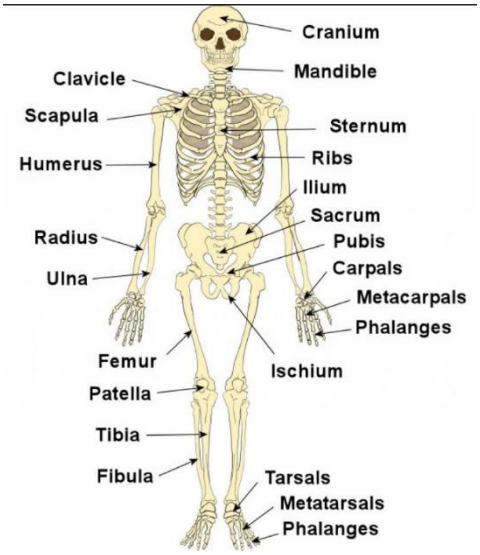
Chapter – 8: Body Movements

- Chew food – move mouth
- Bend our back – lift something
- Move arm from shoulder – bowling in cricket
- Move arm from elbow – eat something
- All these – examples of body movements
- Human beings (animals) – 2 types of body movements –
    - Movement of body parts – hand, mouth, backbone, leg, etc
    - Movement of complete body – locomotion
- To understand body movement – study types of bones, joints, muscles, etc

Skeleton – Framework of Bones

- Press your fingers – over your head, face, neck, shoulder, back, etc – feel some hard structure inside them
- Hard structure – bones
- Complete body – supported on framework – skeleton
- Humans – skeleton – inside the body – endoskeleton (endo – inside)
- Skeleton – lots of bones and some cartilage – bones – hard – cartilage – soft
- Different bones – different shapes and sizes
- X-ray shows all the bones – 206 bones in human body
- Bones – connected through joints – helps in movement of body parts



Description of skeleton

- Strong backbone – skull at top – eye sockets, upper jaw, lower jaw in it
- Ribs – attached at upper part of backbone – form rib cage
- Breastbone – front of rib cage - sternum
- Lower end of backbone – wide, strong structure – hip bone
- Below the neck – shoulder bones – both sides – 2 parts –
    - Collar bone – clavicle
    - Shoulder blade – scapula

- Upper limb – shoulder to hand – arm – 2 arms in human body – attached to shoulder blades – ball and socket joints
- Each arm – 3 parts –
    - Upper arm –
        - Shoulder to elbow – single bone – humerus
    - Lower arm –
        - Elbow to wrist – 2 bones – radius and ulna
        - Connected at elbow by hinge joints
    - Hand –
        - Lots of small bones – form wrist, palm, fingers
- Lower limbs – helps in walking – legs – 2 legs in human body – attached to hip bones – ball and socket joints
- Each leg – 3 parts –
    - Upper leg –
        - Hip to knee – single bone – femur
    - Lower leg –
        - Knee to ankle – 2 bones – tibia and fibula
        - Connected at knee by hinge joints – knee cap – patella
    - Foot –
        - Lots of small bones – form ankle, middle foot, toes

Functions of skeleton

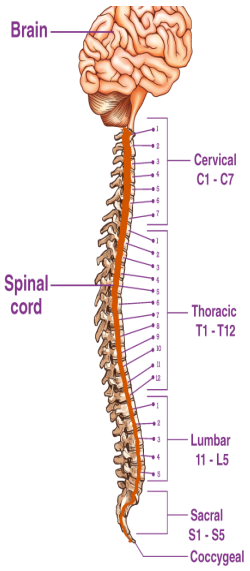
- Holds the body together – gives the shape
- Protects internal organs – brain, heart, lungs, liver, etc
- Provides – lots of points – muscle attach to body
- Helps in body movements

Skull

- Head – bony part
- Made of 22 bony plates – joined together
- Protects the brain – made of soft tissue
- Lower part – protects sense organs – eyes, ears, nose – face bones
- 2 eye sockets – front of the face – contain eyes

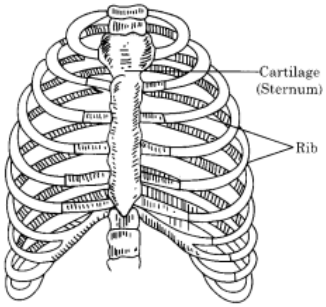
Backbone

- Hard, long structure – in the back of our body
- Backbone – long, hollow, rod-like structure – neck to hips
- Scientific name – vertebral column
- Main support structure – made of 33 small bones – stacked on top of one another
- Small bones – vertebrae – between them – cartilage discs – soft bone
- These soft bones – helps in bending
- IF – backbone made of single bone – we cannot bend our back
- Top 7 vertebrae – form our neck
- Supports the head – at top
- Shoulder bones, rib bones, hip bone – joined to backbone



- Each vertebra – there's a hole in it – spinal cord (main nerve from brain) passes through here
- Backbone – protects the spinal cord

Rib cage

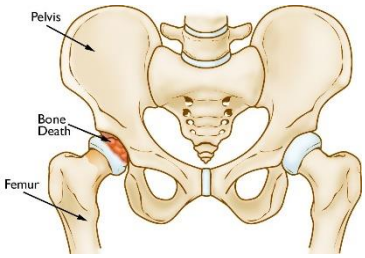


- Take a deep breath – feel the bones on chest
- Chest bones – ribs – curved bones – exist in pairs – 12 pairs in our body
- Like backbone in back – breast bone in front
- One end of rib – attached to back bone – another end – attached to breast bone
- This forms a box-like structure – rib-cage
- Protects delicate internal organs – heart, lungs, liver
- Helps in breathing movements

Shoulder bones

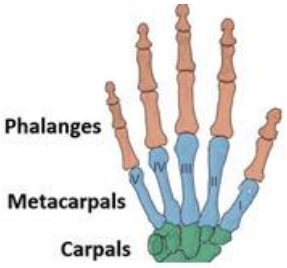
- Arms – attached to shoulders – 2 shoulders – one on each side
- 2 shoulder bones –
    - Collar bone –
        - Long, curved bone
        - One end – attached to shoulder blade – another end – attached to breast bone
        - Keeps the shoulder apart
    - Shoulder blade –
        - Large, triangular bone
        - Attached to backbone through muscles
        - Each shoulder blade – cup shaped socket – upper arm joins here – ball and socket joint

Hip bone



- Large, basin-shaped frame – lower end of backbone – legs attached here
- Also called – pelvic bone (pelvis)
- Made of multiple small bones – joined together
- Protects – lower part – below the stomach
- Thigh bones – joined here – ball and socket joints
- Link between – upper part and legs

Bones of the hand



- 3 parts –
    - Wrist – 8 small bones – carpals
        - Forms movable joint with arm – flexible
    - Palm – 5 longer bones – metacarpals
        - Forms movable joint with fingers
    - Fingers (including thumb) – jointed bones – phalanges
        - 3 bones in each finger
        - 2 bones in thumb

Cartilage

- Most skeleton – hard bones

- Some part – soft bones – can be bent
- Soft bones – firm, flexible material – cartilage
- Softer and elastic bones
- Present at –
    - Pinnae (upper part) of ear
        - Upper part of ear – pinna
        - Lower part of ear – ear lobe
        - Cartilage – provides support and shape to ears – flexible
    - End of nose
        - Cartilage – provides support and shape to nose – flexible
    - End of bones – meet each other – at joints
        - Cartilage – smooth – reduces friction – bones move freely
    - Between vertebrae – backbone
        - Cartilage discs – flexible backbone
        - Absorbs the shock

Joints of the Body

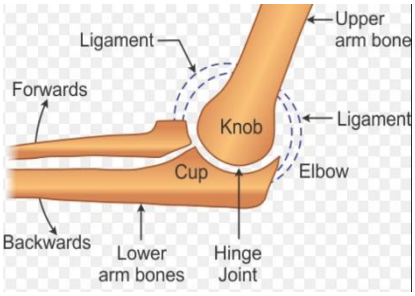
- Skeleton – hard and strong bones – cannot be bent
- Bend our body – at places – bones join together
- Such places – joints
- Arm – bends at elbow – upper arm and lower arm – forms a joint at elbow
- Different types of joints – helps in body movements
- Ends of bones – form joints – connected through ligaments
- Ligaments – elastic – stretch easily
- Ends of bones – covered with cartilage – reduces friction – helps in movements
- Between bones – oily liquid also present

Types of Joints

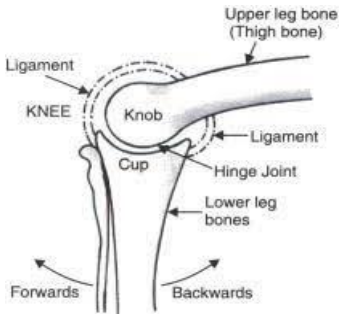
- Different types of joints – different kinds of movements
- Main types of joints –
    - Hinge joints
    - Ball and socket joints
    - Pivot joints
    - Fixed joints

Hinge joints

- Open a door – movement – only forward and backward
- Similarly – many joints in our body – move like a door – hinges
- Elbow –
    - Bends in one direction only – forward and backward
    - Lower end of upper arm – knob
    - Upper end of lower arm – cup
    - Both the ends – held together by ligament

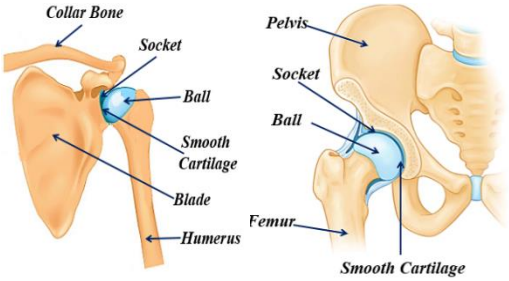


    - Knob fits into the cup – forms a hinge joint
- Knee –
    - Lower end of upper leg – knob
    - Upper end of lower leg – cup
    - Both the ends – held together by ligament
    - Knob fits into the cup – forms a hinge joint
- Finger joints, lower jaw – hinge joint



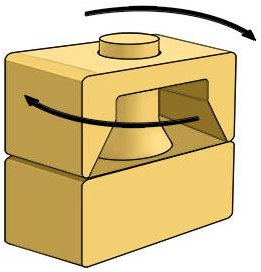
Ball and socket joints

- One end of bone – shaped like ball – fits into socket of another bone
- Ball shaped end – move freely inside socket – bones move in every direction – forward and backward – side to side – even rotation
- Shoulder –
    - Head of upper arm bone – ball
    - Shoulder blade bone – contain sockets
    - Ball fits into socket – upper arm bone – moves freely
- Hip joint –
    - Upper end of thigh bone – ball
    - Hip bone – contain sockets
    - Ball fits into socket – thigh bone – rotate freely



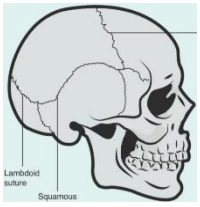
Pivot joints

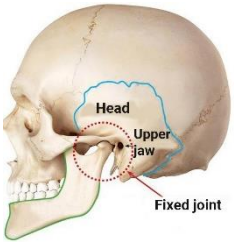
- Cylindrical bone – turns in a ring type bone
- Allows rotation – along an axis
- Connects skull to neck – allows our head – move up and down, side to side
- Another pivot – inside forearm – radius and ulna – near the elbow



Fixed joints

- Some joints – bones cannot move freely – held together strongly
- Provide strength and support to our body
- Skull –
    - Plat shaped bones – joined together by fixed joints
    - Protects brain – most delicate
- Mouth –
    - Lower jaw – movable
    - Upper jaw – connected to skull – fixed joint
- Hip bone –
    - Fixed joints between various hip bones – makes it stronger
    - Connected to back bone – fixed joint





Muscle Contractions Move Bones at Joints

- Muscle – fibrous tissue – ability to contract (decrease its size)
- Muscles attached to bones – contracts – bones move at the joint

- Muscle – can only pull – cannot push – another muscle – contracts – moves the bone in opposite direction
- Muscles – work in pair – one muscle contracts – other stretches (relaxes)
- Muscles cannot stretch on its own – when one muscle contracts – another stretches (relaxes)
- Contraction of muscles – controlled by brain

Bending and straightening of arm

- Arm – 2 parts – lower and upper arm – joined at elbow
- Upper arm bone – 2 muscles – biceps and triceps
- Upper end of muscles – attached to shoulder blade
- Lower end of muscles – attached to lower arm
- Both ends – joined by tendons
- Bend arm –
    - Biceps muscle contracts – pulls the lower arm upwards – bends upward
    - Called flexor muscle – flexes (bends) the arm
    - When biceps muscle contracts – triceps muscle relaxes
- Straighten arm –
    - Triceps muscle contracts – pulls the lower arm bones – lower arm moves out – arm straightens
    - Called extensor muscle – extends (straightens) the arm
    - When triceps muscle contracts – biceps muscle relaxes

Movement in Animals

- Necessary for animals – move from place to place – find food or hide from enemies
- Humans – contract and relax leg muscles – coordinated manner – helps in walking
- Straighten the leg – push the ground backwards – ground pushes you forward – equal force
- Every animal – pushes something backward – body moves forward

Cockroach

- Insect – body covered with – hard, tough outer covering – exoskeleton
- Provides protection – internal organs
- Provides places – attachment of muscles
- Outer skeleton – made of different parts – joined together – allows movement
- 6 legs – 3 on each side - each leg – contain stiff (inflexible), hollow tubes – joined together
- Legs – move easily – with help from muscles – attached to the inside of exoskeleton
- Flexor muscle – bends the leg – extensor muscle – straightens the leg
- 2 pairs of wings – attached by flight muscles
- Cockroach flies – moving wings up and down rapidly – with help of flight muscles
- Downward push on air – cockroach moves upwards – backward push on air – cockroach moves forward

Birds

- Birds – fly in air, walk on ground (hind limbs), swim in water (webbed feet)
- Birds – fly – bodies adapted (modified) by nature –

    - Forelimbs – modified – form wings
    - Flight feather – large flat surface – light but strong
    - Bones – hollow and light
    - Bodies – streamlined and very light
    - Powerful flight muscles
    - Breastbone – extended – support large flight muscles
- They fly – constant flapping (up and down movement) of wings
- One pair of muscles – pulls the wings down – downstroke
- Another pair of muscles – pulls the wings up – upstroke
- Downstroke – wings go down rapidly – pushes air downwards – air pushes the wings upwards – equal force – bird goes up
- After downstroke – wings must return to starting position
- Upstroke – wings move – lowermost to uppermost position – bird partly folds the wings – less effect of air

Movement Without Legs

- Generally – movement associated with legs
- Some animals – do not have legs – use muscles of their body for movement

Earthworm

- No bones – BUT – muscles – helps in contracting and relaxing its body
- Earthworm's body – liquid filled segments (parts) – short and fat – joined together
- 2 types of muscles –
    - Circular –
        - Muscles contract – segments become long and thin
    - Longitudinal –
        - Muscles contract – segments become short and fat again
- Each segment – tiny bristles (hair like structure) – underside
- Bristles – moved into ground – grips the ground – removed from the ground – releases the ground
- 4 steps in movement –
    - All the bristles – grip the ground
    - Circular muscles – front part – contracted – front part becomes long and thin – bristles – removed from ground
    - Longitudinal muscles – front part – contracted – front part becomes short and fat – bristles – grip the ground – same time – circular muscles – back part – contracted – back part becomes long and thin
    - Finally – longitudinal muscles – back part – contracted – back part becomes short and fat
- Like this – earthworm completes one step – small distance
- Keeps on moving – continuous steps
- Body – releases slimy liquid – helps in movement

Snail

- Slow moving animal – shell on its back
- Body – soft – consists – head, foot, shell

- Head – 2 pairs of tentacles – catch prey – larger pair – contain eyes
- Shell – outer skeleton – BUT – not made of bones – protects internal organs
    - In case of dangers – head and foot – goes back inside shell
- Foot – single – large, flat, disc-shaped – made of strong muscles – muscular foot
- Movement – aided (helped) by muscular foot – 2 sets of muscles – contract and relax alternatively – produce wave effect
- Snails are *gastropods* – belly-footed animals – this movement – creeping

Fish

- Fish – moves inside water – its body – adapted for it –
    - Streamlined body –
        - Thin at ends – thick in the middle
        - Water bends around easily – offers least resistance
    - Flexible backbone –
        - Body – bends easily – side to side
    - Powerful body muscles –
        - Muscles – both sides – help in moving the tails
    - Fins –
        - Thin and flat projections
        - Helps in steering, balancing, stopping
        - Tail fins – helps in moving forward
- Push the water backwards – water pushes you forward – equal force
- Fish – swims – moving the tail side to side – alternate contraction and relaxation of muscles
- Side to side movement – pushes the water sideways as well as backwards – moves the fish forward

Snake

- Body – long and cylindrical
- Long and flexible backbone – body bends easily – form curves
- Strong muscles – BUT – no legs
- Use their whole body to move
- Contracts and relaxes muscles – 2 sides of its body – alternatively – form many curves
- Each sideways loop – pushes the ground backwards – forces the snake forward
- Special name – this wave-like movement – ‘slither’
- Snake – down not move straight