

Chapter 1

GENERAL ANATOMY

R. O. Jaji-Sulaimon, M. S. Ajao

OUTLINE

- ◆ Basic anatomy
- ◆ Anatomical terms for describing positions
- ◆ Anatomical planes
- ◆ Anatomical term for describing relations
- ◆ Cell
- ◆ Tissue
- ◆ Bone
- ◆ Cartilage
- ◆ Joint
- ◆ Case study
- ◆ SAQ
- ◆ MCQ (T/F)
- ◆ Answer

BASIC ANATOMY

- ◆ Basic anatomy is one of the major subdivisions of human anatomy. It helps to understand the terminology and concepts of anatomy.
- ◆ Human anatomy uses its own collection of terms. Many of these are taken from Latin and Greek languages and each has a very specific meaning.
- ◆ It is really important to understand the basic terms, which would be used again and again throughout the course of learning anatomy.

ANATOMICAL TERMS FOR DESCRIBING POSITIONS

(Fig. 1.1)

Anatomical position: In this position the body is erect in the standing position with eyes

also looking straight. The palms are hanging by the sides close to the body and are facing forwards. The feet point forwards and the legs are fully extended.

Anatomical position is important because the relations of all structures are described as presumed to be in anatomical position.

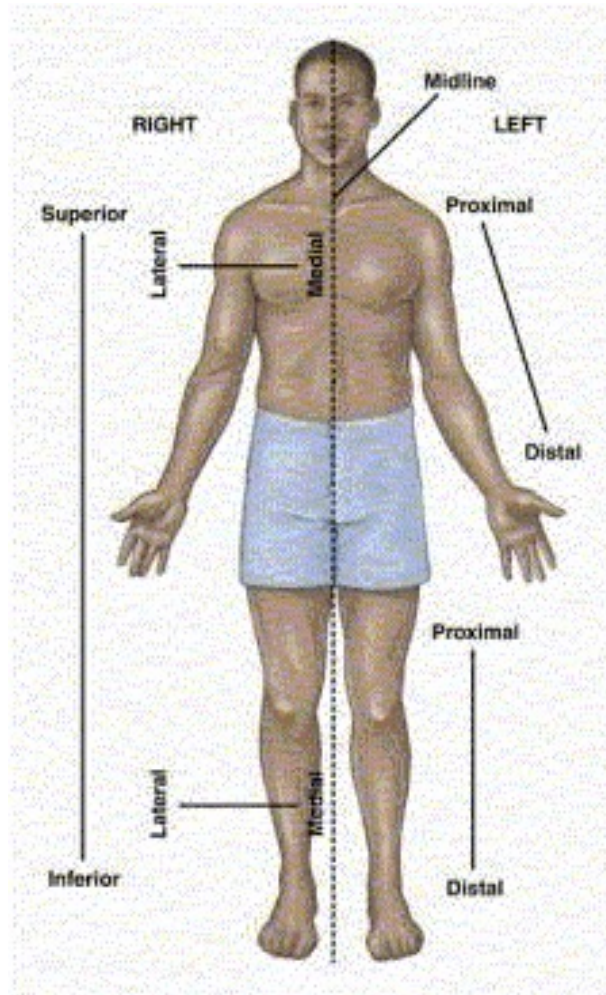


Fig. 1.1a

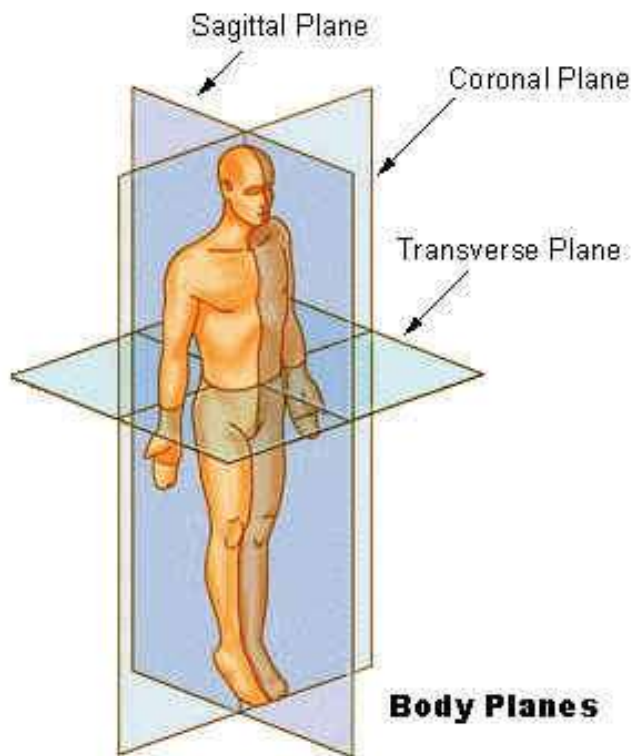


Figure 1.1b Anatomical terms and planes.

ANATOMICAL PLANES

(Figure 1.1)

- ◆ **Median or Mid-Sagittal Plane:** This is the plane which divides the body into equal right and left halves.
- ◆ **Sagittal Plane:** It is any plane parallel to the median plane. This plane divides the body into unequal right and left halves.
- ◆ **Coronal Plane:** It is a vertical plane at right angle to median plane. It divides the body into anterior and posterior parts.
- ◆ **Transverse Plane:** It is the horizontal plane of the body. It is perpendicular to both coronal and sagittal planes.
- ◆ **Oblique Plane:** Any plane other than the above described planes will be oblique plane.

ANATOMICAL TERMS FOR DESCRIBING RELATIONS

Figure 1.2 Some terms for anatomical relations.

Terms of Relation

(Fig. 1.2)

- ◆ Anterior: towards the front.
- ◆ Posterior: towards the back.
- ◆ Superior: towards the head.
- ◆ Inferior: towards the feet.
- ◆ Medial: towards the median plane (near the middle of the body).
- ◆ Lateral: away from the median plane (away from the middle of the body).
- ◆ Flexion: A movement by which the angle of a joint is decreased
- ◆ Extension: A movement by which the angle of a joint is increased
- ◆ Adduction: Movement toward the central axis
- ◆ Abduction: Movement away from the central axis
- ◆ Medial rotation: Rotation toward the medial side of the body
- ◆ Lateral rotation: Rotation towards the lateral side of the body
- ◆ Pronation: This movement occurs in the forearm whereby the palm is turned backwards
- ◆ Supination: This movement also occurs in the forearm whereby the palm is turned forwards

CELL

(Fig. 1.3)

- ◆ The human body, which is made up of numerous cells, begins as a single, newly fertilized cell. Almost all human cells are microscopic in size.
- ◆ To give an idea how small a cell is, an average-sized adult body, according to one estimate, consists of 100 trillion cells.

Figure 1.3 Schematic diagram of the eukaryotic cell.

- ◆ Cell Theory: All known living things are made up of cells. All cells come from preexisting cells by division. The cell is the structural and functional unit of all living things.
- ◆ Cell Structural Overview: The major parts of a cell are the nucleus, cytoplasm, and cell membrane.
- ◆ Cell Division: Cells divide either by mitosis or meiosis. The latter is undertaken by some germ cells.

TISSUE

- ◆ Tissue is a group of cells that have similar structure and that function together as a unit.
- ◆ The intercellular matrix fills the spaces between the cells. This may be abundant in some tissues and minimal in others.
- ◆ The intercellular matrix may contain special substances such as salts and fibers that are unique to a specific tissue and gives that tissue distinctive characteristic.

There are four main tissue types in the body:

- ◆ Epithelial Tissue
- ◆ Connective Tissue
- ◆ Muscle Tissue
- ◆ Nervous Tissue

BONE

- ◆ Bone is a dense type of [connective tissue](#) that is impregnated with inorganic salts mainly the salts of calcium such as calcium phosphate, calcium carbonate etc.
- ◆ The organic portion of the bone constitutes $\frac{1}{3}$ and the inorganic salt component constitutes $\frac{2}{3}$.
- ◆ The inorganic salts are mainly responsible for rigidity and hardness, which make bone resist

compression caused by the forces of weight and impact. The organic connective tissue portion of the bone makes it resilient and thus the bone can afford resistance to tensile forces.

BASIC STRUCTURE OF LONG BONE

A typical long bone of adult human consists of the following parts: shaft (diaphysis) and ends (epiphyses).

CARTILAGE

- ◆ Cartilage is a type of connective tissue composed of special cells known as chondrocytes along with collagen or yellow elastic fibers.
- ◆ The fibers and the cells are embedded in a firm gel like matrix rich in mucopolysaccharides. Cartilage is not as hard and rigid as bone. It is much more flexible and elastic.

Types of cartilage:

There are three types of cartilage:

- ◆ Hyaline cartilage
- ◆ Fibrous cartilage
- ◆ Elastic cartilage

JOINT

- ◆ Joint is a junction between two or more bones or cartilages. It permits movements in a hard and rigid skeleton.
- ◆ Joints are formed in such a way that they keep a balance between the movement, stability and strength of human skeleton.
- ◆ However, there are some types of joints where movements are sacrificed for stability and in other cases the stability is sacrificed for movements. For example the shoulder joint and hip joint are both ball and socket joints but shoulder joint is more mobile and less stable while hip joint is more stable and less mobile.
- ◆ There are more joints in a child than in an adult because as growth proceeds some of the bones fuse together e.g. the ischium, ilium and pubis fuse together to form the pelvic bone (hip bone). Similarly the two halves of the infant frontal bone and of the infant mandible fuse together, five sacral vertebrae form one sacrum and four coccygeal vertebrae form one coccyx.

Classification of Joints

There are three main types of joints in the body. These include:

- ◆ cartilaginous,
- ◆ fibrous, and
- ◆ synovial joints.

Cartilaginous Joints

(Fig. 1.4)

In cartilaginous joints, the articulating bones are united by cartilage. Like fibrous joints, these joints lack joint cavities. Two types of this joint exist, and they include:

- ◆ **synchondrosis** (primary cartilaginous joint), and
- ◆ **symphysis** (secondary cartilaginous joint).

Figure 1.4 Examples of cartilaginous joints.

Fibrous Joints

- ◆ At fibrous joints, the articulating bones are united by fibrous connective tissue.
- ◆ These joints lack cavities and they permit little or no movements.
- ◆ The three main types of fibrous joints include:
 - **sutures**, — **gomphoses**, and — **syndesmoses**.

Synovial Joints

(Fig. 1.5)

Synovial joints are adapted for high degrees of mobility; movement at these joints depends on (i) the nature of the articulating bones, (ii) the arrangement of the ligaments and fibrous capsule of the joint and, (iii) the muscles associated with the joint.

Figure 1.5 Schematic diagram of the synovial joint.

Types of Synovial Joint

Types of synovial joints include:

1. Plane joint
2. Saddle joints
3. Hinge joints
4. Ball and socket joints
5. Condylloid joints; and
6. Ellipsoidal joints

CASE STUDY

The function of a tissue is actually a function of its cells; and the function of a cell is a function of its organelles. Knowing this, what type of organelles would be particularly abundant in cardiac muscle tissue that requires a lot of energy; in reticular tissue within the liver, where cellular debris and toxins are ingested; and in dense regular connective tissue that consists of tough protein strands?

SAQ

Describe how epithelial glands are classified according to structural complexity and secretory function.

MCQ (T/F)

Which of the following are characterized rapid mitotic division?

1. Surface epithelium

2. Nerve cells
3. Skeletal muscle cells
4. Cardiac muscle cells
5. Epidermal cells

ANSWER

- | | |
|-----|---|
| (a) | T |
| (b) | F |
| (c) | F |
| (d) | F |
| (e) | T |

Chapter 2

GENERAL EMBRYOLOGY

O. B. Akinola, B. U. Enaibe, R. O. Jaji-Sulaimon

OUTLINE

- ◆ Introduction to general embryology
- ◆ Gametes and gametogenesis
- ◆ Fertilization and cleavage
- ◆ Blastogenesis and implantation
- ◆ Events of the second week of pregnancy
- ◆ Period of organogenesis
- ◆ Case study
- ◆ SAQ
- ◆ MCQ
- ◆ Answer to questions

INTRODUCTION TO GENERAL EMBRYOLOGY

- ◆ The initial 8 weeks of pregnancy is the embryonic period and is very critical. At the end of this period, the primordia (anlages) of most organs and tissues have been laid down.
- ◆ Week 9 to birth is the foetal period, when developing organs mature and attain definitive status.
- ◆ Exposure of embryo to teratogens (certain drugs, irradiation, etc) can trigger formation of congenital anomalies.
- ◆ Key post-fertilization events of the first 8 weeks of pregnancy include blastogenesis,

implantation, development of chorionic villi, gastrulation, neurulation, and differentiation of germ layers (endoderm, mesoderm and ectoderm).

GAMETES AND GAMETOGENESIS

(Fig. 2.1)

- ◆ The male gamete is the spermatozoon or sperm cell. It is elongated and highly motile
- ◆ The female gamete is the ovum. It is round and immotile
- ◆ The process that converts a spermatogonium to spermatozoon is spermatogenesis. It occurs in the seminiferous tubules of a mature male
- ◆ Successive stages of spermatogenesis include: mitosis (spermatocytosis), meiosis and spermiogenesis (or spermateliosis)
- ◆ Oogenesis (ovogenesis) is the process that leads to the formation of the ovum. This process starts in utero, is suspended in the prepubescent postnatal years, and resumes at puberty. Between puberty and menopause, an ovum is typically released in each menstrual cycle
- ◆ When on oral contraceptive however, the menstrual cycle becomes anovulatory

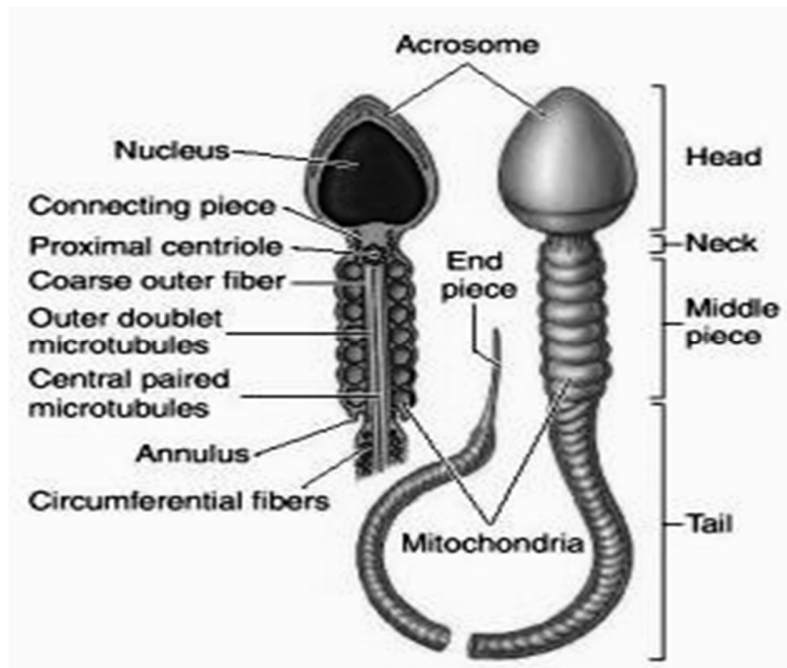


Figure 2.1 Human spermatozoon.

FERTILIZATION AND CLEAVAGE

- ◆ Conception starts at fertilization, when the male and female gametes fuse to form a unicellular diploid cell called **zygote**. This usually occurs in the ampullary region of the uterine tube
- ◆ Cleavage is the series of mitotic cell divisions that converts a unicellular zygote to a multicellular **morula** (Fig. 2.2). Each cell of the morula is termed a blastomere

- ◆ If the two daughter cells from the first mitotic division of the zygote continue to develop independently, monozygotic twins will result

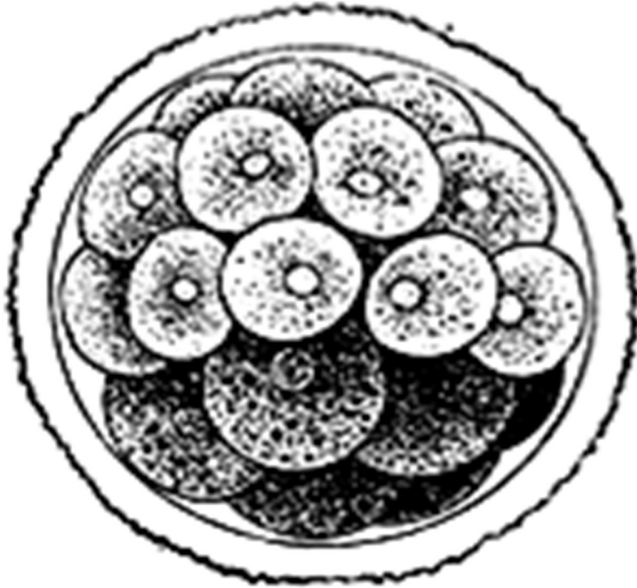


Figure 2.2 The morula

BLASTOGENESIS AND IMPLANTATION

- ◆ Blastogenesis occurs in the uterine cavity. It is the conversion of a morula to a fluid-filled blastocyst. Cells of the blastocyst are arranged as inner embryoblast and outer trophoblast
- ◆ At around the 6th day post-fertilization, the blastocyst begins to implant. Implantation is the embedding of the conceptus (embryo and associated membranes) into the endometrium. The process is completed in the 2nd week of pregnancy
- ◆ Ectopic pregnancy occurs when the conceptus implants outside the uterus, usually in the uterine tube

EVENTS OF THE SECOND WEEK OF PREGNANCY

(Fig. 2.3)

- ◆ In the 2nd week of pregnancy, implantation of the conceptus is completed; the bilaminar embryo (consisting of the hypoblast and epiblast) is formed; and a primitive uteroplacental circulation is established
- ◆ Weeks 1 and 2 constitute the pre-embryonic stage of development

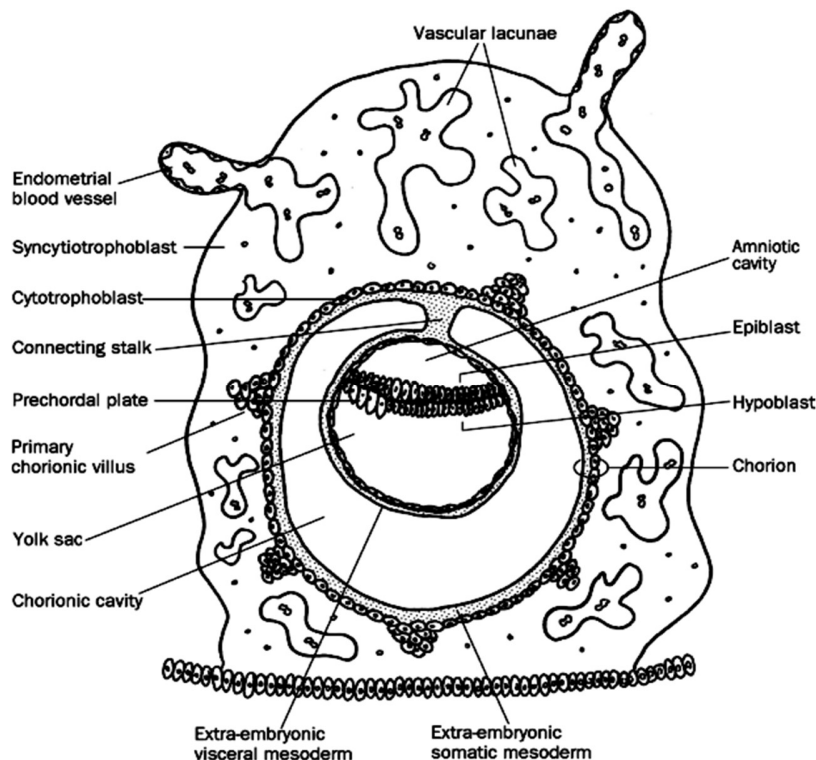


Figure 2.3 The embryo and its membranes at 12 days post-fertilization.

PERIOD OF ORGANOGENESIS (EMBRYONIC PERIOD; 3RD – 8TH WEEKS)

- ◆ Weeks 3 – 8 constitute the embryonic period of development or the period of organogenesis
- ◆ In the 3rd week of development, the following major events occur: gastrulation, neurulation, and angiogenesis. The 3 germ layers (endoderm, mesoderm, ectoderm) formed at gastrulation are the sources of all the tissue of the embryo
- ◆ In the organogenetic period, primordia of all tissues and organs of the body are established from the three germ layers formed at gastrulation
- ◆ Ectoderm forms epidermis and its appendages, as well as the nervous system
- ◆ Endoderm forms the parenchyma of the thyroid and parathyroid glands, as well as the glands of the gastrointestinal tract (GIT) and respiratory system (RS). It also forms the epithelia of the GIT and RS
- ◆ Mesoderm forms the excretory organs, connective tissue stroma of glands and several organs; and the linings of the pericardial, pleural and peritoneal cavities, dermis, and the bulk of the skeletal muscles
- ◆ During the organogenetic period, the embryo is highly susceptible to teratogenic insults that may induce birth defects. These insults include drugs, certain environmental agents and genetic factors

CASE STUDY

A sexually-active woman has not been pregnant in the last 5 years because she is on oral contraceptive pills (OCPs). She visited her doctor to get advice on certain changes she noted in recent times, and indicated her readiness to stop the medication as she prepares to have her first baby.

- a. Why has the woman not been able to conceive while on the OCPs?
- b. How would you explain the fact that the woman still menstruates while on the OCPs?
- c. What hormonal changes will occur once the OCPs are stopped; and how would these changes facilitate pregnancy?

SAQ

The placenta is an accessory structure with maternal and fetal components. Highlight the processes involved in its formation; and explain its obstetric importance and fate.

MCQ (T/F)

Which of these statements are correct?

- a. Ovary releases an ovum around middle of menstrual cycle
- b. Spermatogonia and oogonia are normally found in adult gonads
- c. Primordia of the brain arises in the 3rd week post-fertilization
- d. Oestrogens levels are highest in the secretory phase of menstrual cycle
- e. Corpus luteum is indispensable in the first trimester of pregnancy

MCQ (1 in 5 Questions)

During early embryonic development, which of these is correct?

- a. Syncytiotrophoblast is an endocrine organ
- b. Cleavage largely occurs in the uterine cavity
- c. Ovum undergoes post-fertilization capacitation
- d. Uteroplacental circulation normally begins in the 5th week
- e. Corpus luteum rapidly involutes

Answers

T/F

- (a) F
- (b) F
- (c) T
- (d) F
- (e) T

One in Five

Option 'a' is the best answer

