



# Introduction

“Life is a book with three chapters. Two are already written by God—birth and death. The chapter in the middle is empty; fill it with smile, love and faith.”  
—Anonymous

Human anatomy is the science which deals with the structure of the human body.

The main subdivisions of anatomy are:

- 1 *Cadaveric anatomy* is studied on dead embalmed (preserved) bodies usually with the naked eye (macroscopic or gross anatomy). Head and neck and brain are studied as regional anatomy (Fig. 1.1).
- 2 *Living anatomy* is studied by inspection (Fig. 1.2), palpation, percussion, auscultation, radiography, etc.
- 3 *Embryology (developmental anatomy)* is the study of the prenatal developmental changes in an individual (Fig. 1.3).



Fig. 1.2: Inspection of the chest

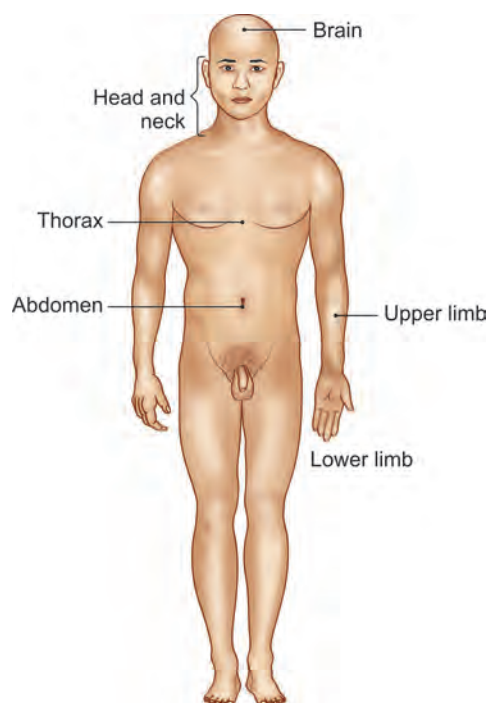


Fig. 1.1: Various regions of the body

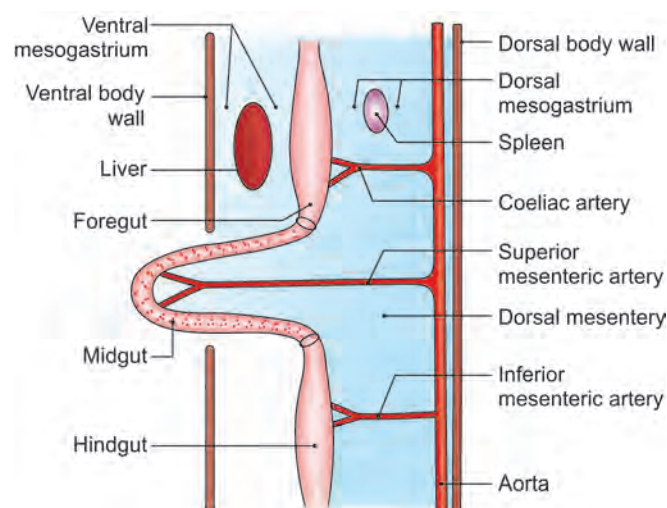


Fig. 1.3: Development of various parts of the gut

- 4 *Histology (microscopic anatomy)* is the study of structures with the aid of a microscope (Fig. 1.4).
- 5 *Surface anatomy (topographic anatomy)* is the study of deeper parts of the body in relation to the skin

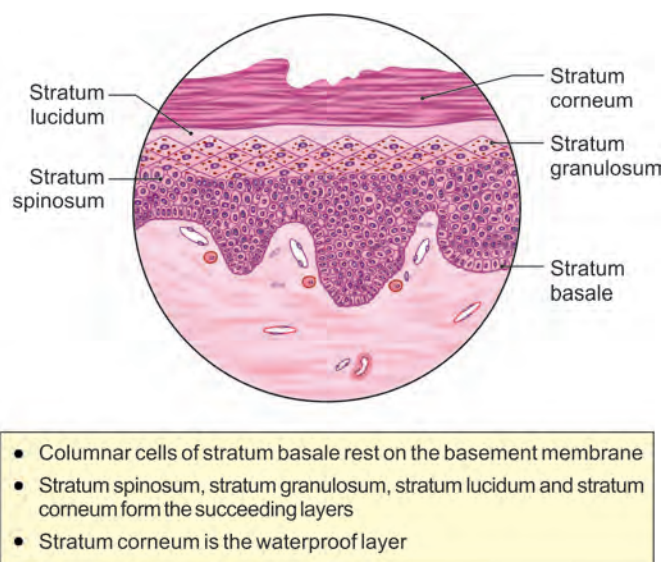


Fig. 1.4: Histology of the skin

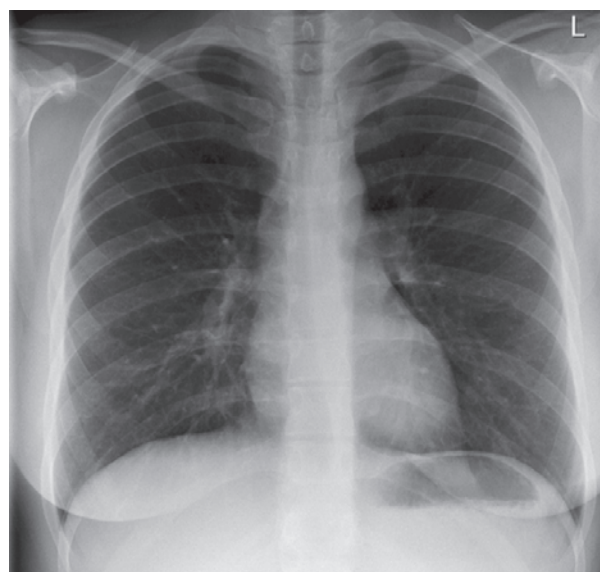


Fig. 1.6: X-ray chest: Posteroanterior view

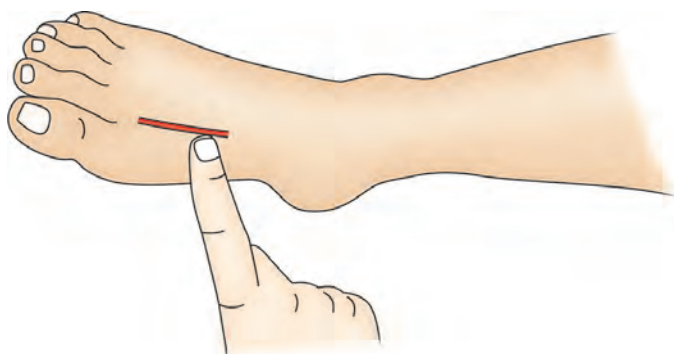


Fig. 1.5: Palpating the dorsalis pedis artery

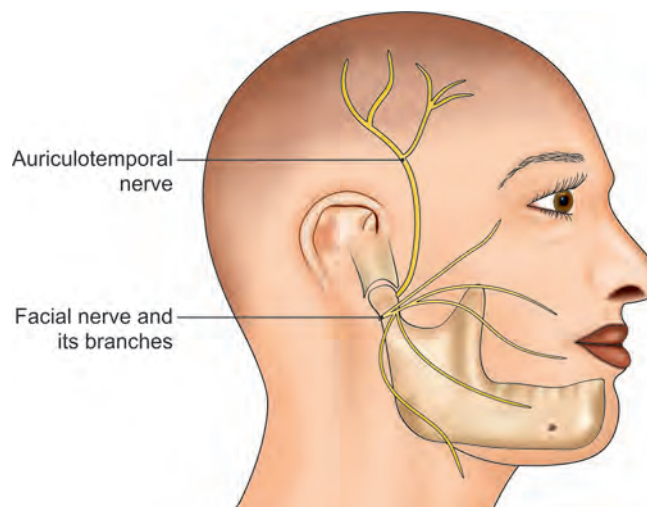


Fig. 1.7: Close relation of the two nerves to the temporomandibular joint

surface, e.g. palpating the artery. It is helpful in clinical practice and surgical operations, e.g. palpating the artery (Fig. 1.5).

- 6 *Radiographic and imaging anatomy* is the study of the bones and deeper organs by plain and contrast radiography (X-ray), by ultrasound and computerised tomographic (CT) scans and MRI scans (Fig. 1.6).
- 7 *Applied anatomy (clinical anatomy)* deals with application of the anatomical knowledge to the medical and surgical practice (Fig. 1.7).
- 8 *Genetics* deals with the study of information present in the chromosomes (see Chapter 43).

## LANGUAGE OF ANATOMY

Various positions, planes, terms in relation to various regions specially head and neck and their movements are described.

### Positions

- *Anatomical position*: When a person is standing straight with eyes looking forwards, both arms by the side of body, palms facing forwards, both feet together, the position is anatomical position (Fig. 1.8).
- *Supine position*: When a person is lying on her/his back, arms by the side, palms facing upwards and feet put together, the position is supine position (Fig. 1.9).
- *Prone position*: Person lying on his/her face, chest and abdomen is said to be in prone position (Fig. 1.10).

### Planes

- A plane passing through the centre of the body dividing it into two equal right and left halves, is

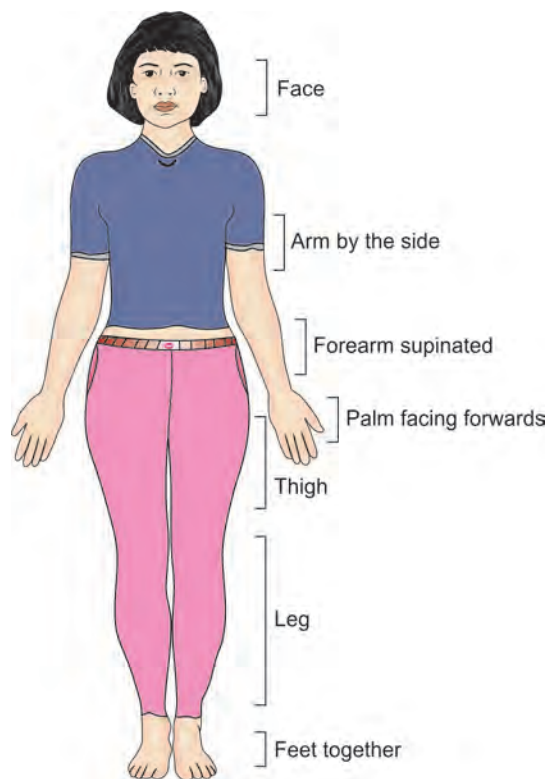


Fig. 1.8: Anatomical position

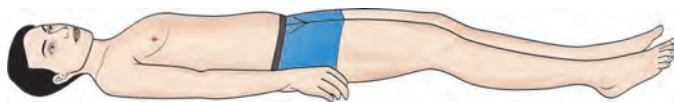


Fig. 1.9: Supine position



Fig. 1.10: Prone position

the median or midsagittal plane (Fig.1.11). Plane parallel to median or midsagittal plane is the sagittal plane.

- A plane at right angles to sagittal or median plane which divides the body into anterior and posterior halves is called a *coronal plane*.
- A plane at right angles to both sagittal and coronal planes which divides the body into upper and lower parts is called a *transverse—horizontal plane*.

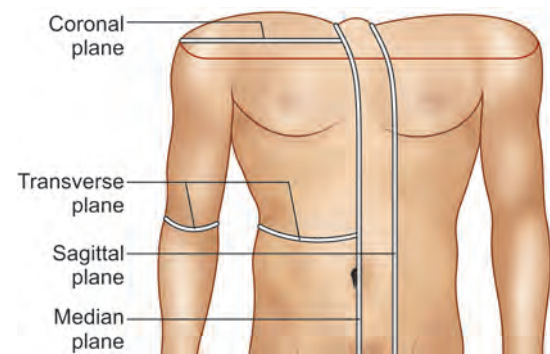


Fig. 1.11: Median, sagittal, coronal and horizontal planes

### Terms Used in Relation to Trunk, Neck and Face

- *Ventral* or *anterior* is the front of trunk, neck and face.
- *Dorsal* or *posterior* is the back of trunk, neck and face.
- *Medial* is a plane close to the median plane.
- *Lateral* is plane away from the median plane.
- *Proximal/cranial/superior* is close to the head end of body (Figs 1.12 and 1.13).
- *Distal/caudal/inferior* is close to the lower end of the trunk.
- *Superficial* is close to skin/towards the surface of body.
- *Deep* is away from skin/away from the surface of body.
- *Ipsilateral* is on the same side of the body as another structure.
- *Contralateral* is on opposite side of the body from another structure.
- *Invagination* is projection inside.
- *Evagination* is projection outside.

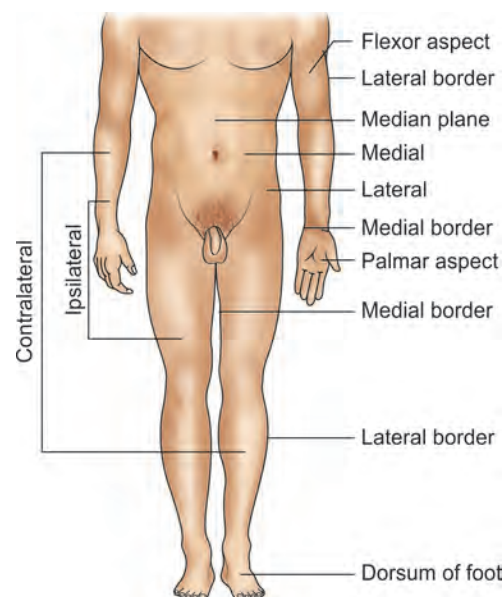


Fig. 1.12: Language of anatomy

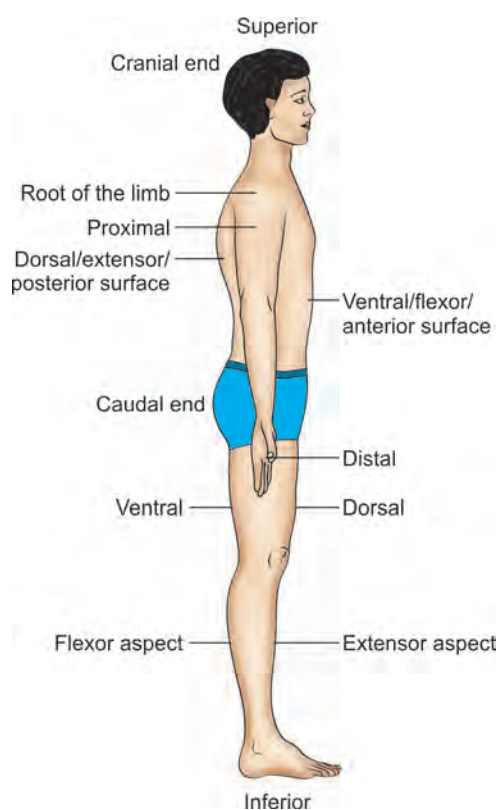


Fig. 1.13: Anatomical terms

#### Terms Used in Relation to Upper Limb

- *Ventral* or *anterior* is the front aspect.
- *Dorsal* or *posterior* is the back aspect.
- *Medial border* lies along the little finger, medial border of forearm and arm.
- *Lateral border* follows the thumb, lateral border of forearm and arm.
- *Proximal* is close to root of limb, while *distal* is away from the root (Fig. 1.13).
- *Palmar* aspect is the front of the palm (Fig. 1.12).
- *Dorsal* aspect of hand is on the back of palm.
- *Flexor* aspect is front of upper limb.
- *Extensor* aspect is back of upper limb.

#### Terms Used in Relation to Lower Limb

- *Posterior* aspect is the back of lower limb.
- *Anterior* aspect is the front of lower limb (Fig. 1.13).
- *Medial border* lies along the big toe or hallux, medial border of leg and thigh (Fig. 1.12).
- *Lateral border* lies along the little toe, lateral border of leg and thigh.
- *Flexor* aspect is back of lower limb.
- *Extensor* aspect is front of lower limb (Fig. 1.13).
- *Proximal* is close to the root of limb, while *distal* is away from it (Fig. 1.13).

#### Terms of Relation Commonly Used in Embryology and Comparative Anatomy, but Sometimes in Gross Anatomy

- Ventral*—towards the belly (like anterior).
- Dorsal*—towards the back (like posterior).
- Cranial* or *rostral*—towards the head (like superior) (Fig. 1.13).
- Caudal*—towards the tail.

#### TERMS RELATED TO BODY MOVEMENTS

Movements in general at synovial joints are divided into four main categories.

- 1 Gliding movement:** Relatively flat surfaces move back-and-forth and from side-to-side with respect to one another. The angle between articulating bones does not change significantly.
- 2 Angular movements:** Angle between articulating bones decreases or increases. In *flexion* there is decrease in angle between articulating bones and in *extension* there is increase in angle between articulating bones. *Lateral flexion* is movement of trunk sideways to the right or left at the waist. *Adduction* is movement of bone toward midline, whereas *abduction* is movement of bone away from midline (Figs 1.14 and 1.15).
- 3 Special movements:** These occur only at certain joints, e.g. pronation, supination at radioulnar joints, protraction and retraction at temporomandibular joint (Figs 1.21 to 1.23).
- 4 Rotation:** A bone revolves around its own longitudinal axis. In *medial rotation* anterior surface of a bone of limb is turned towards the midline. In *lateral rotation* anterior surface of a bone of limb is turned away from midline.

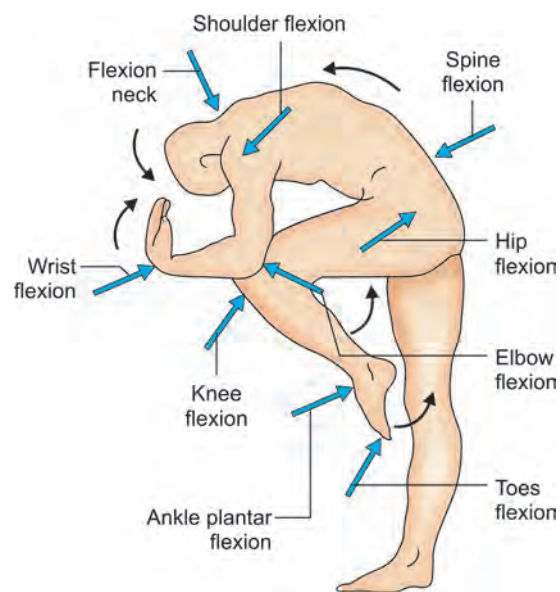


Fig. 1.14: Flexion

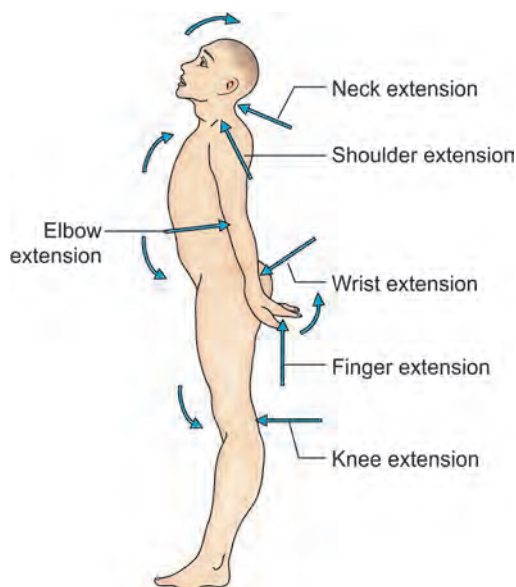


Fig. 1.15: Extension

### In the Neck

- **Flexion:** When face comes closer to chest.
- **Extension:** When face is taken away from the chest (Fig. 1.16).
- **Lateral flexion:** When ear is brought close to shoulder (Fig. 1.17).
- **Rotation:** When neck rotates so that chin goes to opposite side.
- **Opening the mouth:** When lower jaw is lowered to open the mouth (Fig. 1.18).
- **Closure of the mouth:** When lower jaw is opposed to the upper jaw, closing the mouth (Fig. 1.19).
- **Protraction:** When lower jaw slides forwards in its socket in the temporal bone of skull (Fig. 1.20).
- **Retraction:** When lower jaw slides backwards in its socket in the temporal bone of skull (Fig. 1.21).

### In Upper Limb

- **Flexion:** When two flexor surfaces are brought close to each other, e.g. in wrist joint when front of arm and palm move close to each other (Fig. 1.22).
- **Extension:** When extensor or dorsal surfaces are brought in as much approximation as possible, e.g. straighten the forearm at the elbow joint.
- **Abduction of shoulder:** When limb is taken away from the body.
- **Adduction of shoulder:** When limb is brought close to the body.
- **Flexion of shoulder:** If arm is taken towards the front of the chest wall.
- **Extension:** Arm is taken backwards and laterally.
- **Circumduction:** It is movement of distal end of a part of the body in a circle. A combination of extension,

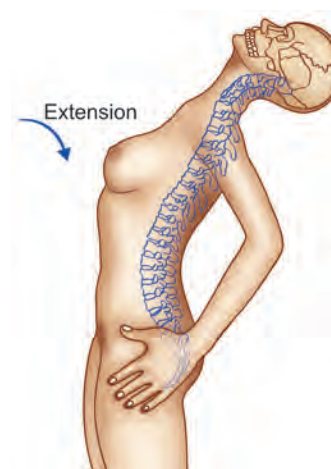


Fig. 1.16: Extension of neck and trunk



Fig. 1.17: Lateral flexion of neck and trunk

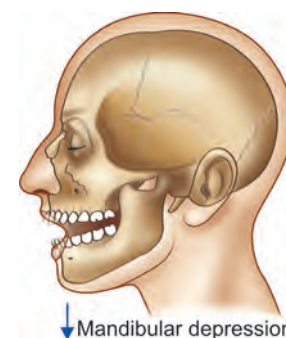


Fig. 1.18: Opening the mouth

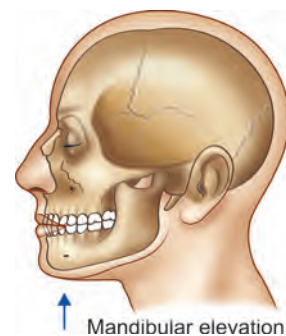


Fig. 1.19: Closure of the mouth

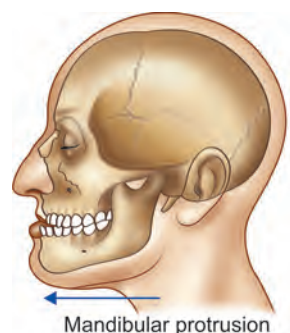


Fig. 1.20: Protraction of lower jaw

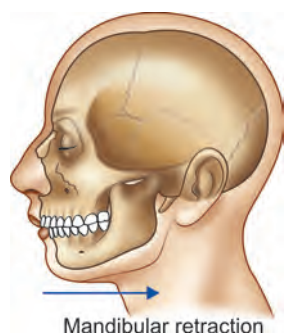


Fig. 1.21: Retraction of lower jaw

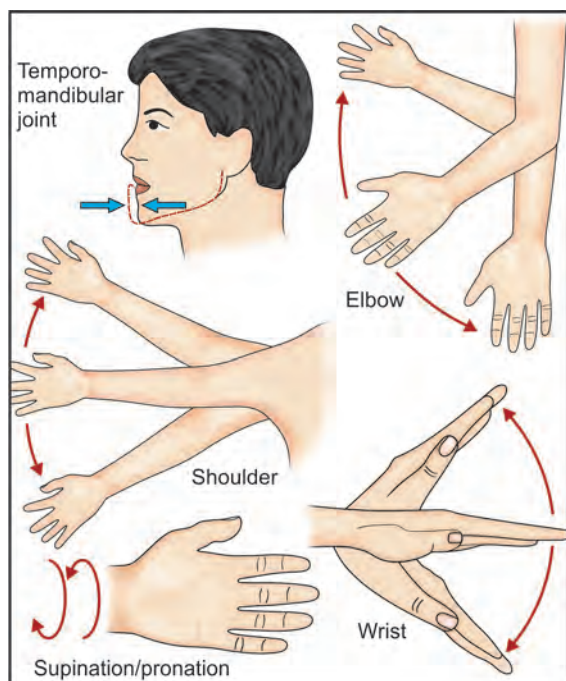


Fig. 1.22: Movements of some of the joints

abduction, flexion and adduction in a sequence is called circumduction as in bowling.

- **Supination:** When the palm is facing forwards or upwards, as in putting food in the mouth.
- **Pronation:** When the palm faces backwards or downwards, as in picking food with fingers from the plate (Fig. 1.22).

- **Adduction of digits/fingers:** When all the fingers get together.
- **Abduction:** When all fingers separate.  
The axis of movement of fingers is the line passing through the centre of the middle finger.
- **Opposition of thumb:** When tip of thumb touches the tips of any of the fingers.
- **Circumduction of thumb:** Movement of extension, abduction, flexion and adduction in sequence.
- **Flexion of thumb:** When thumb is taken across the palm.
- **Extension of thumb:** When thumb is taken backwards in the plane of the palm.
- **Abduction of thumb:** When thumb is put vertically at right angles to plane of the palm.
- **Adduction of thumb:** When thumb is in close contact with lateral side of index finger
- **Flexion of wrist:** When palm comes closer to front of forearm.
- **Extension of wrist:** When dorsum of hand comes closer to back of forearm.
- **Flexion of metacarpophalangeal and interphalangeal joints:** When attempting to make a fist.
- **Extension of metacarpophalangeal and interphalangeal joints:** When opening the fist.

#### In Lower Limb

- **Flexion of thigh:** When front of thigh comes close to or in contact with front of abdomen (Fig. 1.23).
- **Extension of thigh:** When person stands erect.

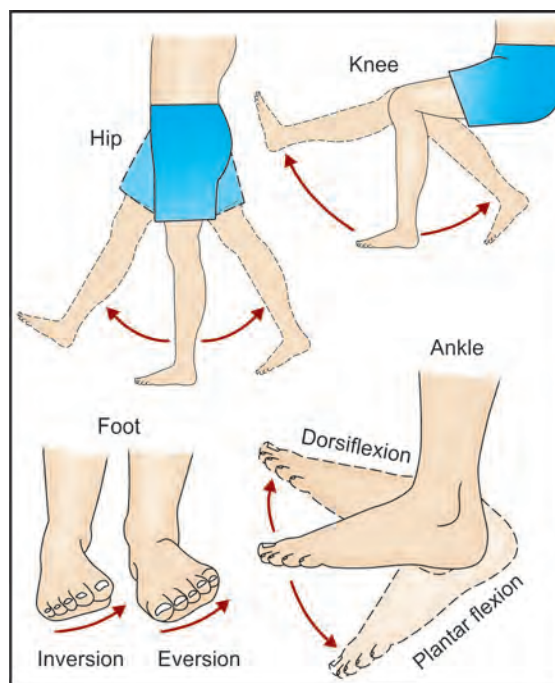


Fig. 1.23: Movements of joints of lower limb

- **Abduction:** When thigh is taken away from the median plane.
- **Adduction:** When thigh is brought close to median plane.
- **Medial rotation:** When thigh is turned medially. It is done by pointing the big toe medially.
- **Lateral rotation:** When thigh is turned laterally. It is done by pointing the big toe laterally.
- **Circumduction:** When flexion, adduction, extension and abduction are done in sequence
- **Flexion of knee:** When back of thigh and back of leg come close to or are in opposition.

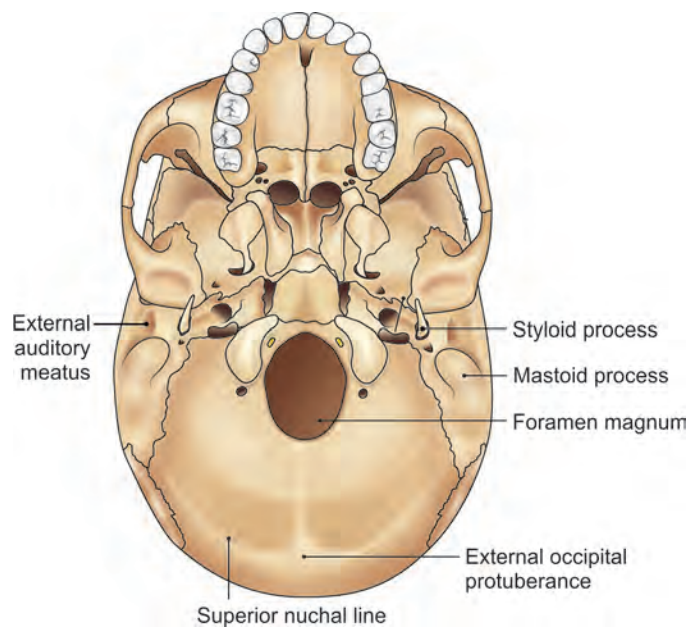


Fig. 1.24: Terms used for describing bone features

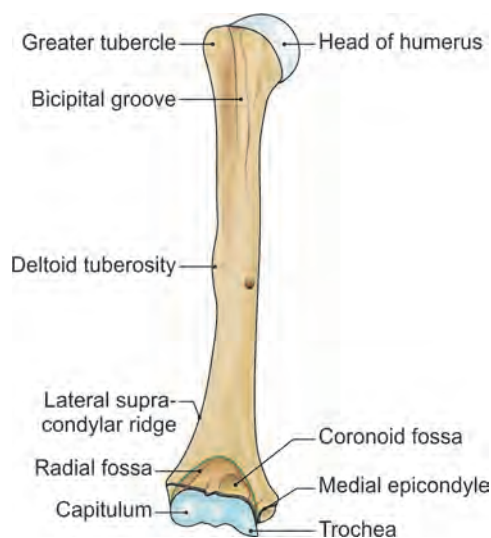


Fig. 1.25: Terms used for describing bone features

### Terms Used for Describing Bone Features

| Bone marking                               | Example                                                                            |
|--------------------------------------------|------------------------------------------------------------------------------------|
| <b>Linear elevation</b>                    |                                                                                    |
| Line                                       | Superior nuchal line and inferior nuchal line of the occipital bone (Fig. 1.24)    |
| Crest                                      | The iliac crest of the hip bone of spine, of scapula                               |
| Ridge                                      | The medial and lateral supracondylar ridges of the humerus (Fig. 1.25)             |
| <b>Rounded elevation</b>                   |                                                                                    |
| Tubercle                                   | Pubic tubercle, lesser and greater tubercles of humerus (Fig. 1.25)                |
| Protuberance                               | External occipital protuberance                                                    |
| Tuberosity                                 | Ischial tuberosity of the hip bone, deltoid tuberosity                             |
| Malleolus                                  | Medial malleolus of the tibia, lateral malleolus of the fibula                     |
| Trochanter                                 | Greater and lesser trochanters of the femur                                        |
| <b>Sharp elevation</b>                     |                                                                                    |
| Spine or spinous process                   | Ischial spine, spine of vertebra, anterior superior iliac spine                    |
| Styloid process                            | Styloid process of temporal bone (Fig. 1.24)                                       |
| <b>Expanded ends for articulation</b>      |                                                                                    |
| Head                                       | Head of humerus, head of femur, head of radius                                     |
| Condyle                                    | Medial and lateral condyles of femur                                               |
| Epicondyle                                 | Medial and lateral epicondyles of femur, medial and lateral epicondyles of humerus |
| (a prominence situated just above condyle) |                                                                                    |
| <b>Small flat area for articulation</b>    |                                                                                    |
| Facet                                      | Facet on head of rib for articulation with vertebral body                          |
| <b>Depressions</b>                         |                                                                                    |
| Notch                                      | Greater sciatic notch and lesser sciatic notch of hip bone                         |
| Groove or sulcus                           | Bicipital groove of humerus                                                        |
| Fossa                                      | Radial and coronoid fossae of humerus, acetabular fossa of hip bone                |
| <b>Openings</b>                            |                                                                                    |
| Fissure                                    | Superior orbital and inferior orbital fissures (Fig. 1.26)                         |
| Foramen                                    | Infraorbital foramen of the maxilla                                                |
| Canal                                      | Carotid canal of temporal bone                                                     |
| Meatus                                     | External acoustic meatus and internal acoustic meatus of temporal bone             |

- **Extension of knee:** When thigh and leg are in straight line as in standing (Fig. 1.23).
- **Dorsiflexion of foot:** When dorsum of foot is brought close to front of leg and sole faces forwards.
- **Plantar flexion of foot:** When sole of foot or plantar aspect of foot faces backwards (Fig. 1.23).

- **Inversion of foot:** When medial border of foot is raised from the ground.
- **Eversion of foot:** When lateral border of foot is raised from the ground (Fig. 1.23).

#### In the Trunk

- Backward bending is called *extension* (Fig. 1.16).
- Forward bending is *flexion*.
- Sideward movement is *lateral flexion* (Fig. 1.17).
- Sideward rotation is *lateral rotation*.

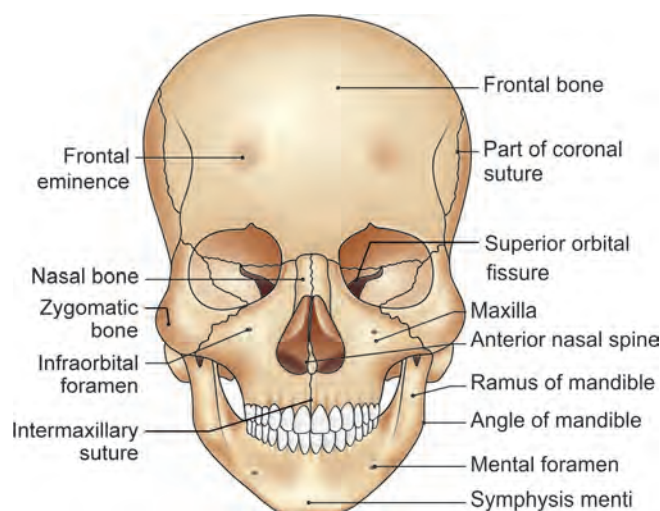


Fig. 1.26: Terms used for describing bone features

#### CLINICAL ANATOMY

1. **Inflammation** is the local reaction of the tissues to an injury or an abnormal stimulation caused by a physical, chemical, or biologic agent. It is characterized by:
  - a. Swelling
  - b. Pain

- c. Redness
  - d. Warmth or heat
  - e. Loss of function.
2. **Paralysis:** Loss of motor power (movement) of a part of body due to denervation or primary disease of the muscles.
  3. **Hemiplegia:** Paralysis of one-half of the body.
  4. **Paraplegia:** Paralysis of both the lower limbs.
  5. **Monoplegia:** Paralysis of any one limb.
  6. **Anaesthesia:** Loss of sensation.
  7. **Tumour (neoplasm):** A circumscribed, noninflammatory, abnormal growth arising from the body tissues.
  8. **Benign:** Mild illness or growth which does not endanger life.
  9. **Malignant:** Severe form of illness or growth, which may be resistant to treatment.



#### FACTS TO REMEMBER

- Hippocrates is the father of medicine.
- Dr Inderjit Dewan researched on osteology and anthropology.
- Anatomical position is the most important position for understanding anatomy.
- Pronation and supination of forearm are special movements which permit "picking up of food (pronation)" and "putting it in the mouth (supination)".
- Big toe being in the same plane as rest of the toes is unique to human.
- There are 12 systems in the body. Medical students learn anatomy as regional anatomy, whereas nursing students learn it as systemic anatomy.



#### Multiple Choice Questions

1. Anatomical position has following features, *except*:
  - a. Person standing erect
  - b. Forearms are pronated
  - c. Feet together
  - d. Eyes looking forwards
2. What is the position of forearms in the anatomical position?
  - a. Pronated
  - b. Supinated
  - c. Midprone
  - d. None of the above
3. The term cranial means:
  - a. Towards the head
  - b. Towards the back
  - c. Towards the tail
  - d. Towards the front



#### Answers

1. b
2. b
3. a