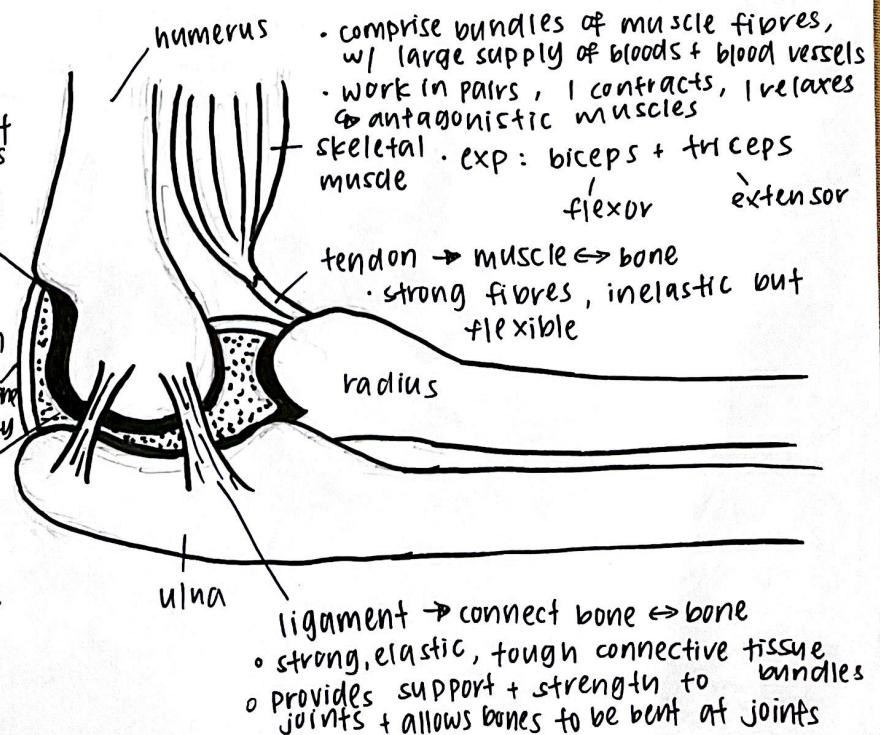


- allows rotational movt. in all directions
- swing in a circular motion
- exp: shoulder joints
↳ humerus + pectoral girdle
- hip joint
↳ femur + pelvic girdle

(b) hinge joint

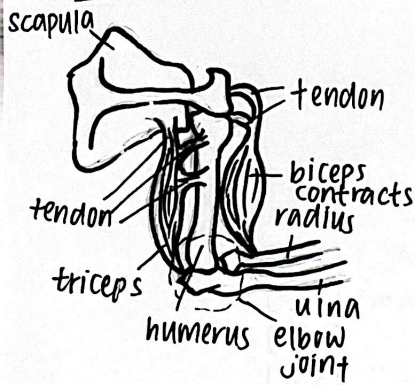


- allows movt of bones in one (1) plane
- exp: knee joint
↳ lower leg swings back + forth
- elbow + phalanges of fingers + toes



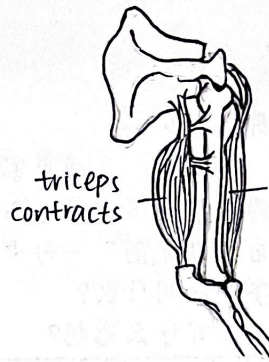
movement of forearm

Bending



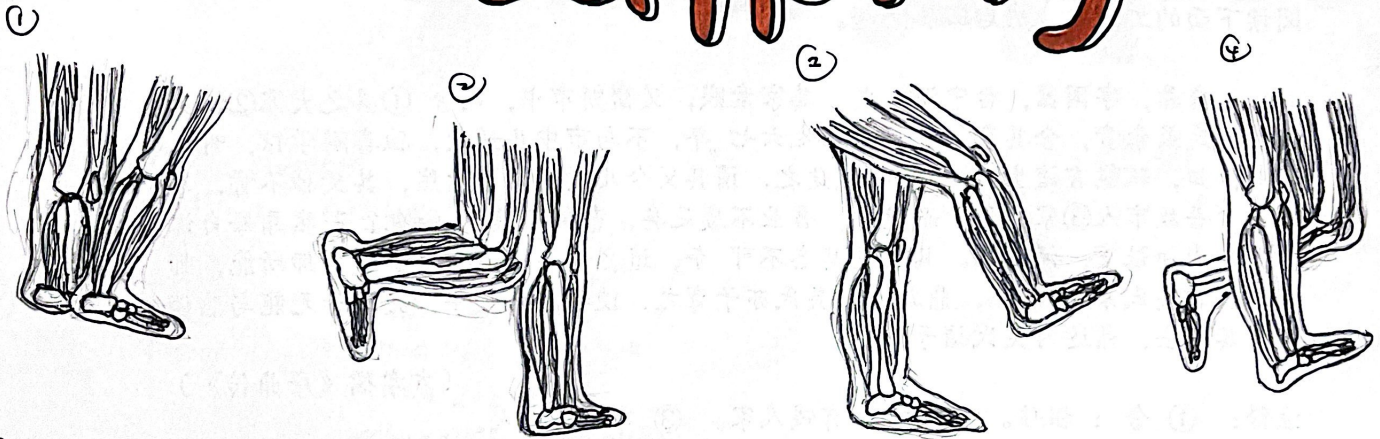
- biceps contracts
- ↳ pull force transmitted to radius thru tendon
- triceps relaxes
- radius pulled ↑
- arm's bent

Straightening



- triceps contracts
- ↳ pull force's transmitted to the ulna thru tendon
- biceps relaxes
- ulna's pulled ↓
- straightened

walking



- ① right calf muscle contracts
- ↳ heels lifted
 - ball of the foot pushes against the ground

- ② biceps femoris contracts at the same time
- ↳ pulls femur ↑

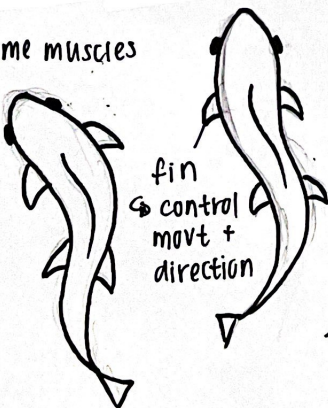
- ③ body weight is now supported by other leg on the ground
- quadriceps femoris contracts
 - ↳ leg straightened

- ④ tibialis contracts
- ↳ heels brought down
 - body weight shifts to the right leg
 - whole sequence is repeated w/ other leg

fish

myotome
→ W-shaped muscle segment

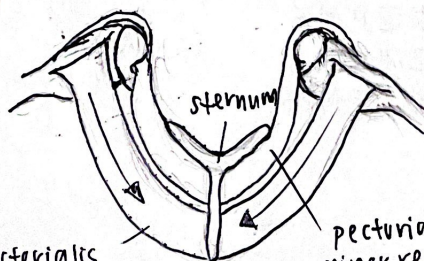
- ③ right myotome muscles contract
- ↳ tail whips to right



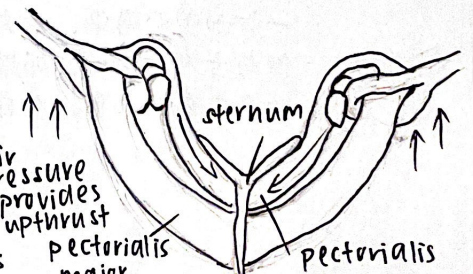
- ① left myotome muscles contract
- ↳ tail whips to left



bird



- pectoralis major contracts
- ↳ ↓ wings

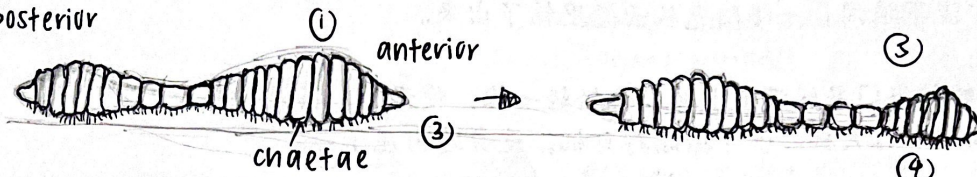


air pressure provides upthrust

- pectoralis minor contracts
- ↳ wings ↑

worm

posterior

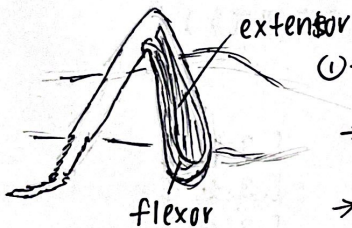


- ② ③ posterior → shortened + pulled to the front
- ④ chaetae at the anterior → anchor to ground
chaetae @ posterior → release their hold

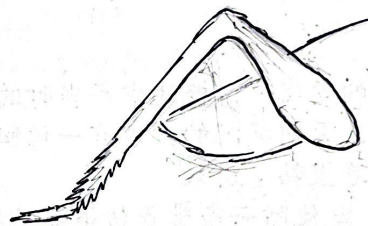
- ① posterior longitudinal muscle contracts, circular muscle relaxes
→ earthworm shorter + thicker

- ② chaetae at anterior → release hold off ground
chaetae at posterior → anchor to ground
- ③ circular muscle @ anterior contracts + longitudinal muscle relaxes
→ longer + thinner
→ anterior extends forward

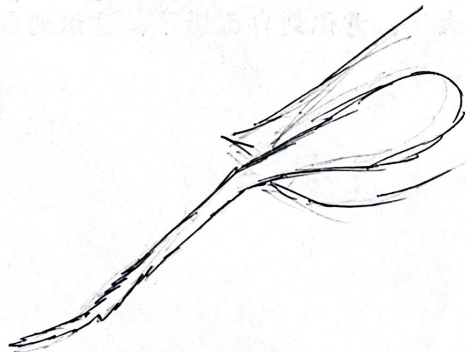
grasshopper



- ① flexor on hind legs contract
→ legs pulled towards the body
→ hind legs are folded into Z-shape
→ ready to jump/leap



- ② the extensor contracts
→ hind legs are straightened backwards



- ③ the catapult-like ejection of hind legs projects the grasshopper forward + up into the air

health issues

- ① osteoporosis
 - weak, brittle, more porous, ~~the~~ bone → break easily
 - low bone mass / density
 - causes:
 - the rate of calcium loss ↑ calcium absorption due to ageing
 - lack of exercise
 - low intake of calcium, phosphorus, vit. D
 - common among women who reach menopause → ↓ oestrogen
 - ⇒ oestrogen → calcium metabolism
 - ↓ level → helps body absorb Ca
 - reduces bone density → reduces Ca loss

- ② osteomalacia
 - soft bone condition
 - causes: lack of Ca, phosphorus + Vit D.
 - common among adults, esp. pregnant woman
 - child = rickets
 - causes softening + weakening of bones → bone defects

- ③ Arthritis
 - common type: osteoarthritis
 - caused by:
 - decreased synovial fluid
 - wear + tear of the cartilage in certain joints
 - cartilage → thinner
 - ligament → shorten + less elastic
 - joints → swollen, painful + less flexible
 - effects: restrict daily activities e.g. walking

- ④ scoliosis
 - backbone bent to the side
 - forming 'S' / 'C' shape when viewed from the back
 - causes:
 - genetic factor
 - abnormal growth of backbone during puberty

practices

- ① good body posture
 - x slouch when standing / sitting
 - exerts pressure on the vertebral column
 - misalignment
 - prevent circulation of blood
 - suppressing nerves + vital organ

- prevent osteoporosis

- ③ Exercise
 - strengthen joint structure + increases flexibility of muscles + ligaments
 - increase bone strength + bone mineral deposition among adults

- ② Proper attire
 - wear proper, comfortable, loose clothing
 - avoid restriction of blood circulation
 - + affect the musculoskeletal syst.
 - suitable pair of shoes
 - low heels + cushion
 - provides support + prevents injury to vertebral column

- ④ Balanced diet
 - food rich in calcium → milk
 - minerals e.g. phosphate → meats + proteins
 - vit. C → citrus → increases bone mass
 - vit D → oily fish, red meat, sunlight
 - aids in calcium absorption