IVC COURSE CODE : 618

PHYSIOTHERAPY

First Year

(w.e.f. 2018-19)

Intermediate Vocational Course

Paper I **: Anatomy & Physiology**

Paper II **: Psychology & Abnormal psychology**

Paper III **: Biomechanics & Exercise Therapy**

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ANNUAL SCHEME OF INSTRUCTION AND EXAMINATION FOR 1ST YEAR PHYSIOTHERAPY COURSE

Part-A		Theory		Practicals		Total	
		Periods	**Marks**	**Periods**	**Marks**	**Periods**	**Marks**
1.	General Foundatin course	150	50	-	-	150	50
2.	English	150	50	-	-	150	50
Part-B							
3.	**Paper-1** Anatomy and Physiology	135	50	135	50	270	100
4.	**Paper-II** Psychology and Abnormal Psychology.	135	50	135	50	270	100
5.	**Paper-III** Biomechanics and Exercise Therapy.	135	50	135	50	270	100
6.	**OJT**	-	-	365	100	365	100
	Total	**705**	**250**	**770**	**250**	**1475**	**500**

II. on the Job Training **[From 1st November to 31st December]**

EVALUATION OF ON THE JOB TRAINING:

The "On the Job Training" shall carry 100 marks for each year and pass marks is 50. During on the job training the candidate shall put in a minimum of 90 % of attendance.

The evaluation shall be done in the last week of January.

Marks allotted for evaluation:

S.No	Name of the activity	Max. Marks allotted for each activity
1	Attendance and punctuality	30
2	Familiarity with technical terms	05
3	Familiarity with tools and material	05
4	Manual skills	05
5	Application of knowledge	10
6	Problem solving skills	10
7	Comprehension and observation	10
8	Human relations	05
9	Ability to communicate	10
10	Maintenance of dairy	10
	Total	100

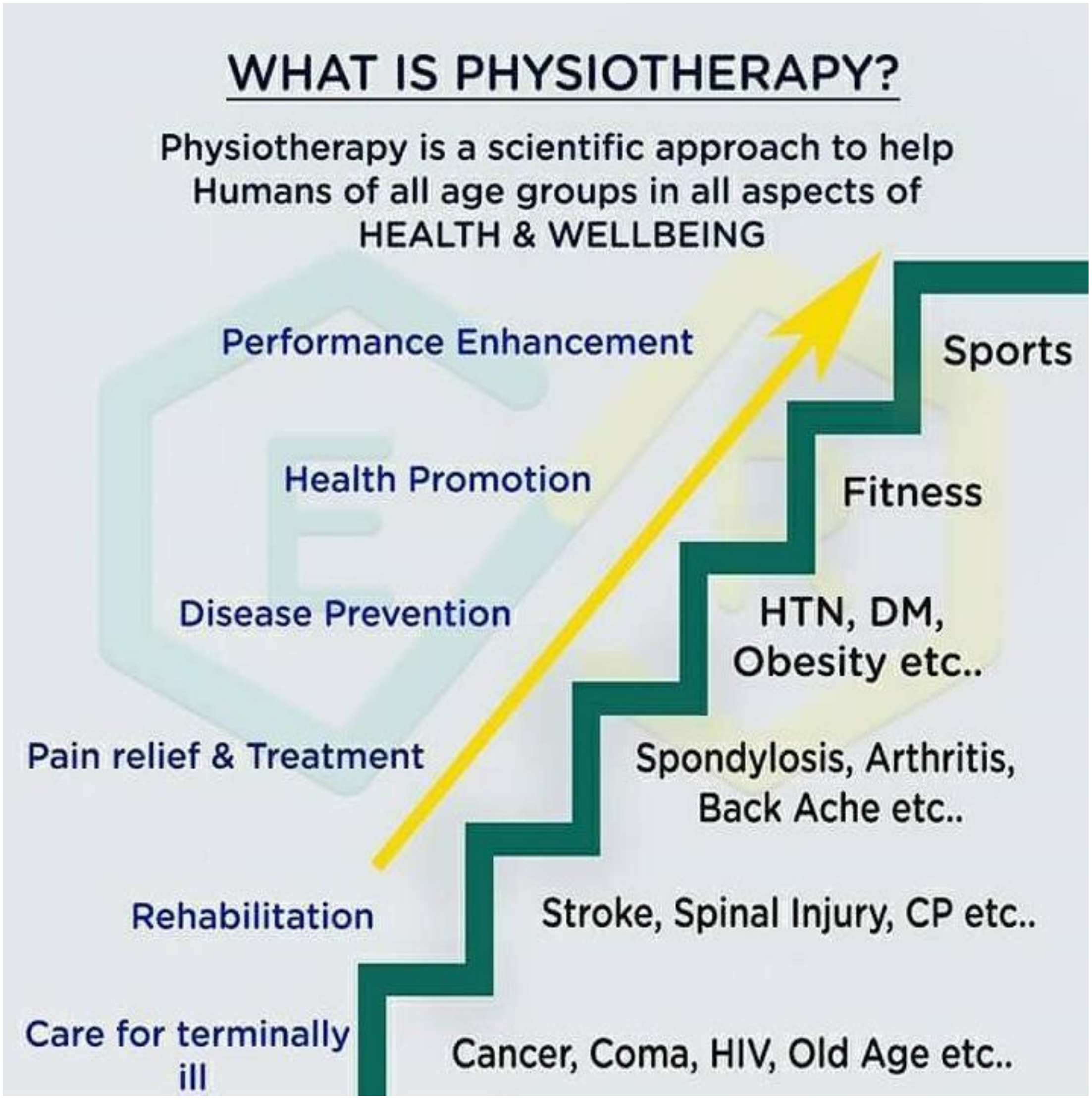
NOTE: The On the Job Training mentioned is tentative. The spirit of On the Job training is to be maintained. The colleges are at liberty to conduct on the job training according to their local feasibility of institutions & industries. They may conduct the entire on the job training periods of I year and (450) II year either by conducting classes in morning session and send the students for OJT in afternoon session or two days in week or weekly or monthly or by any mode which is feasible for both the college and the institution. However, the total assigned periods for on the job training should be completed. The institutions are at liberty to conduct On the Job training during summer also, however there will not be any financial commitment to the department.

PHYSIOTHERAPY

Paper - I

ANATOMY & PHYSIOLOGY

INDEX


WHAT IS PHYSIOTHERAPY?
Physiotherapy is a scientific approach to help Humans of all age groups in all aspects of HEALTH & WELLBEING
Performance Enhancement
Sports
Health Promotion
Fitness
Disease Prevention
HTN, DM, Obesity etc..
Pain relief & Treatment
Spondylosis, Arthritis, Back Ache etc..
Rehabilitation
Stroke, Spinal Injury, CP etc..
Care for terminally ill
Cancer, Coma, HIV, Old Age etc..

UNIT- 1

INTRODUCTION

Contents:

ANATOMY: The word anatomy is derived from a Greek word "Anatome" meaning to cut up. It is the study of structures that make up the body and how those structures relate with each other.

The study of anatomy includes many sub specialties: It is a science that deals with the structures of the body and the relation of various parts to each other. Knowledge of these structures is necessary to understand their functions.

The subject matter of Anatomy includes:

- Cytology – study of cells
- Histology – study of tissues
- Osteology – study of bones
- Myology – study of muscles
- Arthrology - study of joints
- Splanchnology – study of organs
- Neurology – study of nervous system

Descriptive terms used in Anatomy: The arrangement of various parts of body may be:

Symmetric e.g. limbs, eyes, ears and lungs. Their arrangement on the right side and left side are similar.

Asymmetric e.g. spleen and liver. The spleen lies entirely in the left side. Liver lies mostly on the right side.

The following are the few important terms which are used to describe the human body:

Median line (mid sagittal plane): The central plane which divides the body into two halves i.e. right and left.
Medial: nearer to the median line.
Lateral: away from the median line.
Superior: nearer to the head.
Inferior: nearer to the foot.
Anterior: nearer to the front surface of the body.
Posterior: nearer to the back surface of the body.
Proximal: nearer to the origin of the structure.
Distal: away from the origin of the structure.
Superficial: nearer to the skin surface.
Deep: deeper from the skin surface

PHYSIOLOGY: The word physiology derived from a Greek word "for study of nature". It is the study of, how the body and its part work or function. It is the science of life which deals with normal functions of the body. It explains how various systems in the body function together normally as a single unit.

The subject matter of physiology includes the study of various systems like:

- Skeletal system
- Muscular system
- nervous system
- Circulatory system
- Respiratory system
- Digestive system
- Endocrine system
- Excretory system
- reproductive system
- Organs of special senses

Cell: The smallest independent units of life. All life depends on the many chemical activities of cells. Some of the basic functions of cell are: growth, metabolism, irritability and reproduction.

Tissue: Tissue is made up of many similar cells that perform a specific function. The various tissues of the body are divided in to four groups. These are epithelial, connective, nervous and muscle tissue.

Epithelial tissue: - Found in the outer layer of skin, lining of organs, blood and lymph vessels and body cavities.

Connective tissue: - Connects and supports most part of the body. They constitute most part of skin, bone and tendons.

Muscle tissue: - Produces movement through its ability to contract. This constitutes skeletal, smooth and cardiac muscles.

Nerve tissue: - Found in the brain, spinal cord and nerves. It responds to various types of stimuli and transmits nerve impulses.

Organ: - Is an integrated collection of two or more kinds of tissue that works together to perform specific function. For example: Stomach is made of all type of tissues

An organ is a group of tissues arranged in a certain way to carry out a specific function e.g. stomach, heart, kidneys. The human body is highly developed multi-cellular organism containing various organs which perform different functions. The organs are again grouped together to form systems.

Anatomical Position

Anatomical positions are universally accepted as the starting points for positional references to the body. In anatomical position the subject is standing erect and facing the observer, the feet are together, and the arms are hanging at the sides with the palms facing forward.

SYSTEMS OF THE BODY:

A system is a group of organs which together carry out one of the essential functions of the body. The following are some important systems.

1. Cardiovascular system

Components: Heart, blood vessels, and blood.

Functions: Transport of blood; including cells, nutrients, wastes, gases, hormones, etc.

2. Digestive system

Components: Digestive tract which includes mouth, esophagus, stomach, small intestine, large intestine, anus, and accessory organs such as salivary gland, pancreas, liver and gallbladder Functions: Processing and absorption of nutrients

3. Endocrine system

Components: Organs which produce hormones (chemical messengers) which include pituitary, thyroid, thymus, testes, ovaries, etc.

Functions: Long-term regulation of systems by production and release of hormone

Lymphatic system

Components: Includes lymph nodes, lymphatic vessels and their fluid called lymph, tonsils, spleen, and thymus

Functions: Production of lymphocytes for immunity, and collects, filters, and transports fluid (lymph)

5. Muscular system

Components: Includes the skeletal muscles

Functions: Movement of the body and involved in body temperature regulation

6. Nervous system

Components: Includes the brain, spinal cord, nerves, and receptors

Functions: Immediate control of systems, personality, emotions, etc.

7. Reproductive system

Components:

Male: Includes testes, ductus (vas) deferens, prostate, seminal vesicles, and penis. Female: Includes ovaries, fallopian tubes, uterus, and vagina.

Functions: Production of gametes (sperm, egg), implantation and development

8. Respiratory system

Components: Includes the nasal cavity, voice box (larynx), windpipe (trachea), and lungs

Functions: Delivery of air to lungs for oxygen and carbon dioxide exchange

9. Skeletal system

Components: Bones which form the skeleton

Functions: Includes the skeleton which supports, protects, provides for storage of calcium, and serves as a site of blood cell production.

10. Organs of special senses:

Components: eyes, nose, tongue, ears, skin

Functions: helps for vision, smell, taste, hearing and sensation.

CELL

Cell is the basic living structural and functional unit of the body.

Cytology: - It is a branch of science concerned with a study of cells

All living organisms are composed of cell and cell products. Cell is the basic unit of structure function of all living organisms. All cells come from the division of pre existing cell. An organism as a whole can be understood through the collective activities & interactions of its cells.

To know more about cell, we can divide the cell in to four Principal parts: -

Plasma (cell) membrane: it is the outer lining, limiting membrane separating the cell internal parts from extra cellular materials & external environment.

Cytoplasm: cytoplasm is the substance that surround organelles and is located between the nucleus and plasma membrane

Organelles: these are permanent structures with characteristic morphology that are highly specialized in specific cellular activity.

Inclusions: they are the secretions and storage products of cells.

Extra cellular materials are also referred to as the matrix, which are substances external to the cell surface.

Plasma Membrane: Plasma membrane is a thin outer membrane, which maintains the integrity of the cell. It keeps the cell and its contents separate and distinct from the surrounding. It is a double layered measuring about 4.5 nm and made of phospholipids, cholesterol, glyco-lipid, & carbohydrate (oligosaccharides). The bi-layer is self-sealing. If a needle is injected and pulled out, it automatically seals.

Functions: -

Separate the cytoplasm inside a cell from extra cellular fluid.

Separate cell from one another

Provide an abundant surface on which chemical reaction can occur.

Regulate the passage of materials in to and out of cells. It also let some things in and keeps others out.

Cytoplasm

Cytoplasm is a matrix or ground substance in which various cellular components are found. It is thick semi transparent, elastic fluid containing suspended particles and a series of minute tubules and filaments that form cytoskeleton. Water constitutes 75-90% of the cytoplasm. It also contains solid components, proteins, carbohydrates, lipids and inorganic substances. The inorganic components exist as solutions because they are soluble in water. The majority of organic substances however are found as colloids. Colloids are particles that remain suspended in the surrounding medium.

Organelles

Organelles are specialized portion of the cell with a characteristic shape that assume specific role in growth, maintenance, repair and control.

Nucleus, Oval in shape and is the largest structure in the cell. Contain the hereditary factor in the cell. Hence it controls cell activity & structure. Most cell contain single nucleus but some like matured Red Blood cell do not contain. However Muscle cell contain several nucleuses. The nucleus separated from other cell structure by double membrane called nuclear membrane. Pores over the nuclear membrane allow the nucleus to communicate with the cytoplasm. In the nucleus a jelly like fluid that fills the nucleus is karylymph (neucleoplasm), which contain the genetic material called chromosome. Nucleus also contain dark, somewhat spherical, non-membrane bound mass called nucleolus. It contains DNA, RNA and protein, which assist in the construction of ribosome.

Ribosome, tiny granules, composed of Ribosomal RNA (RNA). They are site of protein synthesis Endoplasmic reticulum is a double membrane channel. It is continuous with the nuclear membrane. It involved in intracellular exchange of material with the cytoplasm. Various products are transported from one portion of the cell to another via the endoplasmic reticulum. So it is considered as intracellular transportation. It is also storage for synthesized molecules. Together with the Golgi complex it serves as synthesis & packaging center.

Endoplasmic reticulum (ER) is divided in to two. These are, granular E.R. Containing granule and involving in synthesis of protein and agranular E.R. that synthesize lipid & involves in detoxification.

Golgi Complex, near to the nucleus. It consist 4-8 membranous sacs. It process, sort, pack & deliver protein to various parts of the cell.

Mitochondria, a small, spherical, rod shaped or filamentous structure. It generates energy. Each mitochondria posses two membrane, one is smooth (upper) membrane and the other is arranged with series of folds called cristae. The central cavity of a mitochondrion enclosed by the inner membrane is the matrix.

Lysosomes appear as membrane enclosed spheres. They are formed from Golgi complexes & have single membrane. They contain powerful digestive hydrolytic enzyme capable of breaking down many kinds of molecules. The lysosomal enzyme believed to be synthesized in the granular endoplasmic reticulum and Golgi complex.

The cyto-skeleton, the cytoplasm has a complex internal structure consisting of a series of exceedingly small microfilaments, microtubule & intermediate filaments together referred to as the cyto-skeleton.

Centrosome, a dense area of cytoplasm generally spherical and located nears the nucleus it contain centrioles. It also contains DNA that controls their replication. Centrosomes are made of microtubules, which seam drinking straws. They are Involved in the movement of chromosome during cell division.

Cilia/flagella, thread like appendages, which are made of microtubules. They are found in female reproductive organ and upper respiratory tube. They show rhythmic movement.

Cell inclusion

Large and diverse group of chemicals, which are produced by cells, are cell inclusions. It is mainly organic and includes melanin, glycogen & Lipids.

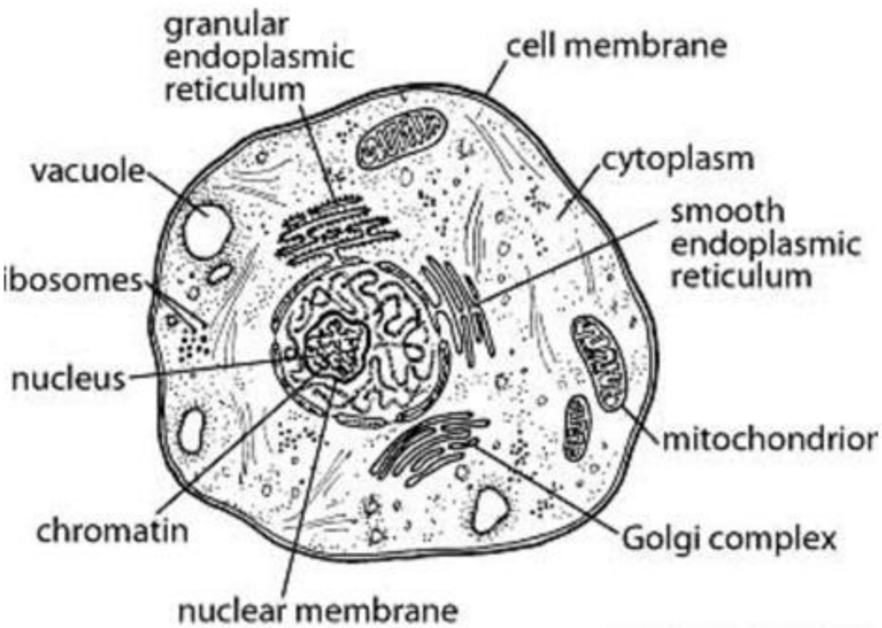


Fig: STRUCTURE OF CELL

FUNCTIONS OF CELL: The following are the important functions performed by a cell.

Ingestion and assimilation: The cell ingests chemical substances like amino acids from intercellular or interstitial fluid. These substances are used to build up complicated substances like proteins.

Growth and repair: The ingested and assimilated materials are used to synthesis new protoplasm. This leads to increase in size and growth of the cell. Also worn out parts of the cell are replaced by this process.

Metabolism: This involves two process:

Anabolism : In which the ingested and assimilated food material is used for growth and repair.

Catabolism : In which food material is broken down to release energy for various functions of the cell.

Respiration :It involves transport of oxygen from lungs through blood to the tissues and removal of waste products like carbon dioxide. This is essential for the survival and functions of a cell.

Excretion: The cell eliminates waste products resulting from catabolism into interstitial fluid. These products are carried by blood for elimination through lungs and kidneys.

Irritability and contractility: The cell is active by means of these two functions. The cell responds to any stimulus by contracting. Or, the impulse is conducted as that occurs in a nerve cell.

Reproduction: after growing to an optimum size, the cell divides into daughter cells. Reproduction of cells occurs by mitosis and meiosis.

SHORT ANSWER QUESTIONS

1. Define Anatomy?
2. Define physiology?
3. Define cell?
4. What are the functions of cell?
5. What are the functions of mitochondria?
6. Write different organelles of cytoplasm?
7. Define system and mention the names of the systems of body?
8. Name the sense organs?
9. Define organ?
10. Define tissue and write the types of tissues?

UNIT- 2

OSTEOLOGY/SKELETAL SYSTEM

Contents:

INTRODUCTION

Osteology is the study of the bones which form the various parts of the skeleton.

The word skeleton comes from the Greek word skeleton meaning “dried up”. It is strong yet light adapted for its function of body protection and motion. The skeletal system includes bones, joints, cartilages and ligaments. The joint give the body flexibility and allow movements to occur. But from structural point of view, the human skeletal system consists of two main types of supportive connective tissue, bone and cartilage.

Functions of the skeletal system:

Support: It forms the internal framework that supports and anchors all soft organs.
Protection: Bones protect soft body organs.
Movement: Skeletal muscles attached to the skeletal system use the bone to levers to move the body and its part.
Storage: Fat is stored in the internal cavities of bones. Bone it self-serves as a storehouse of minerals. The most important being is calcium and phosphors.
Blood cell formation: It occurs within the marrow cavities of certain bones.

The bones are joined together between them by articulations, they form the frame of the body, passive part of the locomotor apparatus whose muscles form the driving elements of them.

The bones have for certain role of protection of internal organs: cranium, rib cage.
The skeleton includes a cartilaginous part and an osseous part.

TERMS USED FOR DESCRIBING THE POSITION OF THE BODY

A. Supine Position:
Lying down (Recumbent) position with the face directed upwards.

B.Prone position:
Lying down (Recumbent) position with the face directed downwards.

C.Lithotomy position

Lying supine with the buttocks at the edge of the table, the hips and knees fully flexed, and the feet strapped in position.

Terms of relation commonly used in Gross Anatomy

a) Anterior - Towards the front
b) Posterior - Towards the back
c) Superior - Towards the head
d) Inferior - Towards the feet
e) Medial - Towards the median plane

Terms of Relation commonly used in Embryology and Comparative Anatomy, but sometimes in Gross Anatomy

a) Ventral - Towards the belly (like anterior)
b) Dorsal - Towards the back (like posterior)
c) Cranial or Rostral - Towards the head (like superior)
d) Caudal - Towards the tail (like inferior)

SPECIAL TERMS FOR LIMBS

a. Proximal - Nearer to trunk
b. Distal -Away from the trunk
c. Radial - The outer border of the upper limb
d. Ulnar - The inner border of the upper limb
e. Tibial - The inner border of the lower limb
f. Fibular - The outer border of the lower limb
g. Pre axial border - The outer border of the upper limb and the inner border of the lower limb
h. Post axial border - The inner border of the upper limb and the outer border of the lower limb
i. Flexor surface The anterior surface of the upper limb, and the posterior surface of the lower limb
j. Extensor surface - The posterior surface of the upper limb and the anterior surface of the lower limb
k. Palmar or volar - Pertaining to(towards)The palm of the hand
l. Plantar - Pertaining to(towards) the sole of the foot

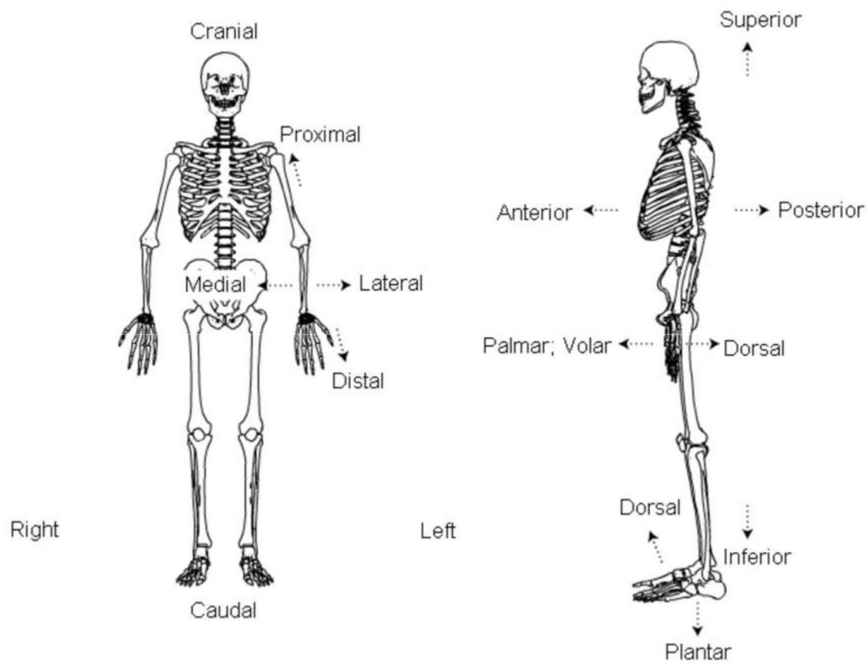


Fig. Anatomical terms

CLASSIFICATION OF SKELETAL SYSTEM: the bony frame work of the human body is known as skeleton. Bones and joints form the skeletal system of the body.

Skeleton can be classified into two groups, Axial skeleton and Appendicular skeleton. Axial skeleton exists in the central axis of the body. It consists of skull, vertebral column, ribs and the sternum or chest bone. Appendicular skeleton system consists pectoral girdle, upper extremity. Pelvic girdle, lower extremity.

AXIAL SKELETON (80 BONES)

Skull (28)

Cranial Bones:

Skull bones

Parietal (2)
Temporal (2)
Frontal (1)
Occipital (1)

Ethmoid (1)
Sphenoid (1)
Hyoid (1)

Facial Bones
- Maxilla (2)
- Zygomatic (2)
- Mandible (1)
- Nasal (2)
- Palatine (2)
- Inferior nasal concha (2)
- Lacrimal (2)
- Vomer (1)

Auditory Ossicles
- Malleus (2)
- Incus (2)
- Stapes (2)

Vertebral Column
- Cervical vertebrae (7)
- Thoracic vertebrae (12)
- Lumbar vertebrae (5)
- Sacrum (1)
- Coccyx (1)

Thoracic Cage
- Sternum (1)
- Ribs (24)

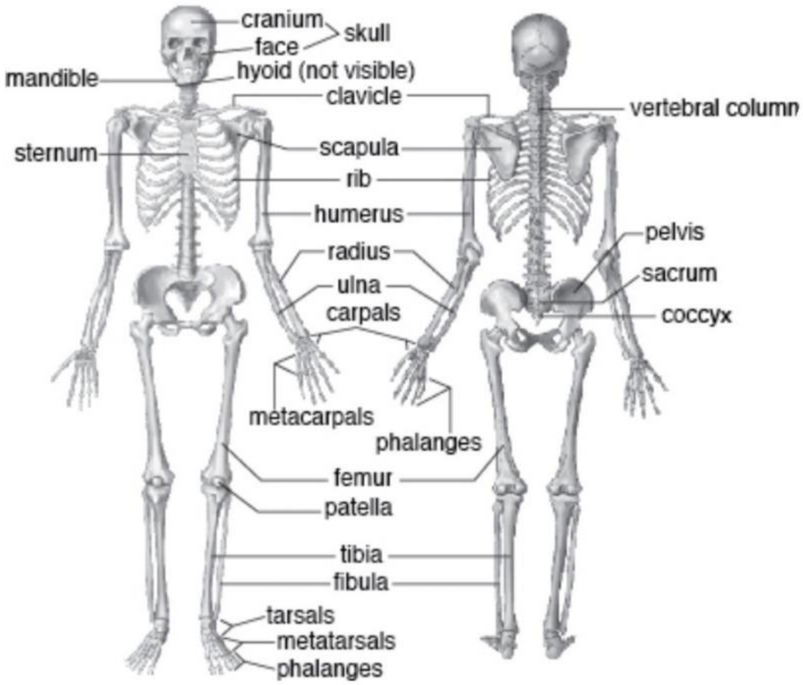


Fig. SKELETON

APPENDICULAR SKELETON (126 BONES)

Pectoral girdles
Clavicle (2)
Scapula (2)

Upper Extremity
Humerus (2)
Radius (2)
Ulna (2)
Carpals (16)
Metacarpals (10)
Phalanges (28)

Pelvic Girdle
Coxal, innominate, or hip bones (2)

Lower Extremity
Femur (2)
Tibia (2)
Fibula (2)
Patella (2)
Tarsals (14)
Metatarsals (10)
Phalanges (28)

BONE: The hardest tissue of the body is called bone. Bone (osseous) is specialized connective tissue that has the strength of cast iron and lightness of pinewood. Living bone is not dry, brittle or dead. It is a moist changing, productive tissue that is continually resorbed, reformed and remodeled.

TYPES OF BONES: Bones of the skeleton are classified as:

a. Long bones
b. Short bones
c. Flat bones
d. Irregular bones
e. Sesamoid bones

Long bones:

Long bone, are called long as its length is greater than its width. The most obvious long bones are in the arm and leg. . A long bone contains a shaft and two extremities. The long bones act a levers and help in various movements of the body. Eg. Humerus, radius, ulna, femur, tibia, fibula.

Short bones:

Short bones are about equal in length, width and thickness, which are shaped with regular orientation .These, have no shaft. But they contain a spongy substance covered by a shell of compact bone e.g. small bones of wrist and ankle. Eg. Carpals bones and Tarsal bones.

Flat bones:

Flat bones are thin or curved more often they are flat. They contain two layers of compact bone with a spongy substance in between .E.g. Ribs, scapulae, sternum and bone of cranium .

Irregular bones:

Irregular bones, they do not fit neatly into any other category. E.g are the vertebral, facial, and hipbone.

Sesamoid bones:

They are small bones embedded within certain tendons, the fibrous cord that connects muscle to bones. Typical sesamoid bones are patella and pisiform carpal bone, which are in the tendon of quadriceps femoris and flexor carpiulnaris muscle respectively.

Functions of bone:

- Support and protection of soft tissues and vital organs.
- To give attachment to muscles.
- Formation of red blood corpuscles in the bone marrow.
- Storage of mineral salts like phosphorus and calcium.

STRUCTURE OF LONG BONE:

Humerus - one of the longest bones in the body. In adults it have: Diaphysis, the tubular shaft, hallow cylindrical with walls of compact bone tissue. The center of the cylinder is the medullary cavity, which is filled with marrow. Epiphysis is roughly spherical end of the bone. It is wider than the shaft. Flat and irregular bones of the trunk and limbs have many epiphysis and the long bones of the finger and toe have only one epiphysis. Metaphysis is the part separating diaphysis from epiphysis. It is made up of epiphyseal plate and adjacent bony trabeculae of cancellous bone tissue.

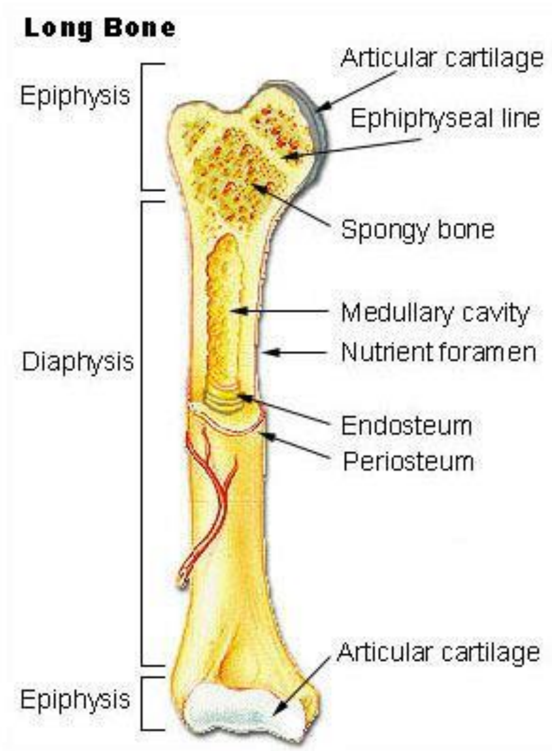


Fig. STRUCTURE OF LONG BONE

Epiphyseal plate is a thick plate of hyaline cartilage, which provides the framework of synthesis of the cancellous bone tissue within metaphysis.

The medullary cavity running through the length of the diaphysis contains Yellow marrow.

The porous latticework of the spongy epiphyses is filled with red bone marrow. The red marrow also known as myeloid tissue.

Endosteum is the lining the medullary cavity of compact bone tissue and covering the trabeculae of spongy bone tissue.

Periosteum is covering the outer surface of the bone. It is absent at joints and replaced by articular cartilage.

BONE (OSSEOUS) TISSUE:

Bone tissue is composed of cells embedded in a matrix of ground substances and fibers. It is more rigid than other tissues because it contains inorganic salts mainly calcium phosphate & calcium carbonate. A network of collagenous fibers in the matrix gives bone tissue its strength and flexibility. Most bones have an outer sheet of compact bone tissue enclosing an interior spongy bone tissue.

Compact bone tissue forms the outer sheet of a bone. It is very hard and dens e. It appears to naked eye to be solid but not. Co mpact bone tissue contains cylinders of calcifie d bone known as osteons (Haversion system). Osteons are made up of concentric layers c alled lamellae, which are arranged seemingly in wider and wider drinking straws. In the center of the osteons are central canals (haversion canal) , which are longitudinal canals that contains blood vessels, nerves and

lymphatic vessels. Central canal s, usually have branches called perforating cana ls /volkmann's canal that run at right angle to central canal extending the system of nerves and vessels out ward to periosteum and to endo steum. Lacunae (Little spaces) that houses os teocytes (bone cells) are contained in lamella. Radiating from each lacuna are tiny canaliculi containing the slender extensions of the osteocytes where nutrients and wastes can pass to and from central canal.

Spongy (cancellous) Bone tissu e Is in the form of an open interlaced pattern that withstands maximum stress and supports i n shifting stress. Trabeculae are tiny spikes of bone tissue surrounded by bone matrix that has calcified.

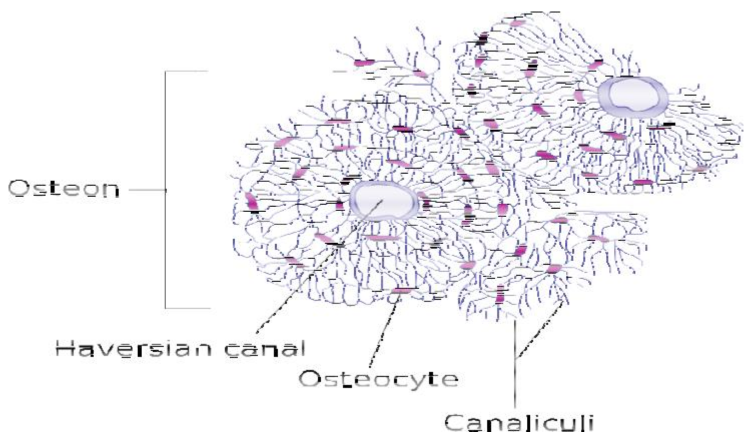


Fig. CROSS SECTION OF BONE

Bone Cells:

Bone contain five types of cells

- Osteogenic cells: These are small spindle shaped cell. They found mostly in the deepest layer of periosteu m and endosteum. They have high mitotic potential and can be transformed into bone forming c ells (osteoblasts).
- Osteoblasts are found in the growing portion of bone including periosteum. They are able to synthesize and secrete un-minerralized ground substance, act as pump cell to move calcium and phosphate in and out of bon e tissue.
- Osteocytes are the main cell of fully developed bones. They have a cell bod y that occupies a lacuna. Osteocytes are derived from osteoblasts. They together with osteoclasts play an important role of homeostasis by helping to release calcium.
- Osteoclasts are multinuclear giant cell, which are found where bone is resorbed during its normal growth. Osteoclasts are derived from white blood cells called monocytes.

- Bone - lining cells are found on the surface of most bones in the adult skeleton. They are believed to be derived from osteoblast that ceases their physiological activity.

Developmental Anatomy and Growth of Bones

Bones develop through a process known as Ossification. Bone in embryo develops in two ways: Intra-membranous ossification, If bone develops directly from mesenchymal tissue. Examples are vault of the skull, flat bones and part of the clavicle. In this type of ossification development continues rapidly from the center. Endochondrial Ossification, when bone tissue develops by replacing hyaline cartilage. The cartilages itself do not converted into bone but the cartilage is replaced by bone through the process. Endochondrial ossification produces long bones and all other bones not formed by intra-membranous ossification.

VERTEBRAL COLUMN:

The vertebral column together with the sternum & ribs constitutes the skeleton of the trunk of the body. It composes 2/5th of the height of the body and has average length in male of 71 cm. and in female 61 cm. The adult vertebral Column contains 26 vertebras. Prior to fusion of sacral & coccygeal vertebrae the total number is 33. It is a strong and flexible to either direction & rotated on itself. Encloses & protect spinal cord, supports the head and serves as a point of attachment for the ribs & muscles of the back.

Inter vertebral discs

Between adjacent vertebrae from cervical to sacrum there are inter vertebral discs. They are fibro-cartilaginous. Each disc is composed of the outer fibrous ring consisting fibro-cartilage called annulus fibrosis and the inner soft, pulpy highly elastic structure called the nucleus pulpous. The disc permits various movement of the vertebral column, absorb shock and form a strong joint.

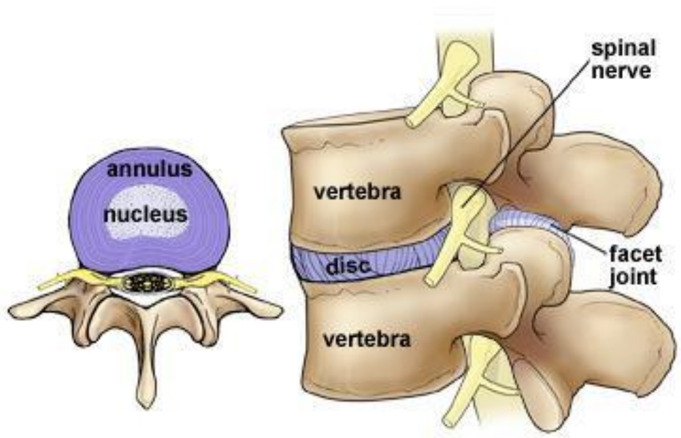


Fig. VERTEBRAL DISCS

Bones Description and function:

Cervical vertebrae (7)- First (atlas), second (axis), and seventh vertebrae are modified, third to sixth are typical,all contain transverse foramina.

Atlas supports head, permits "yes" motion of head at joint between skull and atlas, axis Permits "no" motion at joint between axis and atlas.

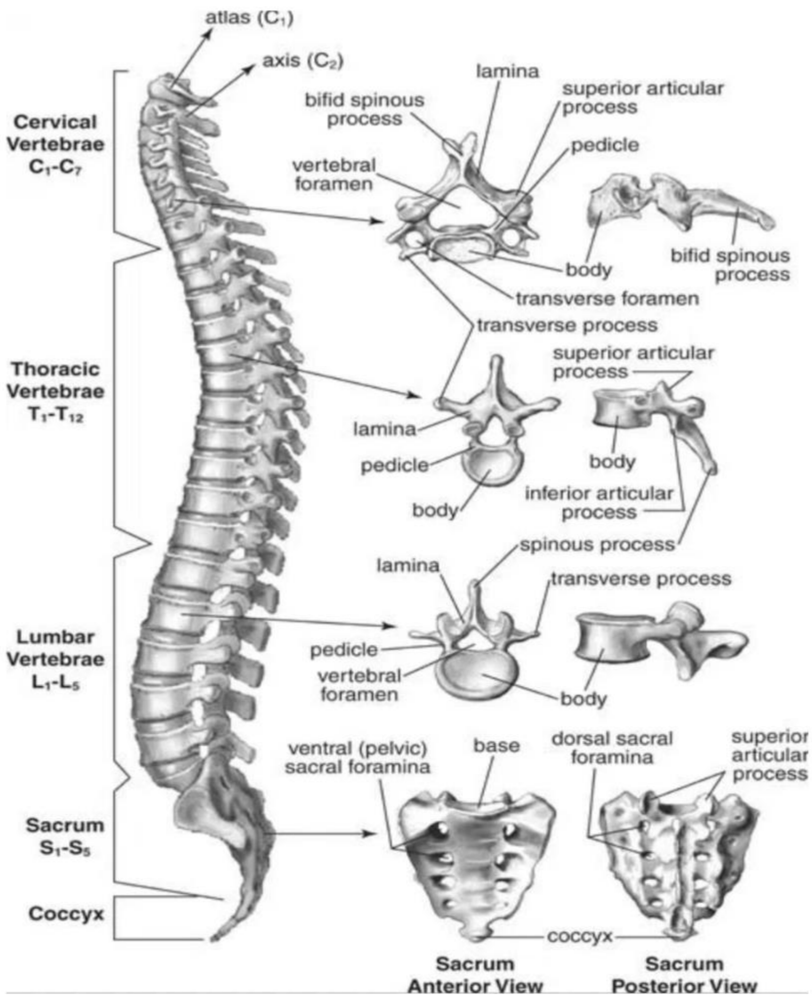


Fig. STRUCTURE OF VERTEBRAL COLUMN

Thoracic vertebrae (12) Bodies and transverse processes have facets that articulate T1-T12 with ribs; laminae are short, thick, and broad. Articulate with ribs; allow some movement of spine in thoracic area.

Lumbar vertebrae (5) Largest, strongest vertebrae; adapted for attachment of back L1-L5 muscles. Support back muscles; allow forward and backward bending of spine.

Sacrum Wedge-shaped, made up of five fused bodies united by four (5 fused bones) intervertebral discs. Support vertebral colum,; give strength and stability to pelvis.

Coccyx Triangular tailbone, united with sacrum by intervertebral (3 to 5 fused bones) disc. Vestige of an embryonic tail.

• In a child there are 33 separate vertebrae, the 9 in the sacrum and coccyx not yet being fused

STRUCTURE OF THORAX

The skeleton of the thorax is made of the following bones:

- **Sternum** in the front
- Twelve pairs of **ribs** at the sides.
- Twelve **thoracic vertebrae** at the back.

STERNUM:

It is also called as breast bone. It is a flat bone which is divided into three parts **namely manubrium sterni, body of sternum and xiphoid bone.**

Manubrium sterni:

It is the upper part which is triangular in shape. It contains:

- Clavicular notches on both sides. These notches articulate with clavicle.
- Suprasternal notch which is present in between the two clavicular notches.
- Articular surfaces ‘on both sides for the first rib.

Body of sternum

The second rib is attached at the junction between manubrium sterni and body of sternum. This junction is called as Angle of Ludwig. The body of sternum has attachments for 3rd, 4th, 5th, 6th and 7th ribs.

Xiphoid bone

It is the lowest part of sternum. To this are attached the diaphragm, linea alba and rectus abdominus muscle.

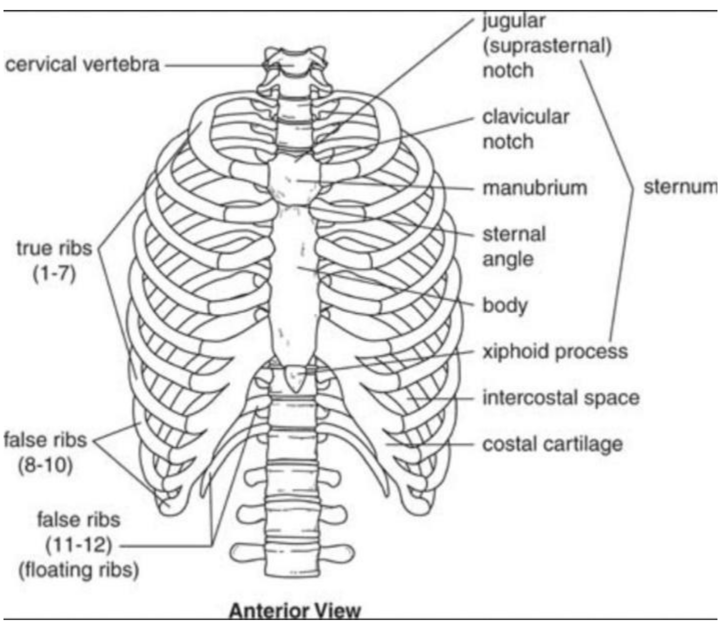


Fig. STRUCTURE OF THORACIC CAGE

RIBS:

They are arranged in twelve pairs, On the back side, all of them are attached to thoracic vertebrae. Depending on their attachment in the front, they are classified as:

- True ribs which are the upper seven pairs. They are attached to the sternum directly.
- False ribs which are the lower three pairs. They are attached to the sternum indirectly (through costal cartilages).
- Floating ribs are the lowest two pairs. They are not attached in front.

A rib consists of the following parts:

Anterior or sternal end: It has depressions for attachment of costal cartilage.

- Posterior or vertebral end: It has a head, neck and tubercle.
- Shaft which has
  - Two surfaces namely inner and outer surfaces
  - Two borders namely upper and lower borders.

Costal cartilages:These are bars of hyaline cartilage. They connect the ribs and sternum.

BONES OF UPPER LIMB

SCAPULA:

It lies at the back of the thorax. It forms the posterior part of the shoulder girdle. It has two surfaces, three angles and three borders.

The surfaces of scapula are:

Anterior or costal surface:

It is called as the suprascapular fossa. It lies nearest to the ribs. Subscapularis muscle is attached to this surface.

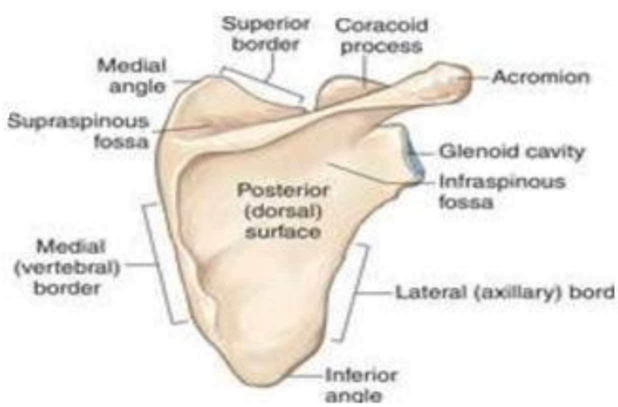


Fig. **SCAPULA**

Posterior or dorsal surface:

It is divided into two fossa by spine of scapula which ends with acromion process. The fossa are:

- **Supraspinous fossa** which is the upper one. It gives attachment to supraspinatous muscle.
- **Infraspinous fossa** which is below. It gives attachement to infraspinatous muscle.

The borders of scapula are:

- **Superior border**:

It lies in the upper part. It extends from the superior angle to the base of corocoid process. Supra scapular notch is at the inner extremity of this border. The suprascapular vessels pass through this notch

Medial or vertebral border:

It is nearest to vertebral column. It extends between superior and inferior angles.

Lateral or axillary border:

It is nearest to axilla. It lies between inferior angle and glenoid cavity.

The angles of scapula are:

Superior angle: It lies at the junction between superior and medial borders.

Inferior angle: It is the junction between medial and lateral borders. It is the lowest point of the scapula.

Lateral or external angle: It contains glenoid cavity which receives the head of humerus (to form shoulder joint*).*

CLAVICLE:

It is also called as collar bone. It is a long and curved bone. It forms the anterior part of shoulder girdle. It contains a shaft, two ends and four borders

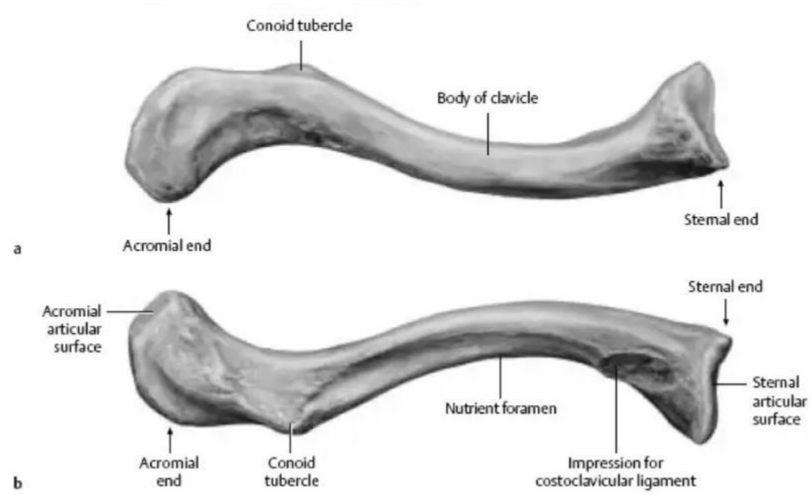


Fig. CLAVICAL BONE

The ends are:

- Medial or **sterna end.** It articulates with sternum.
- Lateral or **acromial** end. It articulates with acromion process of scapula.

The borders of clavicle are superior, inferior, anterior and posterior borders.

HUMERUS:

It is the longest bone of upper limb. It contains two extremities and a shaft.

Upper end: It contains:

- A **hemispherical head** which articulates with glenoid cavity of scapula (at the Shoulder joint)

- **Anatomical neck** which is below the head.
- **Greater tuberosity** which is below the anatomical neck. It is in the outer side of upper extremity.

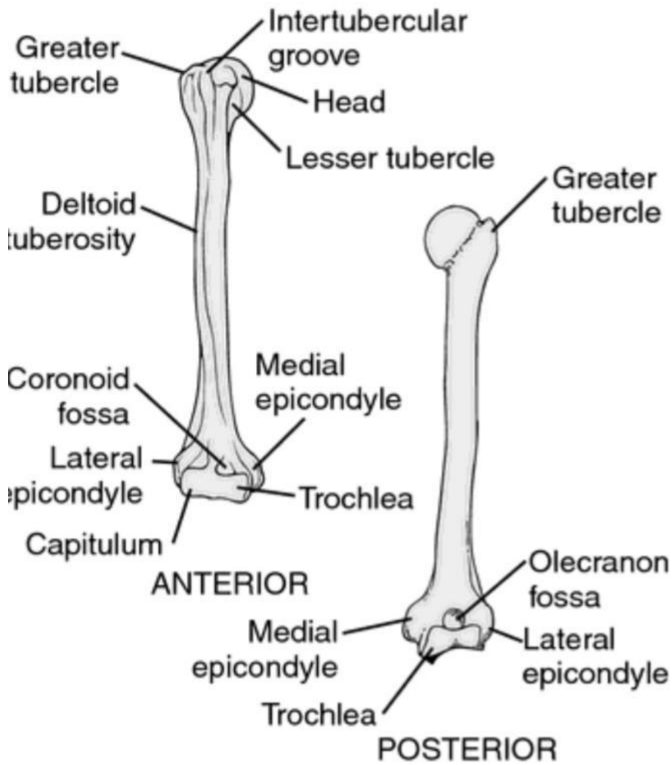


Fig. HUMERUS

- **Lesser tuberosity** which is also below the anatomical neck. But it is at the front.
- **Bicipital groove** or **intertubercular sulcus**: It lies in between these two tuberosities.
- **Surgical neck**: It is a narrow point of the bone below the two tuberosities.

Shaft: It contains

- **Deltoid tuberosity** which is a rough tubercle on the lateral aspect of the shaft. It receives the insertion of deltoid muscle.
- **Spiral** or **radial groove** which is a oblique groove across the back of the shaft. The radial nerve passes through this groove.

Lower end: It contains:

- **Trochlea** which is a pulley - shaped surface on the inner side. It articulates with ulna.
- **Capitulum** on the outer side. It articulates with radius.
- **Coronoid fossa** which is a depression. It lies above the articulating surface for ulna.
- **Olecranon fossa** which lies at the back. It receives the olecranon process of ulna
- **Medial** and **lateral epicondyles** which lie on each side of the articulating surfaces.

ULNA :

It is the inner most bone of the forearm. It contains two extremities and a shaft.

Upper end: It contains:

Coronoid process which is a projection in front. It fits into the coronoid fossa of humerus.

- **Olecranon process** which is an upward projection at the back. It fits into olecranon process of humerus.

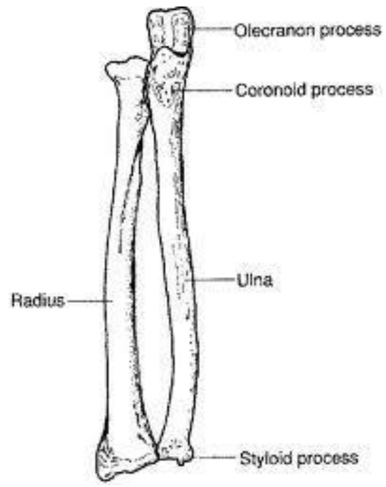


Fig. ULNA

- **Trochlear** no**t**ch which is formed by these two processes. It articulates with trochlear surface of humerus.
- **Radial notch** which is on the outer or lateral aspect. It articulates with head of radius.

Shaft :
It is tapering towards the lower end. If contains surfaces and borders. It gives attachment to:

- Muscles which control movements of wrist and fingers.
- Flexor and extensor muscles of forearm.
- Muscles of pronation and supination of forearm

Lower end: It contains:

- **Head of ulna** which is a small rounded eminence. It articulates with lower extremity of radius.
- **Styloid process** which projects downwards from back of lower extremity.

RADIUS :
It is the lateral or outer most bone of forearm. It contains two extremities and a shaft.

Upper end: It contains:

- A **head** which is more or less button- shaped.
- **Neck** which lies below the head.
- **Biceps tubercle** which lies below and to the medial side of neck. It gives insertion to biceps muscle.

Shaft: It is narrower above and wider below. It contains surfaces which give attachment to a variety of muscles.

Lower end: It contains styloid process which is on the outer or lateral aspect.

BONES OF WRIST AND HAND

Bones of Wrist:
The bones of carpals are arranged in two rows. They are

- First or proximal row made of **scaphoid, lunate, triquetraland pisiform bones**.
- Second or distal row made of **trapezium, trapezoid,capitate and hamate bones.**

Bones of Palm:

They are made of metacarpal bones. They are long bones which contain a head, a shaft and a base. The bases articulate with the distal row of carpal bones. The heads articulate with the proximal row of phalanges.

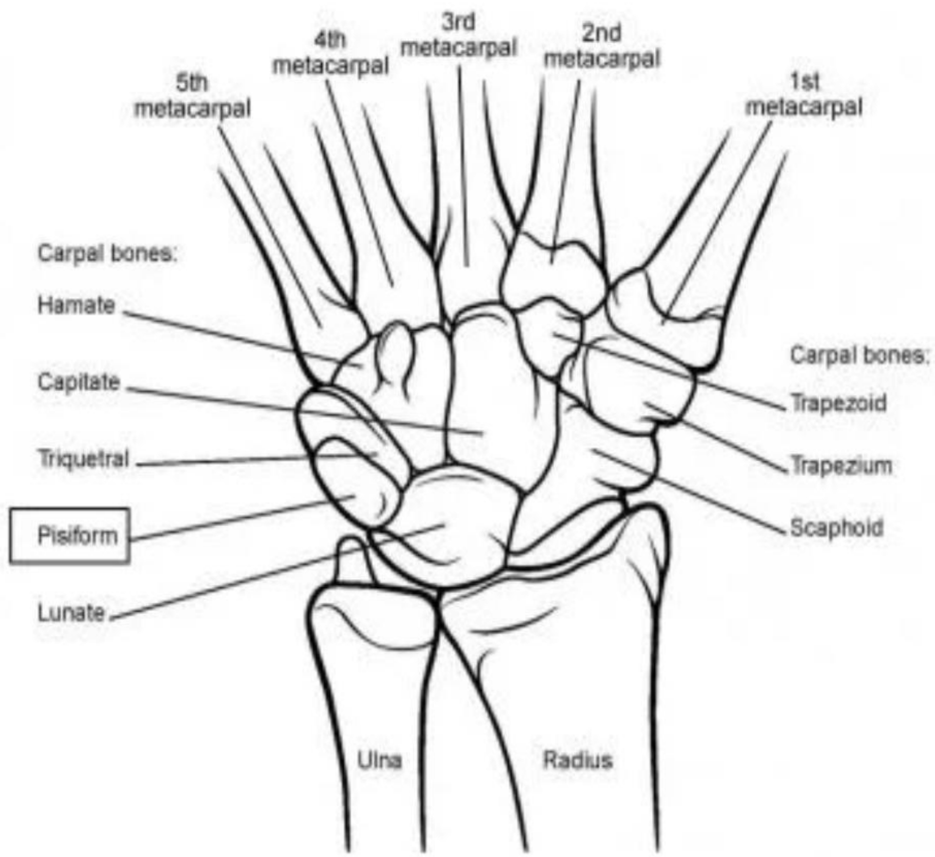


Fig. BONES OF HAND

Bones of fingers:
They are made of phalangial bones. These are long bones. The thumb has two phalanges. Other fingers have three phalanges. They are proximal, middle and distal phalanges.

Metacarpo-phalangeal joints are the joints between meta carpal and phalange al bones.

Interphalangeal joints are the joints between the phalangeal bones themselves.

BONES OF THE PELVIC GIRDLE

The pelvic girdle is the connection between the trunk and lower extremities. It is formed by:

- Two innominate bones, one on each side.
- The sacrum and coccyx in between.

INOMINATE BONE:

It is called as pelvic bone or hip bone. It is made of three parts namely **ilium, ischium and pubis.** All these three bones unite to form a large cup shaped cavity on the outer surface called **acetabulum**. The head of femur fits into acetabulum forming the hip joint.

Ilium :

It is the upper expanded and flat part of innominate bone.
It contains:

1. External or gluteal surface:

This surface contains three ridges namely superior, middle and inferior gluteal ridges. They give attachment to gluteal muscles.

2. Internal surface which is concave.

It forms part of iliac fossa and it gives attachment to iliac muscles.

Pubis:

It is the front portion of innominate bone. It contains:

- A **body** which is more or less square in shape.
- **Symphysis pubis** which is the union of the pubic bones in the front.
- **Superior ramus** which is a bridge of bone projecting from the outer part of body and joins it to ilium.
- **Inferior ramus** which is the lower part of the body and joins it to ischium.

lschium :

It is the solid, broad portion at the lower and back part of innominate bone. It contains:

- A body which forms acetabulum on the outer surface.
- Tuberosity of ischium present at the lowest point. It supports the body weight while sitting.
- Spine of ischium which arises from the back of ischium.

Obturator foramen is a roughly triangular opening which is bounded by:

- Public bone in front and above.
- Ischium behind and below.

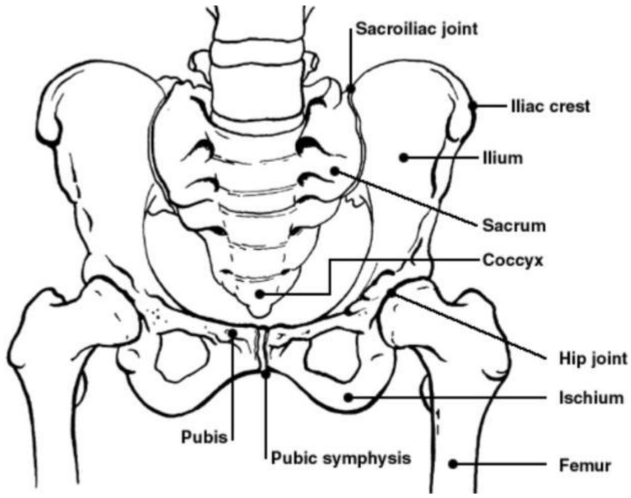


Fig. BONES OF PELVIS

Differences between female and male pelvis

The female pelvis is adapted for pregnancy and child birth. It differs from male pelvis in the following aspects.

- It is shallow and wider than male pelvis.
- Inlet and outlet are longer and nearly oval in shape.
- Bones are lighter and smoother.
- Pubic arch is wider.
- Ischial tuberosities are further apart.
- The coccyx is more movable.

BONES OF LOWER LIMB

FEMUR: It is also called as thigh bone. It is the longest and strongest bone of the skeleton. It contains two extremities and a shaft.

Upper end: It contains:

- A head which is spherical and covered with hyaline cartilage.
- A neck which lies below the head. It is long and flattened.
- Greater trochanter which is on the outer side where the neck joins the shaft.
- Lesser trochanter which is on the inner side where the neck joins the shaft.

Shaft: It is smooth, cylindrical and rounded in front and at the sides. It contains:

- Linea aspera which is a ridge on the posterior aspect
- Gluteal ridge which extends from linea aspera to the back of greater trochanter.
- Spiral line which extends at the inner aspect from linea aspera to lesser trochanter.

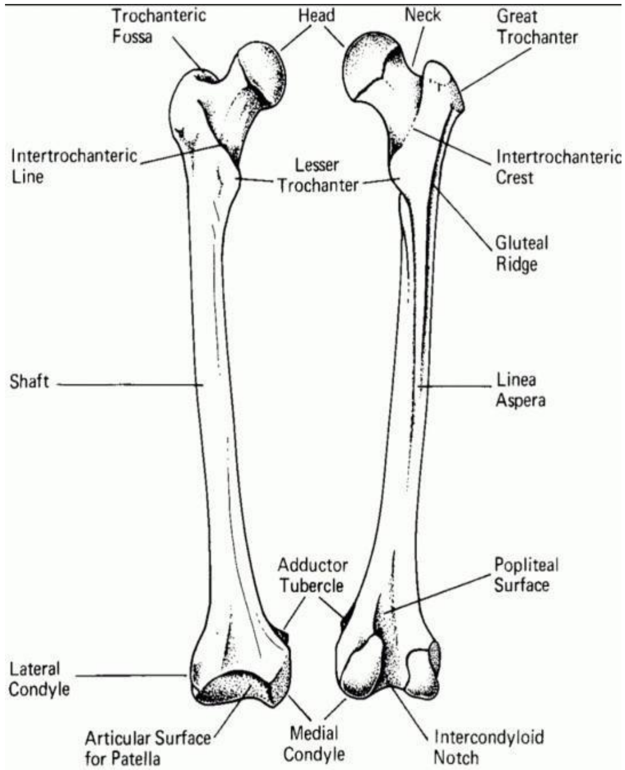


Fig. FEMUR

Lower end: It contains:

- **Medial and lateral condyles** lying one on each side.
- **Intercondylar notch** which lies behind. It separates these two condyles.
- **Adductor tubercle** which is a small tubercle above the medial condyle.
- **Patellar surface** which separates the two condyles in front. Patella rests on this surface.
- **Popliteal surface** which is above the condyles at the back. Popliteal vessels and nerves lie on this surface.

PATELLA:

It is a sesamoid bone developed in the tendon of quadriceps femoris muscle. It contains:

- An apex pointing downwards. The ligamentum patella is attached to the apex.
- An anterior surface which is rough and covered with a bursa

  Posterior surface which is smooth. It articulates with patellar surface of femur (to form knee joint).

TIBIA:
It is the innermost bone of the leg. It is a long bone containing two extremities and a shaft.
Upper end: it contains:

- A head which contains two condyles namely **medial condyle** and **lateral condyle**. The upper surfaces of these condyles articulate with the corresponding condyles of femur.
- **Popliteal notch** which separates the two condyles at the back.
- **Tubercle of tibia** which lies below the condyles in the front.

Shaft:
It is triangular in shape having three borders and three surfaces. The shaft contains:

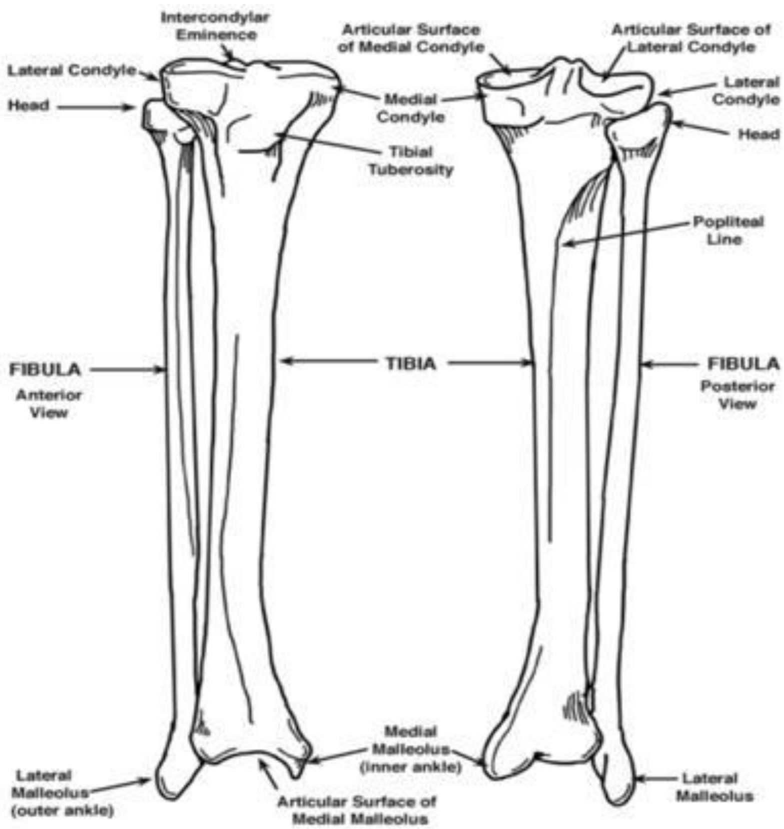


Fig. TIBIA AND FIBULA

1. **Crest of tibia** which is present in the middle third of the anterior border.

- **Soleal line** which is a strong ridge of bone present in the posterior surface.

Lower end:
It is slightly expanded. It has an articular surface for talus to form the ankle joint. **Medial malleolus** is a downward projection present in the medial aspect.

FIBULA:
It is the lateral or outermost bone of the leg. It is a long and slender bone. It contains two extremities and a shaft.
Upper end: It contains:

- A **head** which is expanded. It articulates with the back of lateral condyle of tibia. It does not take part in the formation of knee joint.
- **Styloid process** present in the apex of head. One ligament of knee joint is attached to this.

Shaft: It is thin and gives attachment to several muscles.
Lower end: It contains:

- **Lateral malleolus** which is a downward prolongation of the lower extremity.
- **Malleolar fossa** which is a rough depression behind the malleolus.

BONES OF FOOT
Bones of foot can be classified as:

- Tarsal bones (7 bones)
- Metatarsal bones (5 bones)
- Phalangeal bones (14 bones)

TARSAL BONES:
They include **calcaneum, talus, navicular, cuboid and three cuneiform bones**.

Calcaneum:

It is the largest bone of the foot. It lies at the back of foot. Above, it articulates with talus and in front with cuboid. Calcaneum gives attachment to **tendo calcaneus** of calf muscle.

Talus:

It forms the central and highest point of foot. It articulates at the sides with medial and lateral malleoli and below with calcaneum.

Navicular (or scaphoid):

It is a disc shaped bone. It is present in the medial aspect of foot. It lies between talus at the back and three cuneiform bones in front.

Cuboid:

It is in the lateral aspect of foot. Behind, it articulates with calcaneum. In front, it articulates with two lateral metatarsal bones.

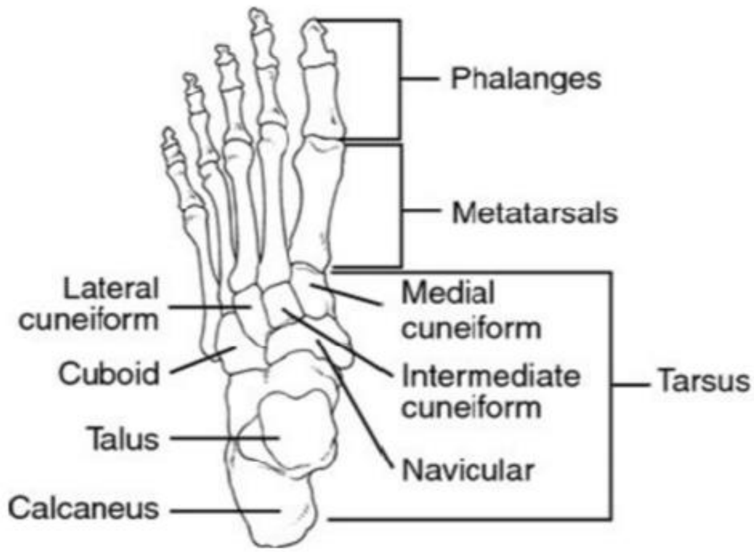


Fig. BONES OF FOOT

Cuneiform bones:

They are three in number namely medial, intermediate and lateral cuneiform bones. Posteriorly they articulate with navicular bone. Anteriorly they articulate with three metatarsal bones.

METATARSAL BONES:

They are five in number. They correspond with the five toes. All of them are long bones. They contain a head, shaft and base.

- The first metatarsal is thick and stout.
- The second metatarsal is longer than others.
- The fifth one has a projection at the lateral side of the base.

PHALANGES:

They are 14 bones, two for the first toe and three for the rest. All of them are long bones.

ARCHES OF FOOT:

In the foot, the bones are so arranged that there are four different arches. There are two **longitudinal arches** and **two transverse arches**. These arches are

- **Medial or internal longitudinal arch**: For this
    - Posterior support is given by calcaneum.
    - Anterior support is given by navicular, three cuneiforms and heads of three inner metatarsal bones.
    - Summit is provided by the talus.

- **Lateral or outer longitudinal** arch: This is formed by calcaneum, cuboid and two outer metatarsal bones.
- **Transverse tarsal arch**: It is formed by the tarsal bones.
- **Transverse metatarsal arch**: It is formed by the heads of metatarsal bones.

BONES OF THE SKULL

Bones of the skull are divided into two groups:

- Bones of cranium (or brain box)
- Bones of face

Bones of cranium:

Cranium is formed by 8 bones they are:

- One frontal bone
- Two parietal bone
- Two temporal bones
- One occipital bone
- One sphenoid bone
- One ethmoid bone

Sutures of the cranium:

Sutures are the immovable joints which unite the bones of the skull. The important sutures are:

- Coronal suture: between the frontal bone and the two parietal bones
- Sagittal suture: between the two parietal bones.
- Lambdoid suture: between the occipital bone and the two parietal bones.

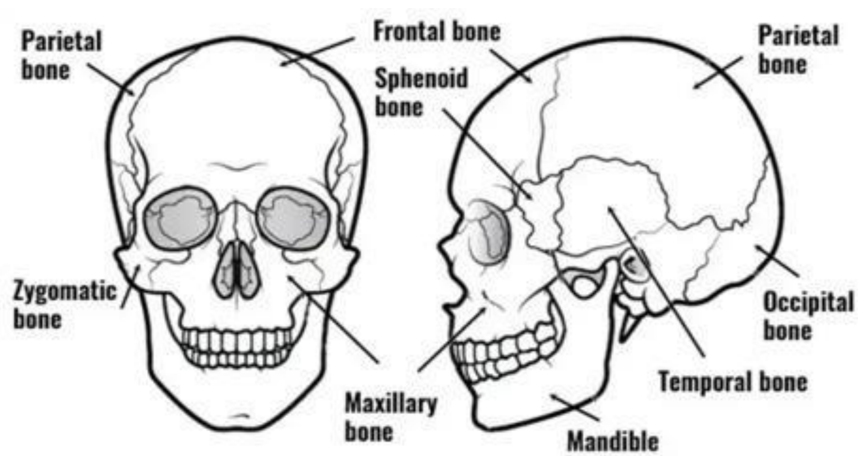


Fig. BONES OF SKULL

BONES OF THE FACE

The bones which make the face are 14 in number. These bones are : 1) Two maxillae (upper jaw) 2) One mandible (lower jaw) 3) Two palate bones 4) Two zygomatic bones 5) Two lacrimal bones 6) Two nasal bones 7) Two inferior turbinate bones 8) One vomer

SHORT ANSWER QUESTIONS

1. Define osteology?
2. Define bone and write its functions?
3. What are the functions of skeletal system?
4. Write the names of upper limb bones?
5. Write the names of lower limb bones?
6. Write the names of cranial bones?
7. Write the names of facial bones?
8. Mention the types of bones?
9. Classify ribs?
10. Write the names of vertebral bones?

ESSAY QUESTIONS

1. Classify skeletal system in detail (Appendicular and Axial)?
2. Write the structure and functions of thorax?
3. Write the structure and functions of vertebral column?
4. Write the types and functions of bones along with structure of long bone?

UNIT- 3

ARTHROLOGY

Contents:

Arthrology, which stems from the ancient Greek word arthros (means "joined"), is the study of those structures that hold the bones together, allowing them to move to varying degrees or fixing them in place depending on the design and function of the joint. The term articulation or joint applies to any union of bones, whether it moves freely or not at all.

TERMS USED FOR DESCRIBING MOVEMENTS

- Flexion :Approximation of the flexor surfaces where by the angle of the joint is reduced
- Extension: Approximation of the extensor surfaces whereby the angle of the joint is increased. It is opposite to flexion
- Adduction : Movement towards the central axis
- Abduction: Movement away from the central axis. It is opposite to adduction
- Medial rotation: Inward rotation
- Lateral rotation : Outward rotation
- Circumduction : Various combinations of the forgoing movements (a to d)
- Pronation :Rotation of the forearm so that the palm is turned Backwards
- Supination : Rotation of the forearm so that the palm is turned forwards
- Protraction :Forwards protrusion
- Retraction : Movement reverse of protraction

Definition of joint: Any connection between bones of the skeleton is called as a **joint or articulation.** Arthrology is the term applied for the study of joints.

Classification of Joints

Structural Classification of Joints

There are three structural classifications of joints: fibrous, cartilaginous, and synovial.

Key Points :

- The type and characteristics of a given joint determine the degree and type of movement.
- Structural classification categorizes joints based on the type of tissue involved in their formations.
- There are three structural classifications of joints: fibrous, cartilaginous, and synovial.

- Of the three types of fibrous joints, syndesmosis are the most movable.
- Cartilaginous joints allow more movement than fibrous joints but less than synovial joints.
- Synovial joints (diarthrosis) are the most movable joints of the body and contain synovial fluid.

A joint, also known as an articulation or articular surface, is a connection that occurs between bones in the skeletal system. Joints provide the means for movement. The type and characteristics of a given joint determines its degree and type of movement. Joints can be classified based on structure and function.

Structural classification of joints categorizes them based on the type of tissue involved in formation. There are three structural classifications of joints: fibrous, cartilaginous, and synovial.

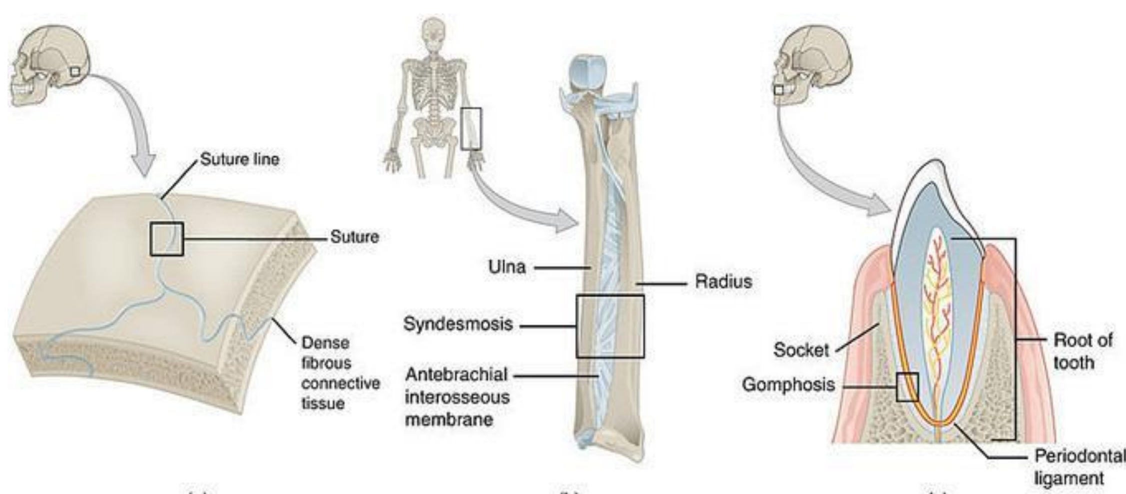
Fibrous Joints

Fibrous joints are connected by dense, tough connective tissue that is rich in collagen fibers. These fixed or immovable joints are typically interlocked with irregular edges. There are three types of fibrous joints.

Sutures are the types of joint found in the cranium (skull). The bones are connected by Sharpey's fibres. The nature of cranial sutures allows for some movement in the fetus. However, they become mostly immovable as the individual ages, although very slight movement allows some necessary cranial elasticity. These rigid joints are referred to as synarthrodial.

Syndesmosis are found between long bones of the body, such as the radio-ulnar and tibio-fibular joints. These moveable fibrous joints are also termed amphiarthrodial. They have a lesser range of movement than synovial joints.

Gomphosis is a type of joint found at the articulation between teeth and the sockets of the maxilla or mandible (dental-alveolar joint). The fibrous tissue that connects the tooth and socket is called the periodontal ligament.



Fibrous joints: Image demonstrating the three types of fibrous joints. (a) Sutures (b) Syndesmosis (c) Gomphosis.

Cartilaginous Joints

Cartilaginous joints are connected by fibrocartilage or hyaline cartilage. They allow more movement than fibrous joints but less than that of synovial joints. These types of joints are further subdivided into primary (synchondrosis) and secondary (symphysis) cartilaginous joints. The epiphyseal (growth) plates are examples of synchondrosis. Symphysis are found between the manubrium and sternum (manubriosternal joint), intervertebral discs, and the pubic symphysis.

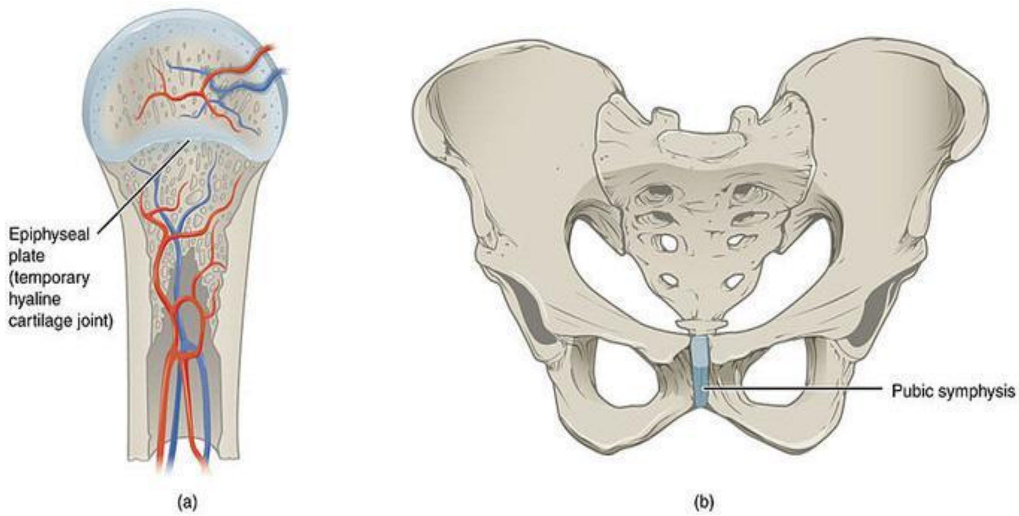


Fig: Cartilaginous Joints: a) synchondrosis joint with epiphyseal plate and b) symphysis joint

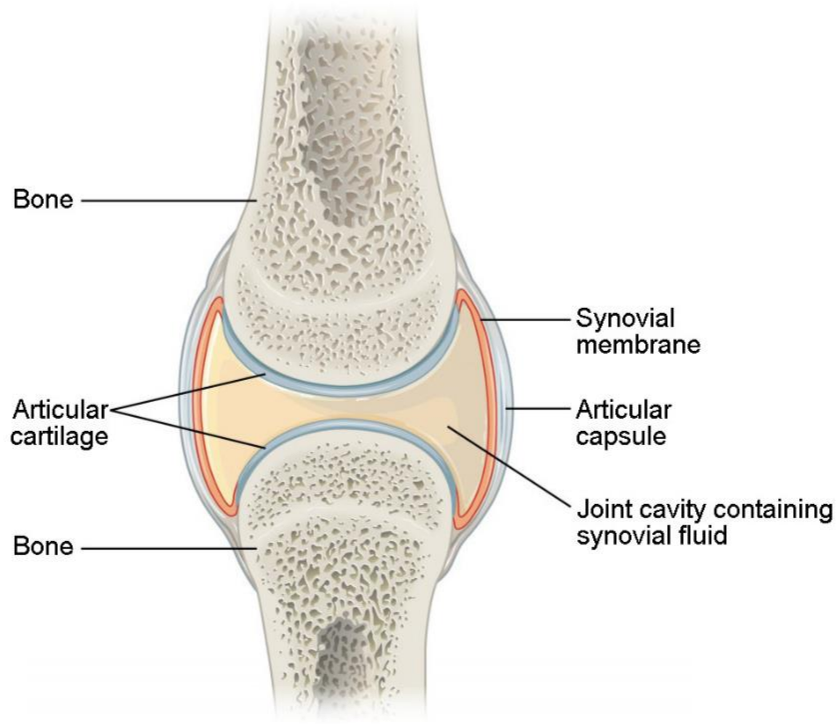


Fig. SYNOVIAL JOINT

Synovial Joints

This is the most common and movable joint type in the body. These joints (also called diarthrosis) have a synovial cavity. Their bones are connected by dense irregular connective tissue that forms an articular capsule surrounding the bones articulating surfaces.

A synovial joint connects bones with a fibrous joint capsule that is continuous with the bones' periosteum. This joint capsule constitutes the outer boundary of a synovial cavity and surrounds the bones' articulating surfaces.

- Synovial cavities are filled with synovial fluid
- **Synovial fluid**: A viscous fluid found in the cavities of synovial joints that reduces friction between the articular cartilage during movement.

Functional Classification of Joints

Functional classification of joints is based on the type and degree of movement permitted.

- Synarthrosis: These types of joints are immobile or allow limited mobility. This category includes fibrous joints such as suture joints (found in the cranium) and gomphosis joints (found between teeth and sockets of the maxilla and mandible).
- Amphiarthrosis: Joints allow a small amount of mobility and include cartilaginous joints such as those found between vertebrae and the pubic symphysis.

- Diarthrosis: joints are the freely movable synovial joints.
    - Synovial joints are further classified based on the different types of movement they provide, including:
        1. Planar joint
        2. Ball and socket joint
        3. Hinge joint
        4. Pivot joint
        5. Condyloid joint
        6. Saddle joint

Planar joints have bones with articulating surfaces that are flat or slightly curved faces. These joints allow for gliding movements, and so the joints are sometimes referred to as gliding joints. The range of motion is limited in these joints and does not involve rotation. Planar joints are found in the carpal bones in the hand and the tarsal bones of the foot, as well as between vertebrae.

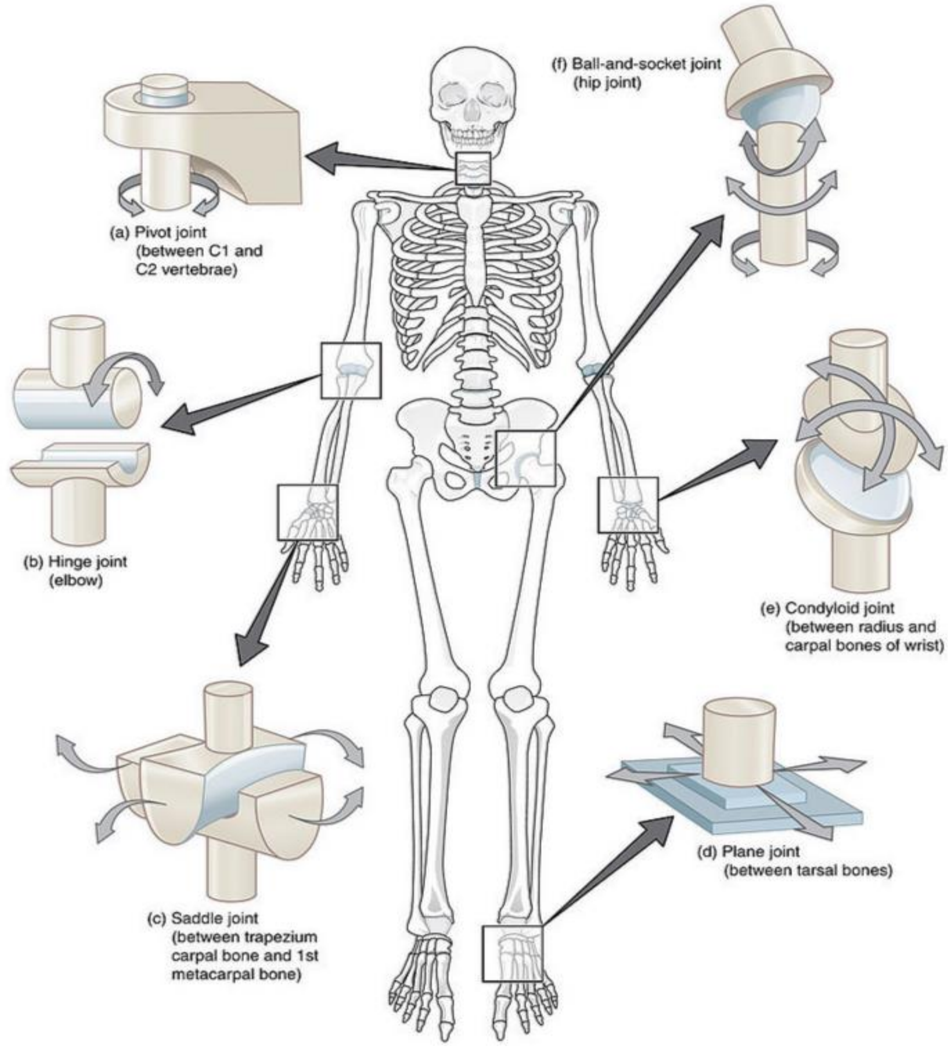


Fig. Types of Synovial Joints: Image of a skeleton and schematics of the different classes of synovial joints.

Ball-and-socket joints possess a rounded, ball-like end of one bone fitting into a cup like socket of another bone. This organization allows the greatest range of motion, as all movement types are possible in all directions. Examples of ball-and-socket joints are the **shoulder and hip joints**.

Hinge joints, the slightly rounded end of one bone fits into the slightly hollow end of the other bone. In this way, one bone moves while the other remains stationary, like the hinge of a door. The **elbow** is an example of a hinge joint. The knee is sometimes classified as a modified hinge joint.

Pivot joints consist of the rounded end of one bone fitting into a ring formed by the other bone. This structure allows rotational movement, as the rounded bone moves around its own axis. An example of a pivot joint is the joint of the **first and second vertebrae of the neck** that allows the head to move back and forth .The **joint of the wrist** that allows the palm of the hand to be turned up and down is also a pivot joint.

Condyloid joints consist of an oval-shaped end of one bone fitting into a similarly oval-shaped hollow of another bone. This is also sometimes called an ellipsoidal joint. This type of joint allows angular movement along two axes, as seen in the **joints of the wrist and fingers**, which can move both side to side and up and down.

Saddle joints are so named because the ends of each bone resemble a saddle, with concave and convex portions that fit together. Saddle joints allow angular movements similar to condyloid joints but with a greater range of motion. An example of a saddle joint is the **thumb joint**, which can move back and forth and up and down, but more freely than the wrist or fingers.

Joints can also be classified by the number of axes of movement they permit:

- Non-axial (gliding): Found between the proximal ends of the ulna and radius.
- Mono-axial (uni-axial): Movement occurs in one plane. An example is the elbow joint.
- Bi-axial: Movement can occur in two planes. An example is the wrist.
- Multi-axial: Includes the ball and socket joints. An example is the hip joint.

The movements possible with synovial joints are:

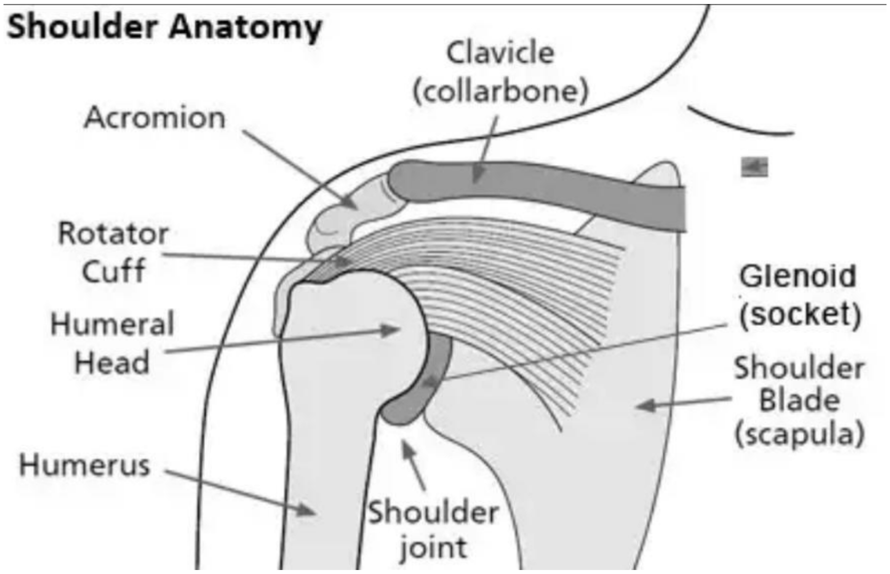
- Abduction: movement away from the body's midline
- Adduction: movement toward the body's midline
- Extension: straightening limbs at a joint
- Flexion: bending the limbs at a joint
- Rotation: a circular movement around a fixed point

CONSTRUCTION OF JOINTS

SHOULDER JOINT:

The shoulder joint (glenohumeral joint) is a ball and socket joint between the scapula and the humerus. It is the major joint connecting the upper limb to the trunk. It is one of the most mobile joints in the human body, at the cost of joint stability.

Structures of the Shoulder Joint:



- Articulating Surfaces

The shoulder joint is formed by the articulation of the head of the humerus with the glenoid cavity (or fossa) of the scapula. This gives rise to the alternate name for the shoulder joint– the glenohumeral joint. Both the articulating surfaces are covered with hyaline cartilage– which is typical for a synovial type joint.

The head of the humerus is much larger than the glenoid fossa, giving the joint inherent instability. To reduce the disproportion in surfaces, the glenoid fossa is deepened by a fibrocartilage rim, called the glenoid labrum.

- **Joint Capsule and Bursae**

The joint capsule is a fibrous heath which encloses the structures of the joint. It extends from the anatomical neck of the humerus to the border of the glenoid fossa. The joint capsule is lax, permitting greater mobility (particularly abduction).

The synovial membrane lines the inner surface of the joint capsule, and produce synovial fluid to reduce friction between the articular surfaces.

To reduce friction in the shoulder joint, several synovial bursas are present. A bursa is a synovial fluid filled sac, which act s as a cushion between tendons and other joint structures.

The bursae that are important clinically are:

Subacromial–Located inferiorly to the deltoid and acromion , and superiorly to the supraspinatus tendon and the joint capsule. It supports the deltoid and supraspinatus muscles. Inflammation of this bursa is the cause of several shoulder problems.

Subscapular– Located between the subscapularis tendon and the scapula. It reduces wear and tear on the tendon during movement at the shoulder joint.

There are other minor bursa present between the tendons of the muscles around the joint.

- **Ligaments**

In the shoulder joint, the ligaments play a key role in stabilizing the bony structures. The majority of the ligaments are thickenings of the joint capsule:

Gleno humeral ligaments (superior, middle and inferior)

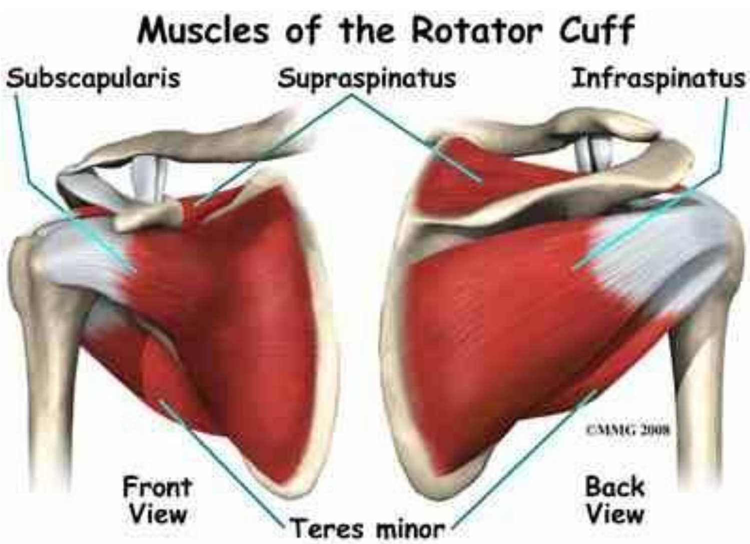
Coraco humeral ligament

Transverse humeral ligament

The other major ligament is the coracoacromial ligament. Unlike the others, it is not a thickening of the joint capsule. It runs between the acromion and coracoids process of the scapula, forming the coraco-acromial arch. This structure over lies the shoulder joint, preventing superior displacement of the humeral head.

Rotator cuff muscles:

Rotator cuff is a common name for the group of 4 distinct muscles and their tendons that provide strength and stability during motion of the shoulder. The muscles arise from the scapula and connect to the head of the humerus, forming a cuff at the glenohumeral joint.



- **Supraspinatus.** This holds the humerus in place and keeps the upper arm stable. And helps lift the arm.
- **Infraspinatus.** This is the main muscle that rotate and extend the shoulder.

- **Teres Minor.** This is the smallest rotator cuff muscle. Its main job is to assist with rotation of the arm away from the body.
- **Subscapularis.** This holds the upper arm bone to the shoulder blade and helps to rotate the arm, hold it straight out and lower it.

KNEE JOINT

The knee joint is a bicondylar type synovial joint, which mainly allows for flexion and extension (and a small degree of medial and lateral rotation). It is formed by articulations between the patella, femur and tibia.

- **Articulating Surfaces:**

Tibiofemoral–The medial and lateral condyles of the femur articulating with the tibia.

Patellofemoral–The anterior and distal part of the femur articulating with the patella.

The tibiofemoral joint is the weight-bearing joint of the knee.

The patellofemoral joint allows the tendon of the quadriceps femoris(the main extensor of the knee) to be inserted directly over the knee, increasing the efficiency of the muscle. Both joint surfaces are lined with hyaline cartilage, and enclosed within a single joint cavity.

The patella is formed inside the tendon of the quadriceps femoris, its presence minimizes wear and tear on the tendon.

- **Menisci**:

The medial and lateral menisci are fibrocartilage structures in the knee that serve two functions:

- To deepen the articular surface of the tibia, thus increasing stability of the joint.
- To act as shock absorbers.

They are C shaped, and attached at both ends to the intercondylar area of the tibia.

In addition to the intercondylar attachment, the medial meniscus is fixed to the tibial collateral ligament and the joint capsule. Any damage to the tibial collateral ligament results in tearing of the medial meniscus.

The lateral meniscus is smaller and does not have any extra attachments, rendering it fairly mobile.

- **Bursa:**

A bursa is synovial fluid filled sac, found between moving structures in a joint–with the aim of reducing wear and tear on those structures. There are four bursa found in the knee joint.

Supra patella bursa–This is an extension of the synovial cavity of the knee, located between the quadriceps femoris and the femur.

Pre patellar bursa– Found between the apex of the patella and the skin.

Infrapatellar bursa– Split into deep and superficial. The deep bursa lies between the tibia and the patella ligament. The superficial lies between the patella ligament and the skin.

Semimembranosus bursa– Located posteriorly in the knee joint, between the semimembranosus muscle and the medial head of the gastrocnemius.

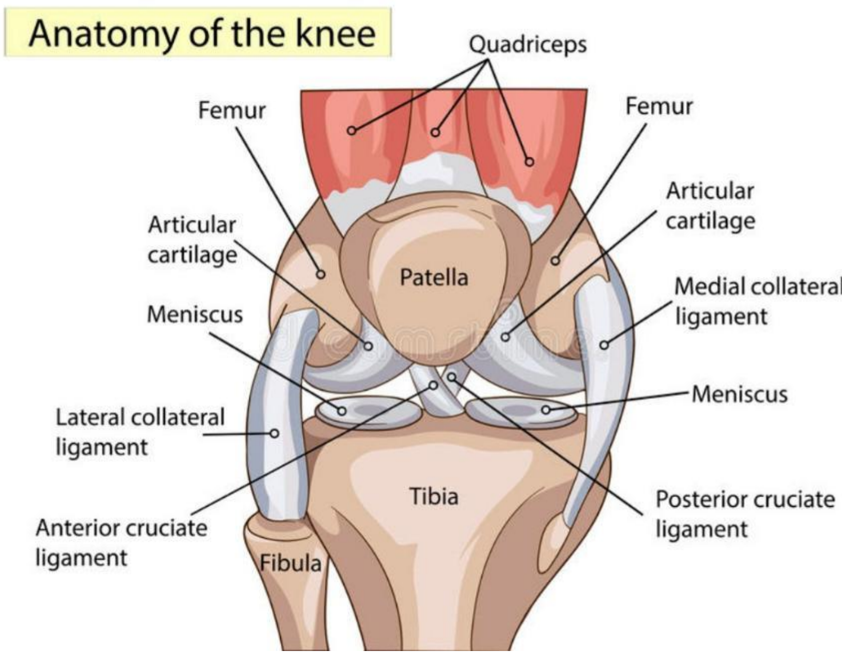


Fig. KNEE JOINT

- **Ligaments:**

The major ligaments in the knee join tare:

Patellar ligament

Collateral ligaments– two strap- like ligaments.

They act to stabilize the hinge motion of the knee, preventing any medial or lateral movement

Tibial (medial) collateral ligament –A wide and flat ligament, found on the medial side of the joint. Proximally, it attaches to the medial epicondyle of the femur, distally it attaches to the medial surface of the tibia.

Fibular (lateral) collateral ligament–Thinner and rounder than the tibial collateral,this attaches proximally to the lateral epicondyle of the femur, distally it attaches to a depression on the lateral surface of the fibular head.

Cruciate Ligaments–These two ligaments connect the femur and the tibia. In doing so,they cross each other, hence the term'cruciate'(Latin for like a cross)

- Anterior cruciate ligament–It prevents anterior dislocation of the tibia onto the femur.
- Posterior cruciate ligament–It prevents posterior dislocation of the tibia onto the femur.

MOVEMENTS OCCURING AT JOINTS:

The movement which occur at joints are classified into three major types

- Gliding movements
- Angular movements
- Rotation or circular movements

- **Gliding movements:**

They occur when two flat surfaces move on each other. e.g. movements between carpal and tarsal bones.

- **Angular movements.**

They bring about an increase or decrease in the angle between bones. Depending on the direction in which the movement occurs, they are further classified into

- Flexion: A movement where similar surfaces come nearer to each other. This reduces the angle between two bones e.g. bending the forearm at elbow.
- Extension: A movement where similar surfaces go apart. Here the angle between two bones is increased. It is the opposite of flexion e.g. straightening of the bent forearm.
- Adduction: A movement which brings the limb towards midline.
- Abduction: It is the opposite of adduction. 'The limb is drawn away from the mid line.

- **Rotation or circular movements**:

They occur when one bone moves around or within another bone.The movement occurs around a central axis. It is further classified into

- **Medial rotation** which occurs towards medial direction.
- **Lateral rotation** which occurs towards lateral direction.
- **Circumduction** is a combination of rotation and angular movements. It involves flexion, abduction, extension, adduction and some rotation. This movement occurs in shoulder, hip etc.

<u>**Articular surfaces of Joints**</u>

Sterno-clavicular joint :

It is a gliding joint between sternum and clavicle. A pad of cartilage is present in the joint cavity between the bones.

Acromio-clavicular joint:

Formed by outer end of clavicle articulating with acromion process of scapula. There is a pad of cartilage between the ends of bones. There is a limited amount of movement in all directions.

Shoulder joint :

It is a ball and socket type of joint. It occurs between head of humerus and glenoid cavity of scapula. The bones are united together by ligaments. These ligaments form a very loose capsule. Also, the shoulder joint has a synovial cavity. The tendon of long head of biceps passes through this.

Movements:

All types of movements like flexion, extension, abduction, adduction, rotation and circumduction are possible at this joint.

Elbow joint :

It is a hinge joint. It is formed by humerus above and radius and ulna below. It is composed of two different joints they are

- **Humero-ulnar joint** formed by trochlear notch of ulna and trochlear surface of humerus.
- **Humero - radial joint** formed by head of radius and capitulum of humerus.

These four atriculating surfaces are covered by a joint capsule.

Movements:
Flexion and extension occur at this joint.

Radio - ulnar joint :

This is formed by the articulation of radius and ulna at their upper and lower extremities. The interosseous membrane joins them throughout their shaft. This joint is further classified as

- Superior radio-ulnar joint formed by head of radius and radial notch of ulna
- Inferior radio-ulnar joint formed by head of ulna and lower end of radius.

Movements:
Pronation and supination occur at these joints.

Wrist joint:

It is a condyloid joint. It is formed by the lower end of radius and three carpal bones (navicular, lunate and triquetral).

Movements: Flexion, extension, abduction and adduction are the movements which occur at this joint.

Metacarpo- phalangeal joints :

They occur between meta carpal and phalangeal bones. The movements at these joints are flexion, extension, adduction and abduction.

Interphalangeal joints :

They occur between phalangeal bones of the same finger. Flexion and extension are the movements possible.

Hip joint :

It is a ball and socket type of joint. It occurs between acetabulum of inominate bone and head of femur. The acetabulum is deepened by a ring of fibro cartilage called **acetabular larbrum**.

The joint capsule is strengthened by three ligaments. They are

- Ilio-femoral ligament in the front.
- Pubo-femoral ligament below.

Movements:
F1exion, extension, abduction, adduction, rotation and circumduction occur at this joint.

Knee joint: It is a hinge joint formed by

- Two condyles of femur articulating with the condyles of tibia
- patella.

The structures of knee joint are

- **Medial and lateral semi lunar cartilages**: They are attached to the upper surface of tibia. They deepen the articular surface.
- **Cruciate ligaments** : Upper attachment is intercondylar notch of femur. Lower attachment is the upper surface of tibia. They receive blood from smaller arteries *(*arterioles) and deliver.

The capsule of the joint is strengthened by medial and lateral ligaments.

Movements

- Flexion
  Extension

Ankle joint

Ankle jointt is a hinge type joint, is formed by **three bones**.The tibia and fibula of the leg, and the talus of the foot:

Movements

- Dorsiflexion (bending the foot up towards the leg).
- Plantar flexion (bending the foot downwards).

JOINTS OF THE FOOT: They are:

- **Tarsal joints**: They occur between talus and calcaneum and also between other tarsal bones.
- **Tarso-metatarsal joints**: Occur between tarsal and metatarsal bones.
- **Metatarso pkalangeal joints**: Occur between metatarsal and phalangeal bones.
- **Inter phalangeal joints**: They occur between phalangeal bones themselves.

SHROT ANSWER QUESTIONS

1. Define joint and write its functions?
2. Mention any six movements occurring at joints?
3. Write the joints of foot?
4. Mention the names of rotator cuff muscles?
5. Mention the ligaments of knee joint?

ESSAY QUESTIONS

1. Classify joints and explain the structure of the synovial joints?
2. Explain the structure of the shoulder joint?
3. Explain the structure of the knee joint?
4. Write the articular surfaces of any five joints along with its movements?

UNIT- 4

MYOLOGY

Contents:

THE MUSCULAR SYSTEM

The muscular system consists of a large number of muscles (more than 300). They bring about various movements in the body. Muscles are attached to bones, cartilages, ligaments, skin or other muscles by fibrous structures called tendons or aponeurosis. Tendon is a cord like structure where as aponeurosis is a strong fibrous sheet. Muscles are richly supplied by blood vessels and nerves.

Each muscle has an origin and insertion. Origin is the remains stationary when the muscle contracts. The end which moves the end is called insertion. But it is not the same in all cases. In some cases, both ends of the muscle may move.

Myology – study of muscles.

Terms used for Describing Muscles

Origin: The end of a muscle which is relatively fixed during its contraction.
Insertion: The end of a muscle which moves during its contraction.

The two terms, origin and insertion, are sometimes interchangeable, when the origin moves and the insertion is fixed.

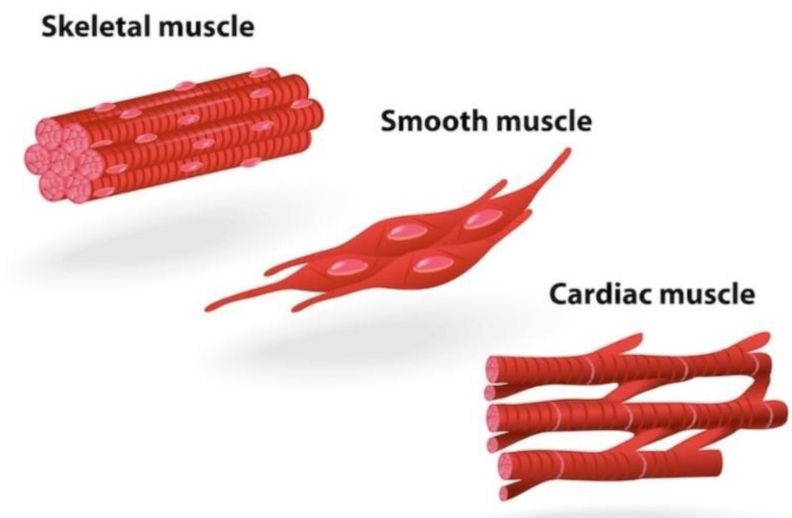
Belly: The fleshy and contractile part of a muscle is called belly and the fibrous, non-contractile and cord-like part of a muscle is called tendon.
Aponeurosis: The flattened tendon.

Raphe: The fibrous band made up of interdigitating fibres of the tendons or aponeuroses. Unlike a ligament, it is stretchable. Ligaments are fibrous, inelastic bands which connect two segments of a joint.

TYPES OF MUSCLE TISSUES:

Muscular tissue can be classified into:

- Smooth, non – striated or involuntary muscles.
- Cardiac muscle or myocardium.
- Skeletal, striated or voluntary muscles.



1.SMOOTH MUSCLES:

- These muscles are often encircled or surround the viscera.
- Do not exhibit cross striation under microscope, being plain and smooth in form.
- These are supplied by autonomic nerves, and therefore, are not under voluntary control.
- Respond slowly to stimuli, being capable of sustained contraction and do not fatigue easily.
- Provide power of regulating the internal environment, related to digestion, circulation, secretion and excretion.
- They are less dependent on nervous control, being capable of contracting automatically, spontaneously and often rhythmically.
- Each muscle is an elongated, spindle – shaped cell, within a single nucleus placed centrally, the myofibrils. Show longitudinal striations. Ex. Muscles of the blood vessels and the erector pili muscles of the skin.

Functions:

- The smooth muscle in the uterus helps a woman to push out her baby.
- In the bladder, smooth muscle helps to push out urine.
- Smooth muscle determines the flow of blood in the arteries.
- Smooth muscles move food through the digestive tract.

2.CARDIAC MUSCLES:

- It forms myocardium of the heart.
- It is intermediate in structure, being striated and at the same time involuntary.
- It is meant for automatic and rhythmic contractions
- Each muscle fibre, having a single nucleus placed centrally, branches and anastomoses with the neighbouring fibres at intercalated discs (apposed cell membranes), the cross striations are less prominent than those in the skeletal muscle.

- The cardiac muscle have a special properties

Functions

-It serves two types of functions:

- Electrical: to pass action potential to one myocyte to another. After action potential is conducted, myocytes execute.
- Mechanical function: contraction and relaxation

-
- **SKELETAL MUSCLES:**

The skeletal muscle is attached to the skeleton. The movement of skeletal muscles can be controlled by will.

Functions

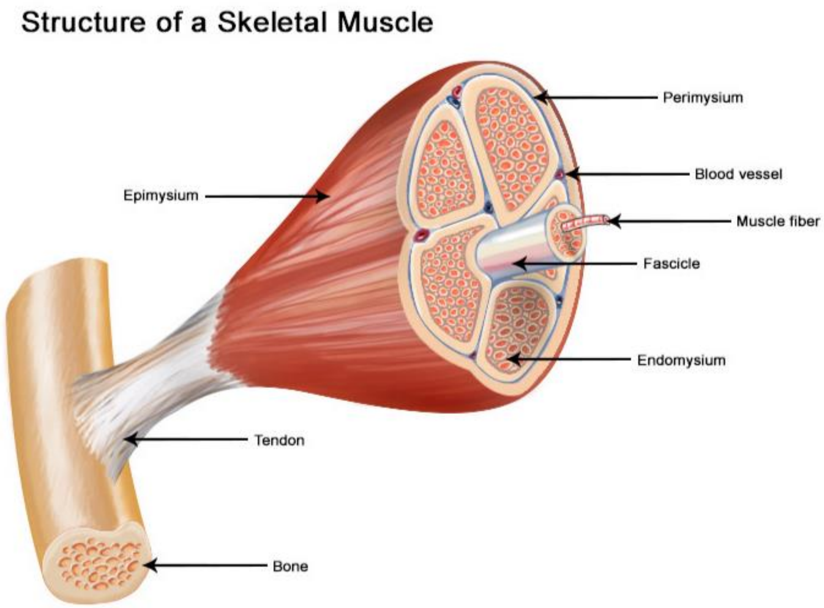
- They give shape, form and appearance to the body.
- They protect the vital organs of the body.
- They keep the joints in proper position.
- They help in venous return and lymphatic drainage.

Structure of the skeletal muscle:

Each skeletal muscle fiber is a single cylindrical muscle cell. An individual skeletal muscle may be made up of hundreds, or even thousands, of muscle fibers bundled together and wrapped in a connective tissue covering. Each muscle is surrounded by a connective tissue sheath called the **epimysium**. Fascia, connective tissue outside the epimysium, surrounds and separates the muscles. Portions of the epimysium project inward to divide the muscle into compartments. Each compartment contains a bundle of muscle fibers. Each bundle of muscle fiber is called a fasciculus and is surrounded by a layer of connective tissue called the **perimysium**. Within the fasciculus, each individual muscle cell, called a muscle fiber, is surrounded by connective tissue called the **endomysium.**

Skeletal muscle cells (fibers), like other body cells, are soft and fragile. The connective tissue covering furnish support and protection for the delicate cells and allow them to withstand the forces of contraction. The coverings also provide pathways for the passage of blood vessels and nerves.

Commonly, the epimysium, perimysium, and endomysium extend beyond the fleshy part of the muscle, the belly or gaster, to form a thick ropelike tendon or a broad, flat sheet-like aponeurosis. The tendon and aponeurosis form indirect attachments from muscles to the periosteum of bones or to the connective tissue of other muscles. Typically a muscle spans a joint and is attached to bones by tendons at both ends.



One of the bones remains relatively fixed or stable while the other end moves as a result of muscle contraction.

Skeletal muscles have an abundant supply of blood vessels and nerves. This is directly related to the primary function of skeletal muscle, contraction. Before a skeletal muscle fiber can contract, it has to receive an impulse from a nerve cell. Generally, an artery and at least one vein accompany each nerve that penetrates the epimysium of a skeletal muscle. Branches of the nerve and blood vessels follow the connective tissue components of the muscle of a nerve cell and with one or more minute blood vessels called capillaries.

The **sarcomere** is the fundamental unit of muscle structure. Its capacity for contraction is the essential trait that makes muscles work. It has two primary components (1) thin filaments made of **actine** (2) thick filaments made of **myosin**

During muscle contraction the thick filaments quickly slide along the thin filaments to shorten the myofibrils. The myofilaments themselves, however, do not contract. This is the action that give muscles their physical force.

Properties of skeletal muscle*:*

- **Excitability and irritability:** It is the property of a muscle to respond to a stimulus. If the response occurs in the form of contraction, It is called as contractility.
- **Tonicity**: Muscles of a living organism are in partially contracted state, even at rest. The resistance to stretch is called as tonicity.
- **All or none response** : When a stimulus given to a muscle i) the muscle either contracts to maximum or ii) it does not contract at all.
- **Summation:** when a second stimulus is given to a muscle even while it is contracting due to the first stimulus, the degree of contraction is more. This phenomenon is called

summation. The increased response is due to stimulation of more and more motor units by repetitive stimuli.

- **Treppe or staircase phenomenon**: stimulation of a muscle at regular short intervals increases the amplitude of contraction. This occurs due to increased irritability of the muscle produced by chemical products of the earlier contractions.
- **Tetani**: when a muscle is stimulated repeatedly at a very faster rate, the muscle contracts maximally. The muscle remains at this state of contraction till i) the stimulus continues or ii) it gets fatigued. This sustained maximal contraction is called tetanus.
- **Refractory period**: It is a period when muscle loses its excitability. During refractory period, the muscle does not respond to any stimulus, however strong it may be.
- **Isotonic contraction**: It is the contraction in which the muscle shortens under constant load. It occurs in muscles during walking, running or lifting.
- **Isometric contraction**: In this type of contraction, the muscle develops tension but it does not shorten in length eg. Maintaining the posture against gravity.
- **Fatigue:** It is a state of reduce excitability and contractility of a muscle. It is produced by rapid and repeated stimulation of the muscle. Fatigue may occur due to depletion of energy and accumulation of metabolites like lactic acid.

PHENOMENON OF MUSCLE CONTRACTION

The following steps are involved in muscle contraction:

- The sequence of events leading to contraction is initiated somewhere in the central nervous system, either as voluntary activity from the brain or as reflex activity from the spinal cord.

- A motor neuron in the ventral horn of the spinal cord is activated, and an action potential passes outward in a ventral root of the spinal cord.

- The axon branches to supply a number of muscle fibers called a motor unit, and the action potential is conveyed to a motor end plate on each muscle fiber.

- At the motor end plate, the action potential causes the release of packets or quanta of acetylcholine into the synaptic clefts on the surface of the muscle fiber.

- Acetylcholine causes the electrical resting potential under the motor end plate to change, and this then initiates an action potential which passes in both directions along the surface of the muscle fiber.

- At the opening of each transverse tubule onto the muscle fiber surface, the action potential spreads inside the muscle fiber.

- At each point where a transverse tubule touches part of the sarcoplasmic reticulum, it causes the sarcoplasmic reticulum to release Ca^{++} ions.

• The calcium ions result in movement of troponin and tropomyosin on their thin filaments, and this enables the myosin molecule heads to "grab and swivel" their way along the thin filament. This is the driving force of muscle contraction.

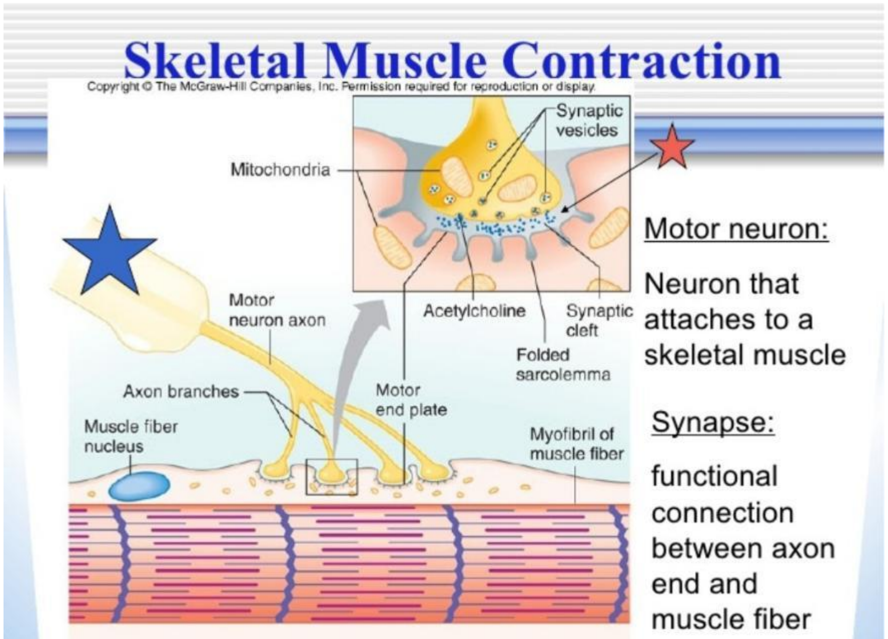


Fig. PHENOMENON OF MUSCLE CONTRACTION

Contraction is turned off by the following sequence of events:

• Acetylcholine at the neuromuscular junction is broken down by acetyl cholinesterase, and this terminates the stream of action potentials along the muscle fiber surface.

• The sarcoplasmic reticulum ceases to release calcium ions, and immediately starts to re-sequester all the calcium ions that have been released.

• In the absence of calcium ions, a change in the configuration of troponin and tropomyosin then blocks the action of the myosin molecule heads, and contraction ceases.

• In the living animal, an external stretching force, such as gravity or an antagonistic muscle, pulls the muscle back to its original length.

Muscle contraction flow chart:

Contraction Phase

Resting state

Motor nerve action potential arrives at motor end plate

Acetylcholine released, sarcolemma and membranes depolarized (Na+ flux into fiber)

Action potential transmitted via T-tubules to SR
Ca++ released from SR terminal cisternae into sarcoplasm
Ca++ bound by troponin
Myosin ATPase activated and ATP hydrolyzed
Tropomyosin shift from actin binding site
Actin-myosin crossbridge formation
Repeated formation & breaking of cross bridges resulting in sliding of filaments and sarcomere shortening

Relaxation Phase

Cholinesterase released and acetylcholine breakdown
Sarcolemma & T-tubules repolarized
SR Ca++ pump activated & Ca++ returned to SR terminal cisternae
Actin-myosin cross bridge formation terminated
Return of tropomyosin to actin binding site
Mg++ complex formed with ATP
Passive sliding of filaments
Sarcomeres return to resting state

Muscle spindles: These are stretch receptors within the body of a muscle that primarily detect changes in the length of the muscle. They convey length information to the central nervous system via afferent nerve fibers. This information can be processed by the brain to determine the position of body parts. The responses of muscle spindles to changes in length also play an important role in regulating the contraction of muscles, by activating motor neurons via the stretch reflex to resist muscle stretch.

MUSCLE GROUPS

There are more than 600 muscles in the body, which together account for about 40 percent of a person's weight.

Most skeletal muscles have names that describe some feature of the muscle.The following are some terms relating to muscle features that are used in naming muscles.

- **Size:** vastus (huge), maximus (large), longus (long), minimus (small),brevis (short).
- **Shape:** deltoid (triangular),rhomboid (like a rhombus with equal and parallel sides), latissimus (wide), teres (round), trapezius (like a trapezoid, a four-sided figure with two sides parallel).
- **Direction of fibers:** rectus (straight), transverse (across), oblique (diagonally), orbicularis (circular).
- **Location:** pectoralis (chest), gluteus (buttock or rump), brachii (arm), supra- (above), infra- (below), sub- (under or beneath), lateralis (lateral).

- **Number of origins:** biceps (two heads), triceps (three heads), quadriceps (four heads).
- **Origin and insertion:** sternocleidomastoideus (origin on the sternum and clavicle, insertion on the mastoid process), brachioradialis (origin on the brachium or arm, insertion on the radius).
- **Action:** abductor (to abduct a structure), adductor (to adduct a structure), flexor (to flex a structure), extensor (to extend a structure), levator (to lift or elevate a structure), masseter (a chewer).

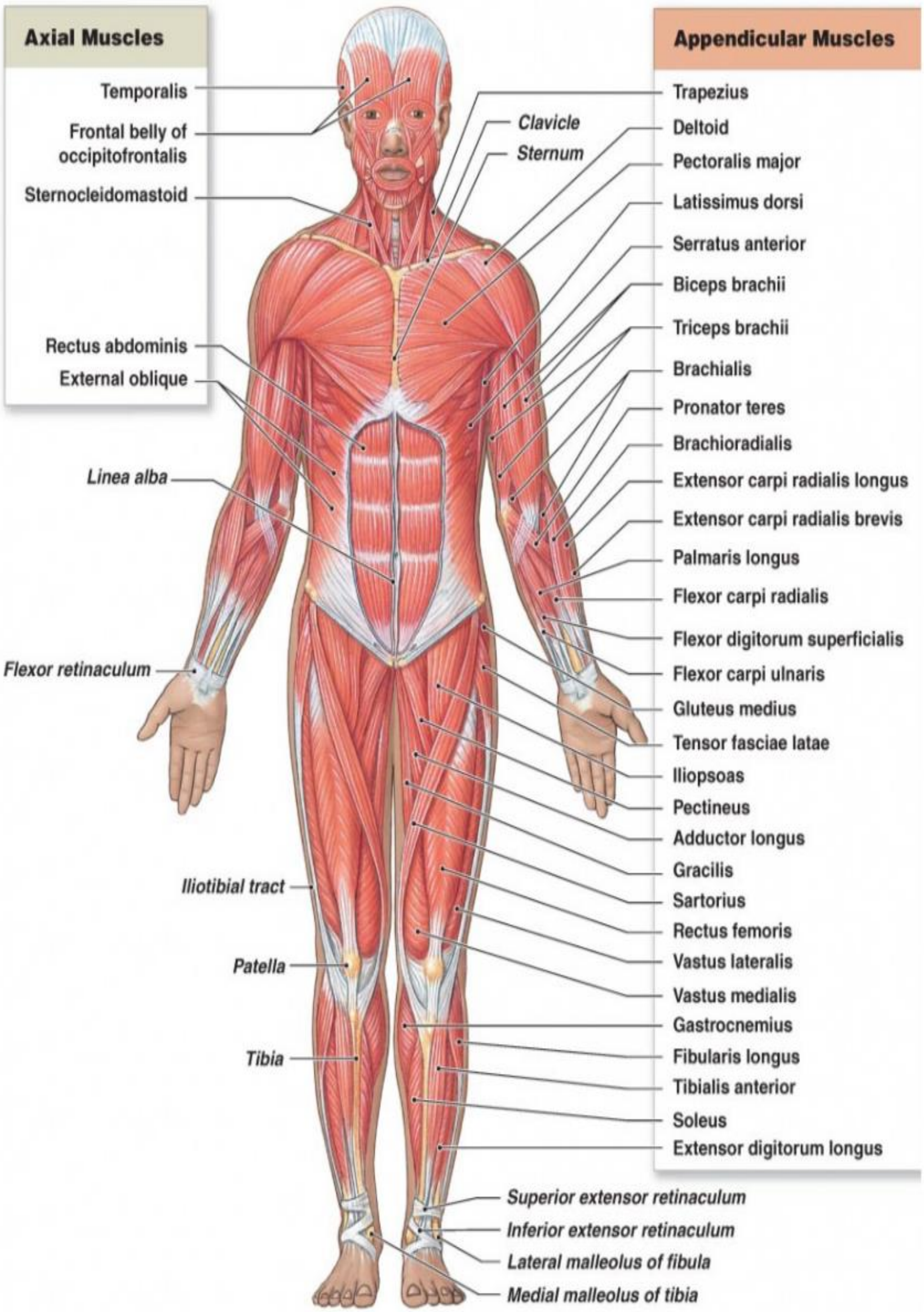
MUSCLES OF UPPER LIMB

S.No	Name of the Muscle	Action
1.	TRAPEZIUS	Stabilizes, elevates, retracts and rotates scapula
2.	LATISSIMUS DORSI	Extends and adducts arm
3.	LEVATOR SCAPULAE	Elevates and scapula
4.	RHOMBOIDUS MAJOR and MINOR	Adducts and rotates scapula
5.	SUBSCAPULARIS	Rotates arm medially
6.	PECTORALIS MAJOR	Flexes ,medially rotates and adducts arm
7.	PECTORALIS MINOR	Abduction and medial rotation of shoulder joint
8.	SERRATUS ANTERIOR	Rotates scapula laterally
9.	SUPRASPINATUS	Abducts arm
10.	INFRASPINATUS	Rotates arm laterally
11.	DELTOID	Abducts arm
12.	TERES MAJOR	Rotates arm medially and also adducts arm
13.	TERES MINOR	Rotates arm laterally
14.	TRICEPS	Extends fore arm
15.	BICEPS , BRACHIALIS and BRACHIORADIALIS	Flexes forearm
16.	PRONATOR TERES	Pronates forearm
17.	FLEXOR CARPI ULNARIS	Flexes and adducts Wrist
18.	FLEXOR CARPI RADIALIS	Flexes and abducts wrist
19.	SUPINATOR	Supinates forearm
20.	EXTENSORVDIGITORUM	Extends fingers
21.	EXTENSOR CARPIULNARIS	Extends and adducts wrist
22.	EXTENSOR CARPI RADIALIS	Extends and abducts wrist
23.	EXTENSOR POLLICIS	Extends thumb
24.	EXTENSOR INDICIS	Extends index finger

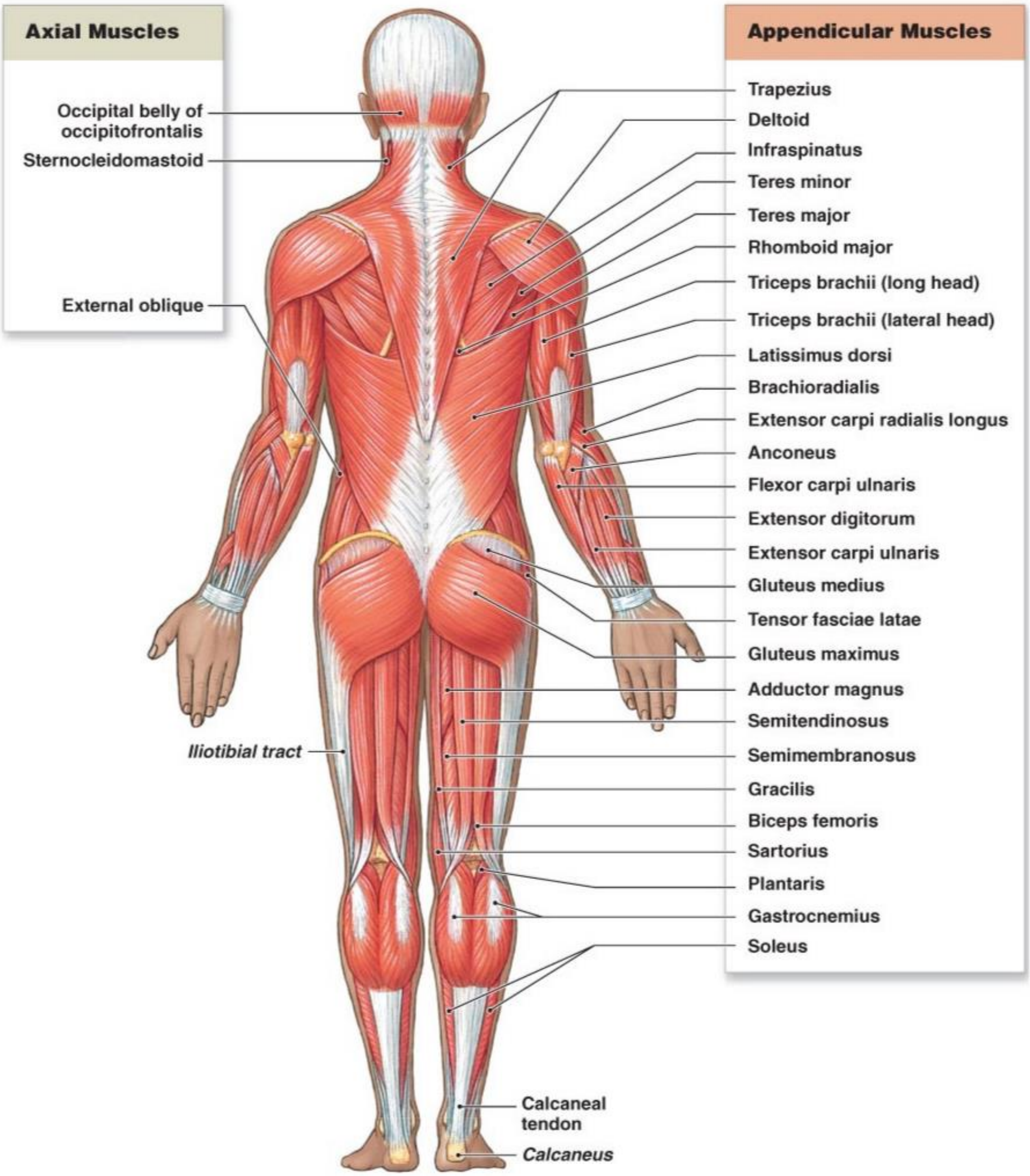
MUSCLES OF TRUNK

S.No	Name of the muscle	Action
1.	RECTUS ABDOMINUS	Flexes trunk and lumbar spine
2.	EXTERNAL OBLIQUE	Bends and rotates trunk same side
3.	INTERNAL OBLIQUE	Bends and rotates trunk opp. Side
4.	TRANSVERSE ABDOMINUS	Supports abdominal wall in forced expiration
5.	QUADRATUS LUMBORUM	Side bending of trunk
6.	ERECTOR SPINE	Extension of spine

The axial and appendicular muscles in anterior view

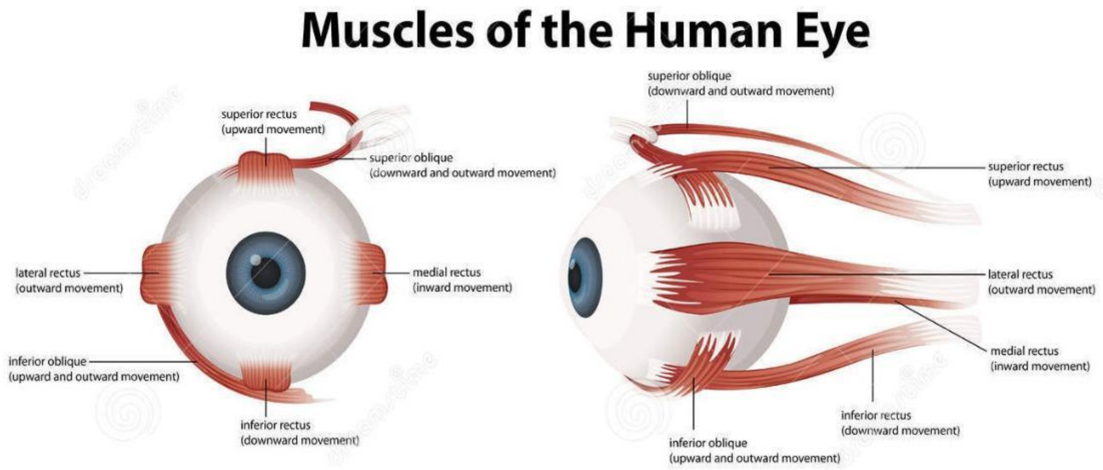


The axial and appendicular muscles in posterior view



MUSCLES OF LOWER LIMB

S.N0	NAME OF THE MUSCLE	ACTION
1.	ILIACUS	Flexes thigh
2.	PSOAS MAJOR	Flexes thigh
3.	TENSOR FACIALATAE	Flexes and abducts thigh
4.	SARTORIOUS	Flexes, abducts and laterally rotates thigh
5.	PECTENIUS	Adducts, flexes and medially rotates thigh
6.	ADDUCTOR BREVIS	Adducts, flexes and medially rotates thigh
7.	ADDUCTOR LONGUS	Adducts, flexes and medially rotates thigh
8.	ADDUCTOR MAGNUS	Adducts, flexes and medially rotates thigh
9.	GRACILIS	Adducts, flexes and medially rotates thigh
10.	GLUTEAL MAXIMUS	Extends thigh
11.	GLUTEUS MEDIUS	Abducts and medially rotates thigh
12.	GLUTEUS MINIMUS	Abducts and medially rotates thigh
13.	PIRIFORMIS	Laterally rotates thigh
14.	OBTURATOR EXTERNUS and INTERNUS	Laterally rotates thigh
15.	QUADRATUS FIMORIS	Laterally rotates thigh
16.	QUADRICEPS : RECTUS FEMORIS VASTUS LATERALI VASTUS MEDIALIS VASTUS INTERMEDIUS	 Extends (lower) leg Extends (lower) leg Extends (lower) leg Extends (lower) leg
17.	HAMSTINGS: BICEPS FEMORIS SEMITENDINOSUS SEMIMEMBRANOSUS	 Flexes (lower)leg Flexes (lower)leg Flexes (lower)leg
18.	POPLITEUS	Flexes , medially rotates (lower) leg
19.	TIBIALIS ANTERIOR	Dorsi flexes and inverts foot
20.	EXTENSOR DIGITORUM LONGUS	Extends toes
21.	EXTENSOR HALLUCIS LONGUS	Extends great toe
22.	FIBULARIS	Plantar flexes and everts foot
23.	GASTROCNEMIUS	Plantar flexes foot
24.	SOLEUS	Plantar flexes foot
25.	PLANTARIS	Plantar flexes foot
26.	FLEXOR DIGITORUM LONGUS	Flexes of toes
27.	FLEXOR HALLUCIS LONGUS	Flexes great toe
28.	TIBIALIS POSTERIOR	Inverts foot



MUSCLES OF EYE BALL

S.NO	NAME OF THE MUSCLE	ACTION
1.	SUPERIOR RECTUS	Rotates eye up and medially
2.	INFERIOR RECTUS	Rotates eye down and medially
3.	MEDIAL RECTUS	Rotates eye medially
4.	LATERAL RECTUS	Rotates eye laterally
5.	SUPERIOR OBLIQUE	Rotates eye down and laterally
6.	INFERIOR OBLIQUE	Rotates eye up and laterally

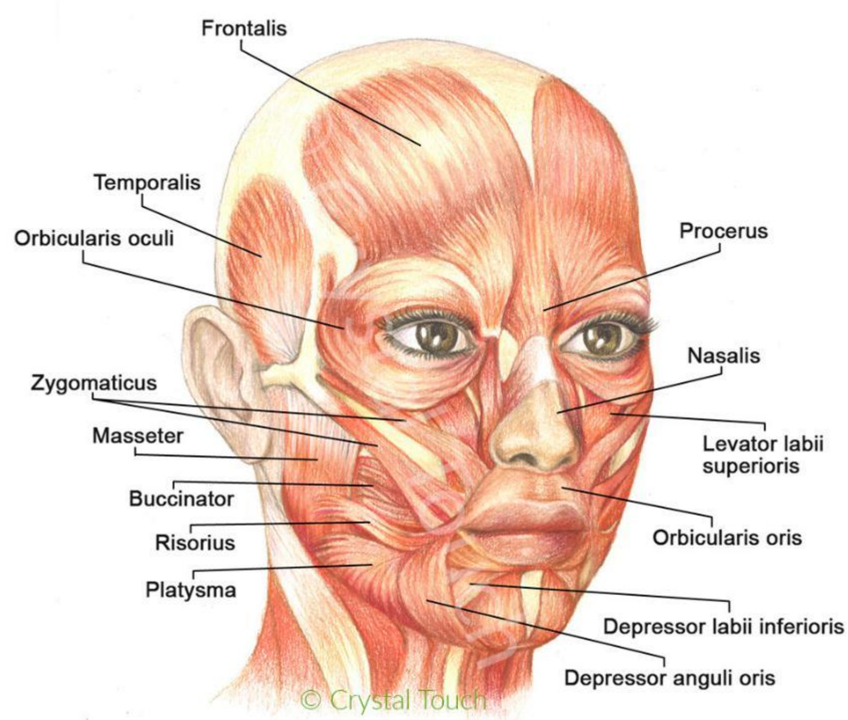


Fig. MUCLES OF FACE

MUSCLES OF FACE

S.NO	NAME OF THE MUSCLE	ACTION
1.	FRONTALIS	Raises eyebrows
2.	CORRUGATOR SUPERCILII	Draws the eyebrows medially Frowning
3.	ORBICULARIS OCULI	Ocular reflex Controls drainage of tears
4.	LEVATOR PALPEBRAE SUPERIORIS	Elevates upper eyelid
5.	PROCERUS	Frowning and concentration Reduces the glare of the sunlight
6.	NASALIS	Elongation of nose
7.	LEVATOR LABII SUPERIORIS	Elevates and everts the upper lip, Modifies the nasolabial fold
8.	ZYGOMATICUS MAJOR	Elevates and everts the upper lip
9.	ZYGOMATICUS MINOR	Elevates and everts the upper lip Curls the upper lip in smiling
10.	LEVATOR ANGULI ORIS	Raises the angle of mouth on smiling
11.	MENTALIS	Raising and everting the lower lip Wrinkling the skin of lower lip
12.	BUCCINATOR	Compresses the cheek against the gums Important for playing wind instruments
13.	ORBICULARIS ORIS	Compresses and protrude the lips (whistling and sucking)
14.	RISORUS	Pulls the corner of mouth laterally in grinning and laughing
15.	PLATYSMA	Depresses the mandible forcefully, Pull the angle of mouth downward, Tenses the skin of neck

SHORT ANSWER QUESTIONS

1. Write the types of muscle tissue?
2. Write the names of muscles of eye ball?
3. Write the names of the muscles of facial expression?
4. Write the properties of skeletal muscle?
5. Write any four muscles of upper limb ?
6. Write any four muscles of lower limb?

UNIT- 5

BLOOD

Contents:

INTRODUCTION

Blood is a specialized connective tissue which is fluid in nature. This plays a very important part in the maintenance of life. It is a fluid tissue composed of two parts. The intracellular substance is called plasma. The Blood is red in colour due to the presence of Hemoglobin pigment. The average volume of blood in the body is about 6 lts. Blood is slightly alkaline with a Ph of about 7.4. The specific gravity of blood is about 1.055.

Composition of blood:

Although it appears as a faint yellow fluid, actually it consists of two parts- a liquid part, the plasma and a solid part- the formed elements or different type of cells, which remain suspended in the plasma. The cells are called as the blood corpuscles- R.B.C. W.BC. And blood platelets. The cells form 45% and the plasma 55% of the total volume of blood.

Functions of blood:

Functions of the Blood

- **Transportation**
  - Oxygen- from inhaled air diffuses into the blood through the thin lung membranes and is carried to all the tissue of the body. Carbon dioxide, a waste product of cell metabolism, is carried from the tissues to the lungs, where it is breathed out.
  - The blood transports foods and other needed substances such as minerals and vitamins, to the cells. These materials may enter the blood from the digestive system or may be released into the blood from body stores.
  - The blood transports waste products from the cells to the sites from which they are released. The kidney removes excess water, minerals, and urea from protein metabolism and maintains the acid-base balance of the blood. The liver removes bile pigments and drugs.
  - The blood carries hormones from their sites of origin to the organs they affect.

- **Regulation**

  Buffers in the blood help keep the PH of body fluids at about 7.4

  The blood serves to regulate the amount of fluid in the tissues by means of substances (mainly proteins) that maintain the proper osmotic pressure.

  The blood transports heat that is generated in the muscles to other parts of the body thus aiding in the regulation of body temperature by the blood, thus aiding in the regulation of body temperature.

- **Protection**
  - The blood carries the cells that are among the body's defenders against pathogens. It also contains substances (antibodies) that are concerned with immunity to disease.
  - The blood contains factors that protect against blood loss.

The Plasma:

The blood consists of a suspension of special cells in liquid called plasma

It is a clear, straw-colored watery liquid. It consists of:

- Water 90 to 92%
- Solid 8-10%. The solids include:
  - Proteins: 7% of albumins, globulins, fibrinogen, prothrombin and heparin.
  - Inorganic constituents: 0.9% of Sodium, Calcium, Potassium, Magnesium etc.
  - Organic Constituents: glucose, amino acids, fatty acids, glycerol, vitamins and non-nitrogenous substances like urea, uric acid, creatinine, ammonia etc.
- Respiratory gases: Oxygen, carbon dioxide and nitrogen.
- Anti-bodies and anti toxins which protect the body against bacterial infection.
- Certain hormones and enzymes.
- Coloring matter: Yellow colour of plasma is due to the presence of small amount of bilirubin, carotene etc.

Plasma proteins:

Albumin: It is the key plasma protein which helps in maintaining the osmotic pressure of the blood. It is synthesized in liver.

Globulin: This is of three types namely alpha, beta and gamma, produced in lymphoid tissue. It helps in maintaining immunity by producing antibodies and immune substance.
Fibrinogen: Which is responsible for coagulation of blood. It is synthesized in liver.

Functions of Blood Plasma

- Essential for blood clotting: The presence of fibrinogen and prothrombin in the plasma takes part in blood clotting, which are produced in the liver.

- Plasma maintains colloidal osmotic pressure of blood and help in regulating the distribution of fluid between the blood and tissues.

- The protein which plasma contains gives the blood the sticky consistency called viscosity, which is necessary to prevent too much fluid passing through the capillary wall into the tissues. This viscosity of blood assists in the maintenance of blood pressure.

- Plasma is concerned with erythrocytes (R.B.C.) sedimentation rate. An increase in fibrinogen raises the sedimentation rate of red blood cells.

• Acts as a buffer: The salts in the plasma are necessary or the building of protoplasm and they act as buffer substances neutralizing acids or alkalis in the body and maintaining the correct reaction of blood.

• Acts as a protein reserve: During starvation the tissue can draw protein from the plasma store.

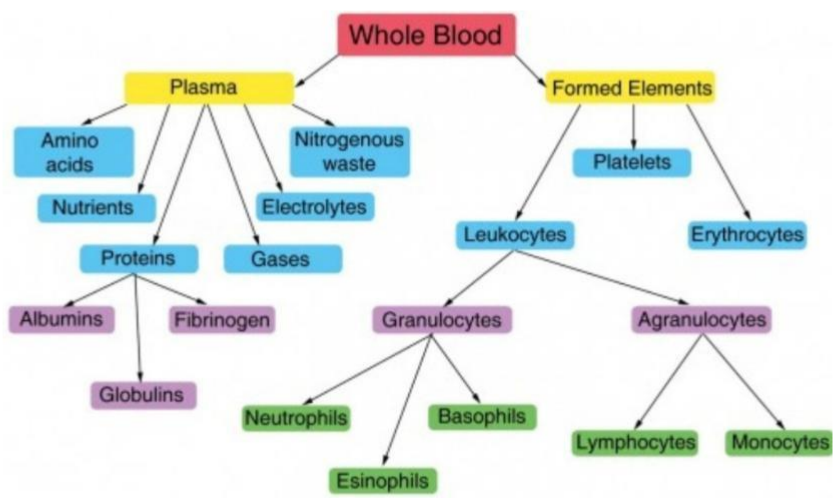
• Protects against infection: The anti-bodies and antitoxins provide protection against infection and neutralize the poisonous bacterial toxins.

• Help in transportation: Plasma protein combines with certain substances can help to carry them in the blood stream.

CELLULAR ELEMENTS OF BLOOD:

The cellular elements of blood are s follows:

- Red blood cells (erythrocytes)
- White Blood cells (Leucocytes)
- Platelets (Thrombocytes)



RED BLOOD CELLS

These Red blood cells or RBC's are also called as erythrocytes. They are circular, biconcave, disc shaped cells. They do not have a nucleus. They have a respiratory pigment called Hemoglobin. The normal RBC count is 4.5 to 5 million per cu mm. There are about 5,000,000 red blood cells in each cubic millimeter.

R.B.C. Serves important functions such as transport of oxygen and maintenance of acid base balance. They are produced in the blood bone marrow and destroyed in the spleen. The average life span of RBC is 120 days. They are also produced in the flat bones and long bones like sternum. Roulex formation is the tendency of RBC to stick to one another like a pile of coin. Polycythemia is a condition where there is an increase in the number of RBC's.

Erythrocyte sedimentation rate (ESR) It is the rate at which RBC's sink to the bottom. Normal values of ESR are 3 to 5 mm per hour in males, 4 to 7 mm per hour in females

ERYTHROPOIESIS

It is the process by which RBC’s are formed in the fetus; RBC’s are formed in liver, spleen and red bone narrow. After birth, they are formed only in the red bone narrow of sternum, ribs, vertebrae etc. the stages of development of RBC’s are as follows:

- Proerythroblast
- Normoblast
- Reticulocyte
- Erythrocyte.

Both vitamin B12 and folic acid are necessary for the development of RBC’s.

HEMOGLOBIN

It is the respiratory pigment of erythrocytes. The red colour of blood due to hemoglobin. It contains a protein which is conjugates with heme. Heme molecule contains four pyrrole rings with iron in the centre. The hemoglobin content of body is about 15 G per 100 ml of blood. Anemia occurs due to a decrease in hemoglobin.

FUNCTIONS OF HEMOGLOBIN

- Transport of oxygen and carbon dioxide
- Maintenance of acid base equilibrium
- As a source for the formation of bilirubin.

WHITE BLOOD CELLS

They are colour less cells containing a nucleus. They are also called as leucocytes.

They are larger in size than RBC’s. Also their number is less when compared to RBC’s (about 8000 per cum).

CLASSIFICATION OF WHITE BLOOD CELLS

These are classified as the following.

Granulocytes

These are of three types they are

- Neutrophils
- Eosinophils
- Basophils

These W.B.C’s have granules in the cytoplasm. They have a nucleus which contains two or more lobes.

NEUTROPHILS: (Polymorphs) they contain granular cytoplasm which stains with neutral dyes. The nucleus may contain 2 to 5 lobes 65 to 75% of total W.B.C’s.

EOSINOPHILS: (Acidophils) These cells are slightly larger than neutrophils. The granules are coarse and closely packed. These granules take up acid stain.

BASOPHILS: (Most cells) they contain coarse granules as in eosinophils. But these granules stain blue with basic dyes. The nucleus is kidney shaped or lobulated.

AGRANULOCYTES: This type of WBC's does not have granules but they have a single nucleus which is not lobed. They are classified into further types they are:

- Lymphocytes
- Monocytes

Lymphocytes:

They are of two types:

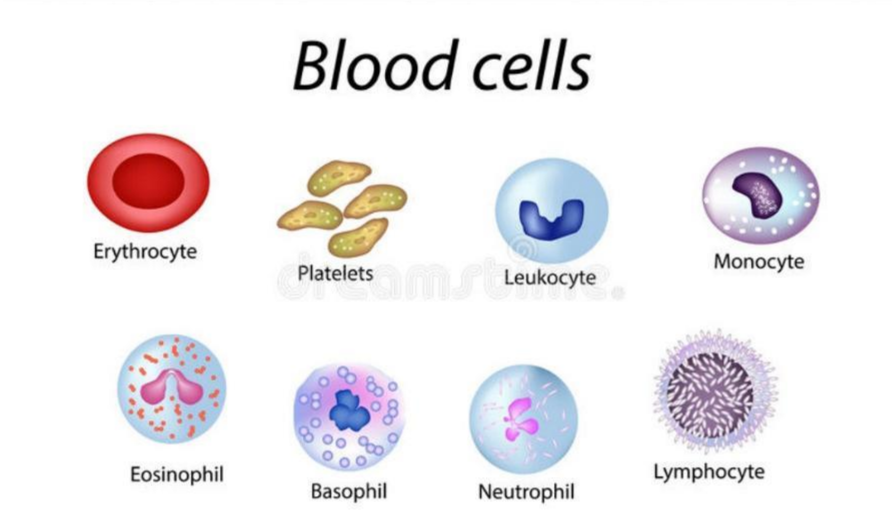
- Small lymphocytes: They occur to the extent of 25% of total WBC's they are smaller in size with a nucleus occupying almost the whole of the cell. So the cytoplasm is less.
- Large Lymphocytes: They are larger in size containing more cytoplasm.

Monocytes:

They are the largest of W.B.C's they occur to the extent of 2 to 4% of WBC's they contain an eccentric nucleus which is notched in the inner side.

FUNCTIONS OF WBC'S:

- Protection against infection: This is done by neutrophils and monocytes which engulf bacteria. This process is called as phagocytosis.
- To aid in the repair of injured tissues.
- To produce immune substances which defend against diseases. This is done by lymphocytes through the synthesis of Gammaglobulin.
- Basophils secrete an anticoagulant substance called heparin.



PLATELETS:

These are called as Thrombocytes. These are round or oval shaped cells with biconcave surface. They are roughly one fourth of size of RBC. Normal platelet count is 2 to 5 lakh per cum of blood. Platelets do not have a nucleus, but cytoplasm contains distinct granules. They are synthesized by mega karyocytes (giant cells) of bone narrow.

FUNCTIONS OF PLATELETS

- Thromboplastin liberated from platelets is essential for clotting.
- They close minute lesions in the wall of blood vessels.
- They aid in body's defense mechanism against bacteria.
- They contain histamine and serotonin
- They contain some antigenic substance also "Thrombocytopenia". It is a condition where there is a decrease in platelet count.

COAGULATION PHENOMENON or CLOTTING OF BLOOD

Clotting of blood is a defense mechanism of the body. It prevents loss of blood from site of injury. If a leak develops in blood vessels. A clot is formed and it plugs the leak. This prevents the loss of blood.

MECHANISM OF CLOTTING

Clotting of blood occurs in the following stages

- "Thromboplastin": It is liberated from disintegrated tissues and damaged platelets.
- "Thromboplastin" converts prothrombin into thrombin. This occurs in presence of calcium ion.
- Thrombin converts fibrinogen to fibrin
- The insoluble forms threads; the formed elements of blood get entangled in this and form the clot.

The mechanism of clotting can be expressed in a simple formula:

- Prothrombin + Calcium+thromboplastin = Thrombin (active) (inactive) (from damaged tissue cells and platelets)
- Thrombin + fibrinogen = Fibrin (fine threads) (inactive)
- Fibrin + blood cells = CLOT

CLOTTING FACTORS

The various factors involved in the scheme of clotting described above are designated by numbers as factors I, II. These factors are:

Factors I - Fibrinogen
Factors II - Prothrombin
Factors III - Thromboplastin
Factors IV - Calcium
Factors V - Quicks labile factor
Factors VI - Existence of these factors not accepted
Factors VII - Quick's stable factor
Factors VIII - Anti hemophilic factor
Factors IX - Christmas factor

CLOTTING TIME

It is the time taken for the clotting of human blood removed from circulation. The average clotting time varies from 5 to 15 minutes.

BLEEDIND TIME : It is a medical test that measures how fast small blood vessels in the skin stop bleeding.

BLOOD GROUPS

In early time, transfusion of blood from one person to another was dangerous and unsuccessful. This is because plasma of some individuals contains some factors. These factors produce agglutination or Hemolysis of the erythrocytes of other person. These reactions occur due to the person's agglutination in blood.

Blood is grouped as follows:
Group A - has **A** agglutinogen and **B** agglutinin
Group B - has **B** agglutinogen and **A** agglutinin
Group AB - has **AB** agglutinogen and no agglutinin
Group 'O' - has no agglutinogen and **AB** agglutinin

Blood Type	Antigen (RBC membrane)	Antibody (plasma)	Can receive blood from	Can donate blood to
A (40%)	A antigen	Anti-B antibodies	A, O	A, AB
B (10%)	B antigen	Anti-A antibodies	B, O	B, AB
AB (4%)	A antigen B antigen	No antibodies	A, B, AB, O	AB
O (46%)	No antigen	Both Anti-A and Anti-B antibodies	O	O, A, B, AB

Fig. Blood groups

Agglutination occurs between the same type of Agglutinogen and Agglutinin. But no Agglutination occurs between different types of Agglutinoges and agglutinins. So it can be seen that group "O" blood can match with all blood groups. But this individual group of individual can receive blood only from O group and not from any other group. Individuals with O group of blood are called universal donors. Individuals with blood group AB can receive blood from all groups. They are called as recipients.

SHORT ANSWER QUESTIONS

1. Define blood and write its functions?
2. Write the composition of blood?
3. Write the composition of plasma?
4. Classify WBC?
5. Write about hemoglobin?
6. Describe clotting time and bleeding time?
7. Mention the blood groups?
8. What is ESR?

ESSAY QUESTIONS

1. Write about the cellular components of the blood with its functions?
2. Explain the clotting mechanism in detail?

UNIT- 6

CARDIO - VASCULAR SYSTEM

Contents:

The cardiovascular system consists of heart and blood vessels It is mainly a transport system. It transports respiratory gases, nutrients and excretory products to various parts of the body. Blood is the medium through which these substances are transported.

HEART

Heart is a conical, hollow, musculotendinous organ. It lies in the thorax between the lungs and behind the sternum. It is about 10 cm long and weighs about 300 grams. The base of the heart is above and apex is below.

1. Position of the heart:

The heart lies in the thorax between the lungs and behind, the sternum. Two thirds of the heart is on the left side. It lies obliquely. It is directed more towards the left side than on the right side. The apex of the heart lies at the level of 5th intercostal space, 9 cm to the left of midline. The base extends to the level of second rib.

Structure of the Heart:

The heart is a hollow organ the walls of which are formed of three different layers. The heart wall has three tissue layers.

- The **endocardium** is a very thin smooth layer of cells that resembles squamous epithelium. This membrane lines the interior of the heart. The valves of the heart are formed by reinforced folds of this material.
- The **myocardium**, the muscle of the heart, is the thickest layer.
- The **epicardium** forms the thin outermost layer of the heart wall and is continuous with the serous lining of the fibrous sac that encloses the heart. These membranes together make up the pericardium. The serous lining of the pericardial sac is separated from the epicardium on the heart surface by a thin fluid- filled space.

Two Hearts and a Partition

Physicians often refer to the right heart and the left heart. This is because the human heart is really a double pump. The two sides are completely separated from each other by a partition called the **septum**. The upper part of this partition is called **interartrial septum**, while the larger the lower portion is called
interventricular septum. The septum, like the heart wall, consists largely of myocardium.

Four Chambers

On either side of the heart are two chambers, one a receiving chamber (atrium) and the other a pumping chamber (ventricle)

- The **right atrium** is a thin-walled chamber that receives the blood retuning from the body tissues. This blood, which is low in oxygen, is carried in the veins, the blood vessels leading to the heart from the body tissues.
- The **right ventricle** pumps the venous blood received from the right atrium and sends it to the lungs.
- The **left atrium** receives blood high in oxygen content as it returns from the lungs.
- The **left ventricle**, which has the thickest walls of all, pumps, oxygenated blood to all parts of the body. This blood goes through the arteries, the vessels that take blood from the heart to the tissues.

Four Valves

Since the ventricles are the pumping chambers, the valves, which are all one way, are located at the entrance and the exit of each ventricle. The entrances valves are the **atrioventricular valves**, while the exit valves are the **semilunar valves**. Semilunar means "resembling a half moon." Each valve has a
Specific name, as follows:

- The **right atrioventricular valve** also is known as the **tricuspid valve**, since it has three cusps, or flaps, that open and closes. When this valve is open, blood flows freely from the right atrium into the right ventricle. However, when the right ventricle begins to contract, the valve closes so that blood cannot return to the right atrium; this ensures forward flow into the pulmonary artery.

- The **left atrioventricular valve** is the **bicuspid valve**, but it is usually referred to as the **mirtal valve**. It has two rather heavy cusps that permit blood to flow freely from the left atrium into the left ventricle. However, the cusps close when the left ventricle begins to contract; this prevents blood from returning to the left atrium and ensures the forward flow of blood into the **aorta**. Both the tricuspid and mitral valves are attached by means of thin fibrous threads to the wall of the ventricles. The function of these threads, called the **chordae tendineae** is to keep the valve flaps from flipping up into the atria when the ventricles contract and thus causing a backflow of blood.

- The **pulmonic** (semilunar) **valve** is located between the right ventricle and the pulmonary artery that leads to the lungs. As soon as the right ventricle has finished emptying itself, the valve closes in order to prevent blood on its way to the lungs from returning to the ventricle.

- The **aortic** (semilunar) **valve** is located between the left ventricle and the aorta. Following contraction of the left ventricle, the aortic valve closes to prevent the flow of blood back from the aorta to the ventricle.

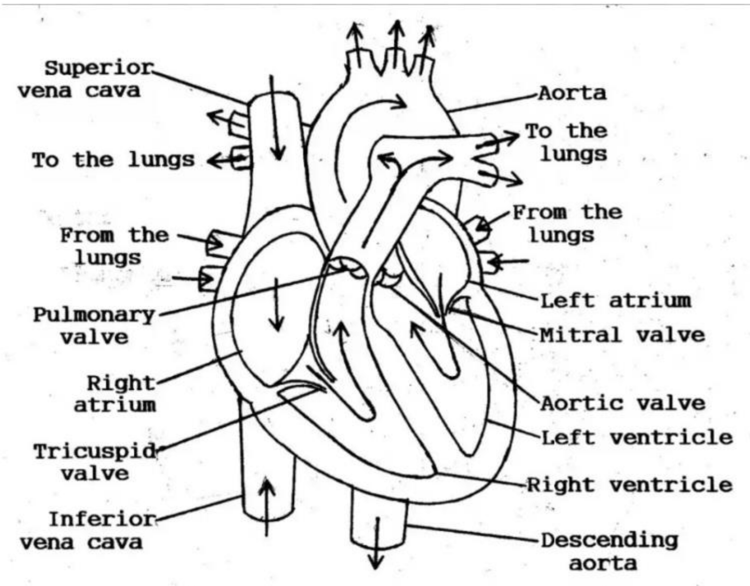


Fig. STRUCTURE OF HEART

5**. Blood vessels attached to heart:**

- The right atrium receives **superior vena cava** and **inferior vena cava**. They carry venous blood to heart.
- From the right ventricle, arises the **pulmonary artery**. It carries venous blood to lungs for oxygenation.
- The left atrium receives four **pulmonary veins**. They carry oxygenated blood to heart.

- **Nerve supply:**

Heart is supplied by sympathetic and vagus nerves. Branches from these nerves pass to the sino auricular node.

Functions of heart:

- Pumping blood around the body
- Sending deoxygenated blood to the lungs to be oxygenated.
- Sending oxygenated blood to the whole body.
- Ensuring that oxygenated and deoxygenated blood do not mix(septum).
- Preventing backflow of blood.
- Regulating blood supply.
- Generating blood pressure.
- Transport of nutrients, oxygen, and hormones to cells throughout the body and removal of metabolic wastes (carbon dioxide, nitrogenous wastes).
- Protection of the body by white blood cells, antibodies, and complement proteins that circulate in the blood and defend the body against foreign microbes and toxins. Clotting mechanisms are also present that protect the body from blood loss after injuries.
- Regulation of body temperature, fluid pH, and water content of the body.

Types of blood Vessels

a."**Arteries**" carry oxygenated blood away from the heart, with the exception of the pulmonary and umbilical arteries which carry deoxygenated blood. Arteries resemble trees because they have branches (arterioles).

b."**Veins** "carry deoxygenated blood towards the heart, with the exception of the pulmonary and umbilical veins which carry oxygenated blood veins resemble rivers because they have tributaries(venules).

c."**Capillaries**" are networks of microscopic vessels connecting arterioles to venules
d."Anastomosis" is a precapillary or postcapillary communication between the neighbouring vessles.

BLOOD CIRCULATION THROUGH THE HEART:

The heart acts as a pump. It maintains a constant circulation of blood throughout the body. It is a achieved as follows:

The superior vena cava and the inferior vena cava bring venous blood from various parts of the body to the heart. This venous blood fills the atrium.

When it is fill, the right atrium contracts sending blood to the right ventricle.

Now the right ventricle contracts. This sends blood to the lungs through the pulmonary trunk (which divides into right and left pulmonary arteries)

The blood gets oxygenated in the lungs. The oxygenated blood is carried by pulmonary veins to the left atrium.

Now, the left atrium contracts and sends blood to the left ventricle.

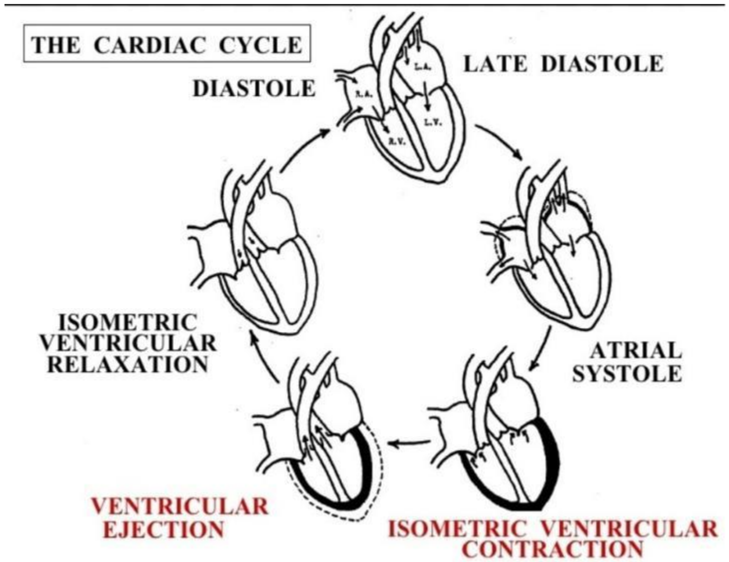
Now, the left ventricle contracts and sends blood into aorta. This blood is circulated throughout the body.

CARDIAC CYCLE:

The function of the heart is to maintain a constant circulation of blood throughout the body. This is achieved by rhythmic contraction of its muscle. Cardiac cycle is the sequence of events which occur in the heart during a single beat. The rate of heart is 72 beats per minute. So the time taken for one beat is 0.8 second. So the sequence of events occurs every 0.8 second. Its refers to a complete heart beat from its generation to the beginning of the next beat.

Cardiac cycle occurs in two phases.
They are

- Systole - a period of contraction
- Diastole - a period of relaxation



The cycle of events occurs as follows

ATRIAL CYCLE - 0.8 sec

- Atrial systole - 0.1 sec
- Atrial diastole - 0.7 sec

VENTRICULAR CYCLE - 0.8 sec

- Ventricular systole 0.3 sec
  - Isovolumetric contraction 0.05 sec
  - Ventricular ejection - 0.25 sec
    Rapid ejection 0.1 sec
    Slow ejection 0.15 sec

- Ventricular diastole 0.5 sec
  - Protodiastole - 0.04 sec
  - Iso volumetric relaxation- 0.06sec
  - Rapid passive filling - 0.11sec
  - Reduced filling - 0.19
  - Last rapid filling - 0.1 sec

VENTRICULAR SYSTOLE

- ISOVOLUMETRIC CONTRATION: During this period contraction is occurring in the ventricles but there is no emptying. This is called the period of isovolumic or isometric contraction, meaning the tension is increasing in the muscle but little or no shortening of the muscle fibers is occurring.
- VENTRICULAR EJECTION: When the right and left ventricular pressure raises the ventricular pressures pushes the semi lunar valves open .immediately blood begins to pour out of the ventricles.

- RAPID EJECTION: Ventricular pressure reaches its maximum value during this phase. Rapid ejection of blood into the aorta occurs because of the pressure between the ventricle and the aorta
- SLOW EJECTION: (end of systole): Ejection of blood from the ventricle continuous but is slower. In this phase ventricular pressure begins to decrease and atrial filling continuous

VENTRICULAR DIASTOLE

- PROTODIASTOLE: Once the ventricular muscle is fully contracted the already falling ventricular pressure drops more rapidly. The elevated pressure in the large arteries immediately push blood back towards the ventricles which snaps the aortic and pulmonary vaives closed
- ISOVOLUMETRIC RELAXATION: it is the beginning of the diastole. At the beginning of the stage the av valves closed. The aortic valves closes followed by closer of the pulmonary valve. Closure of the semilunar valves corresponds to the second heart sound. Ventricular volume is constant (isovolumetric) because all the valves are closed. When the ventricular pressure becomes less than atrial pressure the mitral valve opens.
- RAPID PASSIVE FILLING : During ventricular systole ,large amounts of blood accumulate in the right and left atria because of the closed AV VALVES, therefore as soon as the systole is over and the ventricular pressure fall again, the moderately increased pressures that have developed in the atria during ventricular systole immediately push the AV VALVES open and allow blood to flow rapidly into the ventricles causes the third heart sound .
- REDUCED FILLING: During the middle third of diastole, only a small amount of blood normally flows into the ventricles that continuous empty into the veins and passes through the atria directly into the ventricles.
- LAST RAPID FILLING : During the last third of the diastole the atria contract and give an additional thrust to the inflow of blood into the ventricles this accounts for about ten percent of the filling of the ventricles

PROPERTIES OF CARDIAC MUSCLE:

The cardiac muscle has certain characteristics. They are:

- **Contractility:** By contraction of the cardiac muscles the heart pumps the blood out of its chambers.

- **Conductivity:** The impulses for cardiac contraction are conveyed through a specialized conduction system.

- **Rhythmicity:** Heart muscle has the inherent property of rhythmic contraction. Cardiac contraction occurs in a regular fashion. The two atria and ventricles contract alternately.

• **Refractory period:** During systole, the heart does not respond to any other stimuli, however strong it may be. This is called as refractory period.

HEART SOUNDS:

Totally four sounds are produced by the heart. The first sound as LUB and the second sound as DUB can be heard with a stethoscope. The third and fourth sounds cannot be heard.

First heart sound – S1 it occurs at the beginning of ventricular systole, and produced when the mitral and tricuspid valves are closed.

Second heart sound – S2 it occurs at the closure of aortic and pulmonary valve at the end of ventricular systole
Third heart sound – S3 it occurs during rapid passive ventricular filling phase.
Fourth heart sound – S4 it occurs during last rapid ventricular filling phase.

ELECTROCARDIOGRAM (ECG) :
It is the recording of electrical activity of the heart. Electrocardiograph is the instrument which is used to record the electrical current generated in the heart. By means of this instrument, the electrical current generated in the heart is conducted to remote parts of the body. The heart current can be recorded by connecting any two parts of the body with this instrument. The connections are called as leads.
They are

Lead I: Right arm and left arm.
Lead II: Right arm and left leg.
Lead III: Left arm and left leg.

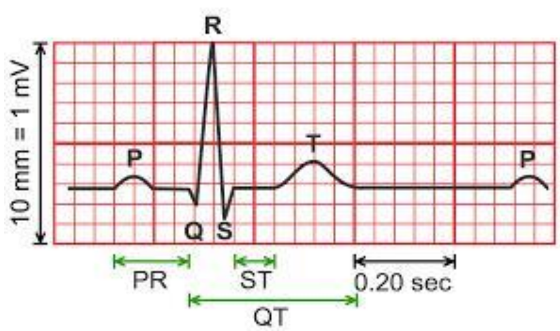


Fig. ELECTRO CARDIO GRAPH

Connections Over the chest with indifferent electrodes are also sometimes used. The ECG recordings are designed by letters P, Q, R, S, and T. The wave P is caused by contraction of atria. The wave Q, R and S are produced by the contraction of ventricles. The wave T is produced by the relaxation of ventricles. During diseases of the heart, these waves are abnormal in shape and position.

CARDIAC OUTPUT:
It is defined as the quantity of blood pumped by the heart in one minute.

Stroke volume is the amount of blood ejected per beat of the heart. It is about 70 ml. So, every minute some 5040 ml (nearly 5 liters) of blood is pumped by the heart. Cardiac output depends on the following factors:

- Amount of blood returned to the heart through veins (venous return).
- Force and rate of contraction of the heart.
- Peripheral resistance offered by blood vessels.

VITAL SIGNS

Vital signs are measurements of the body's most basic functions. The four main vital signs routinely monitored by medical professionals and health care providers include the following:

- Body temperature
- Pulse rate
- Respiration rate (rate of breathing)
- Blood pressure

Vital signs are useful in detecting or monitoring medical problems. Vital signs can be measured in a medical setting, at home, at the site of a medical emergency, or elsewhere.

BODY TEMPERATURE:

The normal body temperature of a person varies depending on gender, recent activity, food and fluid consumption, time of day, and, in women, the stage of the menstrual cycle. Normal body temperature can range from 97.8 degrees F (or Fahrenheit, equivalent to 36.5 degrees C, or Celsius) to 99 degrees F (37.2 degrees C) for a healthy adult.

Temperature recording gives an indication of core body temperature which is normally tightly controlled (thermoregulation) as it affects the rate of chemical reactions. Body temperature is maintained through a balance of the heat produced by the body and the heat lost from the body.

The main reason for checking body temperature is to solicit any signs of systemic infection or inflammation in the presence of a fever (temp > 38.5 °C/101.3 °F or sustained temp > 38 °C/100.4 °F), or elevated significantly above the individual's normal temperature. Other causes of elevated temperature include hyperthermia.

Temperature depression (hypothermia) also needs to be evaluated. It is also noteworthy to review the trend of the patient's temperature. A fever of 38 °C is not necessarily indicate an ominous sign if the patient's previous temperature has been higher.

A person's body temperature can be taken in any of the following ways:

- **Orally.** Temperature can be taken by mouth using either the classic glass thermometer, or the more modern digital thermometers that use an electronic probe to measure body temperature.
- **Rectally.** Temperatures taken rectally (using a glass or digital thermometer) tend to be 0.5 to 0.7 degrees F higher than when taken by mouth.
- **Axillary.** Temperatures can be taken under the arm using a glass or digital thermometer. Temperatures taken by this route tend to be 0.3 to 0.4 degrees F lower than those temperatures taken by mouth.

- **By ear.** A special thermometer can quickly measure the temperature of the ear drum, which reflects the body's core temperature (the temperature of the internal organs).
- **By skin.** A special thermometer can quickly measure the temperature of the skin on the forehead.

Body temperature may be abnormal due to fever hyperthermia (high temperature)

or hypothermia (low temperature). A fever is indicated when body temperature rises about one degree or more over the normal temperature of 98.6 degrees Fahrenheit. Hypothermia is defined as a drop in body temperature below 95 degrees Fahrenheit.

How to use a glass thermometer?

There should not be anything hot or cold in your mouth for 10 minutes before taking a temperature.

- Take the thermometer out of its holder.
- Hold the thermometer by the end opposite the colored (red, blue, or silver) tip.
- Clean the thermometer with soap and warm water or rubbing alcohol. Rinse with cool water.

Oral Glass Thermometer

- Turn the thermometer in your hand until you see the red, blue, or silver line. The line should read less than 96° F (35.6° C). If the line reads more than 96° F (35.6° C), firmly shake the thermometer downward several times. Shake the thermometer over a couch or bed. This will keep it from breaking if it slips out of your hand.
- Check the thermometer again to make sure it reads less than 96°F (35.6°C).
- With your mouth open, put the end with the red, blue, or silver-colored tip under your tongue.
- Close your lips gently around the thermometer. Do not bite the glass thermometer.
- Keep the thermometer under your tongue for 3 minutes.
- Remove the thermometer without touching the tip.
- Gently wipe the thermometer with a tissue.
- Hold the thermometer at eye level.
- Slowly turn the thermometer until you see the red, blue, or silver-colored line. Each long mark on the thermometer is the same as 1 degree. Short marks are the same as 0.2 degree.
- Your caregiver may want you to keep a temperature record. Write down the time and your temperature each time you take it.
- Wash the thermometer with soap and warm water. Do not use hot water because it may break the thermometer.

How to use a digital thermometer?

There should not be anything hot or cold in your mouth for 10 minutes before taking your temperature.

- Take the thermometer out of its holder.
- Put the tip into a new throw-away plastic cover if one is available. If you do not have a cover, clean the pointed end (probe) with soap and warm water or rubbing alcohol. Rinse it with cool water.
- With your mouth open, put the covered tip under your tongue.
- Close your lips gently around the thermometer.
- Keep the thermometer under your tongue until the digital thermometer beeps.
- Remove the thermometer when numbers show up in the "window".

Digital Thermometer

- Read the numbers in the window. These numbers are your temperature.
- Your caregiver may want you to keep a temperature record. Write down the time and your temperature each time you take it.
- Remove or eject the throw-away cover if you used one.
- Place the thermometer back in its holder.

Infrared Thermometers – These thermometers use a crystal which is sensitive to infrared or heat radiation. When it detects heat, then it emits a signal and this signal's strength provides the temperature reading. Bolometer and Pyrometers also fall in the category of some different types of infrared thermometers. One of the exclusive qualities of it is that it is based on non-contact mechanism which makes them really easy to use. The biggest disadvantage of it is that it is only able to measure the temperature of the surface of the object.

PULSE RATE:

The pulse rate is a measurement of the heart rate, or the number of times the heart beats per minute. As the heart pushes blood through the arteries, the arteries expand and contract with the flow of the blood. Taking a pulse not only measures the heart rate, but also can indicate the following:

- Heart rhythm
- Strength of the pulse

The normal pulse for healthy adults ranges from 60 to 100 beats per minute. The pulse rate may fluctuate and increase with exercise, illness, injury, and emotions. Females ages 12 and older, in general, tend to have faster heart rates than do males. Athletes, such as runners, who do a lot of cardiovascular conditioning, may have heart rates near 40 beats per minute and experience no problems.

How to check the pulse

As the heart forces blood through the arteries, you feel the beats by firmly pressing on the arteries, which are located close to the surface of the skin at certain points of the body. The pulse is commonly taken at the wrist (radial artery).Alternative sites include the elbow (brachial artery), the neck (carotid artery), behind the knee (popliteal artery), or in the foot (dorsalis pedis or posterior tibial arteries). The pulse rate can also be measured by listening directly to the heartbeat using a stethoscope. For most people, it is easiest to take the pulse at the wrist. If you use the lower neck, be sure not to press too hard, and never press on the pulses on both sides of the lower neck at the same time to prevent blocking blood flow to the brain.

When taking pulse:

- Using the first and second fingertips, press firmly but gently on the arteries until you feel a pulse.
- Begin counting the pulse when the clock's second hand is on the 12.
- Count your pulse for 60 seconds (or for 15 seconds and then multiply by four to calculate beats per minute).
- When counting, do not watch the clock continuously, but concentrate on the beats of the pulse.

PULSE OXYMETER: a device that measures the oxygen saturation of arterial blood in a subject by utilizing a sensor attached typically to a finger, toe, or ear to determine the percentage of oxyhemoglobin in blood pulsating through a network of capillaries

- It is a device intended for the non-invasive measurement of arterial blood oxygen saturation and pulse rate. Oxymeters are used medically by patients with asthma, emphysema, chronic obstructive pulmonary disease (COPD), chronic obstructive airway diseases (COAD), and other respiratory conditions. Pilots use pulse oxymeters to help guard against hypoxia. This blood oxygen tester can also help athletes, such as mountain climbers and walkers, to improve their performance.

RESPIRATORY RATE:

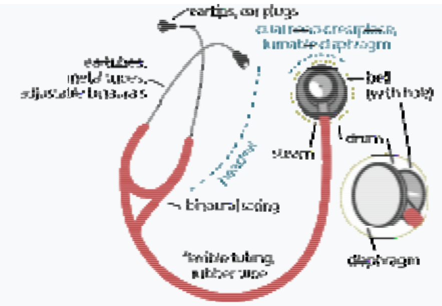
The respiration rate is the number of breaths a person takes per minute. The rate is usually measured when a person is at rest and simply involves counting the number of breaths for one minute by counting how many times the chest rises. Respiration rates may increase with fever, illness, and with other medical conditions. When checking respiration, it is important to also note whether a person has any difficulty breathing.

Normal respiration rates for an adult person at rest range from 12 to 16 breaths per minute. Respiratory rate is a clear indicator of acidotic states, as the main function of respiration is removal of CO_2 leaving bicarbonate base in circulation.

Stethoscope:

The **stethoscope** is an acoustic medical device for auscultation, or listening to the internal sounds of an animal or human body. It typically has a small disc-shaped resonator that is placed against the chest, and two tubes connected to earpieces. It is often used to listen to lung and heart sounds. It is also used to listen to intestines and blood flow in arteries and veins. In combination with a sphygmomanometer, it is commonly used for measurements of blood pressure. There are two types of stethoscopes are being used now a days. They are:

1. Acoustic:



Parts of a binaural stethoscope

Acoustic stethoscope, with the bell upwards

Acoustic stethoscopes are familiar t o most people, and operate on the transmission of sound from the chest piece, via air-filled h ollow tubes, to the listener's ears. The chest pie ce usually consists of two sides that can be pla ced against the patient for sensing sound: a diap hragm (plastic disc) or bell (hollow cup). If the diaphragm is placed on the patient, body s ounds vibrate the diaphragm, creating acoustic pr essure waves which travel up the tubing to the l istener's ears. If the bell is placed on the patient, the vibrations of the skin directly produce acous tic pressure waves traveling up to the listener's ears. The bell transmits low frequency sounds, while the diaphragm transmits higher frequen cy sounds.

2. Electronic:

The main function of these types of stethoscopes is that they convert analog sound signals into digital ones. An electronic stethosc ope (or **stethophone**) overcomes the low sound levels by electronically amplifying body sou nds.

Because the sounds are transmitted electronically, an electronic stethoscope can be a wireless device, can be a recording device, and can provide noise reduction, signa l enhancement, and both visual and a udio output. Electronic stethoscopes are also used with computer-aided auscultation programs to analyze the recorded heart sounds pa thological or innocent heart murmurs.

BLOOD PRESSURE (BP):

It is defined as the lateral pressure e xerted by blood on blood vessels. The blood pr essure which is normally expressed is arterial blo od pressure.

It has two phases:

Systolic blood pressure:

It is the maximum blood pressure, this occurs during the systole of the heart. (Rang e 100 to 120 mm Hg.)

Diastolic blood pressure: It is the minimum pressure. It occurs during the diastole of the heart (range 60 to 80 mm Hg.)

Pulse pressure is the difference be tween systolic and diastolic blood pressure (It is nearly 40 mm Hg.)

Factors affecting blood pressure:

- Blood volume
- Cardiac output

- Peripheral resistance
- Elasticity of blood vessels
- Diameter of the lumen of blood vessels
- Viscosity of blood

1**. Blood volume** is the total amount of blood in circulation. A sufficient amount of blood in blood vessels is necessary to maintain normal blood pressure. Loss of blood as in hemorrhage produces a fall in blood pressure.

• **Cardiac output** is the quantity of blood pumped by the heart in one minute. It is the product of stroke volume (the amount of blood ejected per beat of the heart) and rate of the heart. An increase in stroke volume increases systolic blood pressure. An increase in cardiac output increases both systolic and diastolic blood pressure.

• **Peripheral resistance** is the resistance offered by blood vessels for the flow of blood. Resistance is offered mainly by small blood vessels, especially arterioles.

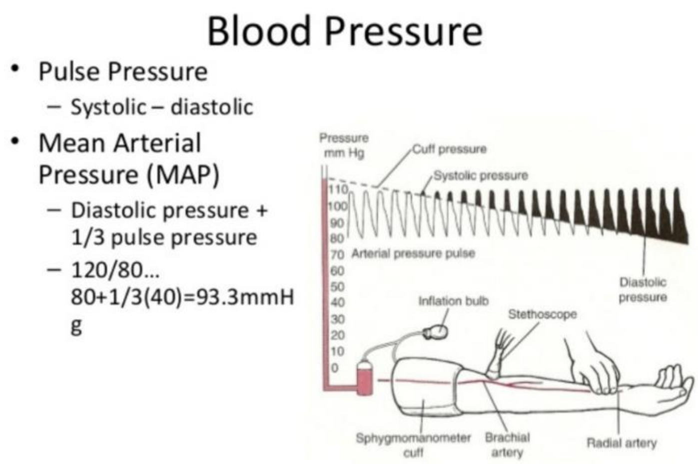
• **Elasticity** of the arterial walls distends the aorta when the ventricle contracts. The elastic recoils when the ventricle relaxes. This recoil pushes the blood downwards. Decrease in elasticity as in atheroma produces a rise in blood pressure.

• **Diameter of the lumen of blood vessels** can be altered. Narrowing of the lumen increases the resistance to blood flow and this increases blood pressure. Enlargement of the lumen has the opposite effect.

• **Viscosity of blood** is its stickiness. The viscosity of blood depends on plasma, plasma proteins and number of the red blood cells. An increase in viscosity increases blood pressure.

Measurement of blood pressure:

Blood pressure is usually measured by an instrument called "sphygmomanometer". It consists of a mercury manometer, cuff and hand pump. The cuff is tied around the cubital fossa of the individual. Then the hand pump is pressed so that air is inflated in the cuff. When the cuff is fully inflated, air pressure is more than blood pressure. So blood flow in the brachial artery is completely is obstructed. Now the hand pump is slowly released, till the time the appearance of the first sound is heard (by means of a stethoscope put in the cubital fossa).



The manometric reading is now noted. This reading is the systolic blood pressure. Later, the hand pump is slowly released till the time the sound becomes louder and louder. Later it stops. The manometric reading is noted when the sound disappears. This reading is the diastolic blood pressure.

LYMPHATIC CIRCULATION

Lymph is a tissue fluid which is formed by the passage of substances from blood capillaries into tissue spaces. It flows in a closed system called lymphatic system. This system consists of lymph vessels, lymph capillaries, lymph nodes etc.

Composition of lymph:

Lymph is a colourless fluid which consists of blood plasma and lymphocytes but not platelets. It is alkaline in reaction. Compared to plasma, it contains a high amount of fat. It contains low proteins and Nutrients. Lymph from intestine contains a high amount of fat

Formation of lymph:

Lymph is formed by filtration of tissue fluid into lymphatic capillaries.

Lymphatic system:

It is a closed system through which lymph flows. This system consists of "lymph capillaries", lymph vessels, lymph nodes etc.

Lymph node: These are small bean shaped glands which carries fluid nutrients and waste materials between the body tissues and the blood stream.

Functions of lymphatic system:

- Lymph nodes protect the body against infection by filtering and destroying bacteria.
- Also, lymph nodes are the sites where lymphocytes are produced.
- The lymphatic's drain the excess fluid from tissues back to circulation.
- The lymphatics carry waste products from tissues to blood.

Other lymphatic tissues:

In addition to lymph node, lymphatic tissues are present in the following sites:

1. Spleen 2. Thymus 3. Tonsils 4. Appendix 5. Peyer's patches in intestine

SPLEEN:

It is a dark purple colored lymphoid structure. It is highly vascular and bean shaped and measures about 12 cm in length. It is present in the left side of the abdominal cavity below the diaphragm.

Structure of spleen: Spleen contains the following structures:

- An outer covering of fibro elastic tissue called *capsule.*
- Trabaculae arises from the capsule and passes into the substance of the gland.
- The spaces between trabaculae contain the splenic tissue. These tissues contain the lymphoid tissues called as Malphigian corpuscles.
- Spleen is supplied by splenic artery and drained by splenic vein.

Functions of spleen

- Spleen produces all types of blood cells during fetal life.
- Red blood cells are destroyed in spleen.
- Histocytes of spleen ingest and destroyed foreign particles including bacteria.
- Spleen serves as a reservoir of blood.
- It also produces antibodies.

THYMUS:

The thymus gland contains lymphoid tissue. It lies in the thorax behind the sternum but in front of heart and arch of aorta. It weighs about 10 to 15 grams at birth and it grows until puberty. Later it gradually decreases in size and shrinks. The thymus takes part in the production of T-lymphocytes.

TONSILS:

Tonsils are collections of lymphoid tissue. There are two tonsils, one each lies on each side of the pharynx. Tonsils are supplied with blood and lymphatic vessels. The surface of tonsil is covered with mucous membrane which is studded with crypts. Lymphocytes are present in the fluid on the surface of tonsil and also in the crypts.

SHORT ANSWER QUESTIONS

1. Define cardiovascular system?
2. Write about the types of blood vessels?
3. What are the properties of the cardiac muscle?
4. Define cardiac output?
5. Write about heart sounds?
6. What is pulse, and mention the sites to be used to count pulse?
7. What do you mean by ECG?
8. Write the composition of lymph?
9. What are the functions of lymphatic system?
10. Write the names of the other lymphoid organs?
11. What are the functions of spleen?
12. What is pulse oxymeter?
13. What is stethoscope and mention its parts?
14. What are vital signs and mention the normal volumes?

ESSAY QUESTIONS

1. Write the structure and functions of heart with a labeled diagram?
2. Explain in detail about cardiac cycle ?
3. Explain in detail about blood pressure and factors effecting BP and technique of measurement?

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UNIT- 7

NERVOUS SYSTEM

Contents:

The nervous system is the major controlling, regulatory and communicating system in the body. It is the center of the all mental activity including thought learning and memory. Together with the endocrine system, the nervous system is responsible for regulating and maintaining homeostasis. Through the receptors, the nervous system keeps us in touch with our environment, both external and internal. This system creates awareness of the environment such that the body can respond by adapting.

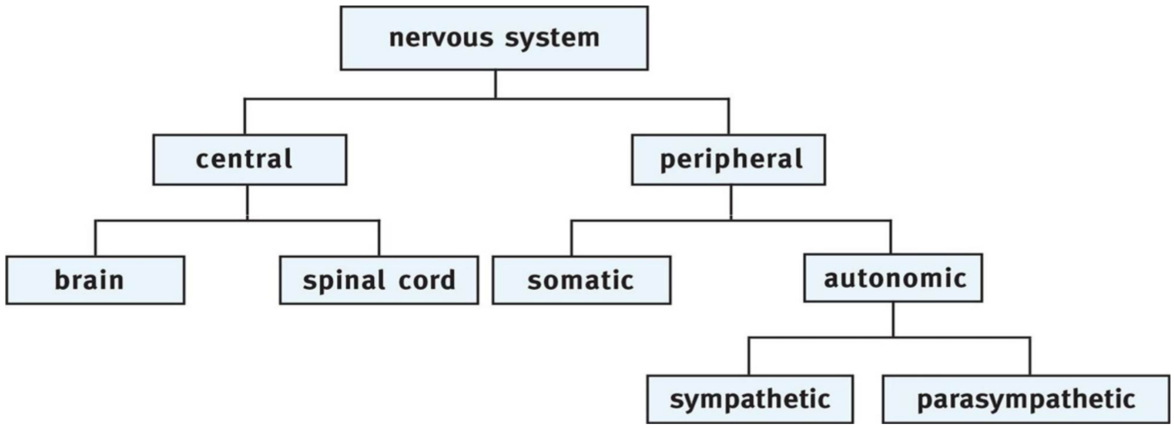
Functions of the nervous system

- Monitoring body-sensory
- processing info-integrative
- initiate a response-motor
- homeostasis-maintaining balanced internal environment

Divisions of the nervous system

- 1) Central nervous system
  - Brain and spinal cord
  - All sensory impulses travel to here, all motor responses originate here

- 2) Peripheral nervous system
  - Organs
    - Cranial nerves
    - Spinal nerves
  - Somatic
    - Sensory organs of skin, head,
    - Motor nerves to skeletal muscle
    - Voluntary control
  - Autonomic
    - Motor nerves to visceral organs, blood vessels, glands
    - Sympathetic--respond to stress
    - Parasympathetic-normal functioning



Nerve tissue: There are two types of nervous tissues–the neurons (nerve cells) and glia (neuroglia). The neuron is the basic structural unit of the nervous system. The glia is cells of supporting tissue for the nervous system. There are several different types of glia, but their general function is support (physical, nutritive, etc.).

Nervous tissues are specialized to:

1. **Receive Stimuli**. Cells receiving stimuli are said to be "irritable" (as are all living cells to a degree).
2. **Transmit Information**.
3. **"Store" Information**. The storing of information is called memory.

THE NEURON: The structural and functional unit of nervous system is called as Neuron. Each neuron is composed of a cell body and many extensions from the cell body called neuron processes or nerve fibres.

CELL BODY: The neuron cell body is also called the some, is the spherical shape of the neuron that contains the nucleus. The cell body connects the dendrites, which bring information to the neuron , and the axon, which sends information to the other neurons.

NEURON PROCESSES: There are two types of neuron processes–dendrites and axons.

Dendrite. A dendrite is a neuron process which carries impulses toward the cell body. Each neuron may have one or more dendrites. Dendrites receive information and transmit (carry) it to the cell body.

Axon. An axon is a neuron process which transmits information from the cell body to the next unit. Each neuron has only one axon.

Information Transmission. Information is carried as electrical impulses along the length of the neuron.

Coverings. Some neuron processes have a covering which is a series of Schwann cells, interrupted by nodes (thin spots). This gives the neuron process the appearance of links of sausage. The Schwann cells produce a lipid (fatty) material called myelin. This myelin acts as an electrical insulator during the transmission of impulses.

TYPES OF NEURONS

Neurons may be identified according to shape, diameter of their processes, or function.

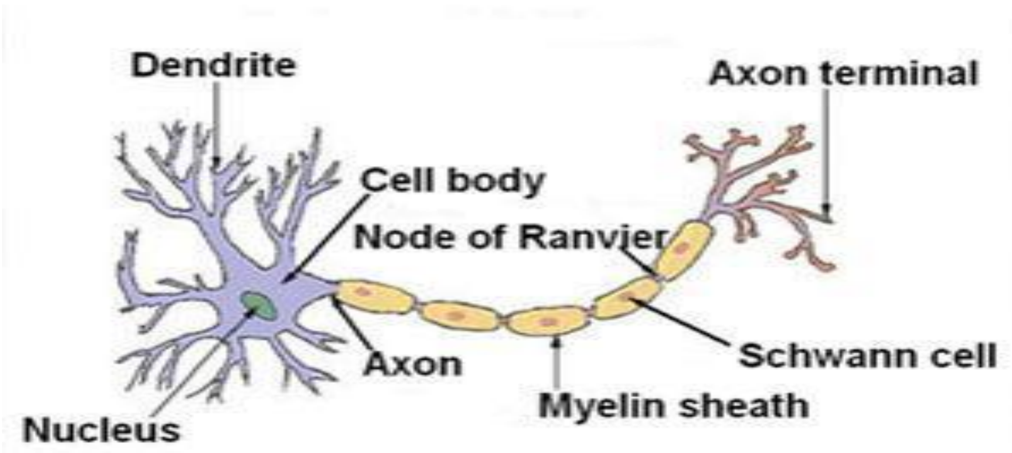


Fig. NEURON

• **According to Shape**. A pole is the point where a neuron process meets the cell body. To determine the type according to shape and count of the number of poles.

- **Multipolar neurons**. Multipolar neurons have more than two poles (one axon and two or more dendrites).
- **Bipolar neurons.** Bipolar neurons have two poles (one axon and one dendrite).
- **Unipolar neurons**. Unipolar neurons have a single process which branches into a T-shape. One arm is an axon, the other is a dendrite.

• **According to Diameter (Thickness) of Processes**. Neurons may be rated according to the thickness of myelin surrounding the axon. In order of decreasing thickness, they are rated A (thickest), B, and C (thinnest). The thickness affects the rate at which impulses are transmitted. The thickest are fastest. The thinnest are slowest.

• **According to Function**.

- **Sensory neurons**. In sensory neurons, impulses are transmitted from receptor organs (for pain, vision, hearing, etc.) to the central nervous system (CNS).
- **Motor neurons**. In motor neurons, impulses are transmitted from the CNS to muscles and glands (effector organs).
- **Interneurons**. Interneurons transmit information from one neuron to another. An interneuron “connects” two other neurons.

PARTS OF THE CENTRAL NERVOUS SYSTEM

THE BRAIN

The brain is an organ located in the skull. It weighs about 3 pounds. The senses (taste, smell, sight, hearing, and touch), emotions, thoughts, and movement are controlled by the brain. The right side of the brain controls the left side of the body and the left side of the brain controls the right side of the body.

THE DIFFERENT PARTS OF THE BRAIN

It develops from a single tube which initially shows three enlargements, the fore-runners of the brain, termed, fore-brain, mid-brain and hind-brain. Thus:

The Fore-Brain, becomes the cerebral hemispheres, corpus straitum and the thalami

The Mid-Brain, The mid-brain — these three

The Hind-Brain, the Pons Varolli, — form the

Medulla oblongata, — Brain Stem

And the Cerebellum

The Cerebrum fills the front and upper portion of the cranial cavity, termed respectively the anterior and middle cranial fossa. It consists of two large hemispheres of nerve cells (grey matter) and nerve fibres (white matter). The outer layer of grey matter is termed the cortex .The two cerebral hemispheres are separated by a deep cleft, but united at their bases by the corpus callosum, a mass of white matter consisting of nerve fibres. Beneath this are islands of grey matter, the basal gangila.

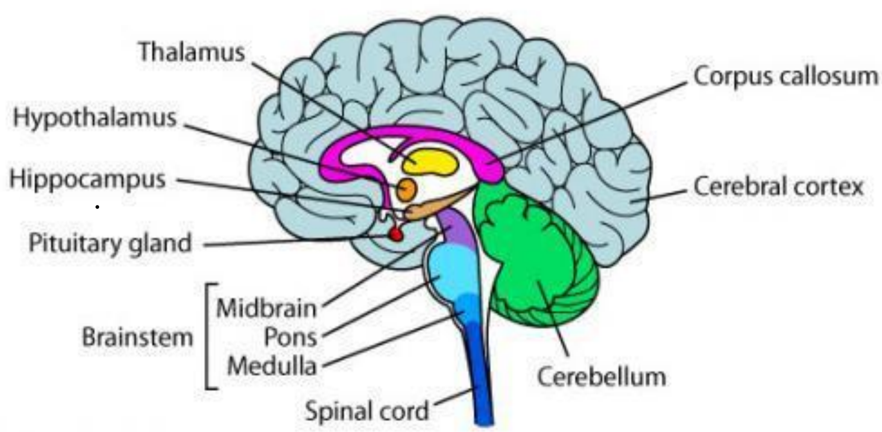


Fig. Parts of the Brain

Areas of the Brain. Fissures and sulci divide the cerebral hemisphere into areas. The cerebral cortex is arranged in convolution or irregular folds in order to increase the expanse of grey matter. The depressions between the convolutions are called **sulci** and the deepest sulci form the longitudinal and lateral fissures. These fissures or sulci divide the brain into named areas or 'lobes' which correspond in position to the bones beneath which they lie, e.g. the frontal, temporal, parietal and occipital lobes.

The longitudinal fissure is a deep cleft in the median plane separating the cerebrum into right and left cerebral hemispheres, into a thin plate of dura mater called the falx cerebri. Similary a thin partition of dura mater, the falx cerebelli, divides the cerebellum into right and left hemispheres.

The lateral sulcus, or the fissure of Sylvius, separates the temporal lobe from the frontal lobe (anteriorly) and from the parietal lobe more posteriorly.

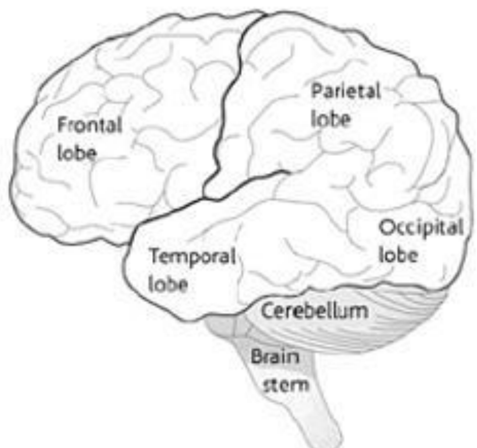


Fig. LOBES OF CEREBRUM

The **central sulcus or fissure** of Rolando seperates the frontal from the parietal lobes. The occipital lobes of the cerebrum are situated behind the parietal lobes and rest upon the tentorium cerebelli - a fold a dura mater which separates the middle cranial fossa from the posterior cranial fossa below.

- **Frontal lobe:** executive function, decisions, personality, language, planning, movement
- **Parietal lobe:** intelligence, reasoning, sensation, reading
- **Occipital lobe:** vision
- **Temporal lobe:** language, behavior, hearing, vision, emotions, memory

The **Cerebral Cortex** is composed of many layers of nerve cells,it is the grey matter of the cerebrum. It is arranged in irregular folds or convolutions, an arrangement which increases the surface area of the cerebral cortex, as scalloping a piece of material increases the length cortex, as scalloping a piece of material increases the length of its exact edge.

The **white matter** lies more deeply and consists of the nerve fibres belonging to the cells of the cortex.

The **motor area** lies just in front of the central sulcus , extending down as far as the lateral sulcus. This area of the cortex contains large cells which form the beginning of the motor pathway which controls movement of the opposite side of the body. The body is represented upside down the lower limb, trunk, upper limb, neck and finally head controlling areas lie, from above down, in the motor area as indicated in

The lowest part of the motor cortex is called Broca's area and is concerned with speech. Broca's area and is concerned with speech. Broca's area lies in the left cerebral hemisphere in right-handed people, and on the opposite side in those who are left-handed.

The **sensory cortex** lies immediately behind the central sulcus. Here the various modalities of sensation are appreciated and interpreted.

The **auditory area** lies in the temporal lobe just below the longitudinal fissure. Here sound impressions are received and interpreted.

The **visual area** lies at the tip of the occipital lobe and receives images and impressions for interpretation.

The centres of taste and smell lie well forward in the temporal lobe.

The **white matter** of the cerebral hemispheres consists of nerve fibres running to and from the cortex linking up the various 'centres' of the brain with the spinal cord.

Basal Ganglia. As already mentioned, embedded in the mass of white matter of each cerebral hemisphere are certain small areas of grey matter, termed the basal ganglia or nuclei. Two of these are the caudate and lentiform nuclei and together form the corpus striatum. These structures are closely related to another mass of grey matter, the thalamus, which lies medially to them. It is likely that this system in some way influences tone and posture, integrates and co-ordinates the main voluntary muscle movements which are the concern of the great descending motor pathway, or the pyramidal system.

The ***Thalamus*** is chiefly concerned with the reception of sensory impulses, which may be either interpreted at a subcortical level, or relayed on to the sensory area of the cerebral cortex. It appears to have an important regulating action on many of the highest centres for sensation and movement.

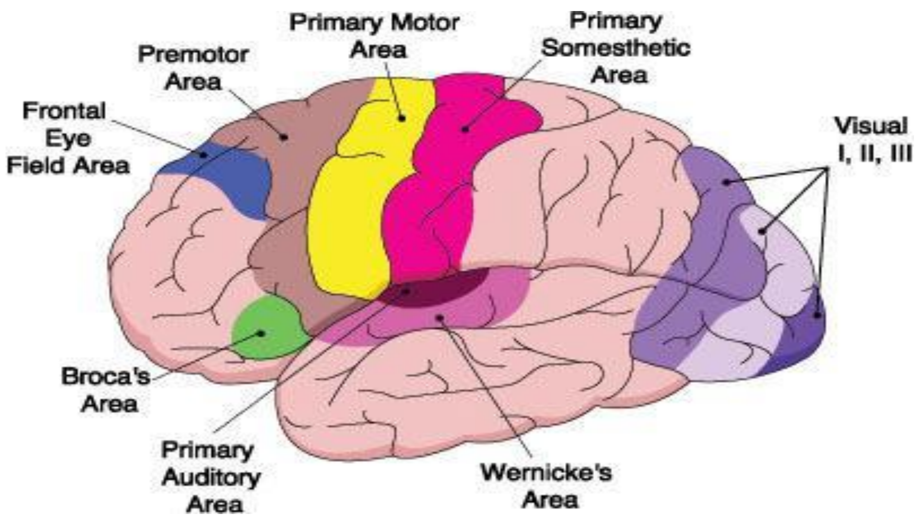


Fig. THE DIFFERENT AREAS OF THE BRAIN

The Hypothalamus. In the region of the floor of the third ventricle are certain nuclei which have definite physiological activity. Some of them are related to the autonomic nervous system forming the 'highest part of that system'. Some nuclei also have connections with the posterior lobe of the pituitary gland of the endocrine system on which they exert control. Functions such as body temperature regulations, hunger and thirst are regulated by centres in the hypothalamus.

The Internal capsule is formed by fibres of the great motor and sensory pathways which link the cerebral cortex with the brain stem and spinal cord. In this part of their course these nerve fibres are closely packed together as they pass between the islands of grey matter.

Thrombosis of the artery supplying the internal capsule may lead to damage of the opposite side of the body (hemiplegia), such a cerebrovascular catastrophe constitutes a 'stroke'.

The Functions of the Cerebrum.

- The cerebral cortex contains the higher centres controlling mental behaviour, thought, consciousness, moral sense, will, intellect, speech, language, and the special senses.
- The cortex is the origin of all voluntary motor impulses controlling the skeletal muscles.
- It is the final area for the reception of all incoming sensory nerve impulses and for their appreciation and interpretation, including skin sensation, touch, pain, pressure, temperature, vibration, texture, shape, and size, and muscle and joint sense.

The Brain Stem is composed of the mid-brain, pons varolii and medulla oblongata.

The **mid-brain** forms the upper part of the brain stem. Through it runs the cerebral aqueduct connecting the third and fourth ventricles.

The mid-brain contains centres for the control of balance and the movements of the eyes.

The **Pons varolii** forms the middle portion of the brain stem and thus contains the same ascending and descending pathways as the mid-brain. There are many fibres running transversely through the pons which link the two lobes of the cerebellum and the cerebellum with the cerebral cortex.

The **medulla oblongata** forms the lower portion of the brain stem linking the pons with the spinal cord. The medulla lies in the posterior cranial fossa and joins the spinal cord just below the foramen magnum of the occipital bone.

The main features of the medulla are that here the descending motor pathways cross from one side of the brain stem to the other. This is called the motor discussion. A similar arrangement of the sensory pathways occurs in the medulla and is referred to as the sensory discussion.

The medulla contains the nuclei or cell bodies of several important cranial nerves. It also contains certain 'vital centres which control respiration and the cardiovascular system. Injury to this part of the brain stem is therefore liable to have very serious consequences.

The Cerebellum is the largest part of the hind-brain. It occupies the posterior cranial fossa and is roofed over by the tentorium cerebelli, a fold of dura mater which separates it from the occipital lobes of the cerebrum.

It is separated from the pons and medulla by the cavity of the fourth ventricle. It is divided into two hemispheres, right and left, by a deep cleft into which dips another fold of dura mater, the falx cerebelli.

The arrangement of grey and white matter is similar to that found in the cerebrum with the grey matter arranged at the surface. The surface is ridged rather than folded into convolutions, the fissures between the ridges being very much closer together than the sulci of the cerebral cortex.

The cerebellum has connections with many other parts of the nervous system. Its principal connections are with the cerebral hemisphere of the opposite side and with the brain stem. It also receives fibres from the spinal cord and is connected with the reflex centres of sight in the roof of the mid-brain, with the thalamus and with the auditory or acoustic nerve of hearing.

The functions of the cerebellum

- It to regulate posture and postural activities.
- It plays an important part in muscular co-ordination and the maintenance of balance.
- Whereas the cortico-spinal fibres running between the cerebral cortex and the spinal cord cross (see above), and thus the cerebral cortex controls the movement of the opposite side of the body, the cerebellar hemisphere controls muscle tone and posture on its own side.

A unilateral lesion of the cerebellum causes disturbance of posture and muscle tone. Movement is very inco-ordinate, a patient may be unable to put food into his mouth , he sways in walking and tends to fall towards the affected side. All voluntary movements are slow, and the muscles of the limbs are limp and flail-like. Speech is slow.

The spinal cord

The spinal cord has two functions:

Transmission of nerve impulses. Neurons in the white matter of the spinal cord transmit sensory signals from peripheral regions to the brain and transmit motor signals from the brain to peripheral regions.

Spinal reflexes. Neurons in the gray matter of the spinal cord integrate incoming sensory information and respond with motor impulses that control muscles (skeletal, smooth, or cardiac) or glands.

The spinal cord is an extension of the brainstem that begins at the foramen magnum and continues down through the vertebral canal to the first lumbar vertebra (L_1). Here, the spinal cord comes to a tapering point, the conus medullaris. The spinal cord is held in position at its inferior end by the filum terminale, an extension of the pia mater that attaches to the coccyx. Along its length, the spinal cord is held within the vertebral canal by denticulate ligaments, lateral extensions of the pia mater that attach to the dural sheath.

The following are external features of the spinal cord

- Spinal nerves emerge in pairs, one from each side of the spinal cord along its length.
- The cervical nerves form a plexus
- The cervical enlargement is a widening in the upper part of the spinal cord (C_4–T_1). Nerves that extend into the upper limbs originate or terminate here.
- The lumbar enlargement is a widening in the lower part of the spinal cord (T_9–T_{12}). Nerves that extend into the lower limbs originate or terminate here.
- The anterior median fissure and the posterior median sulcus are two grooves that run the length of the spinal cord on its anterior and posterior surfaces, respectively.
- The cauda equina are nerves that attach to the end of the spinal cord and continue to run downward before turning laterally to other parts of the body.
- There are four plexus groups, cervical, brachial, lumbar, and sacral. The thoracic nerves do not form a plexus
- Roots are branches of the spinal nerve that connect to the spinal cord. Two major roots form the following:
    - A ventral root (anterior or motor root) is the branch of the nerve that enters the ventral side of the spinal cord. Ventral roots contain motor nerve axons, transmitting nerve impulses from the spinal cord to skeletal muscles.
    - A dorsal root (posterior or sensory root) is the branch of a nerve that enters the dorsal side of the spinal cord. Dorsal roots contain sensory nerve fibers, transmitting nerve impulses from peripheral regions to the spinal cord. A dorsal root ganglion is a cluster of cell bodies of a sensory nerve. It is located on the dorsal root.

The following are internal features of the spinal cord

- **Gray matter** appears in the center of the spinal cord in the form of the letter H (or a pair of butterfly wings) when viewed in cross section:

- The gray commissure is the crossbar of the H.

- The anterior (ventral) horns are gray matter areas at the front of each side of the H. Cell bodies of motor neurons that stimulate skeletal muscles are located here.

- The posterior (dorsal) horns are gray matter areas at the rear of each side of the H. These horns contain mostly inter neurons that synapse with sensory neurons.

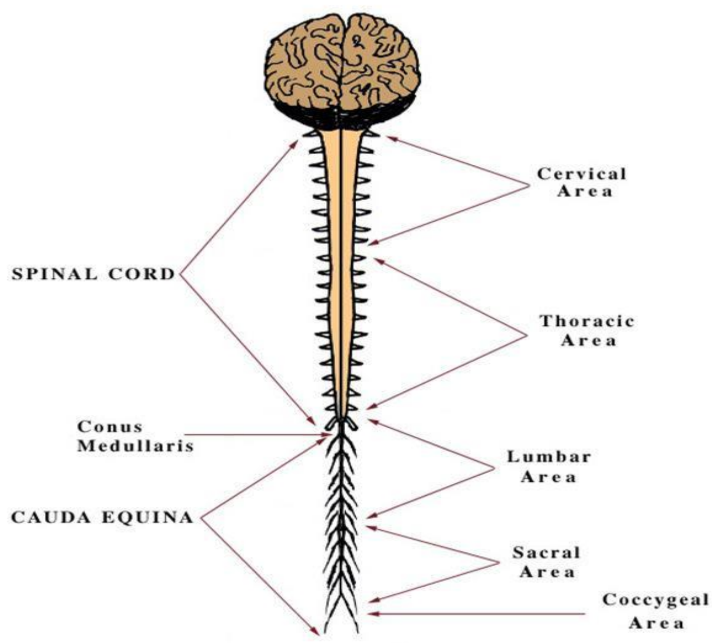


Fig. SPINAL CORD

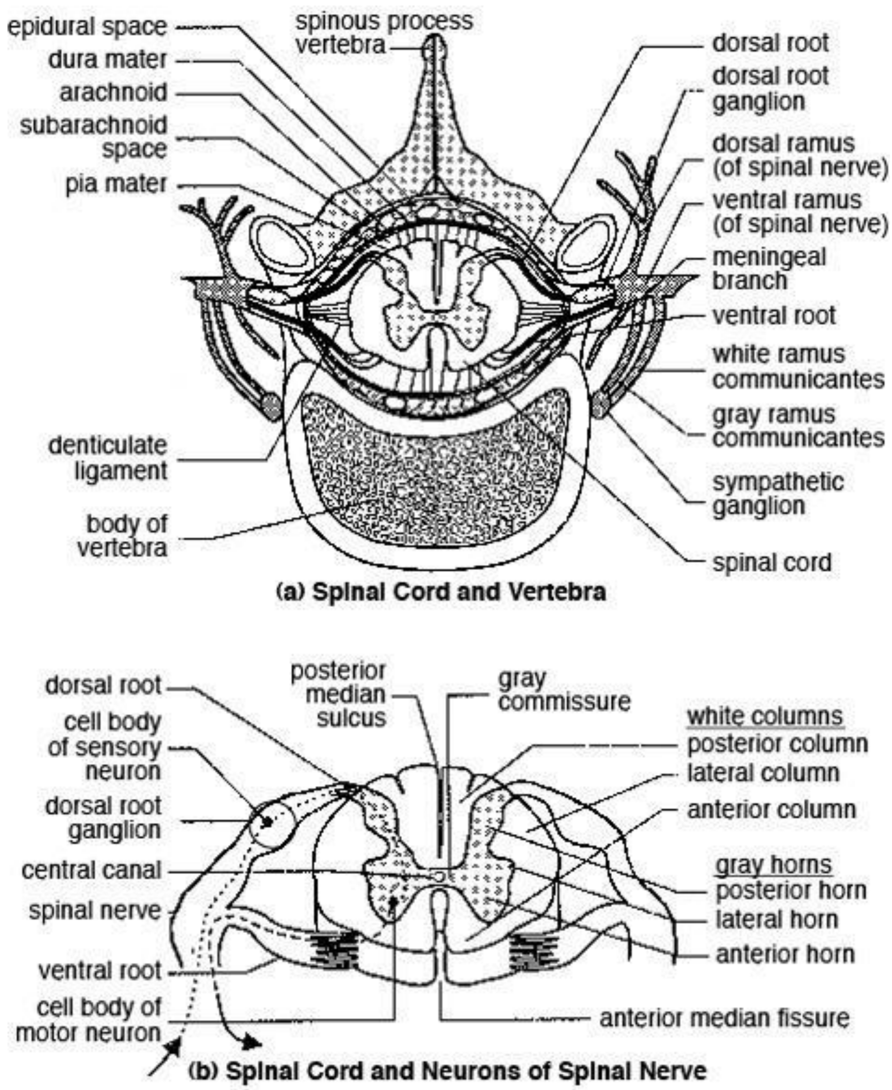
- The lateral horns are small projections of gray matter at the sides of H. These horns are present only in the thoracic and lumbar regions of the spinal cord. They contain cell bodies of motor neurons in the sympathetic branch of the autonomic nervous system.
- The central canal is a small hole in the center of the H crossbar. It contains CSF and runs the length of the spinal cord and connects with the fourth ventricle of the brain.

- **White columns** (fasciculi) refer to six areas of the white matter, three on each side of the H. They are the anterior (ventral) columns, the posterior (dorsal) columns, and the lateral columns.

- Fasciculi are bundles of nerve tracts within white columns containing neurons with common functions or destinations:

  - Ascending (sensory) tracts transmit sensory information from various parts of the body to the brain.

- Descending (motor) tracts transmit nerve impulses from the brain to muscles and glands.



COVERINGS OF THE CNS

The coverings of the CNS are skeletal and fibrous.

- **Skeletal Coverings**.

(1) Brain. The bones of the cranium form a spherical case around the brain. The cranial cavity is the space enclosed by the bones of the cranium.

(2) Spinal cord. The vertebrae, with the vertebral foramina, form a cylindrical case around the spinal cord. The overall skeletal structure is the vertebral column (spine). The vertebral (spinal) canal is the space enclosed by the foramina of the vertebrae.

- **Meninges (fibrous membranes)**. The brain and spinal cord have three different membranes surrounding them called meninges. These coverings provide protection.

  1.Dura mater. The dura mater is a tough outer covering for the CNS. Beneath the dura mater is the subdural space, which contains a thin film of fluid.

  2.Arachnoid mater. To the inner side of the dura mater and subdural space is a fine membranous layer called the arachnoid mater. It has fine spider web-type threads which extend inward through the subarachnoid space to the pia mater. The subarachnoid space is filled with cerebrospinal fluid (CSF).

  ARACHNOID - spider-like

  3.Pia mater. The pia mater is a delicate membrane applied directly to the surface of the brain and the spinal cord. It carries a network of blood vessels to supply the nervous tissues of the CNS.

BLOOD SUPPLY OF THE CNS

a. **Blood Supply of the Brain**. The paired internal carotid arteries and the paired vertebral arteries supply blood rich in oxygen to the brain. Branches of these arteries join to form a circle under the base of the brain. This is called the cerebral circle (of Willis). From this circle, numerous branches supply specific areas of the brain.

- A single branch is often the only blood supply to that particular area. Such an artery is called an end artery. If it fails to supply blood to that specific area, that area will die (stroke).

- The veins and venous sinuses of the brain drain into the paired internal jugular veins, which carry the blood back toward the heart.

b. **Blood Supply of the Spinal Cord**. The blood supply of the spinal cord is by way of a combination of three longitudinal arteries running along its length and reinforced by segmental arteries from the sides.

CEREBROSPINAL FLUID (CSF)

A clear fluid called cerebrospinal fluid (CSF) is found in the cavities of the CNS. CSF is found in the ventricles of the brain, the subarachnoid space, and the central canal of the spinal cord. CSF and its associated structures make up the circulatory system for the CNS.

- **Choroid Plexuses**. Choroid plexuses are special collections of arterial capillaries found in the roofs of the third and fourth ventricles of the brain. The choroid plexuses continuously produce CSF from the plasma of the blood.

- **Path of the CSF Flow**. Blood flows through the arterial capillaries of the choroid plexuses. As CSF is produced by the choroid plexuses, it flows into all four ventricles. CSF from the lateral ventricles flows into the third ventricle and then through the cerebral aqueduct into the fourth ventricle. By passing through three small holes in the roof of the fourth ventricle, CSF enters the subarachnoid space. From the subarachnoid space, the CSF is transported through the arachnoid villi (granulations) into the venous sinuses. Thus, the CSF is formed from arterial blood and returned to the venous blood.

Composition of CSF: It contains water glucose proteins nitrogenous substances electrolytes and other cells.

The functions of the cerebrospinal fluid. It acts as a buffer, protecting the brain and spinal cord. It conveys nourishment to the tissues of the central nervous system. It excretes waste products from brain and spinal cord.

Lumbar puncture. Because the spinal cord ends at the level of the first of second lumbar vertebrae and the sub-arachnoid space extends to the level of the second sacral vertebra, a sample of cerebrospinal fluid may be drawn off by introducing a lumbar puncture needle into the sub-arachnoid space between these points a process called lumbar puncture.

The examination of the cerebrospinal fluid thus obtained may reveal important information in conditions such as meningitis and sub-arachnoid cerebral hemorrhage.

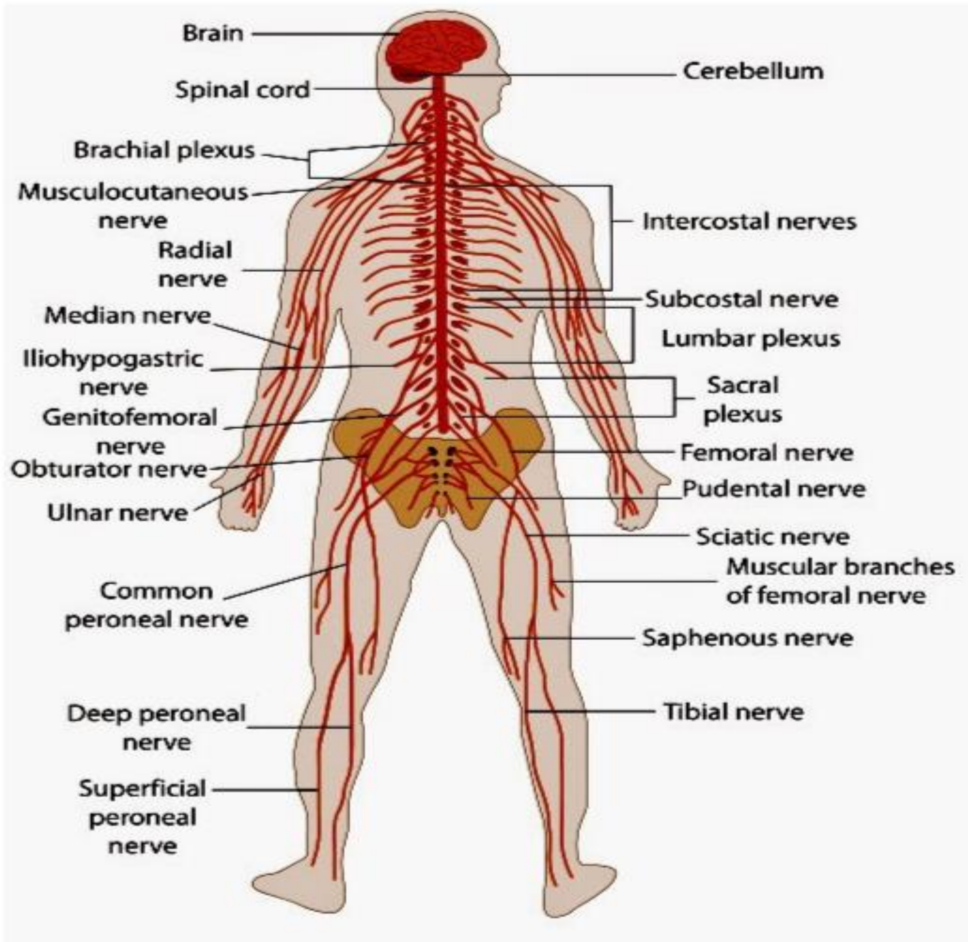
THE PERIPHERAL NERVOUS SYSTEM (PNS):

Definition.

The peripheral nervous system (PNS) is that portion of the nervous system generally concerned with commands for skeletal muscles and other muscles made up of striated muscle tissue, as well as sensory information from the periphery of the body. The sensory information is carried to the CNS where it is processed. The PNS carries commands from the CNS to musculature.

A nerve is a collection of neuron processes, together and outside the CNS. (A fiber tract is a collection of neuron processes, together and inside the CNS.)

General Characteristics of the Peripheral Nerves. The PNS is made up of a large number of individual nerves. These nerves are arranged in pairs. Each pair includes one nerve on the left side of the brainstem or spinal cord and one nerve on the right side. The nerve pairs are in a series, each pair resembling the preceding, from top to bottom.



Categories of PNS Nerves. PNS nerves include cranial nerves and spinal nerves.

1.Cranial nerves. The 12 pairs of nerves attached to the right and left sides of the brainstem are called cranial nerves. Each cranial nerve is identified by a Roman numeral in order from I to XII and an individual name. For example, the Vth (”fifth”) cranial nerve is known as the trigeminal nerve (N.).

TRI - three

GEMINI -alike

TRIGEMINAL -having three similar major branches

2.Spinal nerves. Attached to the sides of the spinal cord are 31 pairs of spinal nerves. The spinal nerves are named by:

- The region of the spinal cord with which the nerve is associated.

- An Arabic numeral within the region. For example, T-5 is the fifth spinal nerve in the thoracic region.

CRANIAL NERVES

The cranial nerves are 12 pairs of nerves that pass through small holes at the base of the skull. These nerves are responsible for carrying information and connecting the brain to different parts of the body (sensory organs, motors, muscles, organs, etc.)

Our brain is in continuous communication through the spinal cord with almost all of the brain nerves. That is, if for example, we notice that we are stepping on something soft, that signal is transmitted through our leg nerves until reaching the spinal cord and from there taking over until that signal reaches the brain (afferent order) and there the order is given to keep stepping because it's pleasant. This new order to keep stepping, will "descend" (efferent order) from our brain, passing through the spinal cord and will reach our feet again through the same nerve fibers as before.

I- Olfactory Nerve (Sensory)

It's the first of the 12 pairs of cranial nerves. It is responsible for the sense or smell. It's a sensory nerve, in charge of

transmitting olfactory stimuli from the nose to the brain, which is responsible for smell.Its actual origin is given by the cells of the olfactory bulb. It is the shortest cranial pair of all.

II- Optic Nerve (Sensory)

This cranial pair is the second of the 12 pairs of cranial nerves and it is responsible for conducting visual stimuli from the eye to the brain for vision. It is made of axons from the ganglion cells of the retina that take the information of the photoreceptors to the brain, where later it will be integrated and interpreted. It emerges in the diencephalon.

III- Oculomotor (Mixed)

This cranial nerve is also known as the common ocular motor nerve. It is the third of the 12 pairs of cranial nerves. It controls eye movement and is also responsible for pupil size. It originates in the midbrain.

IV- Trochlear (Mixed)

This nerve has motor and somatic functions that are connected to the superior oblique muscle of the eye, being able to make the eyeballs move and rotate. Its nucleus also originates in the mesencephalon as well as the oculomotor nerve. It is the fourth of the 12 pairs of cranial nerves.

V- Trigeminal (Mixed)

It is a mixed cranial nerve (sensitive, sensory and motor), being the largest of all cranial nerves, it is the fifth of the 12 pairs of cranial nerves. Its function is to carry sensitive information to the face, to convey information for the chewing process. The sensory fibers convey sensations of touch, pain, and temperature from the front of the head including the mouth and also from the meninges.

VI- Abducent (Mixed)

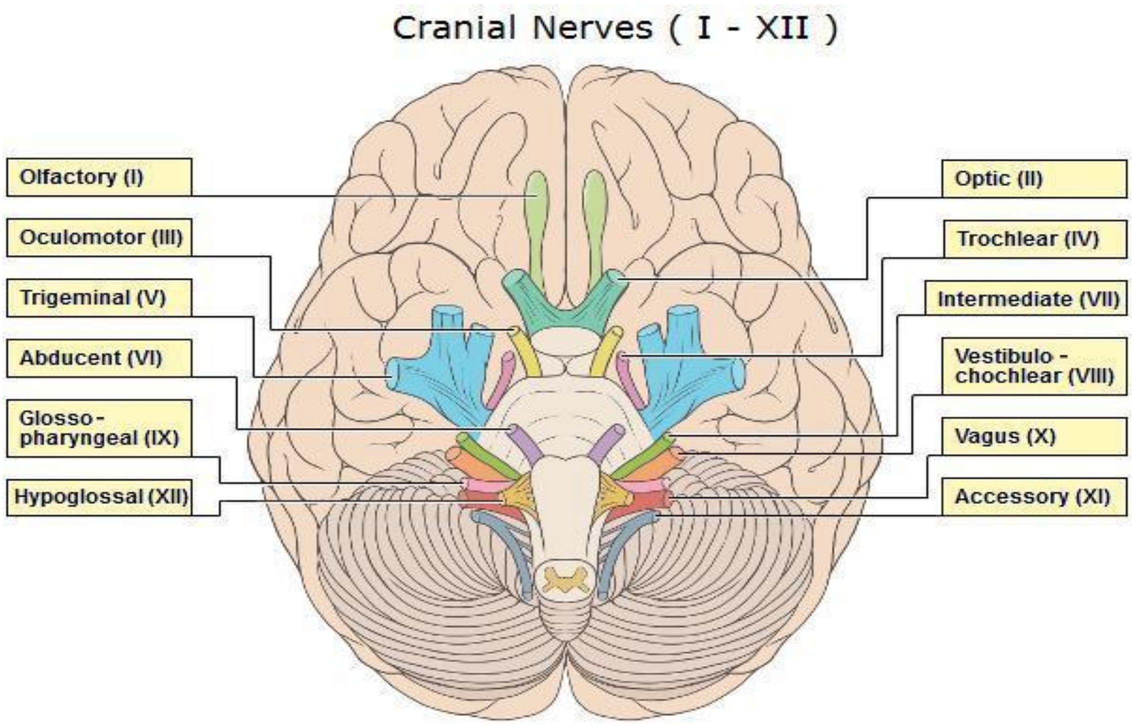
It is also known as the external ocular motor cranial nerve and it is the sixth of the 12 pairs of cranial nerves. It is a cranial motor pair, responsible for transmitting the motor stimuli to the external rectus muscle of the eye and therefore allowing the eye to move to the opposite side from where we have the nose.

VII- Facial or Intermediate (Mixed)

This is another mixed cranial pair since it consists of several nerve fibers that perform different functions, like ordering the muscles of the face to create facial expressions and also send signals to the salivary and lacrimal glands. On the other hand, it collects taste information through the tongue. It is the seventh of the 12 pairs of cranial nerves.

VIII- Vestibulo-Cochlear (Mixed)

It is a sensory cranial nerve. It is also known as the auditory and vestibular nerve, thus forming vestibulocochlear. It is responsible for balance and orientation in space and auditory function. It is the eighth of the 12 pairs of cranial nerves.



IX- Glossopharyngeal (Mixed)

It is a nerve whose influence lies in the tongue and pharynx. It collects information from the taste buds (tongue) and sensory information from the pharynx. It leads orders to the salivary gland and various neck muscles that help with swallowing. It also monitors blood pressure. It is the ninth of the 12 pairs of cranial nerves.

X-Vagus (Mixed)

This nerve is also known as pneumogastric nerve. It is the longest nerve of the autonomic nervous system. It helps to regulate many critical aspects of human physiology , including the heart rate, blood pressure, sweating and digestion. It is the tenth of the 12 pairs of cranial nerves.

XI-Accessory

This cranial pair is named the spinal nerve. It is a motor nerve and could be understood as one of the most "pure". It governs movements of the head and shoulders by supplying the sternocleidomastoid and trapezius muscles in the (anterior and posterior) regions of the neck. The spinal nerve also allows us to throw our heads back. Thus, we would say that it intervenes in the movements of the head and the shoulders. It is the eleventh of the 12 pairs of cranial nerves.

XII-Hypoglossal

It is a motor nerve which, like the vagus and glossopharyngeal, is involved in tongue muscles, swallowing and speech. It is the twelfth of the 12 pairs of cranial nerves.

THE MAIN NERVE PLEXUSES AND THEIR TRUNKS

The anterior primary divisions of the spinal nerves, other than those which arise in the thoracic region and form the intercostal nerves, are arranged into four main plexuses.

The Cervical Plexus is formed by the first four cervical nerves. It lies in the neck beneath the sternomastoid muscle. Many branches arise from it to supply some of the muscles of the neck. The phrenic nerves which supply the diaphragm arise from the plexus.

The Brachial Plexus is formed by the four lower cervical nerves and the first thoracic nerve. It is situated in the posterior triangle of the neck behind the clavicle and in the axilla. At first, three trunks are formed; these then divide and unit again to form three cords, lateral, medial, and posterior. From these cords 5 principal nerves arise which supply the arm and some of the neck and chest muscles.

The Lumbo-Sacral Plexus provides the principal spinal nerves to the lower limb.

The Lumbar Plexus from the first 4 lumbar nerve roots lies in the psoas muscle supplying it and divides into two branches, the femoral nerve passing beneath the inguinal ligament, through the femoral triangle to supply the muscles on the front of the thigh, and the obturator nerve which enters the thigh through the obturator foramen to supply the muscles on the inner side of it.

The Sacral plexus consists of the 4th and 5th lumbar nerves and the sacral nerves uniting to form the great sciatic nerve which passes into the thigh through the great sacral notch supplying the hamstring muscles. It then divides into the medial and lateral popliteal nerves which supply the muscles on the back of the thigh and all the muslces, back and front, below the knee.

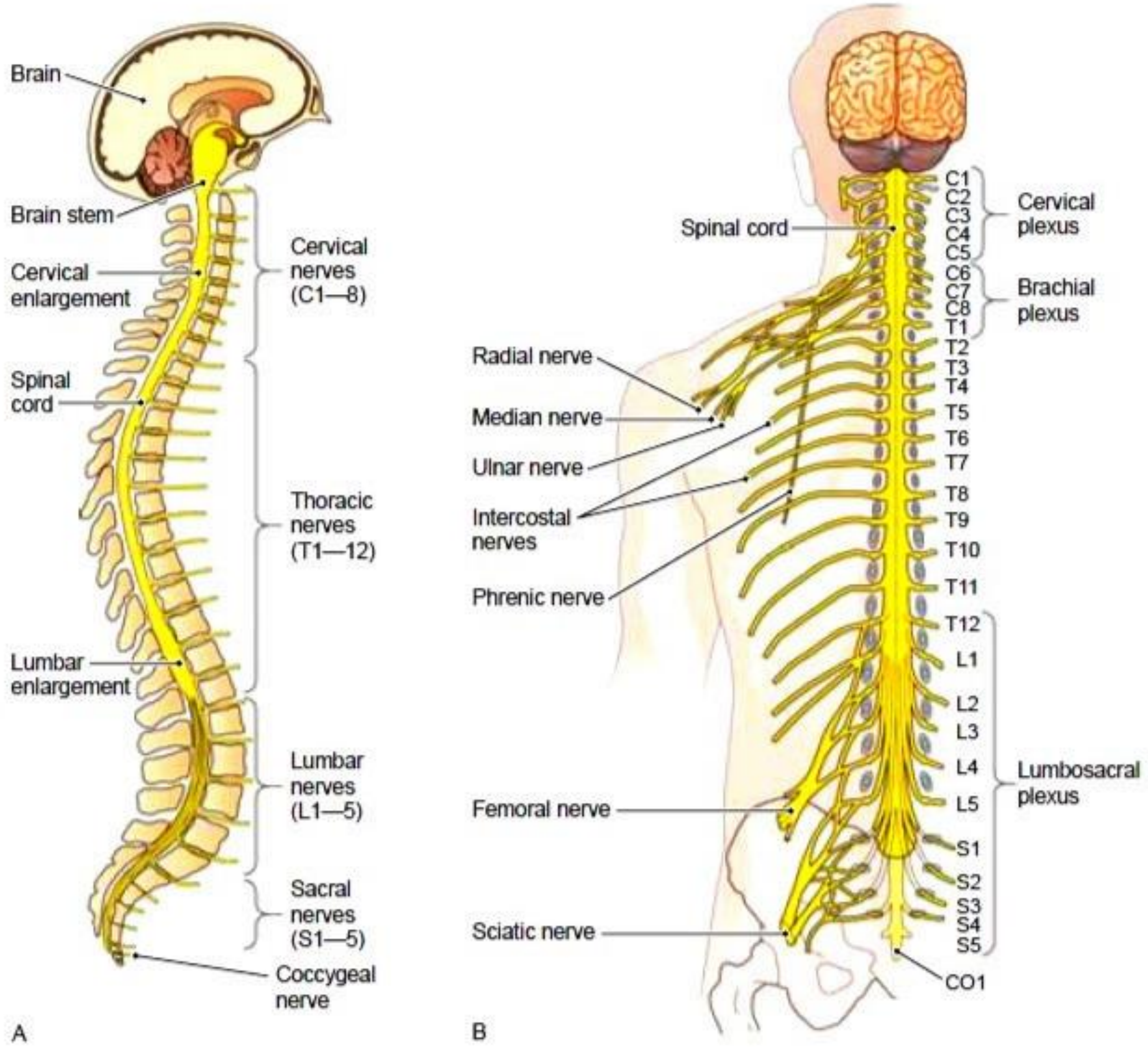


Fig. SPINAL CORD & PLEXUS

SYNAPSE: In the nervous system, a synapse is a structure that permits a neuron or nerve cell to pass an electrical or chemical signal to another neuron or to the target efferent cell. Between these cell there is a small gap called synapse. The synapse comprises:

- the ending of the one neuron (axon),
- the gap,
- The receiving end of the next neuron (dendrite).

A synapse involving neurons can be

- Chemical synapse: the junction the neurons such that the nerve impulse is transmitted from a neuron to another neuron or to a muscle cell or gland cell.
- Electrical synapse: the junction between two apposed neurons that allows faster nerve

transmission.

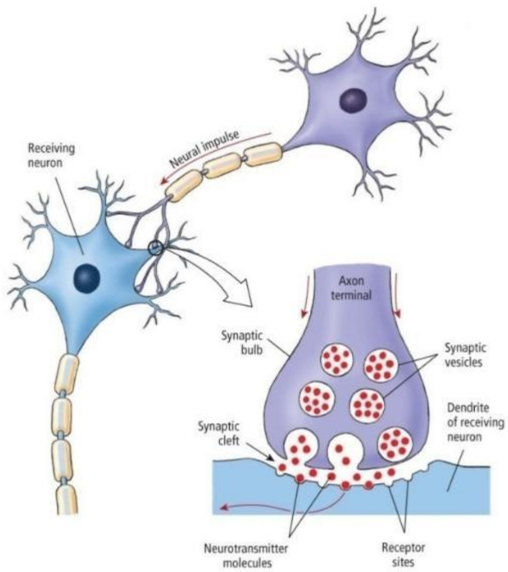


Fig. SYNAPSE

The motor Nerve pathways. Impulses travel in descending tracts called the cerebrospinal of pyramidal tracts, from the cerebral cortex to the spinal cord. The first neurons, upper motor neurons, have their cell bodies in the pre- Rolandic area of the cerebral cortex and many fibres converge to be closely grouped together as they pass between the caudate and lentiform nuclei, in the internal capsule.

The lower motor neurons, which begin as cell bodies in the anterior horn of the spinal cord pass out in the anterior root of a spinal nerve to be distributed to the periphery, ending in a motor organ such as a muscle.

Motor neuron lesions. In considering the clinical aspect, it is necessary to differentiate between a lesion of an upper motor neuron, i.e., of the central motor pathway and a lesion of a lower motor neuron.

In an ***upper motor neuron lesion*** - hemiplegia is an example - the muscles are not paralyzed but are weak and control of them is lost. The muscles of the limbs may be spastic and involuntary movements may occur which are uncontrollable and often lead to serve rigidity in spasm. Reflexes are exaggerated. There is no loss of muscle tone and no wasting of the affected muscles.

In a ***lower motor neuron lesion***, as in poliomyelitis, the affected muscles are paralyzed, being limp and flaccid, there is wasting and normal reflexes are lost, if the subject is a child the limb may not develop.

SHORT ANSWER QUESTIONS

1. Classify nervous system and write the functions of nervous system?
2. What is cerebral cortex?
3. What are the functions of basal ganglia?
4. What are the functions of thalamus and hypothalamus?
5. Write about meninges?
6. What is CSF and write its composition?
7. Write the functions of CSF?
8. What is neuron and mention its types?
9. Draw the diagram of neuron and label it?

ESSAY QUESTIONS

1. Explain in detail about the structure and functions of Brain.
2. Mention the names of Cranial nerves and its functions
3. Explain in detail about the structure and functions of Spinal cord.

UNIT- 8

RESPIRATORY SYSTEM

Contents:

Respiratory system is the system of respiratory passages, lungs and respiratory muscles of human body. Respiratory system is responsible for exchange of gases between the human body and the surroundings. In the process of exchange of gasses, human body gains oxygen and gets rid of carbon dioxide. Other gasses of atmosphere have no significant role in human respiratory system. Respiratory system is extremely important for human body because the process of respiration cannot be stopped even for a few seconds. If the process of respiration stops even for a minute or two, the condition will become serious and will ultimately end in death.

RESPIRATION:

Respiration is defined as the exchange of gases between body tissues and the external environment. Supply of oxygen to the tissues and excretion of carbon dioxide occur only through respiration.

The functions of respiration are:

- Transport of oxygen to tissues and excretion of carbon dioxide.
- Excretion of volatile substances like ammonia.
- Regulation of temperature through loss of heat in the expired air.
- Maintenance of pH of blood.
- Regulation of water balance through excretion of water vapour.

RESPIRATORY SYSTEM: The respiratory system consists of the Following structures:
1) Nasal cavity 2) Pharynx 3) Larynx 4) Trachea 5) Bronchi6) Bronchioles 7) Alveoli.

1. Nasal cavity:

It is divided into right and left portions by means of **nasal septum**. The nasal cavity is lined by mucous membranes. The entrance to nasal cavity is formed by "anterior nares" (nostrils). They contain small hairs which act as filters for dust. The back of nasal cavities contains posterior nares. They form the entrance to nasopharynx.

2.Pharynx: It is divided into three parts**:**

- **Nasopharynx** which lies behind the nasal cavities. It contains openings for Eustachian tubes on the lateral wall.
- **Oropharynx** which is continuous in front with mouth and below with laryngeal part of pharynx. Its lateral wall contains the tonsils.
- **Laryngopharynx** which is the lowest part. It lies behind the larynx

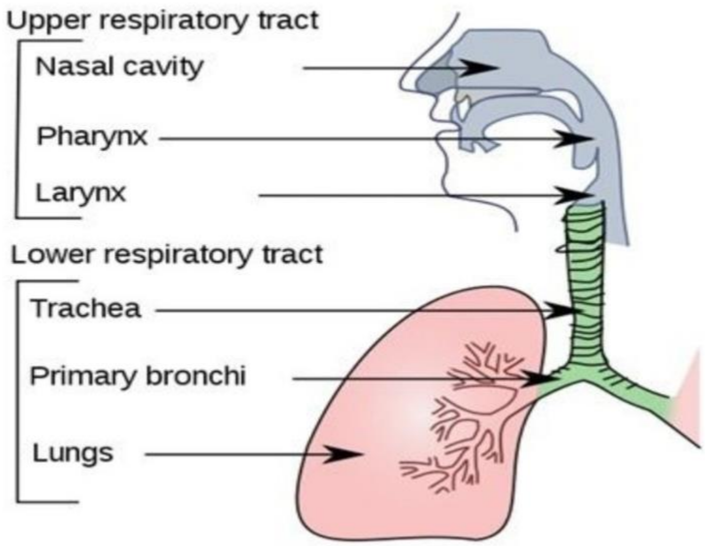


Fig. RESPIRATORY TRACT

3. Larynx : Its lies between pharynx above and trachea below. It is formed by the following cartilages:

- "Thyroid cartilage" which is the largest.
- "Cricoid cartilage" which lies below the thyroid cartilage.
- "Two aretenoid cartilages" at the back of cricoid.
- "Epiglottis" attached to the top of thyroid cartilage

4.Trachea (Wind pipe):

It is a cylindrical tube which is about 11 cm. in length. It beings at the lower end of pharynx, at the level of 5th thoracic vertebra, it divides into two bronchi. Trachea is made of sixteen to twenty C-shaped incomplete cartilages. These cartilages are connected by fibrous tissue at the back. The trachea is lined by mucous membrane made of ciliated epithelium.

5. Bronchi:

The trachea ends by dividing into two bronchi namely right and left bronchi. They pass to the corresponding lung. The right bronchus is shorter and wider than the left. Bronchi are made of complete rings of cartilage.

6. Bronchioles:

They are formed by the division of bronchi. Bronchioles are the finest branches of bronchi. Bronchioles do not have cartilage. They are lined by cuboidal epithelium.

7. Alveoli (Air sacs):

They are the final termination of each bronchi. They contain a thin layer of epithelial cells surrounded by numerous capillaries. Exchange of gases takes place through the walls of these capillaries.

THE LUNGS:

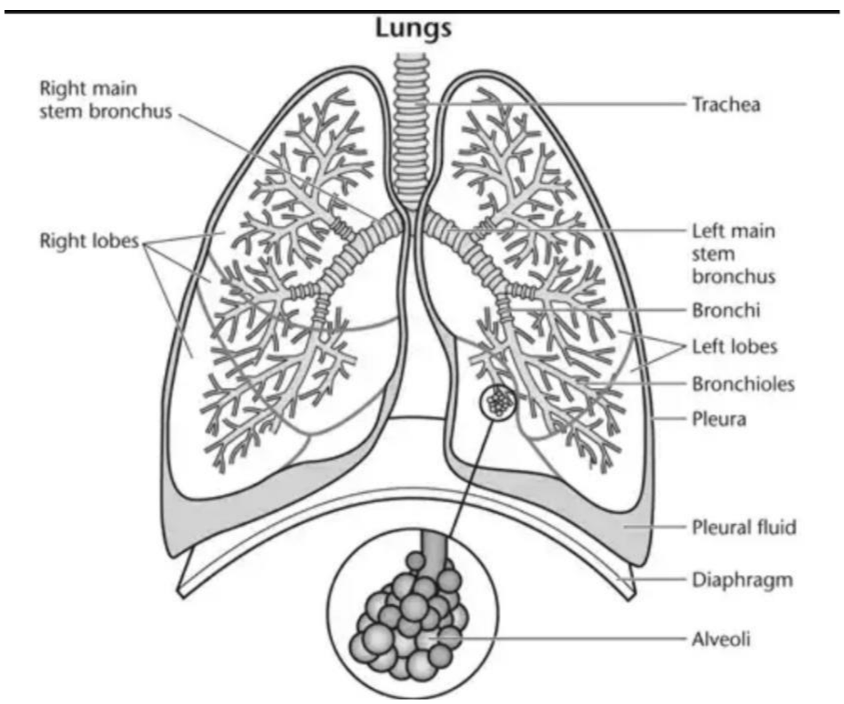
Lungs are the principal organs of respiration. They are two in number lying one on each side of the chest cavity. The two lungs are separated in the middle by heart and other structures of mediastinum.

Shape:

Lungs are conical in shape. The apex of lungs is above, rising slightly over the clavicle. The base of lungs is near the diaphragm.

Lobes:

Each lung is divided into lobes by means of fissures. The right lung which is bigger has three lobes. The left lung has two lobes. Each lobe is composed of a number of lobules. Each lobe contains a small bronchial tube. This tube divides and sub divides and ends finally in air sacs.



Pleura:

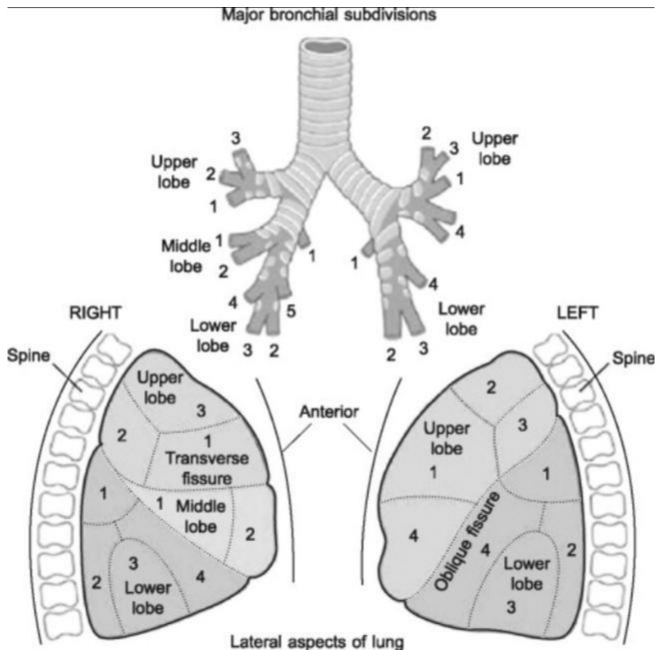
It is a serous membrane which covers the lungs. It is made of two layers. The inner layer is called as **visceral layer**. It is very close to the lungs. **Parietal layer** is the outer layer. The space between these two layers is filled with **pleural fluid**.

Root of the lungs:

The medial surface of each lung has a vertical slit called **hylum**. Structures like blood vessels, nerves and lymphatics pass through the hylum. These structures together constitute the root of lung. The root of lung is formed by:

- "Pulmonary arteries" which carry impure blood to the lungs from heart.
- "Pulmonary veins" which carry oxygenated blood from lungs to the heart.
- "Bronchial arteries" which are branches of thoracic aorta. They carry arterial blood which nourishes the substance of lung tissue.
- "Bronchial veins" which return venous blood of lungs to superior vena cava.

- "Bronchi" which divide into bronchioles.
- "Lympthatic" vessels and lymph glands.
- Sympathetic and vagus nerve which supply the lungs.



BRONCHO PULMONARY SEGMENTS

- **Bronchopulmonary segment** is a portion of lung supplied by a specific tertiary bronchus (also called a segmental bronchus) and arteries. These arteries branch from the pulmonary and bronchial arteries, and run together through the center of the segment. Veins and lymphatic vessels drain along the edges of the segment. The segments are separated from each other by layers of connective tissue. Each bronchopulmonary segment is a discrete anatomical and functional unit, and this separation means that a bronchopulmonary segment can be surgically removed without affecting the function of the others.

There are 10 bronchopulmonary segments in the right lung: Three in the superior lobe, two in the middle lobe, and five in the inferior lobe. Some of the segments may fuse in the left lung to form usually 8-9 segments (4–5 in the upper lobe and 4–5 in the lower lobe).

Right lung

- Superior lobe
  - Apical segment
  - Posterior segment
  - Anterior segment
- Middle lobe
  - Lateral segment
  - Medial segment
- Inferior lobe
  - Superior segment
  - Medial-basal segment
  - Anterior-basal segment
  - Lateral-basal segment
  - Posterior-basal segment

Left lung

Superior lobe

Apico-posterior segment (merger of "apical" and "posterior")

Anterior segment

Lingula of superior lobe

Inferior lingular segment

Superior lingular segment

Inferior lobe

Superior segment

Anteromedial basal segment (merger of "anterior basal" and "medial basal")

Posterior basal segment

Lateral basal segment

Blood vessels of lungs:

- **Pulmonary arteries** which carry impure blood from the right ventricle to the lungs. These arteries divided and sub divided to from arterioles ultimately from a network of capillaries. The thin membrane of these capillaries enables exchange of gases which is a function of respiration.
- **Pulmonary veins** formed by the union of capillaries. The pulmonary veins carry oxygenated blood to left atrium of heart.
- **Bronchial arteries** which carry oxygenated blood from thoracic aorta directly to lungs. This blood nourishes the substance of lung tissue.
- **Bronchial veins** which return the venous blood of lungs to superior vena cava.

MECHANISM OF RESPIRATION: Respiration involves two stages: 1) inspiration 2) expiration

Inspiration (or breathing in):

It is an active process. It is produced by the contraction of the following muscles:

- Diaphragm, the contraction of which enlarges the chest cavity vertically (i.e., from above downwards).
- Intercostal muscles when contract produce elevation or ribs and sternum. This enlarges the chest cavity in all the other four sides.
- The lungs expand at this stage and fill this increased space. Now, the pressure in the lungs is less than atmospheric pressure. So air flows into the lungs.

Expiration (or breathing out):

It is a passive process. It is produced by the relaxation of diaphragm and intercostals muscles. This produced reduction in the size of chest cavity. So the pressure in the lungs increases which forces the air out. The rate of respiration is 16 to 18 per minute in adults. The rate is higher in children.

REGULATION OF RESPIRATION: Respiration is regulated by two controls: 1) Nervous control 2) Chemical control.

- **Nervous control**: It is exerted by "respiratory center" present in the medulla oblongata of brain. From this centre afferent impulses pass to:
  - Diaphragm through phrenic nerve. . .
- 2. Intercostal muscles through intercostal nerves.

These impulses cause rhythmic contraction of diaphragm and intercostal muscles. Afferent impulses arise due to the distention of air sacs. They are carried by vagus to the respiratory centre. .

- **Chemical control:**

This is affected through carbon dioxide content of blood. An increase in the level of carbon dioxide produces stimulation of the respiratory centre. A decrease in carbon oxide level produces the opposite effect.

LUNGVOLUMES AND CAPACITIES

Pulmonary function can be examined by **the spirometry technique**.

LUNG VOLUMES

Tidal volume (TV): Volume of air inhaled or exhaled with each breath during normal breathing (0.5L).

Inspiratory reserve volume (IRV) : Maximal volume of air inhaled at the end of a normal inspiration (3L)

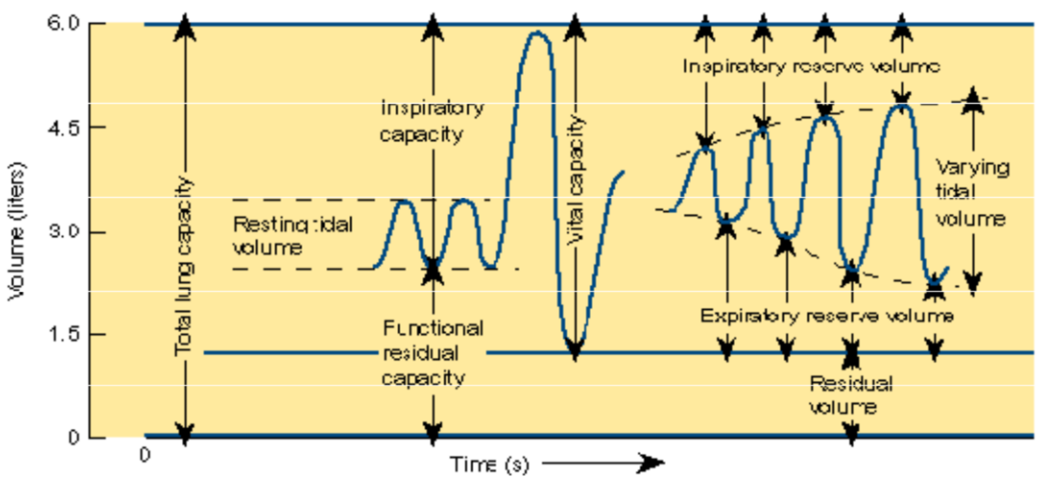
Expiratory reserve volume (ERV) : Maximal volume of air exhaled at the end of a tidal volume (1.2L)

Residual Volume (RV): The volume of gas remains in the lung after maximal expiration. (1-1.2L)

LUNG CAPACITIES

Inspiratory capacity (IC): Maximal volume of air inhaled after a normal expiration (3.6L) (TV+IRV)

Functional Residual Capacity (FRC): The volume of gas that remains in the lung at the end of passive expiration. (2-2.5L or 40% of the maximal lung volume) (ERV+RV).



FRC and RV cannot be measured with an ordinary spirometer.

Total Lung Capacity (TLC): The maximal lung volume that can be achieved voluntarily. (5-6L) (IRV+ERV+TV+RV)

Vital capacity (VC): The volume of air moved between TLC and RV. (4-5L)(IRV+ERV+TV). Multiplying the tidal volume at rest by the number of breaths per minute gives **the total minute volume** (6L/min). During exercise the tidal volume and the number of breaths per minute increase to produce a total minute volume as high as 100 to 200L/min.

ABNORMAL TYPES OF RESPIRATION

1. Cheyne-stokes breathing:

It is a form of periodic breathing in which groups of breaths are separated by periods of apnea. This occurs because the C02 tension of arterial blood is reduced to a very low level. So the respiratory centre cannot be stimulated. Respiration starts again, only when the C02 tension increases. Cheyne-stokes breathing occurs in uremia, opium poisoning and increased intracranial pressure.

- **Apnea** - stopping of respiration for short intervals.
- **Hyperpnea** - increase in depth of respiration.
- **Dyspnea** - difficulty in breathing.
- **Polypnea** - respiration characterised by rapid rate.
- **Tachypnea** - exceedingly high rate of respiration.

ARTIFICIAL RESPIRATION:

It is employed when respiration fails due to drowning, carbon monoxide poisoning etc. Artificial respiration must be given immediately when respiration fails. Most methods employed are designed to increase and decrease the capacity of thorax. So air can be drawn into the lungs and expelled. The follow are a few methods of artificial respiration:

- **Schafer's method and Holger Nialson method:** Both involve compression of thoracic cavity by pressure against ribs.

- **Mouth to mouth method:** It involves blowing air into lungs through mouth.
- **Instrumental methods**: They are Drinker's method, Bragg- Paul's method and Iron lung method. These methods can be carried out only in hospitals.

ESSAY QUESTIONS

1. Explain in detail about the parts of the Respiratory system?
2. Explain in detail about the structure of the Lungs along with Broncho pulmonary segments?
3. Write about the mechanism of the respiration?
4. Mention briefly about lung volumes and capacities?

UNIT- 9

DIGESTIVE SYSTEM

Contents:

The digestive system includes the digestive tract and its accessory organs, which process food into molecules that can be absorbed and utilized by the cells of the of the body. Food is broken down, bit by bit until the molecules are small enough to be absorbed and the waste products are eliminated.

The digestive tract, also called the alimentary canal or gastrointestinal (GI) tract, consists of long continuous tube that extends from the mouth to the anus.

The tongue and teeth are the accessory structures located in the mouth. The salivary glands, liver, gallbladder and pancreas are major accessory organs that have a role in digestion. These organs secrete fluids into the digestive tract.

Food undergoes three types of processes in the body:

- Digestion
- Absorption
- Elimination

Digestion and absorption occur in the digestive tract. After the nutrients are absorbed, they are available to all cells in the body and are utilized by the body cells in metabolism.

The digestive system prepares nutrients for utilization by body cells through six activities, or functions.

- **Ingestion**: The first activity of the digestive system is to take the food through the mouth. This process called ingestion, has to takes place before anything else can happen.
- **Mechanical digestion**: The large piece of the food that are ingested have to be broken into smaller particles that can be acted upon by various enzymes. This is mechanical digestion , which begins in the mouth with chewing or mastication and continues with churning and mixing actions in the stomach.
- **Chemical digestion**: The complex molecules of carbohydrates, proteins, and fats are transformed by chemical digestion into smaller molecules that can be absorbed and utilized by the cells.
- **Movements**: After ingestion and mastication, the food particles move from the mouth into the pharynx, then into the oesophagus. This movement is deglutition or swallowing. Mixing movements occur in the stomach as a result of smooth muscle contraction.
- **Absorption**: The simple molecules that result from chemical digestion pass through cell membranes of the lining of the small intestine into the blood or lymph capillaries. This process is called absorption.

- **Elimination**: The food molecules that cannot be digested or absorbed need to be eliminated from the body. The removal of the indigestible wastes through the anus, in the form of feces, is defecation or elimination.

PARTS OF DIGESTIVE SYSTEM:

Digestive system consists of the following parts:

1. Mouth 2.Pharynx 3.Oesophagus 4.Stomach 5.Small intestine 6.Largeintestine 7.Rectum 8.Anus

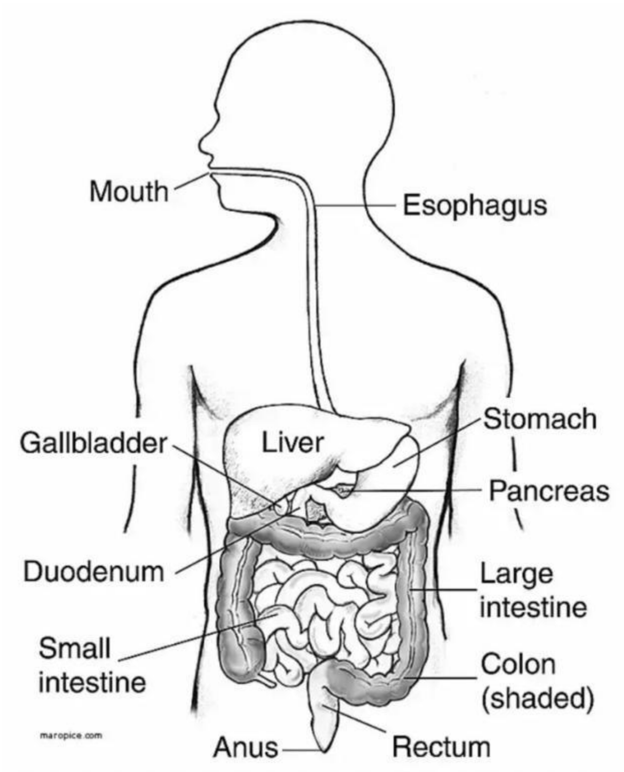


Fig. STRUCTURE OF DIGESTIVE SYSTEM

MOUTH and ASSOCIATED ORGANS:

Mouth (oral or buccal cavity): Anterior opening is oral orifice, continuous with oropharynx posteriorly. Oral mucosa produces antimicrobial peptides called defensins to prevent infection.

Lips & Cheeks:

Lips (labia): formed by orbicularis oris muscle

Red margin: reddish area visible externally; redness due to blood within blood vessels showing through (poor keratinization)
Labial frenulum: median fold that joins lips to gums
Cheeks: formed by buccinator muscles
Vestibule: recess between cheeks & gums (& lips & gums)

Oral cavity proper: cavity within teeth & gums
Palate: forms roof of mouth
Hard palate: formed from palatine bone & palatine process of maxilla
soft palate: formed mostly of skeletal muscle
uvula: projects downward from free edge of soft palate, closes off naso pharynx during swallowing
Tongue: occupies floor of mouth & fills most of oral cavity composed of *skeletal muscle* that grips & mixes food with saliva to form a ***bolus*** intrinsic muscles, change shape of tongue, extrinsic muscles, change position of tongue (protrude, retract, move side to side).

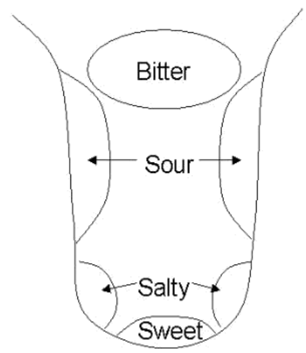
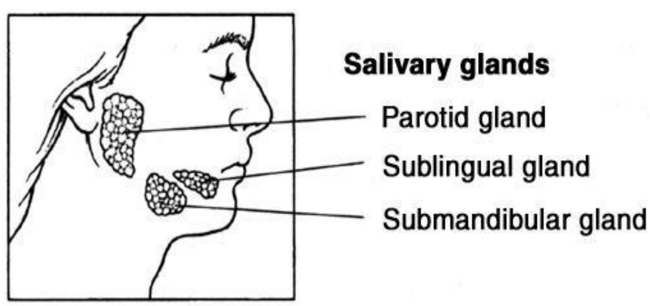


Fig. TONGUE

Salivary Glands: Glands inside & outside oral cavity that secrete saliva.

- **Parotid glands**: Paired glands anterior to ear between masseter muscle & skin.
- **Submandibular glands**: Walnut-sized glands that lie along medial aspect of mandible .
- **Sublingual gland**: Anterior to submandibular gland under tongue.



Saliva: mostly water, slightly acidic secretion containing electrolytes (sodium, chloride, bicarbonate ions), salivary amylase (digestive enzyme), mucin, lysozyme, IgA & metabolic wastes (urea & uric acid) protection against infection provided by IgA, lysozyme, defensins and a cyanide compound bacteria at back of tongue convert nitrites into nitric oxide, which acts as an antibiotic control of salivation, primarily controlled by parasympathetic division of ANS salivatory nuclei in brain stem stimulated by sensory receptors in mouth, which trigger ANS.

TEETH: Lie in sockets (alveoli) in gum-covered margins of maxilla & mandible and it's primary function is mastication (chewing)

There are 2 sets of teeth

- **Primary teeth**: **Temporary (milk or baby) teeth**,set of 20 teeth that first appear at about 6 months & generally last from 6 to 12 years.
- **Permanent teeth**: usually 32 teeth including wisdom teeth. Each half of the upper and lower jaw contains 8 teeth. They are, 2 incisors, 1 canine, 2 premolars and 3 molars

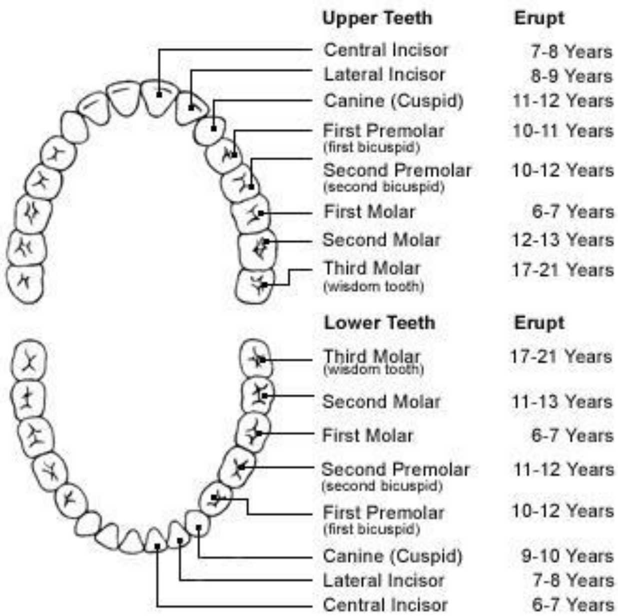


Fig. Structure of Tooth

PHARYNX: Food passes from mouth into oropharynx and then laryngopharynx stratified squamous mucosa surrounded by 2 skeletal muscle layers to propel food into esophagus. Pharynx lies between the mouth and oesophagus. Pharynx consists of three parts:

i. Nasopharynx
ii. Oropharynx
iii. Laryngopharynx

i.Nasopharynx

It lies behind the nasal cavity. It extends from base of skull to the level of soft palate. On either side, it has an opening for Eustachian tube.

ii. Oropharynx:

It lies behind the mouth. It extends between soft palate above and upper opening of larynx below. The lateral walls of oropharynx contain the tonsils.

iii.Laryngopharynx :

It is the lowest part and it lies behind the larynx.

Oropharynx and laryngopharynx serve as a common channel for the passage of food and air. Through both these parts, food is conducted from mouth to oesophagus and air from nasopharynx to larynx.

ESOPHAGUS: Food moving through laryngopharynx is routed into the esophagus as the epiglottis closes off the larynx.

Esophagus extends about 25 cm from pharynx to stomach,route is through thoracic cavity posterior to trachea & then piercing diaphragm at esophageal hiatus to extend into abdominal cavity.
It lies betwe3n the trachea and vertebral column. The wave motion of food in oesophagus is called “Peristalisis motion “.

Esophagus joins stomach at cardiac orifice.

Cardiac (gastro esophageal) sphincter: smooth muscle valve preventing backflow of food from stomach into esophagus.

Heartburn: symptom of gastro esophageal reflux disease (GERD), backflow of acidic gastric juice from stomach into esophagus.

Deglutition (The act of swallowing) :

In the mouth, food is masticated and mixed well with saliva. The action of tongue and cheeks convert food into a round mass called bolus. This bolus is swallowed.

ABDOMINAL CAVITY AND ITS CONTENTS

Abdomen is the largest cavity in the body. It is oval in shape and contains a variety of organs. It can be divided into two parts. An upper large cavity – Abdomen, a lower small cavity – Pelvis.

Contents of abdomen:

The abdomen contains stomach, intestines, liver, spleen, pancreas, kidneys, adrenal glands, abdominal aorta, inferior vena cava, peritoneum, fat etc.

STOMACH AND ITS DIGESTIVE FUNCTION

Stomach is the dilated portion of alimentary canal and it receives food from esophagus. It lies in the upper part of abdominal cavity below the left half of diaphragm.
Parts of Stomach:

1. Two surfaces : An anterior and posterior surface
2. Two borders : An upper border called lesser curvature
3. Two ends : upper end called cardiac end and it is guarded by Cardiac sphincter. Lower end is called pyloric end which is guarded by pyloric sphincter.
4. Fundus : A dome shaped upper part lying to the left of cardiac end.
5. Body : The main part of stomach
6. Pyloric antrum : The lower end.

STRUCTURE OF STOMACH

Stomach contains of the following four coats:

- Peritoneal coat (made of serous covering
- Muscular coat (made of longitudinal, circular and oblique fibres
- Submucous coat (made of areolar tissue)

Mucous coat (made of mucous membrane)

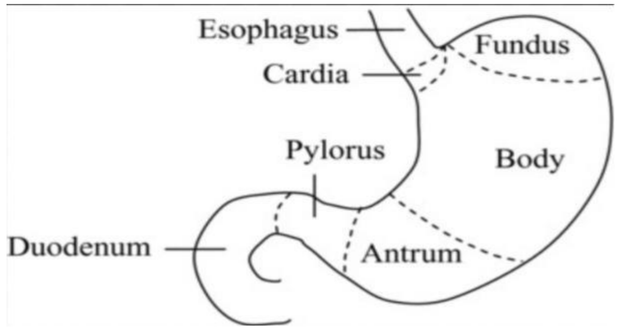


Fig. PARTS OF STOMACH

Secretions of Stomach:

The mucous membrane of stomach contains glands which secrete gastric juice continuously. The secretion of gastric juice occurs due to:

- A reflex mechanism through vagus nerve
- Gastrin, a hormone secreted by the action of food stuffs on gastric mucous membrane.
- Psychological effects produced by taste or smell of food. Gastric juice contains pepsin, rennin, hydrochloric acid and intrinsic factor.

SMALL INSTESTINE:

Small Intestine is the part of alimentary canal which extends from the pyloric end of the stomach to caecum (the first part of large intestine).

Parts: Small intestine consists of three parts:

- Duodenum
- Jejunum
- Ileum

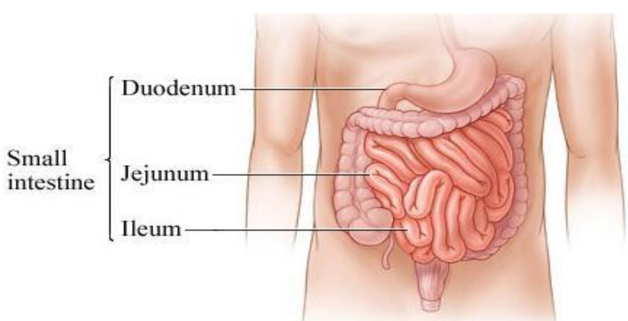


Fig. PARTS OF SMALL INTESTINE

1.Duodenum:

It is C - shaped fixed part which is attached to posterior abdominal wall by peritoneum. The head of pancreas lies in the concavity of duodenum. Also the bile duct and pancreatic duct open together at the concave surface.

2.Jejunum: It is the continuation of duodenum and it is the middle portion of small intestine.

3.Ileum: It forms the last part of the small intestine

LARGE INTESTINE:

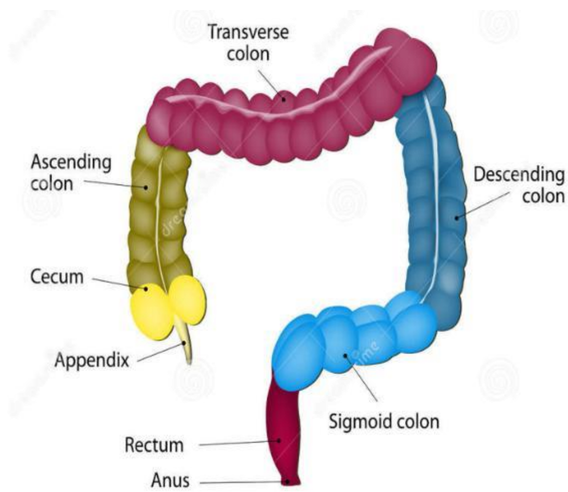
Large intestine (colon) extends from the end of ileum to rectum. Large intestine consists of the following parts: caecum, appendix, ascending colon, transverse colon and sigmoid colon.

1. Caecum :

It is a short rounded sac which lies in the right iliac fossa. It commences at ileocaecal valve where the ileum joins the caecum.

2. Vermiform appendix:

It springs out from the caecum at about an inch from the ileocaecal junction. It is present in the right iliac fossa. The lumen of appendix communicates with that of caecum .The appendix is composed of the same four coats as intestine but he submucous coat contains lymphoid tissue.



3. Ascending Colon:

It ascends upwards from caecum and in front of right kidney. It turns to the left below the liver and forms the transverse colon.

4. Transverse Colon:

It is the loop of large intestine which extends between the lower surfaces of liver and spleen. At the lower surface of spleen, it turns downwards to form descending colon.

5. Descending Colon:

It extends from the lower surface of spleen to brim of pelvis. It lies in the left lumbar region.

6. Sigmoid Colon:

It is the continuation of descending colon and it continues below with rectum.

RECTUM:

It occupies the lower posterior part of the pelvis. It extended between sigmoid colon and anus. The lower part of rectum is dilated and it is called rectal ampula.

ANUS:

It is a small canal measuring about one inch in length. The opening of anus is guarded by a sphincter called anal sphincter. This sphincter is under voluntary control.

PHYSIOLOGY OF DIGESTION

Human Alimentary Canal (Or Gut), and Their Functions.

Structure	Function
Mouth	Where food enters the alimentary canal and digestion begins
Salivary glands	Produce saliva containing amylase
Oesophagus	Muscular tube which moves ingested food to the stomach
Stomach	Muscular organ where digestion continues
Pancreas	Produces digestive enzymes
Liver	Produces bile
Gall bladder	Stores bile before releasing it into the duodenum
Small intestine - duodenum	Where food is mixed with digestive enzymes and bile
Small intestine – ileum	Where digested food is absorbed into the blood and lymph
Large intestine – colon	Where water is reabsorbed
Large intestine – rectum	Where faeces are stored
Large intestine – anus	Where faeces leave the alimentary canal

Digestive enzymes

Digestion is the breakdown of large, insoluble food molecules into small, water-soluble molecules using mechanical and chemical processes.

Mechanical digestion includes:

- chewing in the mouth
- churning in the stomach

Chemical digestion involves **enzymes**. These are proteins that function as biological **catalysts**.

Different enzymes

Enzymes can break down nutrients into small, soluble molecules that can be absorbed.
For example, amylase causes the breakdown of **starch** into simple sugars.

Where enzymes are produced

Enzyme	Substrate	End-products	Where produced
Salivary amylase	Starch	Maltose	Salivary glands
Protease	Protein	Amino acids	Stomach, pancreas
Lipase	Lipids (fats and oils)	Fatty acids and glycerol	Pancreas
Pancreatic amylase	Starch	Maltose	Pancreas
Maltase	Maltose	Glucose	Small intestine

Where digestion happens

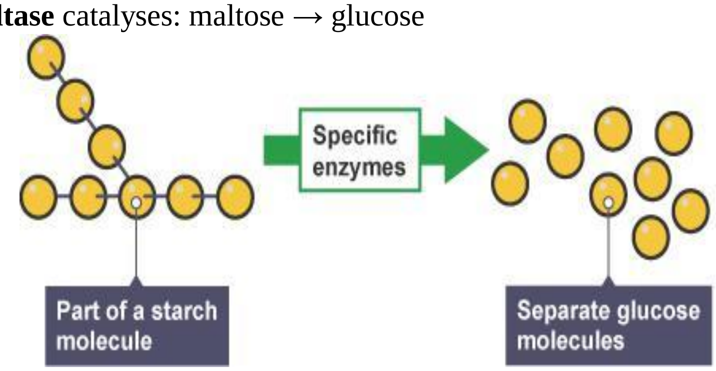
- **Proteases** catalyse the breakdown of proteins into **aminoacids** in the stomach and small intestine
- **Lipases** catalyse the breakdown of fats and oils into **fatty acids** and **glycerol** in the small intestine
- **Amylase** catalyses the breakdown of **starch** into maltose in the mouth and small intestine
- **Maltase** catalyses the breakdown of **maltose** into **glucose** in the small intestine

Other substances in digestion

Different **enzymes** work best at different **pH** values. The pH varies in the gut.

The mouth

Saliva is slightly alkaline. Enzymes in saliva convert starch into glucose:
- **amylase** catalyses: starch → maltose
- **maltase** catalyses: maltose → glucose



The digestion of starch to glucose needs two enzymes

In the stomach

The stomach produces **hydrochloric acid**. It kills many harmful **microorganisms** that might have been swallowed along with the food. The enzymes in the stomach work best in **acidic** conditions – at a low pH.

Bile:

After it has been in the stomach, food travels to the small intestine. The enzymes in the small intestine work best in **alkaline** conditions - but the food is acidic after being in the stomach. **Bile** is a substance produced by the liver and stored in the gall bladder.

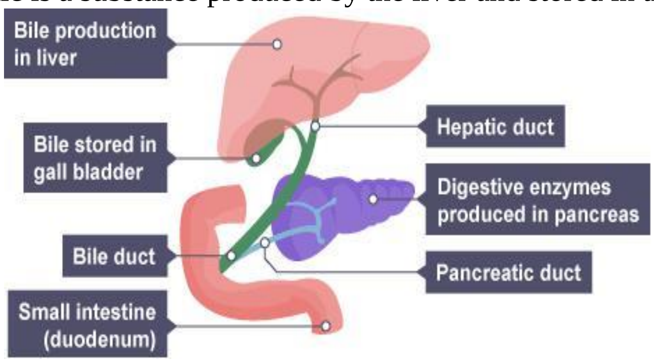


Fig. Bile and enzyme production in the liver and pancreas

Bile is secreted into the small intestine where it has two effects:

- It **neutralises** the acid - Providing the alkaline conditions needed in the small intestine
- It **emulsifies** fats - Providing a larger surface area over which the lipase enzymes can work

Absorption

Absorption is the movement of digested food molecules through the wall of the intestine into the blood or **lymph**.

The **small intestine** is the region where digested food is absorbed. Most absorption happens in the **ileum**. This is the longest part of the small intestine and is between 2-4 metres long. The small intestine has a large internal surface area for absorption to happen quickly and efficiently.

The villi

The **villi** (one is called a **villus**) are tiny, finger-shaped structures that increase the surface area. They have several important features:

- **Wall just one cell thick** - Ensures that there is only a short distance for absorption to happen by **diffusion** and **active transport**
- **Network of blood capillaries** - Transports **glucose** and **amino acids** away from the small intestine in the blood
- **Internal structure called a lacteal** - Transports **fatty acids** and **glycerol** away from the small intestine in the lymph

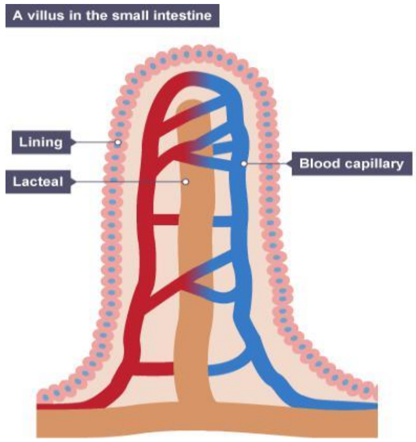


Fig. VILLI OF SMALL INTESTINE

The **hepatic portal vein** transports absorbed food from the small intestine to the liver.

Assimilation and egestion

Digested and undigested foods have different outcomes once they have passed through the alimentary canal (gut).

Assimilation

Assimilation is the movement of digested food molecules into the cells of the body where they are used. For example:

- **glucose** is used in **respiration** to provide energy
- **amino acids** are used to build new proteins

The liver is also where toxins, such as alcohol, are broken down. The **liver** is important in assimilation. For example, it converts glucose into **glycogen** (a complex carbohydrate used for storage) and amino acids into proteins.

The liver is involved in the process of **deamination**. This is the removal of the nitrogen-containing part of amino acids, to form **urea**, followed by the **release of energy** from the remainder of the amino acid.

Egestion

The **small intestine** absorbs most of the water in the contents of the gut. By the time the contents reach the end of the small intestine, most of the digested food has also been absorbed.

The remaining material consists of:

- Water
- Bacteria (living and dead)
- Cells from the lining of the gut
- Indigestible substances - such as **cellulose** from plant cell walls

The **colon** is the first part of the **large intestine**. It absorbs most of the remaining water. This leaves semi-solid waste material called **faeces**. The faeces are stored in the **rectum**, the last part of the large intestine. **Egestion** happens when these faeces pass out of the body through the **anus**.

Defecation:

Defecation is the final act of digestion, by which organisms eliminated solid, semisolid, or liquid waste material from the digestive tract via the anus. Humans expel feces with frequency varying from a few times daily to a few times weekly.

ACCESSORY ORGANS OF DIGESTION

Digestion of food is aided by the following abdominal organs which are situated outside the alimentary canal. They are:

- Liver
- Gall bladder
- pancreas

LIVER

Position: largest gland in body, it lies under diaphragm & mostly within rib cage, occupies most of right hypochondriac & epigastric regions.

4 primary lobes: right (largest lobe), left, quadrate & caudate

• **Falciform ligament**: separates left & right lobes & suspends liver from diaphragm &anterior abdominal wall

• **Round ligament** (ligamentum teres): fibrous remnant of fetal umbilical vein (ductusvenosus)

• **Hepatic artery & hepatic portal vein** travel through lesser omentum and enter liver common hepatic duct

• **Bile** travels through right & left hepatic ducts, which lead into **common hepatic duct** . Common hepatic duct fuses with **cystic duct** to form (common**) bile duct** .

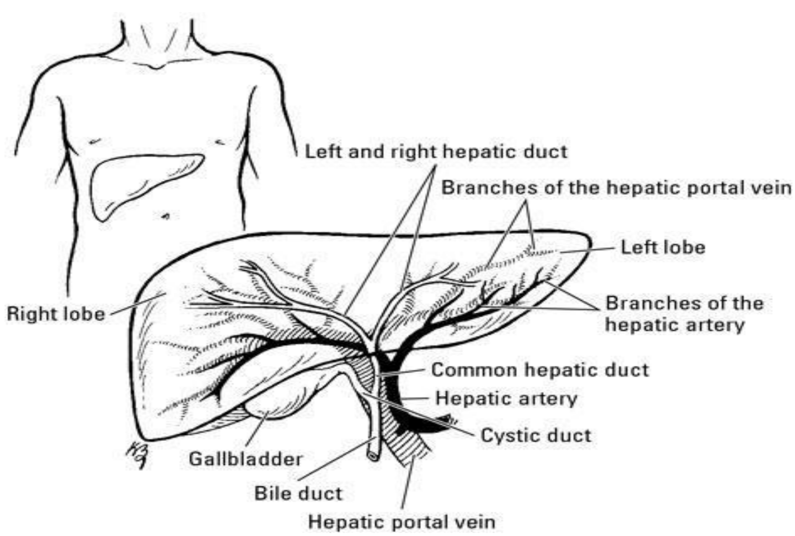


Fig: LIVER

Liver and structures passing through the hylum

Four Surfaces: they are

- **Superior surface** which is in contact with the under surface of diaphragm.
- **Inferior surface** which is facing the abdominal viscera. The hylum or portal fissure is present in the inferior surface. The blood vessels of liver and bile duct pass through the hylum.
- **Anterior surface** which is separated from ribs and coastal cartilages by the diaphragm.
- **Posterior surface** which lies in front of vertebral column, aorta, inferior vena cava and lower end of oesophagus.

Internal (minute or microscopic structure): The liver consists of a large number of liver cells called lobules. Each lobule has a central vein. The connective tissue lying in between the lobules contains the branches of:

- Portal vein
- Hepatic artery
- Bile duct

Blood supply: Blood is brought to liver by: i) hepatic artery ii) portal vein.
But blood is carried from liver to inferior vena cava through **hepatic veins.**

Bile ducts: The secretion of liver (bile) is carried through bile ducts which are formed by the union of biliary canaliculi. The biliary canaliculi are small biliary channels present in between the lobules of liver.

Composition of bile: Bile is a yellow-green alkaline solution consisting of bile salts, bile pigments, cholesterol, neutral fats, phospholipids & a variety of electrolytes

Bile salts: Cholesterol derivates that emulsify fats (suspend in water), aiding indigestion & absorption of fats

Bilirubin: Bile pigment produced as a waste product of heme of hemoglobin during red blood cell breakdown.

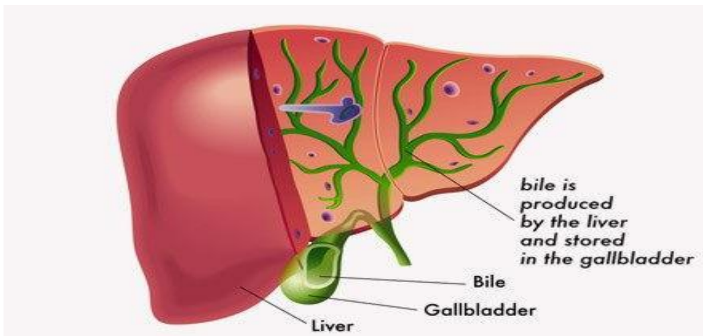
Functions of the liver:

- Secretion of bile.
- Synthesis and storage of glycogen.
- Formation of urea by the de-amination of amino acids.
- Synthesis of plasma proteins like albumin and globulin.
- Conversion of unsaturated fats into saturated fats.
- Storage of iron and vitamin B_{12}.
- Synthesis of prothrombin and fibrinogen which are necessary for blood coagulation.
- Synthesis of heparin, the natural anti coagulant.
- Production of heat as a result of metabolic reaction.
- Inactivation of toxic substances and drugs.
- Storage of vitamins A, D, E and K.

GALLBLADDER

Gall bladder is pear shaped storage sac for bile. It is situated in the under surface of the right lobe of liver. It consists of a fundus, body and neck.

Functions of gall bladder: The gall bladder stores the bile that is secreted in liver. Also it concentrates the bile stored in it.



BILE: It is an alkaline fluid secreted by the liver and stored in gall bladder. About 500 to 1000 ml of bile is secreted by liver per day. But the capacity of gall bladder is only 30 ml. So bile is concentrated in gall bladder. Bile contains 86% of water, bile salts, bile pigments, mucin, cholesterol and other substances.

Bile salts: Bile salts are mixture of sodium salts. The bile salts increase the digestive activity of lipase, a pancreatic enzyme. Also they help in the absorption of fats (like glycerol, fatty acids and cholesterol) and fat soluble vitamins (A, D, E and K).

Bile pigments: They are bilirubin and biliverdin. They are formed form hemoglobin which is released in the destruction of worn out red blood cells in the spleen.

PANCREAS

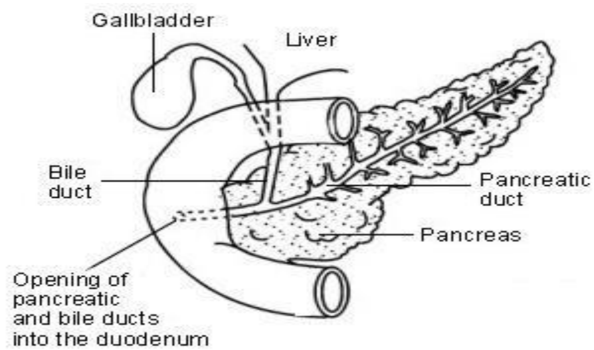
Position: Pancreas is a long, slender gland which lies transversely across the posterior abdominal wall. It lies behind the stomach at the level of 1st and 2nd lumbar vertebrae. **Parts**: It consists of the following:

Head lies in the C – shaped curve of duodenum.
Body lies in front of the body of lumbar vertebrae
Tail lies in contact with the hylum of spleen.

Secretions: the secretions of pancreas can be classified into: 1) exocrine secretion 2) endocrine secretion.

• Exocrine secretion: it is pancreatic juice which is digestive in function. It is conveyed to duodenum through pancreatic duct. Pancreatic juice contains the following digestive enzymes:

- Lipase, which converts fats into fatty acids and glycerol.
- Amylase, which converts starch into maltose.
- Trypsin which converts peptones not amino acids.



• Endocrine secretions: It is secreted by the islets of Langerhans and directly poured into circulation. This secretion contains two different hormones which are secreted by the two different cells of islets of Langerhans. These hormones are:

- Glucagon – secreted by alpha cells
- Insulin – secreted by beta cells

ESSAY QUESTIONS

1. Explain the structures of Digestive system with a labeled diagram?
2. Explain the physiology of Digestion?
3. Write the structure and functions of Liver?

UNIT- 10

EXCRETORY SYSTEM

Contents:

Excretory system is a passive biological system that removes excess, unnecessary materials from the body fluids of an organism, so as to help to maintain internal chemical homeostasis and prevent damage to the body. The dual functions of the excretory system is the elimination of the waste products of metabolism and drain the body of used up and broken down components in a liquid and gaseous state. Only the organs specifically used for the excretion are considered a part of the excretory system. In the narrow sense, the term refers to the **Urinary system.**

The urinary system is the main excretory system of the body. It consists of 1) two kidneys 2) two ureters 3) an urinary bladder 4) an urethra.

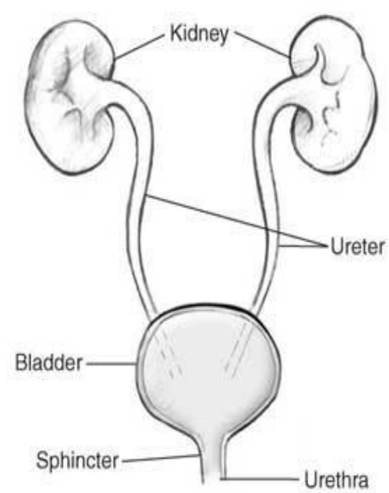


Fig. URINARY SYSTEM

Parts of urinary system

KIDNEY:

They are two bean shaped organs lying on the posterior abdominal wall, on each side of the vertebral column.

Functions of the kidneys:

- Excretion of water and waste products of protein metabolism.
- Excretion of excess salt.
- Excretion of harmful substances, drugs and toxins.
- Regulation of pH of blood.

Positions of the kidneys:

The kidneys extend from the level of last thoracic vertebra to the third lumbar vertebra. The right kidney is smaller than the left kidney. Each kidney measures 11 cm is length 5 cm in width and 3 cm in thickness. Each kidney weighs about 150 grams.

The outer border of kidney is "convex". The inner border is concave and it is called as "hylum". Blood vessels enter and leave the kidney through the hylum. A suprarenal gland is situated at the apex of each kidney.

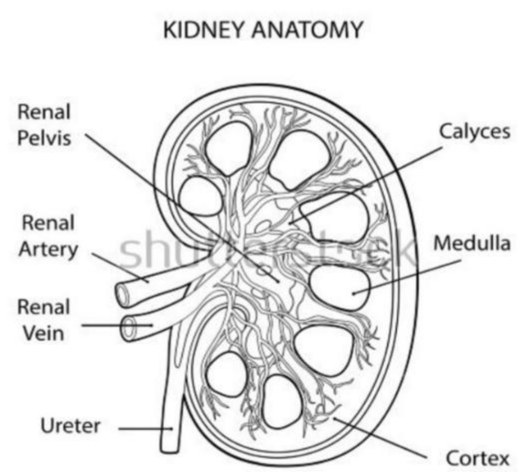


Fig : STRUCTURE OF KIDNEY

Structure of kidney:

Kidney is surrounded by an outer fibrous capsule. Below this lies the substance of the kidney which-consists of:

- An outer cortex which is reddish- brown in colour.
- Inner medulla which contains "pyramids" of the kidney.
- An upper expanded end or ureter called "pelvis". Microscopically the kidneys are made of a number of structural and functional units called "**nephrons**". There are about one million nephrons in each kidney.

A nephron consists of two parts:

1. Malphigian bodies made of Bowman's capsule and glomerulus.

2. Renal tubules.

Malphigian bodies:

It is made of 1) an upper expanded end of the renal tubule called "Bowman‘s capsule" 2) a bunch of capillaries called "glomerulus" which are packed in Bowman’s capsule. The malphigian bodies are present in the cortex.

Renal tubules:

They consist of four parts:

- Proximal convoluted tubule situated in the cortex.
- Loop of Henle present in the medulla.
- Distal convoluted tubule present in the cortex.
- Collecting tubules which pass through the medulla and open into the pelvis of kidney.

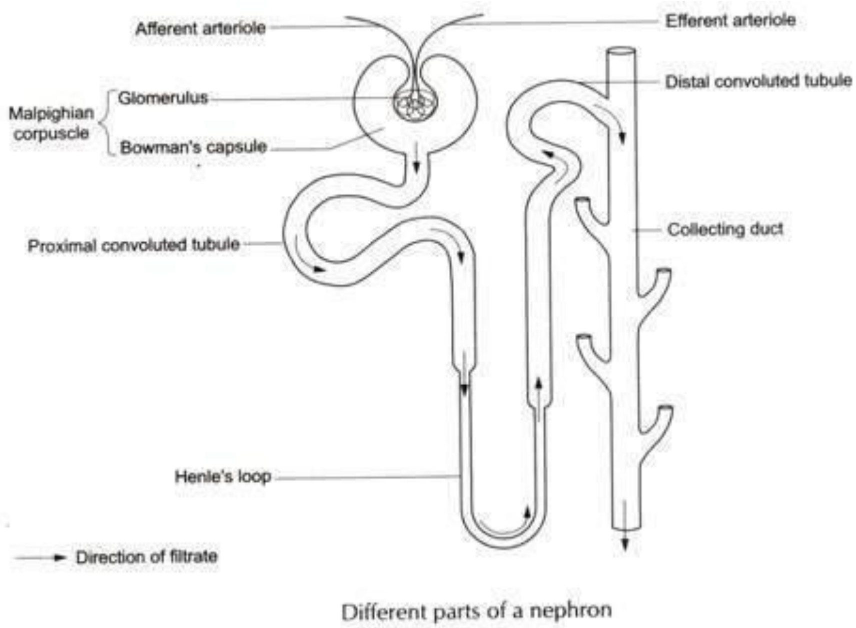


Fig. STRUCTURE OF NEPHRON

Blood supply to kidney:

Kidneys are supplied by renal arteries which are branches of abdominal aorta. Venous blood of kidney is drained by renal veins which open into inferior vena cava.

FORMATION OF URINE:

The formation of urine by kidneys involves three processes:

- Glomerular filtration
- Tubular secretion
- Tubular reabsorption

1. Glomerular filtration:

Filtration of water, salts and other substances occurs in the glomeruli. Glomerular filtrate is the fluid that is formed after filtration. About 100 ml of glomerular filtrate is formed per minute. This filtrate passes into the proximal convoluted tubule.

2. Tubular secretion:

It is an active process which occurs in the convoluted tubules. Abnormal substances or normal substances present in excess in blood are eliminated by this process. Potassium, hydrogen and drugs like penicillin are excreted by tubular secretion.

3. Tubular reabsorption:

The rate of glomerular filtration is about 100 ml per minute. So about 6 litres of glomerular filtrate can be formed in one hour. But the volume of urine eliminated per day is only about 1.5 litres. It is so, because nearly 99 percent of the glomerular filtrate is reabsorbed. Reabsorption of water occurs in the convoluted tubules and collecting tubule. In addition to water, some salts are also reabsorbed in the renal tubules.Urine is the fluid that results from the above three processes. It enters the collecting tubules and then into the pelvis of kidney. From there, it enters the urinary bladder through ureter.

URETER:

It is the duct which carries urine from the kidney to bladder. It is a tube like structure measuring about 26 cm in length. It commences from the pelvis of kidney. Later it passes down in the abdominal cavity and opens in the posterior aspect of urinary bladder. Ureter is made of 1) an outer fibrous layer 2) middle muscular layer 3) inner mucous layer.

URINARY BLADDER:

It is a pear shaped muscular sac which acts as a reservoir for urine. It lies in the pelvic cavity behind symphysis pubis. The lowest part of bladder is called as base and the upper part is called "fundus".

Bladder has three openings, two for ureters and one for urethra. The triangular area between these openings is the "trigone of the bladder".

Bladder is made of four layers 1) outer serous coat 2) muscular coat 3) sub-mucous coat 4) mucous lining made of transitional epithelium. The bladder is controlled by pelvic nerves and sympathetic fibres from hypogastric plexus.

URETHRA:

It is a canal through which urine passes from the bladder to the outside. It differs in the males and females. But a sphincter is present in both.

Male urethra :

It is about 20cm in length. It consists of three parts 1) Pelvic part 2) Perineal part 3) Pineal part.

Female urethra:

It is short and measures about 4 cm in length. It starts from the base of bladder at the trigone. It opens externally in front of vaginal opening.

MICTURITION:

It is the act of passing urine. When urine accumulates in the bladder, it produces stretching of its walls. This raises the pressure within the bladder. This occurs when 170 to 230 ml of urine has collected in the bladder. This in turn stimulates the afferent nerves of the bladder. The impulses are carried to higher centres which control micturition.

Micturition occurs due to contraction of muscular coat of the bladder and relaxation of the sphincter. It is also assisted by contraction of abdominal muscles.

Composition of urine:

The volume of urine excreted in man varies from 1 to 2 liters daily. The colour of urine is pale amber odour is aromatic and reaction is slightly acidic (pH 6). Specific gravity varies from 1010 to 1025.

Urine consists of:

Water – 96%
Urea – 2%
Uric acid and salts – 2%

SKIN:

Skin is the outer covering of body which is in contact with external environment.

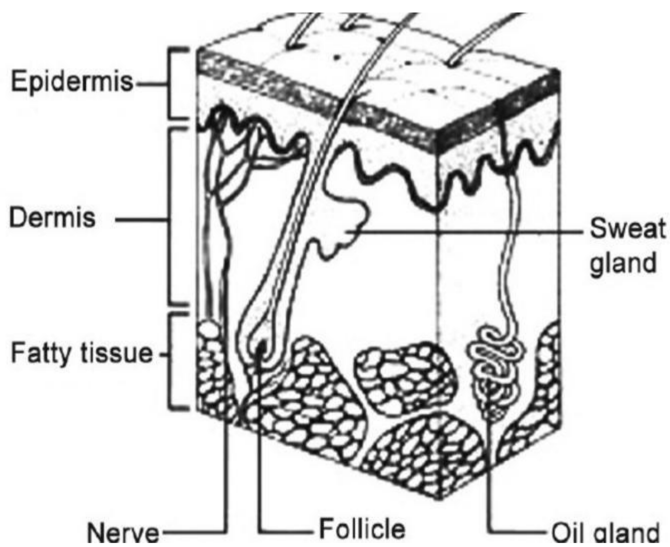


Fig. STRUCTURE OF SKIN

Structure of skin: Skin consist of

- An outer layer called **epidermis**
- An inner layer called **dermis**.

Epidermis: It is made of stratified epithelium and contains the following layers:

1. Stratum cornium : Containing scale like cells which are constantly replaced. These cells have a protein called keratin.
2. Stratum lucidum : A glistening layer
3. Stratum granulosum : Has spindle shaped cells with granules in the cytoplasm.
4. Stratum germinativum : Contains cuboidal cells. The skin cells multiply in this layer.

Dermis: It is the inner layer which forms true skin. It contains the following structures:

- Melanophore cells containing melanin pigment and some elastic fibres which maintain texture of skin.
- Arterial and venous capillaries and sensory nerve endings.
- Sweat and sebaceous glands.
- Hair roots and erector pili muscles (contraction of these muscles produce straightening of the hair).

SECRETIONS OF SKIN: The two secretions of skin are sweat and sebum.

Secretion of sweat: Sweat is secreted by sweat glands which arise from dermis. They are twisted tubular glands and their ducts open in epidermis. Sweat glands are more numerous in the palms of hands and sole of feet. About 500ml of sweat is formed in 24 hours.

Sweat contains mainly water, some salts and trace of other waste products.

Perspiration of sweating can be classified into:

- **Insensible perspiration** which evaporates quickly and so it is not observed.
- **Sensible Perspiration** Which occurs during excessive sweating? So production of sweat is more than evaporation.

The secretion of sweat is controlled by sympathetic nerves.

Secretion of sweat: Sweat is a greasy secretion produced by sebaceous glands. They have a duct which opens into hair follicle. The sebaceous glands are present in the skin of many parts except the palm of hands and sole of feet. Sebum keeps the skin oily and prevents it from drying.

Functions of skin:

- Protection of underlying structure from injury.
- Excretion of salts like sodium chloride and metabolites like urea.
- Provides sensation which gives the awareness of environment
- Secretion of sweat and sebum.
- Regulation of body temperature.
- Synthesis of Vitamin D from ergosterol of skin by the action of ultraviolet rays of sun.

REGULATION OF BODY TEMPERATURE: Regulation of body temperature is an important function performed by the skin. The normal body temperature is 98.4^0 (37^0C), It may be slightly lower in the morning and it may increase in severe muscular exercise. The normal body temperature is maintained by a balance between heat production and heat loss.

Heat production: heat can be produced in the body by the following Factors:

- Increased activity of muscles as in severe exercise.
- Increased activities of liver and other glandular structures.
- Increased metabolism like oxidation of food stuffs and combustion of fat.

Heat loss: Loss of heat occurs through the skin by:

- Conduction to objects in contact like clothing.
- Convection by which the hot air around the body moves up and it is replaced by cool air.
- Radiation by which heat is given to the surrounding air.
- Evaporation of sweat makes the skin cool and leads to heat loss.

Body temperature is controlled by 'Heat regulating centre' present in the hypothalamus.

SHORT ANSWER QUESTIONS

1. Write the main parts of excretory system?
2. What are the functions of kidneys?
3. What is micturition?
4. Write the composition of urine?
5. Draw the labeled diagram of nephron?
6. Write the functions of skin?
7. What is the normal body temperature and how it is maintained?

ESSAY QUESTIONS

1. Explain in detail about urinary system with a labeled diagram.
2. Explain in detail about the formation of urine and phenomenon of micturition?

UNIT- 11

ENDOCRINE SYSTEM

Contents:

Endocrine System: a system of small glands scattered throughout the body that influences the metabolic activities of cells through hormones

Hormones: chemical messengers released to the blood by the cells of endocrine glands that regulate the metabolic activities of other cells in the body. Hormones signal target cells to perform specific chemical reactions

Endocrine Glands: pituitary, thyroid, parathyroid, adrenal, pineal and thymus glands.

- Organs with major functions outside the endocrine system containing endocrine tissue/cells: pancreas, gonads, hypothalamus (neuroendocrine organ)
- Tissues that produce hormones also found within: adipose cells, small intestine, stomach, kidneys, heart

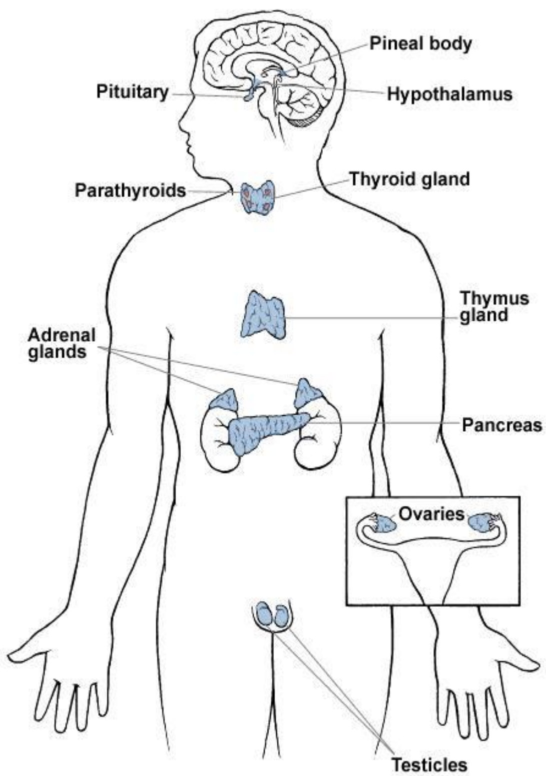


Fig. ENDOCRINE GLANDS

Major Endocrine Glands:
- Pituitary gland
- Thyroid gland
- Parathyroid gland
- Adrenal glands
- Pancreas
- Sex glands (gonads)
- Thymus
- Pineal gland

PITUITARY GLAND

The pituitary gland is situated at the base of brain in a hollow called sella turcica of sphenoid bone. It consists of two main lobes:
- Anterior lobe (anterior pituitary)
- Posterior lobe (posterior pituitary)

Anterior Pituitary (Adenohypophysis): The anterior lobe of pituitary contains three types of cells namely chromophobe, eosinophil , and basophil.

Hormones of anterior pituitary*:* The anterior lobe of pituitary secretes the following hormones:
- Growth hormone (GH)
- Prolactin (PRL)
- Follicle- stimulating hormone (FSH)
- Luteinizing hormone (LH)
- Thyroid-stimulating hormone (TSH)
- Adrenocorticotrophic hormone (ACTH)

- **Growth Hormone (GH):** Stimulates cell division in most cells (major targets are bone
  - skeletal muscle)
- **Prolactin (PRL):** Stimulates milk production by mammary glands of breasts
- **Follicle-stimulating hormone (FSH):**Stimulates gamete production in gonads (ovaries
  - testes)
- **Luteinizing hormone (LH):** Promotes production of gonadal hormones (testosterone, estrogen & progesterone)
- **Thyroid-stimulating hormone (TSH):**Stimulates normal development of &secretion of hormones from thyroid gland
- **Adreno corticotropic hormone (ACTH** *or* **corticotropin):** Stimulates release of corticosteroid hormones from adrenal cortex

Disorders of anterior pituitary:

- Hyper secretion: In children, can lead to **gigantism** after long bones have developed, can lead to **acromegaly.**
- Hypo secretion*:* In children, can lead to **pituitary dwarfism**.

Posterior pituitary (Neurohypophysis): Receives & stores hormones from hypothalamus for later release

- **Oxytocin:** Produced by paraventricular nucleus of **hypothalamus** stimulates uterine contraction during childbirth & milk ejection during nursing
- **Antidiuretic hormone (ADH):** Produced by supra optic nucleus of hypothalamus stimulates kidney tubules to retain water deficiency of ADH secretion leads to **diabetes insipidus**

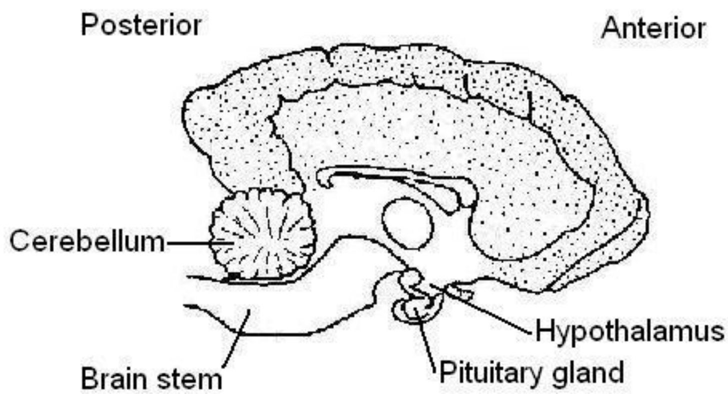


Fig. PITUITARY GLAND

THYROID GLAND:

The thyroid gland is situated in the lower part of neck on the thyroid cartilage. The thyroid gland contains two lobes, one on each side of the trachea. These two lobes are connected by an isthumus which lies in front of the trachea.

Secretions of thyroid hormones: The thyroid gland synthesizes and secretes two hormones: **thyroxine** and **tri-iodothyronine.**

- **Thyroxine (T4):** Major hormone released from thyroid follicles (contains 4 iodine molecules)
- **Tri-iodothyronine (T3):** (contains 3 iodine molecules) generally formed from T4 by leaving an iodine molecule

Thyroid hormone formed by joining 2 tyrosine-iodine complexes.

Regulation of secretion: The secretion of thyroid hormone is controlled by thyroid stimulating hormone of anterior pituitary.

Functions of thyroid hormones:

- Increases oxygen consumption and heat production in tissues.
- Increases basal metabolic rate (BMR) .
- Increases the absorption and utilization of glucose.
- Anabolic effects like growth promotion and protein synthesis.

- Increases the rate of cholesterol synthesis in liver.
- Mylination of central nervous system.
- Storage of iodine.

Disorders of thyroid function:
Hypothyroidism:

- Cretinism: which occurs due to intra- uterine thyroid deficiency. It produces mental retardation.
- Myxodema: This is due to thyroid deficiency occurring after birth. It produces retardation of physical growth.
- Endemic goiter: This occurs due to deficiency of iodine in food. It produces enlargement of the thyroid gland.

Hyperthyroidism:

Grave's disease which is due to excessive production of TSH. It produces protrusion of eye balls, rapid pulse and nervousness.

Parathyroid Glands

The parathyroid glands are four in number. They embedded on the posterior surface of the thyroid gland, two lying on each side.

Functions of Parathyroid hormone (Parathormone or PTH):

- Raises blood calcium levels by stimulating osteoclasts, enhancing absorption of calcium by kidneys, & increasing absorption of calcium by cells of intestine
- PTH activates the inactive form of vitamin D in the kidneys; vitamin D enhances absorption of calcium by intestine.

Disorders of parathyroid hormone:

- Hyper secretion: Produces osteitis fibrosa. It is characterized by decalcification of bone leading to loss of strength and fibrous appearance.
- Hypo secretion: Produces hypocalcemia which leads to tetany.

Adrenal Glands/ Suprarenal Glands

They are pyramid-shaped glands situated on the top of the each kidney. The adrenal gland can be divided into two parts which are different in structure and function. They are 1. Adrenal cortex 2.Adrenal medulla.
Adrenal Cortex: releases corticosteroid hormones. They are :

- **Mineralocorticoids:** They are **Aldosterone** and **desoxycorticosterone**. They help to maintain electrolyte and water balance of the body.
- **Glucocorticosteroids:** They are **cortisol,cortisone** and **corticosterone.**

- **Gonadocorticoids:** Secondary source of sex hormones;
  They are **androgens(**in males), and **oestrogen** (in females).

Their important functions are:

- To increase the synthesis of glycogen.
- To increase the breakdown of protein into aminoacids.

- Mobilization and redistribution of fat.
- Decreasing the production of eosinophils and lymphocytes.
- Anti-inflammatory and anti-allergic effect.

Disorders:

• **Addison's disease**: low level of adrenal cortex hormones resulting in bronzing of skin, low blood sugar (low energy & weak immunity) & low blood sodium (low blood pressure)

- **Cushing syndrome**: high level of adrenal cortex hormones resulting in high blood sugar (& possibly diabetes mellitus), high blood sodium (hypertension), swelling & obesity & possible masculinization in women

• **Adrenal medulla:** releases **catecholamines** (norepinephrine & epinephrine). Release is stimulated by **sympathetic nervous system** ("fight or flight" response)

- **Epinephrine*:*** stimulates heart rate & metabolism
- **Norepinephrine*:*** influences peripheral vasoconstriction & blood pressure.

<u>Pancreas</u>

The pancreas lies on the posterior abdominal wall in front of abdominal aorta and lumbar vertebrae.

The endocrine cells present in pancreas are the **islets of Langerhans.** They secrete **insulin** and **glucagon**.

• **Insulin:** released by beta cells of islets, lowers blood glucose levels by stimulating glucose storage & uptake of glucose by cells for energy.

- Insulin deficiency may leads to **diabetes mellitus.**
- Insulin-dependent diabetes mellitus (IDDM): autoimmune disease where immune cells attack & destroy beta cells.
- Non-insulin-dependent diabetes mellitus (NIDDM): insulin receptors do not properly respond to insulin.

• **Glucagon:** raises blood glucose levels by stimulating glucose removal from glycogen storage deposits in liver cells & gluconeogenesis

<u>Gonads (sex glands)</u>

The sex glands are **(ovaries & testes):** produce steroidal sex hormones

• **Ovaries**: Produce Estrogens, Progesterone, Inhibin & Relaxin

- **Estrogens** (estrone & estradiol) &**progesterone-** produced by ovary cells are responsible for maturation of female reproductive organs & regulation of menstrual cycle also, maintain pregnancy & prepare mammary glands for lactation
- **Inhibin -**Inhibits FSH during ovarian cycle;
- **Relaxin** released during pregnancy increases flexibility of pubic symphysis & helps dilate uterine cervix

• **Testes**: produce Testosterone, an Androgen (male sex hormone)

Testosterone produced by cells of testes is responsible for maturation of male reproductive organs & sperm cell production.

Androgen inhibits FSH to regulate spermatogenesis

Pineal Gland

It is a very small gland situated in the brain.
It secretes **melatonin.**
M**elatonin** appears to be involved in maintenance or sleep/wake (day/night) cycles

- Melatonin derived from the amino acid serotonin.
- More melatonin released in darkness, less in light, norepinephrine from sympathetic fibers stimulate secretion of melatonin (may cause sleepiness).
- During sleep, plasma levels of melatonin increase & then decrease before awakening, therapeutic use to induce sleep still under investigation.

Thymus

It is a gland present in the upper chest cavity on the trachea. It secretes Thymopoietins & Thymosins.
They involved with normal development of T cells (lymphocytes), may slow aging

Other Hormone-Producing Structures:

Heart*:* Specialized cardiac muscle cells of atria secrete atrial natriuretic peptide (ANP), which reduces blood volume, blood pressure, & blood sodium levels.
GI tract: Enteroendocrine cells secrete hormones that aid indigestion.
Placenta: Secretes steroid hormones that help during pregnancy & human chorionic gonadotropin (hCG).
Kidney: Secretes erythropoietin that stimulates red blood cell synthesis in bone marrow.
Skin: Secretes inactive vitamin D (cholecalciferol), which is activated by PTH in kidneys.
Adipose Tissue*:* secretes leptin, which binds to neurons regulating appetite control & leads to sensation of satiety.

SHORT ANSWER QUESTIONS

1. Define endocrine system and the names of endocrine glands?
2. What is hormone?
3. Write the hormones of anterior pituitary gland?
4. Mention the disorders of anterior pituitary gland?
5. Mention the disorders of Thyroid gland?
6. What are the functions of parathyroid hormones?
7. Write about insulin?
8. Write the functions of adrenal gland?
9. What are the sex glands?
10. Write about thymus?

UNIT- 12

REPRODUCTIVE SYSTEM

Contents:

The Reproductive system or Genital system is a system of sex organs within an organism which work together for the purpose of sexual reproduction. These organs are responsible for producing the egg and sperm cell gametes and hormones. These hormones function in the maturation of the reproductive system, the development of sexual characteristics, and regulation of the normal physiology of the reproductive system.

Female Reproductive System Anatomy

Ovaries

The **ovaries** are a pair of small glands about the size and shape of almonds, located on the left and right sides of the pelvic body cavity lateral to the superior portion of the uterus. Ovaries produce female sex hormones such as estrogen and progesterone as well as ova (commonly called “eggs”), the female gametes. Ova are produced from oocyte cells that slowly develop throughout a woman’s early life and reach maturity after puberty. Each month during ovulation, a mature ovum is released. The ovum travels from the ovary to the fallopian tube, where it may be fertilized before reaching the uterus.

Fallopian Tubes

The **fallopian tubes** are a pair of muscular tubes that extend from the left and right superior corners of the uterus to the edge of the ovaries. The fallopian tubes end in a funnel-shaped structure called the infundibulum, which is covered with small finger-like projections called fimbriae. The **fimbriae** swipe over the outside of the ovaries to pick up released ova and carry them into the infundibulum for transport to the uterus. The inside of each fallopian tube is covered in cilia that work with the smooth muscle of the tube to carry the ovum to the uterus.

Uterus

The **uterus** is a hollow, muscular, pear-shaped organ located posterior and superior to the urinary bladder. Connected to the two fallopian tubes on its superior end and to the vagina (via the **cervix**) on its inferior end, the uterus is also known as the womb, as it surrounds and supports the developing fetus during pregnancy. The inner lining of the uterus, known as the **endometrium**, provides support to the embryo during early development. The visceral muscles of the uterus contract during childbirth to push the fetus through the birth canal.

Vagina

The **vagina** is an elastic, muscular tube that connects the cervix of the uterus to the exterior of the body. It is located inferior to the uterus and posterior to the urinary bladder. The vagina carries sperm to the uterus and fallopian tubes. It also serves as the birth canal by stretching to allow delivery of the fetus during childbirth.

Vulva

The **vulva** is the collective name for the external female genitalia located in the pubic region of the body. The vulva surrounds the external ends of the urethral opening and the vagina and includes the mons pubis, labia majora, labia minora, and clitoris.

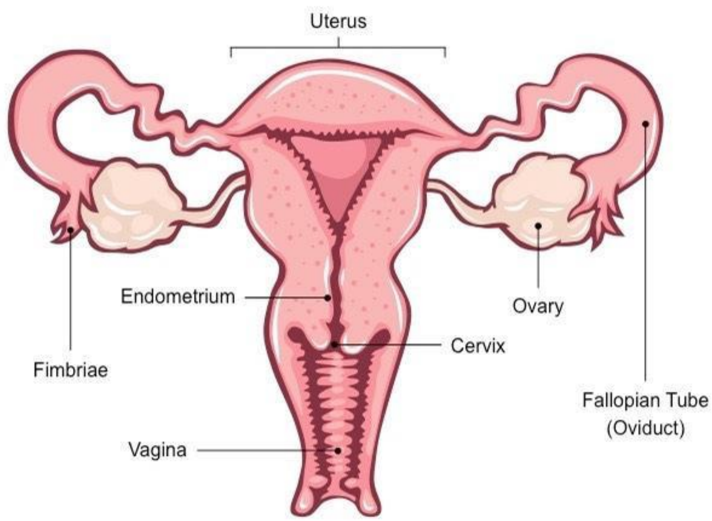


Fig. FEMALE REPRODUCTIVE SYSTEM

Breasts and Mammary Glands

The breasts are specialized organs of the female body that contain mammary glands, milk ducts, and adipose tissue. The two breasts are located on the left and right sides of the thoracic region of the body. In the center of each breast is a highly pigmented nipple that releases milk when stimulated. The areola, a thickened, highly pigmented band of skin that surrounds the nipple, protects the underlying tissues during breastfeeding. The mammary glands are a special type of glands that have been modified to produce milk to feed infants. Within each breast, 15 to 20 clusters of mammary glands become active during pregnancy and remain active until milk is no longer needed. The milk passes through milk ducts on its way to the nipple, where it exits the body.

Female Reproductive System Physiology

The Reproductive Cycle

The female reproductive cycle is the process of producing an ovum and readying the uterus to receive a fertilized ovum to begin pregnancy. If an ovum is produced but not fertilized and implanted in the uterine wall, the reproductive cycle resets itself through menstruation. The entire reproductive cycle takes about 28 days on average, but may be as short as 24 days or as long as 36 days for some women.

Oogenesis and Ovulation

Under the influence of follicle stimulating hormone (FSH), and luteinizing hormone (LH), the ovaries produce a mature ovum in a process known as ovulation. By about 14 days into the reproductive cycle, an oocyte reaches maturity and is released as an ovum. Although the ovaries begin to mature many oocytes each month, usually only one ovum per cycle is released.

Fertilization

Once the mature ovum is released from the ovary, the fimbriae catch the egg and direct it down the fallopian tube to the uterus. It takes about a week for the ovum to travel to the uterus. If sperm are able to reach and penetrate the ovum, the ovum becomes a fertilized zygote containing a full complement of DNA. After a two-week period of rapid cell division known as the germinal period of development, the zygote forms an embryo. The embryo will then implant itself into the uterine wall and develop there during pregnancy.

Menstruation

While the ovum matures and travels through the fallopian tube, the endometrium grows and develops in preparation for the embryo. If the ovum is not fertilized in time or if it fails to implant into the endometrium, the arteries of the uterus constrict to cut off blood flow to the endometrium. The lack of blood flow causes cell death in the endometrium and the eventual shedding of tissue in a process known as menstruation. In a normal menstrual cycle, this shedding begins around day 28 and continues into the first few days of the new reproductive cycle.

Pregnancy

If the ovum is fertilized by a sperm cell, the fertilized embryo will implant itself into the endometrium and begin to form an amniotic cavity, umbilical cord, and placenta. For the first 8 weeks, the embryo will develop almost all of the tissues and organs present in the adult before entering the fetal period of development during weeks 9 through 38. During the fetal period, the fetus grows larger and more complex until it is ready to be born.

Lactation

Lactation is the production and release of milk to feed an infant. The production of milk begins prior to birth under the control of the hormone prolactin. **Prolactin** is produced in response to the suckling of an infant on the nipple, so milk is produced as long as active breastfeeding occurs. As soon as an infant is weaned, prolactin and milk production end soon after. The release of milk by the nipples is known as the "milk-letdown reflex" and is controlled by the hormone oxytocin. **Oxytocin** is also produced in response to infant suckling so that milk is only released when an infant is actively feeding.

ANATOMY OF THE MALE REPRODUCTIVE SYSTEM

Scrotum

The **scrotum** is a sac-like organ made of skin and muscles that houses the testes. It is located inferior to the penis in the pubic region. The scrotum is made up of 2 side-by-side pouches with a testis located in each pouch. The scrotum helps in maintaining the low temperature (2-2.5^0 C lower than the normal internal body temperature) of testes necessary for spermatogenesis.

Testes

The 2 **testes**, also known as testicles, are the male gonads responsible for the production of sperm and **testosterone**. The testes are ellipsoid glandular organs around 1.5 to 2 inches long and an inch in diameter. Each testis is found inside its own pouch on one side of the scrotum and is connected to the abdomen by a spermatic cord and cremaster muscle. The **cremaster** muscles contract and relax along with the scrotum to regulate the temperature of the testes. The inside of the testes is divided into small compartments known as lobules. Each lobule contains a section of seminiferous tubule lined with epithelial cells. These epithelial cells contain many stem cells that divide and form sperm cells through the process of spermatogenesis.

Epididymis

The **epididymis** is a sperm storage area that wraps around the superior and posterior edge of the testes. The epididymis is made up of several feet of long, thin tubules that are tightly coiled into a small mass. Sperm produced in the testes moves into the epididymis to mature before being passed on through the **male reproductive organs**. The length of the epididymis delays the release of the sperm and allows them time to mature.

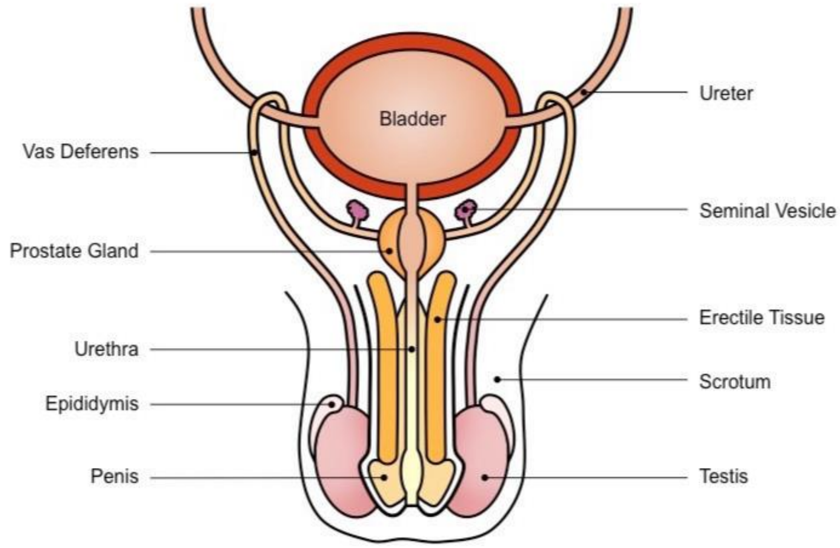


Fig. MALE REPRODUCTIVE SYSTEM

Spermatic Cords and Duct us Deferens

Within the scrotum, a pair of spermatic cords connects the testes to the abdominal cavity. The spermatic cords contain the ductus deferens along with nerves, veins, arteries, and lymphatic vessels that support the function of the testes.

The **ductus deferens**, also known as the vas deferens, is a muscular tube that carries sperm superiorly from the epididymis into the abdominal cavity to the ejaculatory duct. The ducts' deferens is wider in diameter than the epididymis and uses its internal space to store mature sperm. The smooth muscles of the walls of the ductus deferens are used to move sperm towards the ejaculatory duct through peristalsis.

Seminal Vesicles

The **seminal vesicles** are a pair of lumpy exocrine glands that store and produce some of the liquid portion of semen. The seminal vesicles are about 2 inches in length and located posterior to the urinary bladder and anterior to the rectum. The liquid produced by the seminal vesicles contains proteins and fructose to feed sperm cells so that they survive long enough to fertilize the oocyte.

Ejaculatory Duct

The **ductu**s deferens passes through the prostate and joins with the urethra at a structure known as the ejaculatory duct. The ejaculatory duct contains the ducts from the seminal vesicles as well. During ejaculation, the ejaculatory duct opens and expels sperm and the secretions from the seminal vesicles into the urethra.

Urethra

Semen passes from the ejaculatory duct to the exterior of the body via the urethra, an 8 to 10 inch long muscular tube. The urethra passes through the prostate and ends at the external urethral orifice located at the tip of the penis. Urine exiting the body from the urinary bladder also passes through the urethra.

Prostate

The **prostate** is a walnut-sized exocrine gland that borders the inferior end of the urinary bladder and surrounds the urethra. The prostate produces a large portion of the fluid that makes up semen. This fluid is milky white in color and contains enzymes, proteins, and other chemicals to support and protect sperm during ejaculation. The prostate also contains smooth muscle tissue that can constrict to prevent the flow of urine or semen.

Cowper's Glands

The **Cowper's glands**, also known as the **bulbourethral** glands, are a pair of pea-sized exocrine glands located inferior to the prostate and anterior to the anus. The Cowper's glands secrete a thin alkaline fluid into the urethra that lubricates the urethra and neutralizes acid from urine remaining in the urethra after urination. This fluid enters the urethra during sexual arousal prior to ejaculation to prepare the urethra for the flow of semen.

Penis

The **penis** is the male external sexual organ located superior to the scrotum and inferior to the umbilicus. The penis is roughly cylindrical in shape and contains the urethra and the external opening of the urethra. The function of the penis is to deliver semen. In addition to its reproductive function, the penis also allows for the excretion of urine through the urethra to the exterior of the body.

Semen

Semen is the fluid produced by males for sexual reproduction .Semen contains sperm, the male reproductive gametes, along with a number of chemicals suspended in a liquid medium. The chemical composition of semen gives it a thick, sticky consistency and a slightly alkaline pH.In healthy adult males, semen contains around 100 million sperm cells per milliliter. These sperm cells fertilize oocytes inside the female fallopian tubes.

Physiology of the Male Reproductive System

Spermatogenesis

Spermatogenesis is the process of producing sperm and takes place in the testes and epididymis of adult males. Prior to puberty, there is no spermatogenesis due to the lack of hormonal triggers. At puberty, spermatogenesis begins when luteinizing hormone (LH) and follicle stimulating hormone (FSH) are produced. LH triggers the production of testosterone by the testes while FSH triggers the maturation of germ cells. Testosterone stimulates stem cells in the testes known as spermatogonium to undergo the process of developing into spermatocytes. Each diploid spermatocyte goes through the process of meiosis I and splits into 2 haploid secondary spermatocytes. The secondary spermatocytes go through meiosis II to form 4 haploid spermatid cells. The spermatid cells then go through a process known as spermiogenesis where they grow a flagellum and develop the structures of the sperm head. After spermatogenesis, the cell is finally a sperm cell, or spermatozoa. The spermatozoa are released into the epididymis where they complete their maturation and become able to move on their own.

Fertilization

Fertilization is the process by which a sperm combines with an oocyte, or egg cell, to produce a fertilized zygote. The sperm released during ejaculation must first swim through the vagina and uterus and into the fallopian tubes where they may find an oocyte. After encountering the oocyte, sperm next have to penetrate the outer corona radiata and zona pellucida layers of the oocyte. Sperm contain enzymes in the acrosome region of the head that allow them to penetrate these layers. After penetrating the interior of the oocyte, the nuclei of these haploid cells fuse to form a diploid cell known as a zygote. The zygote cell begins cell division to form an embryo.

FAMILY PLANNING AND CONTRACEPTIVE METHODS

Family planning allows people to attain their desired number of children and determine the spacing of pregnancies. It is achieved through use of contraceptive methods and the treatment of infertility .

BENEFITS OF FAMILY PLANNING / CONTRACEPTION
Preventing pregnancy-related health risks in women
A woman's ability to choose if and when to become pregnant has a direct impact on her health and well-being. Family planning allows spacing of pregnancies and can delay pregnancies in young women at increased risk of health problems and death from early childbearing. It prevents unintended pregnancies, including those of older women who face increased risks related to pregnancy.

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Reducing infant mortality

Family planning can prevent closely spaced and ill-timed pregnancies and births, which contribute to some of the world's highest infant mortality rates. Infants of mothers who die as a result of giving birth also have a greater risk of death and poor health.

Helping to prevent HIV/AIDS

Family planning reduces the risk of unintended pregnancies among women living with HIV, resulting in fewer infected babies and orphans. In addition, male and female condoms provide dual protection against unintended pregnancies and against STIs including HIV.

Empowering people and enhancing education:

Family planning enables people to make informed choices about their sexual and reproductive health. Family planning represents an opportunity for women to pursue additional education and participate in public life, including paid employment in non-family organizations. Additionally, having smaller families allows parents to invest more in each child. Children with fewer siblings tend to stay in school longer than those with many siblings.

Reducing adolescent pregnancies:

Pregnant adolescents are more likely to have preterm or low birth-weight babies. Babies born to adolescents have higher rates of neonatal mortality. Many adolescent girls who become pregnant have to leave school. This has long-term implications for them as individuals, their families and communities.

Slowing population growth:

Family planning is key to slowing unsustainable population growth and the resulting negative impacts on the economy, environment, and national and regional development efforts.

METHODS OF CONTRACEPTION:

There are different methods of contraception, including:

- long-acting reversible contraception
- hormonal contraception,
- barrier methods
- emergency contraception
- fertility awareness
- Permanent contraception.

LONG-ACTING REVERSIBLE CONTRACEPTION:

Long-acting reversible contraception (LARC) is a contraceptive that lasts for a long time.

- The intra uterine device (IUD) that lasts for five to ten years
- The implant that lasts for three or five years.

LARCs are the most effective types of contraception. They are more than 99% effective at preventing pregnancy.

HORMONAL CONTRACEPTIVES

These are contraceptives that use hormones to prevent pregnancy. Hormonal contraceptives include the **pill** and the **Depo Provera injection**.

There are two types of **pill**:

- combined oral contraceptive pill
- progestogen-only contraceptive pill

The **Depo Provera injection** is another type of hormonal contraception.

BARRIER METHODS

Barrier methods stop sperm from entering the vagina. The two barrier methods are:

- condoms
- internal condoms

Condoms protect against sexually transmissible infections (STIs) as well as unintended pregnancy.

These can buy from online shops and from some pharmacies, supermarkets and other shops.

EMERGENCY CONTRACEPTION

There are two types 1.Emergency Contraceptive Pill (ECP) 2. Copper IUD.

The ECP is approved to be taken up three days after unprotected sex. For women of an average weight, the ECP is 98% effective.

For women who weigh more than 70kg, a copper IUD is recommended.

FERTILITY AWARENESS

Fertility awareness is learning the signs of fertility in your menstrual cycle to help you plan or avoid a pregnancy.

PERMANENT CONTRACEPTION

Permanent contraception, sometimes called sterilization, prevents all future pregnancies. It is very difficult or impossible to reverse. For males it is **vasectomy** and for females it is **tubal ligation**.

SHORT ANSWER QUESTIONS

1. Write the parts of male reproductive system?
2. Write the parts of female reproductive system?
3. Write about testis?
4. Write about uterus?
5. What are the functions of ovaries?
6. Write about fallopian tubes?
7. What is pregnancy?
8. Write the different types of contraceptive methods?
9. Write the benefits of family planning?

PHYSIOTHERAPY

Paper - II

PSYCHOLOGY & ABNORMAL PSYCHOLOGY

INDEX

UNIT- 1

PSYCHOLOGY

Contents:

INTRODUCTION

Psychology studies and explains the behaviour of entire living organisms. The term behaviour includes the cognitive, Conative and affective, conscious, subconscious or unconscious, implicit or explicit. It also includes the behaviour of people from infancy to old age, the normal as well as abnormal.

Meaning and Definitions of Psychology:

Psychology is the scientific study of behaviour and mental processes. Behaviour includes all of our outward or overt actions and reactions, such as verbal and facial expressions and movements.

Mental processes refer to all the internal and covert activity of our mind such as thinking, feeling and remembering. It is a scientific study because to study behaviour and mental processes, the psychologists use the scientific methods for understanding more precisely and accurately.

The word Psychology has its origin from two Greek words '**Psyche**' and **'Logos'**, 'psyche' means **'soul'** and 'logos' means '**study**'. Thus literally, Psychology means '**the study of sou**l' or '**science of soul'**.

1. The first definition of the Psychology was the study of the soul:

The earliest attempts at defining Psychology owe their origin to the most mysterious and philosophical concept, namely that of soul. What is soul? How can it be studied? The inability to find clear answers to such questions led some ancient Greek philosophers to define psychology as the study of the mind.

2. In terms of the study of the mind:

Although the word mind was less mysterious and vague than soul, yet it also faced the same questions, namely what is mind? How can it be studied, etc. This definition was also rejected.

3. In terms of the study of consciousness:

The description and explanation of the states of consciousness is the task of Psychology which is usually done by the instrument introspection—process of looking within.

This definition was also rejected on the grounds that:

- It could not include the study of the consciousness of animals.

- It would not include subconscious and unconscious activities of mind.
- The introspection method for the study proved that it is most subjective and unscientific method.

- **In terms of the study of behaviour:**

The most modern and widely accepted definition of psychology even today, is the study of behaviour, both humans and animals.

William McDougall:

In his book An Outline of Psychology, "Psychology is a science which aims to give us better understanding and control of the behaviour of the organism as a whole".

JB Watson:

Psychology is "the science of behaviour" (taking into account the human as well as animal behaviour).

NL Munn:

"Psychology is the science and the properly trained psychologist is a scientist or at least a practitioner who uses scientific methods and information resulting from scientific investigations".

SCOPE OF PSYCHOLOGY

The subject-matter of our science is, then, the Soul or Mind. The psychologist investigates those phenomena which we call sensations, perceptions, thoughts, volitions, and emotions, he analyzes them, classifies them, and seeks to reduce them to the smallest number of fundamental activities. He studies the nature of their exercise and the laws which govern their operations, and he endeavors to enunciate a body of general truths which will accurately describe their chief and most characteristic features. But Psychology cannot rest here. Whether it wishes it or not, Psychology is inevitably a branch of Philosophy. It cannot remain satisfied with the mere generalization of facts, it must pass on to inquire into the inner nature and constitution of the root and subject of this phenomena. It must seek to explain the effect by its cause. Consequently a work which does nothing more than describe and classify the operations of the mind, omitting all discussion regarding the mind itself, is but an abortive attempt at a science of Psychology.

Besides the fact that the chief interest for mankind in Psychology is due to the expectation that some information as regards the nature of the soul itself can be thence derived, there is another reason for the explicit treatment of these metaphysical problems here. The two sets of questions are incapable of isolation. They can never be really separated. Our final conclusions as regards many vital philosophical problems are necessarily determined by the view taken of the nature of mental activity in the empirical part of the science. The sensationalist doctrines, for instance, on perception, intellectual cognition, or volition, cannot be reconciled with the intuitionalist conception of the mind. It is, consequently, only fair to the reader that the philosophical conclusions to which the treatment of mental phenomena presented to him logically lead, and should be clearly pointed out.

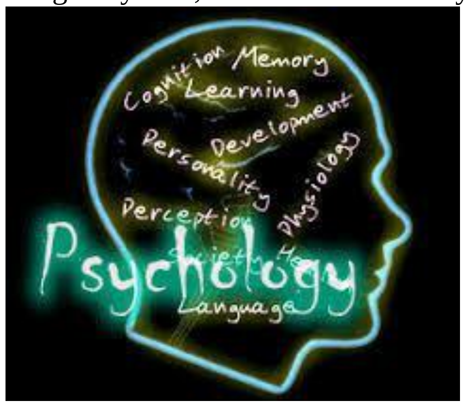


FIG - PSYCHOLOGY

BRANCHES OF PSYCHOLOGY

The subject psychology is grouped into different branches for the sake of convenience and specialized study. First we divide it into two broad categories, namely pure psychology and applied psychology. Pure psychology provides the frame work and theory. It contains deals with the formulation of psychological principles and theories. In applied psychology the theory generated or discussed through pure psychology fids its practical shape. Here we discuss ways and means of the applications of psychological rules.

1**. Pure Branches**:

Pure branches provide the theoretical frame work of the subject. These branches deal with formulation of principles, theories and suggest different methods for the assessment of behaviour. The pure branches also suggest certain techniques for the modification of problematic behaviour.

The important pure branches are:

a. General psychology:

This branch deals with the fundamental rules, principles and theories of psychology in relation to the study of behaviour of normal adult human beings. It explains various psychological processes like sensations, perceptions, emotions, learning, intelligence, personality, etc.

b. Physiological psychology:

This branch describes the biological basis of behaviour. There is a close relationship between body and mind; the functions of each other are mutually influenced. The functioning of the brain, nervous system, endocrine glands and their relation to cognitive, Conative and affective behaviour is explained in this branch of psychology.

c. Developmental psychology:

Human life passes through various stages of development from conception to old age. This branch explains the growth and development of various processes in relation to behaviour.

d. Child psychology:

Childhood extends from 2 to 12 years. This is a crucial period in the life. Future life depends upon development during childhood. Growth and development will be rapid during this stage. Child psychology deals with these aspects.

e. Animal psychology:

This branch deals with behaviour of animals. Many psychological experiments are conducted to know the functioning of mind in animals. Animals like rats, dogs, chimpanzees, pigeons, guinea pigs, cats are some of the animals used for experimentation. Findings of these experiments are many times generalized to human behavior also.

f. Abnormal psychology:

Today the life is complex. The individual is facing a lot of competition and experiencing frustrations and conflicts. Constant pressures in life are leading to psychological abnormalities. Abnormal psychology deals with various kinds of mental disorders, their symptoms and causes.

g. Social psychology:

Human being is a social animal. Naturally the behavior of an individual is influenced by society and in turn influences the society. Social psychology deals with interrelationships of people among themselves, likes and dislikes of people, attitudes and interests, the prejudices and social distances people have, group behaviour, group cohesiveness, group conflicts, etc.

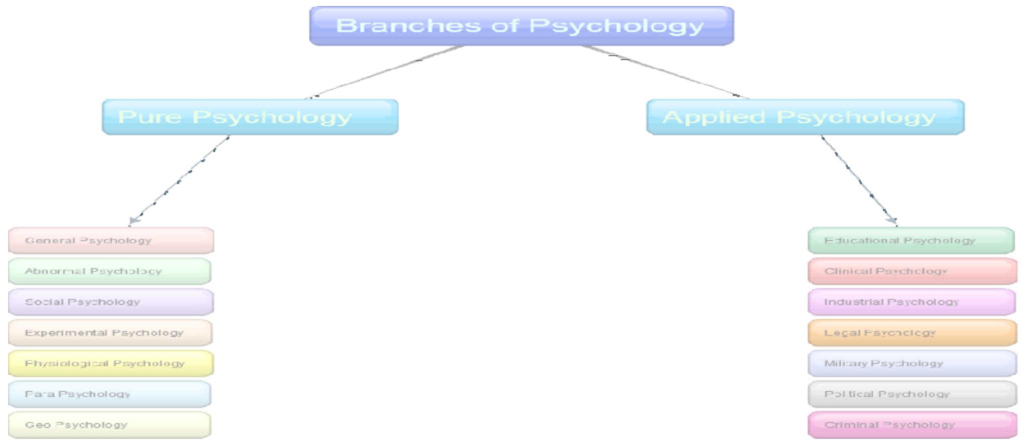


FIG – BRANCHES OF PSYCHOLOGY

- **Applied Branches**

Applied branches deal with the application of psychological principles and techniques for approaching the problems in different fields of life.

a. Educational psychology:

This is the most important field where psychological principles are applied. In the field of education 'learner' is the focal point. Other aspects like management, teachers, teaching and learning aids are all meant for learners.Learners differ in their abilities, hence they need different approaches of teaching, learning material, etc. This branch addresses to the problems and improvement in teaching and learning processes.

b. Clinical psychology:

This branch deals with the therapeutic aspect of mental disorders. There are many types of mental illness requiring varied types of therapies like chemotherapy, psychotherapy, recreational and occupational therapies, behaviour therapy, etc.

c. Industrial psychology:

Human beings are different from machines. They will have many problems in their work place like adjustment, safety, security, health, financial and such other problems. Both the management and workers need to cooperate in dealing with such problems. Industrial psychology seeks application of psychological principles, theories and techniques for the study of all these problems and the industrial environment.

d. Counseling psychology:

Mental disorders may not be completely and easily cured just by drugs and other physical therapies.In addition to other therapies, these patients need counseling also. Counseling is a process in which an interaction takes place between a trained counselor and a client. This branch also helps people to overcome adjustment problems.

***e. Environmental psychology*:**

Environmental psychology is the psychological study of humans and their interactions with their environments. The types of environments studied are limitless, ranging from homes, offices, classrooms, factories, nature, and so on. However, across these different environments, there are several common themes of study that emerge within each one. Noise level and ambient temperature are clearly present in all environments and often subjects of discussion for environmental psychologists. Crowding and stressors are a few other aspects of environments studied by this sub-discipline of psychology. When examining a particular environment, environmental psychology looks at the goals and purposes of the people in the using the environment, and tries to determine how well the environment is suiting the needs of the people using it. For example, a quiet environment is necessary for a classroom of students taking a test, but would not be needed or expected on a farm full of animals. The top common, more well known areas of psychology that drive this applied field include: cognitive, perception, learning, and social psychology.

f . Military psychology

This branch of psychology is concerned with the use of psychological principles and techniques in the world of military science. How to keep the morale of the soldiers and citizens high during war time,how to fight war of propaganda and intelligence services, How to secure better recruitment of the personnel for the armed forces and how to improve the fighting capacities and organisational climate and leadership etc.

ESSAY ANSWER QUESTIONS

1.Explain in detail about pure and applied branches of psychology?

UNIT- 2

PERCEPTION and ILLUSION
THINKING, REASONING AND PREOBLEM SOLVING

Contents:

PERCEPTION

Everyday different stimuli around us will be stimulating our sense organs. Many of these stimuli are received by our sense organs and are converted into sensations. These sensations are transmitted to the concerned parts of brain. In turn the brain will interpret these sensations. It is only after such interpretation we understand what the stimulus is. Hence in understanding the world around us, attention occurs first, followed by sensation and finally interpretation by brain. This process of 'interpretation of stimulus is known as perception. So perception involves two processes: sensation and interpretation. But interpretation of any stimulus requires past experience also. For example, a child who has not seen an elephant earlier either in photo or directly cannot identify that animal, whereas another child who has seen earlier will identify the animal easily.

Hence, perception may be defined as "a process of interpretation of a present stimulus on the basis of past experience".

E.G.Boaring, H.S.Langfield & H.P.Weld –Perception is the" first event in the chain which leads from stimulus to action"

Charles G.Morris-" All the processes involved in creating meaningful patterensd out of a jumble of sensory impressions fall under the general category of perception "

Perception is not as simple as said here. It is an integrated approach. It is a synthetic process where different physiological and psychological processes are involved. For example, the accuracy of sense organs, clarity of sensations, mental set of an individual, etc. Otherwise our perception may go wrong.

Principles of Perceptual Organisation:

William James American psychologist has said if we understand the world as it appears to us, it will be a big booming- buzzing confusion. Hence, we do not see the things as they appear, but we see them as we want, i.e. more meaningfully. In perceptual process we select a particular stimulus with our attention and interpret it. In the same way whenever it is necessary many discrete stimuli in our visual field are organised into a form and perceived more meaningfully than they appear.

This phenomenon was well explained by Gestalt psychologists. They believed that the brain creates a coherent perceptual experience by perceiving a stimulus as a whole than perceiving discrete entities. This is more meaningfully stated in the gestalt principle as 'the whole is better than sum total of its parts'. This is explained under many sub-principles of perception.

- Figure-ground Relationship:

According to this principle any figure can be perceived more meaningfully in a background and that figure cannot be separated from that background. For example, letters written with a white chalk piece are perceived clearly in the background of a blackboard.

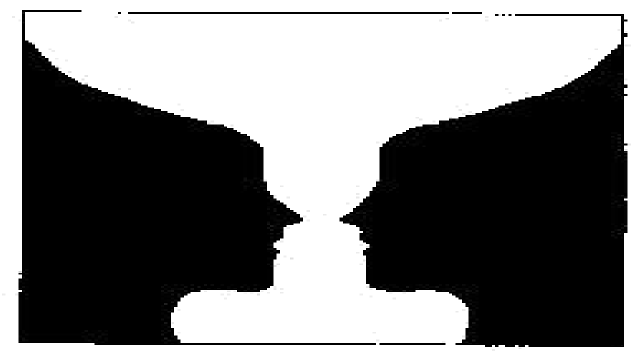


FIG – FIGURE GROUND RELATION

In the above figure two faces can be seen in the background of a white colour. So also the white background can be perceived as a vessel in the background of two faces.

- Grouping of Stimuli

As said above, according to gestalt principle, the objects can be perceived meaningfully when they are grouped together. There are some principles which are followed by us in order to make our perception more meaningful. They are as follows:

a. Similarity

Stimuli need not be nearer to each other for perception. If there is similarity in these objects, they are grouped together and perceived, even if they are away. For example, in this Figure grouping will be done according to similarity, i.e. all circles, squares and triangles are grouped separately

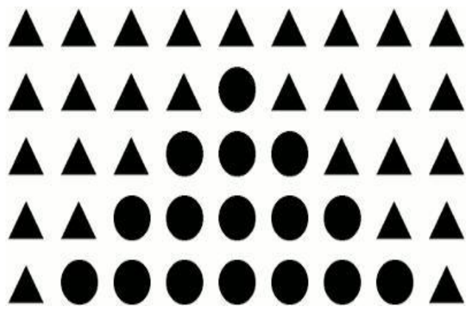


FIG – PRINCIPE OF SIMILARITY

b. Proximity:

Proximity means nearness. The objects which are nearer to each other can be perceived meaningfully by grouping them. For example the thirty six dots grouped in their close proximity appear as a square while the same thirty six dots grouped in four appear as nine squares

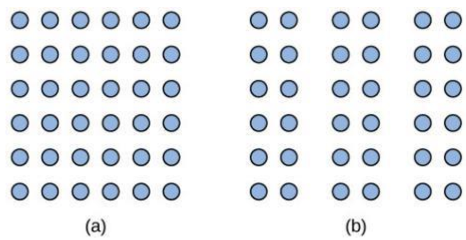


FIG – PRINCIPLE OF PROXIMITY

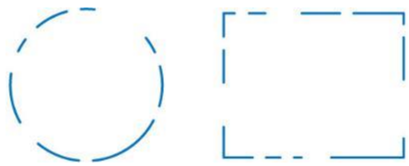
c. Continuity:

Any stimulus which extends in the same direction or shape will be perceived as a whole Figure and For example, in this figure though the curved line is broken, it is perceived as a continuous line, so also straight line is not seen with semicircles but as a continuous line the dots are perceived as existing in the same line of direction continuously.

FIG – PRINCIPLE OF CONTINITY

d. Closure:

When a stimulus is presented with gaps, the human tendency is to perceive that figure as complete one by filling the gaps psychologically. For example, in the Figure the gaps are filled psychologically and perceived as a circle and a rectangle.



. **FIG – PRINCIPLE OF CLOSURE**

- Perceptual Constancy:

This refers to stableness in perception. We have a tendency to perceive the objects as relatively stable and unchanging in shape and size, inspite of a change in the image that we receive. For example, when we see a person from 5′ distance, the size of the image in our eyes differs from the image of the same person from 100′ distance. Even then we perceive him as the same person. When we see people and houses from the top of hill, the images will be very small like Lillyputs. But we do not get confused by this. We perceive them correctly according to their actual size. Perceptual constancy depends upon several factors like past experience, expectancy, habits, motivations, cognitive styles, learning, imagination, etc.

Types of perceptual constancy:

There are different types of perceptual constancies. They are shape, brightness and colour, size constancy, etc.

Depth Perception:

Ability of a person to perceive the distance is known as depth perception. This is very important ability to judge the distance between us and other people, objects and vehicles moving particularly when we are on roads. This is also known as third dimension. The other two dimensions are left and right, and above and below

Cues:

Depth perception is possible due to certain cues. These cues help us to understand the distance between one person and the other person or object.

These are of two types:

Monocular cues:

These are the cues that can operate when only one eye is looking. Some of such cues are:

a Linear perspective:

The distances separating the images of far objects appear to be smaller. For example, imagine that you are standing in the center of the road and looking off into the distance. It appears that the road would seem to run closer and closer together at the other end.

FIG.- LINEAR PERSPECTIVE:

b Aerial perspective:

The nearer objects appear clearer than the distant objects. For example, a hill in far of distance appears farther away because the details do not seem clearly.

FIG - AERIAL PERSPECTIVE

c Interposition:

When one object obstructs our view of another, the front one appears nearer than the partly covered one. For example, the hill which appears full is definitely nearer than the partly seen.

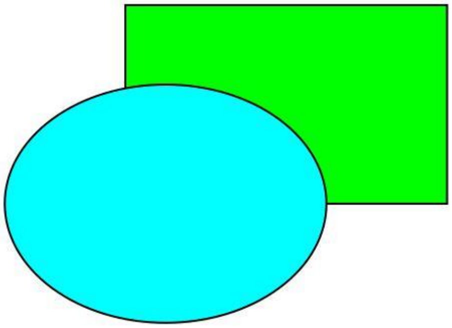


FIG - INTERPOSITION:

d Gradient structure:

A gradient is a continuous change in something- a change without abrupt transitions. Usually the regions closer to the observer have a coarse texture and many details. As the distance increases, the texture becomes finer and finer. This happens very gradually and gives a cue about the depth or distance for example the structures which are nearer appear larger than the distant one which appears smaller as the move away.

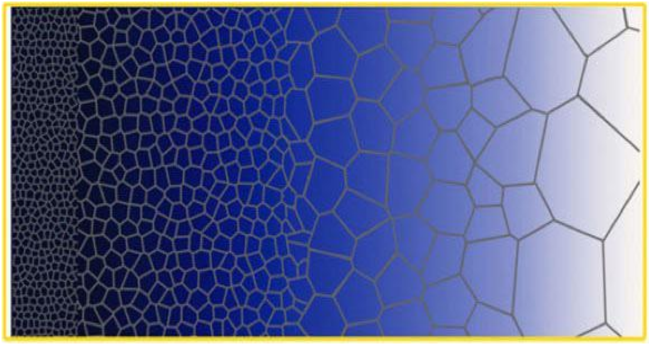


FIG - GRADIENT STRUCTURE

There are some other monocular cues also viz., movement, shadow, etc.

Binocular cues:

Sometimes the depth can be perceived when both eyes are used. This is called binocular cue. There are 2 binocular cues:

a. Retinal disparity:

The image of the object which falls on both the retinas differs. Disparity will be more when the object is closer than when it is far away. Depending upon the correspondence between the distance and the amount of disparity, the depth can be perceived.

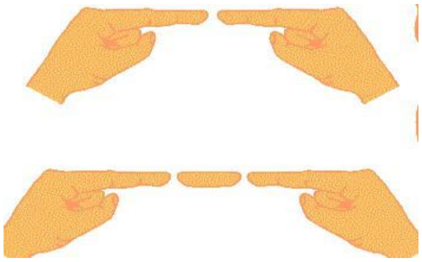


FIG - RETINAL DISPARITY

b. Convergence or divergence:

When the object moves nearer and nearer to our eyes, our eyeballs converge, and as the object moves away from us the eyeballs diverge. This process acts as a binocular cue to perceive the depth.

- Perception of Movement:

When a particular object appears in different places at different times we understand that the object is in movement. This process is called perception of movement. Such an ability to perceive movement is gained from birth itself as a natural process.

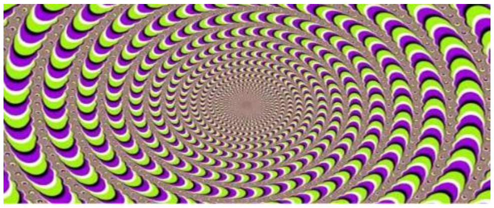


FIG - PERCEPTION OF MOVEMENT

This is a most important ability. It is only by this ability the organism can understand the world around and can perceive the dangers / threats in the movement, so that it can easily escape from such dangers.

- Apparent motion:

Sometimes we perceive that the objects are moving. In fact the objects are stationary, i.e. they will not be moving. Hence the perception of an object which is not moving, as an object moving is an illusion. For example, when we are moving fast in a bus, the trees, plants and other non-moving objects appear to move in the opposite direction.

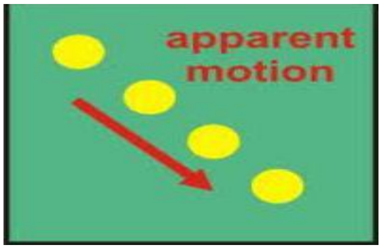


FIG – APPARENT MOTION

In the same way, even the movements of figures in a film appear to move, though they remain without movement. Since moving pictures are taken continuously and the film reel is run very fast, it produces a movement feeling called stroboscopic motion or phi phenomenon.

ILLUSIONS

Illusion is a false perception. Here the person will mistake a stimulus and perceive it wrongly. For example, in the dark, a rope is mistaken as a snake or vice versa. The voice of an unknown person is mistaken as a friend's voice. A person standing at a distance who is not known may be perceived as a known person.

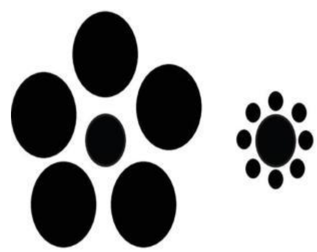
Most of our illusions are visual and auditory. But illusions pertaining to other senses are also possible.

Types of illusions:

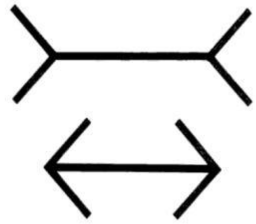
1. Optical illusion 2. Tactile illusion 3. Auditory illusion.

1. **Optical illusion:**

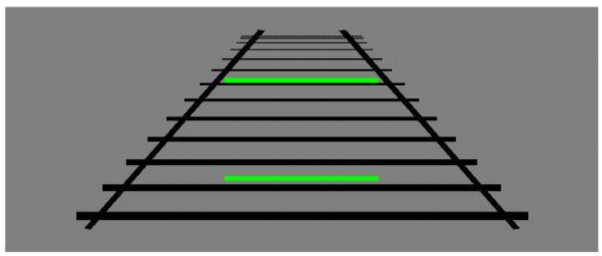
Illusion of size: illusion of this type provides false perception of the size of the objects. For example, a foot ball in the hands of a child may be perceived larger than on e in the hands of an adult, despite the fact that the foot ball is virtually the same size in both situations.



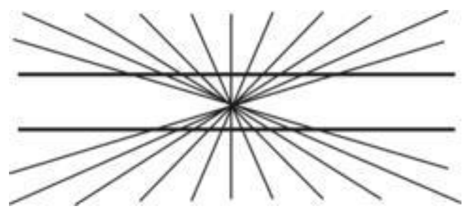
Illusion of length: The most well known version of the Müller-Lyer illusion consists of two parallel lines, one of which ends in inward pointing arrows, the other which ends with outward pointing arrows. When observing the two lines, the one with the inward pointing arrows appears to be significantly longer than the other. In other versions, one of each type of arrow is put at each end of a single line. The viewer attempts to identify the middle point of the line, only to find that he/she is consistently off to one side.



Illusion of perspective This is the famous Ponzo illusion. It is caused on account of misleading perspective cue as we hasten to add a third dimension to the stimulus. The top line looks larger simply because it appears to be farther away.



Illusion of curvature: visual illusion in which a semicircle appears more curved than a shorter circular arc with the same radius of curvature



Horizontal – vertical illusion: The vertical–horizontal illusion is the tendency for observers to overestimate the length of a vertical line relative to a horizontal line of the same length. This involves a bisecting component that causes the bisecting line to appear longer than the line that is bisected.

2. **Auditory Illusions**

While optical illusions deceive the eyes through visual images, auditory illusions mislead the ears through sounds. These sounds are usually those that are not really present in the physical stimulus, but is heard by the ears and perceived as a sound related to the stimulus in the environment. There are also auditory illusions that come from "impossible sounds", such as the Shepard tone which appears to continually ascend and descend in pitch but actually does not.

3. **Tactile Illusion**

While optical and auditory illusions are common manifestations of several psychological disorders such as schizophrenia and psychosis, tactile illusion is experienced by patients who have undergone amputation. The phantom limb is a tactile illusion wherein the patient still 'feels' pain on the leg, arm, or digit that has already been removed.

HALLUCINATION:

Sometimes we come across instances where the individual perceives some stimulus, even when it is not present. This phenomenon is known as hallucination. The person may see an object, person, etc. or he may listen to some voice though there are no objects and sounds in reality.

Hallucinations pertain to all the sensations appear in people, but visual and auditory hallucinations are more common. Usually persons with unsound mind, emotionally disturbed, alcoholics and those who are in confused states may experience hallucinations. However, among abnormal people and intoxicated persons hallucinations are very common.

THINKING

Meaning and Definition

Thought or thinking is a mental process which allows beings to model the world, and so to deal with it effectively according to their goals, plans, and desires. Words referring to similar concepts and processes include cognition, consciousness, idea, and imagination.

Thinking involves the deeply cereberal manipulation of information, as when we form concepts, engage in problem solving, reason and make decisions. Thinking is a higher cognitive function and the analysis of thinking processes is part of cognitive psychology.

Acc**.Ross**:“Thinking is a mental activity in its cognitive aspect or mental activity with regard to psychological aspects”.

Acc.**Gilmer**:"Thinking is a problem-solving process in which we use ideas or symbols in place of overt activity"

Nature of thinking:

- It is essentially a cognitive activity
- it is always directed to achieve some end or purpose
- it is described as a problem solving behavior
- it is a symbolic activity
- it is mental exploration instead of motor explanation
- it can shift very rapidly
- it is an internal activity

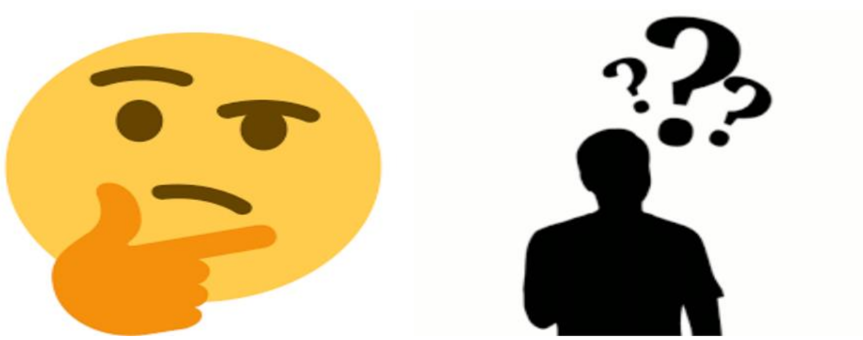


FIG – THINKING

Tools of Thinking

The various tools which are involved in thinking process are

Images: In thinking, we usually manipulate the images instead of actual objects, or experiences.

Concepts: Thinking always takes place by using the concepts in the mind. Without concepts there cannot be thinking, because everything around us is recorded in the brain in the form of concepts. Concepts decrease the efforts in thinking. Ex. When we listen the word elephant, we not only reminded about the nature of elephant but also our particular experience and understanding about them will come into consciousness.

Symbols and signs: They substitute the actual objects, experiences and activities. Ex: Traffic lights, railway signals, school bells, etc.

Language: It is the most efficient and developed tool in the process of thinking. Generally we think in our mother tongue or the language which is very familiar to us. Our thinking will flow like stream because of language. When one listens or reads a sentence, one is stimulated to think.

Muscle Activity: Thinking shows a slight implicit movement of groups of muscle. That is slight muscular responses are noticed when we utter a word. A high positive correlation has been found to exist between thinking and muscular activities of an individual.

Brain functions: Whatever may be the role of the muscles, thinking is primarily a function of the brain. Our mind is said to be the chief instrument of the thinking process. The experiences registered by our sense organs have no meaning, and thus cannot serve as stimulating agents, or instruments for thinking unless these impressions are received by our brain cells and properly interpreted to derive some meaning. The mental pictures or images can be stored, reconstructed or put to use only on being processed by the brain. What happens in our thought process is simply the function or product of the activities of our brain.

Types / Classification of Thinking

- Perceptual or Concrete Thinking:

This is the simplest form of thinking the basis of this type is perception, i.e. interpretation of sensation according to one's experience. It is also called concrete thinking as it is carried out on the perception of actual or concrete objects and events.

2. Conceptual or Abstract Thinking:

Here one makes use of concepts, the generalized objects and languages, it is regarded as being superior to perceptual thinking as it economizes efforts in understanding and problem-solving.

3. Reflective Thinking:

This type of thinking aims in solving complex problems, thus it requires reorganization of all the relevant experiences to a situation or removing obstacles instead of relating with that experiences or ideas. This is an insightful cognitive approach in reflective thinking as the mental activity here does not involve the mechanical trial and error type of efforts. In this type, thinking processes take all the relevant facts arranged in a logical order into an account in order to arrive at a solution of the problem.

4. Creative Thinking:

This type of thinking is associated with one's ability to create or construct something new, novel or unusual. It looks for new relationships and associations to describe and interpret the nature of things, events and situations. Here the individual himself usually formulates the evidences and tools for its solution. For example; scientists, artists or inventors. The creative thinker is one who expresses new ideas and makes new observations, new predictions and new inferences.

- Critical Thinking:

It is a type of thinking that helps a person in stepping aside from his own personal beliefs, prejudices and opinions to sort out the faiths and discover the truth, even at the expense of his basic belief system. Here one resorts to set higher cognitive abilities and skills for the proper interpretation, analysis, evaluation and inference, as well as explanation of the gathered or communicated information resulting in a purposeful unbiased and self-regulatory judgment.

An ideal thinker is habitually inquisitive, well-informed, open-minded, flexible, fair-minded in evaluation, free from personal bias and prejudices, honest in seeking relevant information, skilled in the proper use of the abilities like interpretation, analysis, synthesis, evaluation and drawing conclusion and inferences, etc. The critical thinking is of a higher order well-disciplined thought process which involves the use of cognitive skills like conceptualization, interpretation, analysis, synthesis and evaluation for arriving at an unbiased, valid and reliable judgment of the gathered or communicated information or data as a guide to one's belief and action.

- Non-directed or Associative Thinking:

There are times when we find ourselves engaged in a unique type of thinking which is non-directed and without goal. It is reflected through dreaming and other free-flowing uncontrolled activities. Psychologically these forms of thought are termed as associative thinking.

Here day-dreaming, fantasy and delusions all fall in the category of withdrawal behaviour that helps an individual to escape from the demands of the real world by making his thinking face non-directed and floating, placing him somewhere, ordering something unconnected with his environment. We hear there is nothing seriously abnormal in behaviour involving daydreaming and fantasy but behaviour involving **delusions** definitely points towards abnormality.

A person under the influence of such delusions may think or believe that he is a millionaire, the ruler of the universe, a great inventor, a noted historian or even God. In contrast, a person in the grip of delusion may be inclined to be the most incapable, unworthy and unwanted person and may develop guilt feelings or complain that he is the victim of some incurable physical or mental diseases

REASONING

Meaning of Reasoning:

It is one of the best forms of controlled thinking consciously towards the solution of a problem. It is realistic in the sense that the solution is sought always in reference to the reality of the situation. We can solve many problems in our day-dreams, dreams and imaginations but they are unrealistic solutions.

As **Sherman** defined, "reasoning is a process of thinking during which the individual is aware of a problem identifies, evaluates, and decides upon a solution".

Reasoning is used not only when we want to solve an immediate problem but also when we anticipate future problems. Reasoning plays a significant role in one's adjustment to the environment. It not only determines one's cognitive activities but also influences the behaviour and personality.

Definitions "Reasoning is a stepwise thinking with a purpose or goal in mind" —**Garrett**.

- "Reasoning is the term applied to highly purposeful, controlled and selective thinking"—**Gates**.
- "Reasoning is the word used to describe the mental recognition of cause and effect relationships, it may be the prediction of an event from an observed cause or the inference of a cause from an observed event"—**Skinner**.

Thus reasoning is a highly specialized thinking which helps an individual to explore mentally the cause and effect relationship of an event or solution of a problem by adopting some well-organized systematic steps based on previous experience combined with present observation.

FIG - REASONING

Types of Reasoning:

Reasoning may be classified into two types.

- **Inductive reasoning**:

It is a specialized thinking aimed at the discovery or construction of a generalized principle by making use of particular cases, special examples and identifying of elements or relations.

For example, Mohan is mortal, Radha is mortal, Karim is mortal, therefore, all human beings are mortal.

- **Deductive reasoning**:

It is the ability to draw some logical conclusions from known statement or evidences. Here one starts with already known or established generalized statement or principle and applies it to specific cases. For example, all human beings are mortal you are a human being, therefore, you are mortal.

PROBLEM SOLVING

Meaning and Definition

From birth onwards, everybody in this world is faced with some problem or the other. There are needs and motives that are to be satisfied. For this purpose definite goals or aims are set. In an attempt to realize them one experiences obstacles and interferences. It creates a problem for him which needs serious attention and deliberate effort on his part to overcome the obstacle in the attainment of the objectives. For this purpose one has to set oneself to think and reason and proceed systematically in a scientific manner

Problem-solving is a mental process that involves discovering, analyzing and solving problems. The ultimate goal of problem-solving is to overcome obstacles and find a solution that best resolves the issue. The best strategy for solving a problem depends largely on the unique situation. In some cases, people are better off learning everything they can about the issue and then using factual knowledge to come up with a solution. In other instances, creativity and insight are the best options.

Skinner – "problem solving is processes of overcoming difficulties that appear to interfere with the attainment of a goal". It is a procedure of making adjustment in spite of interference.

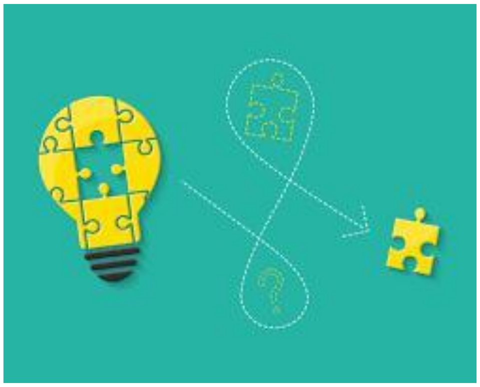


FIG – PROBLEM SOLVING

The Steps in Problem-Solving

In order to correctly solve a problem, it is important to follow a series of steps. Many researchers refer to this as the problem-solving cycle, which includes developing strategies and organizing knowledge.

While this cycle is portrayed sequentially, people rarely follow a rigid series of steps to find a solution. Instead, we often skip steps or even go back through steps multiple times until the desired solution is reached.

- Identifying the Problem: While it may seem like an obvious step, identifying the problem is not always as simple as it sounds. In some cases, people might mistakenly identify the wrong source of a problem, which will make attempts to solve it inefficient or even useless.
- Defining the Problem: After the problem has been identified, it is important to fully define the problem so that it can be solved.
- Forming a Strategy: The next step is to develop a strategy to solve the problem. The approach used will vary depending upon the situation and the individual's unique preferences.
- Organizing Information: Before coming up with a solution, we need to first organize the available information. What do we know about the problem? What do we not know? The more information that is available, the better prepared we will be to come up with an accurate solution.
- Allocating Resources: Of course, we don't always have unlimited money, time, and other resources to solve a problem. Before you begin to solve a problem, you need to determine how high priority it is. If it is an important problem, it is probably worth allocating more resources to solving it. If, however, it is a fairly unimportant problem,

then you do not want to spend too much of your available resources into coming up with a solution.

- Monitoring Progress: Effective problem-solvers tend to monitor their progress as they work towards a solution. If they are not making good progress toward reaching their goal, they will evaluate their approach or look for new strategies.
- Evaluating the Results: After a solution has been reached, it is important to evaluate the results to determine if it is the best possible solution to the problem. This evaluation might be immediate, such as checking the results of a math problem to ensure the answer is correct, or it can be delayed, such as evaluating the success of a therapy program after several months of treatment.

SHORT ANSWER QUESTIONS:

1.Define perception?
2. What is meant by illusion and mention its types?
3. What is meant by hallucination?
5. Define thinking?
6. Define reasoning and write its types?
7. Define problem solving?
8. Mention any four problem solving steps?

ESSAY ANSWER QUESTIONS:

1. Explain various principles of perception in detail?
2. Explain about tools and types of thinking?

UNIT- 3

MOTIVATION AND ATTENTION

Contents

MOTIVATION

Introduction and

Motivation is an important factor which encourages persons to give their best performance and help in reaching enterprise goals. A strong positive motivation will enable the increased output of employees but a negative motivation will reduce their performance. A key element in personnel management is motivation.

Motivation has been variously defined by scholars.

Berelson and Steiner: "A motive is an inner state that energizes, activates, or moves and directs or channels behaviour goals."

Lillis: "It is the stimulation of any emotion or desire operating upon one's will and promoting or driving it to action."

Dubin: "Motivation is the complex of forces starting and keeping a person at work in an organization."

Vance: "Motivation implies any emotion or desire which so conditions one's will that the individual is properly led into action."

NEEDS

Needs are general wants or desires. Every human being has to strive for the satisfaction of his basic needs, if he is to maintain and enhance himself in this world. For the sake of proper understanding and clarity we would like to divide the human needs in to the given categories.

FIG - NEEDS

Types of needs

1. Biological Needs:

These needs are basic to human life and, hence, include food, clothing, shelter, air, water and necessities of life. These needs relate to the survival and maintenance of human life. They exert tremendous influence on human behavior. These needs are to be met first at least partly before higher level needs emerge. Once physiological needs are satisfied, they no longer motivate the man.

- Safety Needs:

After satisfying the physiological needs, the next needs felt are called safety and security needs. These needs find expression in such desires as economic security and protection from physical dangers. Meeting these needs requires more money and, hence, the individual is prompted to work more. Like physiological needs, these become inactive once they are satisfied.

- Social Needs:

Man is a social being. He is, therefore, interested in social interaction, companionship, belongingness, etc. It is this socializing and belongingness why individuals prefer to work in groups and especially older people go to work.

- Esteem Needs:

These needs refer to self-esteem and self-respect. They include such needs which indicate self-confidence, achievement, competence, knowledge and independence. The fulfillment of esteem needs leads to self-confidence, strength and capability of being useful in the organisation. However, inability to fulfill these needs results in feeling like inferiority, weakness and helplessness.

- Self-Actualization Needs:

This level represents the culmination of all the lower, intermediate, and higher needs of human beings. In other words, the final step under the need hierarchy model is the need for self-actualization. This refers to fulfillment.

The term self-actualization was coined by Kurt Goldstein and means to become actualized in what one is potentially good at. In effect, self- actualization is the person's motivation to transform perception of self into reality.

DRIVES

A Need gives rise to a drive which may be defined as an aroused reaction tendency or a state of heightened tension that sets up activities in an individual and sustains them for increasing his general activity level. The existence of a need moves or drives the individual from wit in and directs its activities to a goal that may bring about the satisfaction of the need. The strength of the drive depends on the strength of the stimuli involving related the need.

Types of drives

1. Primary drives/ biological drives-hunger, thirst, escape from pain and sex.

2. Secondary / socio psychological drives-fear of anxiety, striving for achievement, desire for approval aggression and dependence.

MOTIVES

Motive is an inner state of mind and generated through basic needs or drives. It compulse an individual to respond by creating a kind of tension or urge to act.

Types of motives

- **Physiological Motives**:

a. Hunger motive:

We eat to live. The food we take is digested and nutritional substances are absorbed. The biochemical processes get their energy from the food in order to sustain life. When these substances are exhausted, some imbalancement exists. We develop hunger motive in order to maintain homeostasis. This is indicated by contraction of stomach muscles causing some pain or discomfort called hunger pangs. Psychologists have demonstrated this phenomenon by experiments.

- Thirst motive:

In our daily life regularly we take fluids in the form of water and other beverages. These fluids are essential for our body tissues for normal functioning. When the water level in the body decreases we develop motive to drink water. Usually thirst motive is indicated by dryness of mouth. Experiments by psychologists have shown that just dried mouth getting wetted is not enough. We need to drink sufficient quantity of water to satiate our thirst.

c. Need for oxygen:

Our body needs oxygen continuously. We get it through continuous respiration. Oxygen is necessary for the purification of blood. We cannot survive without regular supply of oxygen. Lack of oxygen supply may lead to serious consequences like damage to brain or death.

d. Motive for regulation of body temperature:

Maintenance of normal body temperature (98.6°F or 37.0°C) is necessary. Rise or fall in the body temperature causes many problems. There are some automatic mechanisms to regulate body temperature, like sweating when the temperature rises above normal or, shivering when it falls below normal. These changes motivate us to take necessary steps. For example, opening of windows, put on fans, take cool drinks, remove clothes, etc., when the temperature increases to above normal level, and closing doors and windows, wear sweaters, take hot beverages when temperature falls down. In this way we try to regulate the body temperature.

e. Need for sleep:

Sleep is an essential process for normal functioning of body and mind. When our body and mind are tired they need rest for rejuvenation of energy. It is observed that there is excess accumulation of a toxin called ‘Lactic acid’ when tired. After sleep it disappears and the person becomes active. Sleep deprivation also leads to psychological problems like confusion, inability to concentrate, droopy eyelids, muscle tremors, etc.

f. Need for avoidance of pain:

No organism can continue to bear pain. Whenever we experience pain we try to avoid it. We are motivated to escape from painful stimulus. For example, when we are under hot sun we go to shade. When something is pinching we avoid it.

g. Sex motive:

This is a biological motive, arises in the organism as a result of secretion of sex hormones-like androgens and estrogens. Sex need is not essential for the survival of the individual, but it is essential for the survival of the species. However, fulfillment of the sex need is not like satisfying hunger or thirst

- Maternal drive:

This is an instinct or an inborn tendency. Every normal woman aspires to become a mother. That is why in many cases the women who cannot bear children of their own, will sublimate that motive and satisfy it through socially acceptable ways, like working in orphan schools, baby sittings or adopting other's children.

MASLOWS VIEW POINT/ HUMANISTIC THEORY:

This theory believes in striving tendency of the individual for realizing his potentialities, especially creative ones, strengthening self-confidence and attaining the ideal self. There are two important persons related to this theory— Abraham Maslow and Carl Rogers.

These are:

a. Biological motives like hunger, thirst, etc.
b. Safety and security needs (protection from external threats)
c. Love and belongingness needs (Affection, warmth, etc.)
d. Esteem needs (self-esteem, respect, approval, etc.)
e. Self-actualisation motive (achieving maximum development of one's potentialities).

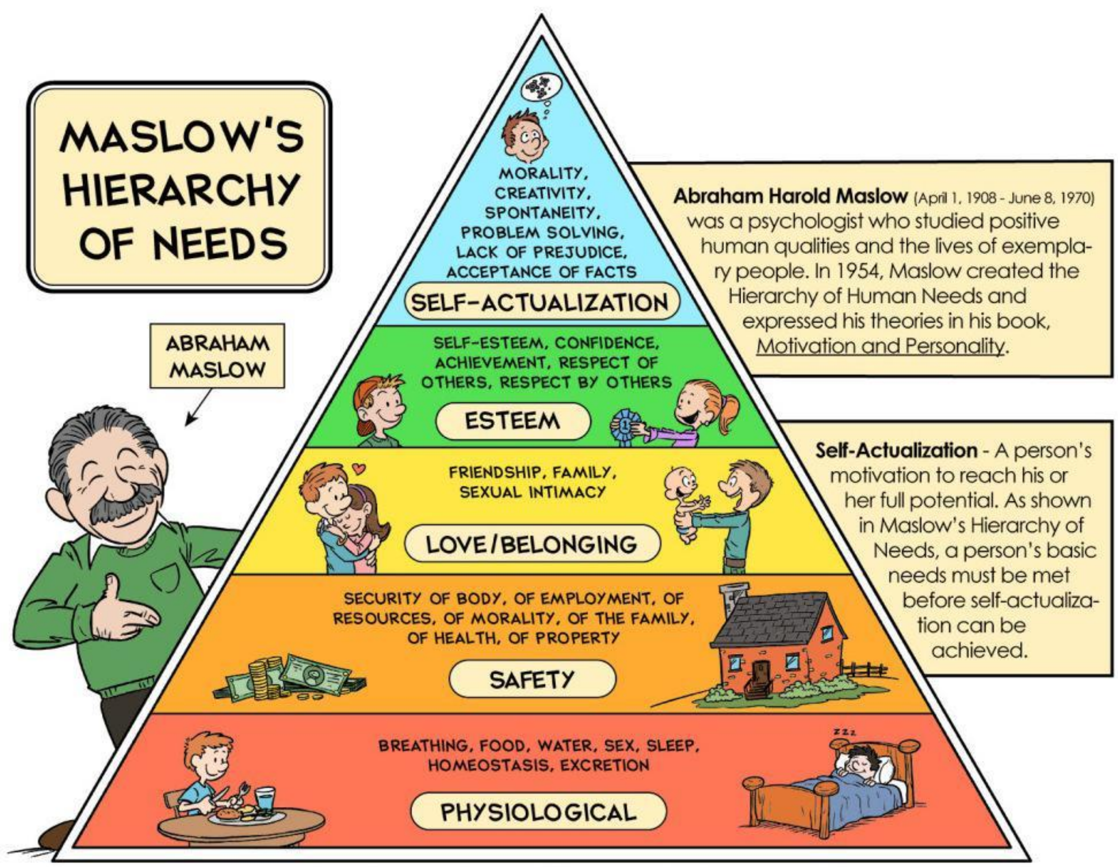


FIG - MASLOWS HIERARCHY OF NEEDS

Maslow has explained that every individual struggles to fulfill basic needs first, and then followed by safety, love, esteem and finally actualisation needs.

According to him the needs at one level should be satisfied at least partially, before the next level needs become active. Most of the people end their struggle to reach third or fourth level needs. Only a few will aspire for self-actualisation which is the ultimate goal of life.

Self-actualisation means becoming everything one is capable of, or becoming what he can, that is, fulfillment of his basic potentialities. Maslow explains that the self- actualized people experience, what he calls the ‘peak experiences’, when they fulfill the need for self-actualisation.

Carl Rogers, as a humanist believes in the strength and potentialities of human beings. According to him all human beings have a natural inclination for learning and a desire to grow and progress known as self-actualizing tendency.

Every individual will strive to realize his potentialities and to grow to become a fully functioning person. Hence in the view of Rogers, the motivation for self-growth and becoming a fully functioning person are important concepts.

ATTENTION

Attention is the term used or given to the perceptual processes that select certain inputs for inclusion in our conscious experience, or awareness at any given time. It is the process involving the act of listening, and concentrating on a topic, object or event for the attainment of desired ends.

“Attention is the concentration of consciousness upon one object other than upon another”— **Dumville.**

“Attention is the process of getting an object or thought clearly before the mind”—**Ross.**

“Attention is being keenly alive to some specific factors in our environment. It is a preparatory adjustment for response”—**Morgan.**

Thus attention is essentially process and not a product. It helps in our awareness or consciousness of our environment, which is of selective kind, because in a given time, we can concentrate or focus our consciousness on a particular object only.

The concentration provided by the process of attention helps us in the clarity of the perception of the perceived object or phenomenon. Thus attention is not merely a cognitive factor but is essentially determined by emotions, interest, attitude and memory.

Thus attention is a process which is carried out through cognitive abilities and helped by emotional and behavioural factors to select something out of the various stimuli present in one's environment and bring it in the centre of one's consciousness in order to perceive it clearly for deriving the desired end.

FIG- ATTENTION

Types of Attention:

- **Non-volitional** or **Involuntary Attention**

This type of attention is aroused without the play of will. Here we attend to an object or condition without making any conscious effort, e.g. a mother's attention towards her crying child, attention towards the members of the opposite sex, and towards bright colours, etc.

The attention which is aroused by the instincts is called "enforced non-volitional attention". A young man when we remark on his sex instinct or his curiosity, he becomes quite attentive in his task.

The other subtype of non-volitional attention, produced by the sentiments is called "spontaneous non-volitional attention". It is the result of properly developed sentiment, towards the object, or idea of a person around which our sentiments are formed with.

(b**) Volitional** or **Voluntary Attention**

When the 'exercised will' is called upon, it becomes volitional attention. Because it demands the conscious efforts on our part it is least automatic and spontaneous like that of non-volitional attention. Attention payed at the time of solving an assigned problem of mathematics, answering question in an examination hall and so on comes under volitional attention category. Volitional attention is further subdivided into two categories:

- A single act of volition is sufficient to bring about attention in the case of implicit attention, e.g. for single act of will can arouse attention.

- In explicit volitional attention we need repeated acts of will to sustain it, e.g. here attention is obtained by repeated acts of will.

Duration and Degree of Attention

People may possess the ability to grasp a number of objects or in other words, to attend a number of stimuli in one short “presentation”. This ability of an individual is evaluated in terms of the span of attention, which differs from person to person and even situation to situation.

The term “span of attention” is designed in terms of the quality, size extent to which the perceptual field of an individual can be effectively organized in order to enable him to attain a number of things in a given spell of short duration

SHORT ANSWER QUESTIONS:

1. Define motivation?
2. Define need and mention the types of needs?
3. Define drive and mention the types of drive?
4. Mention the types of physiological motives?
5. Draw the Maslow hierarchical structure of needs?
6. Define attention?
7. What is meant by voluntary attention?
8. What is meant by involuntary attention?

UNIT- 4

LEARNING and INDIVIDUAL DIFFERENCES

Contents:

LEARNING

INTRODUCTION

A new born child is helpless at birth. He depends upon others. But in due course, he learns a number of things. He learns to crawl, stand, walk, run, eat, speak, dress etc. The process of learning continues till death. Even an adult during the course of his daily routine goes on learning and adding to his experience. Why does a person learn? He learns because he has to make adjustment in the changing environment. The stimulus from the environment is there on the one hand.

Learning is a key process in human behaviour. All living is learning. If we compare the simple, crude ways in which a child feels and behaves, with the complex modes of adult behaviour, his skills, habits, thought, sentiments and the like- we will know what difference learning has made to the individual

The individual is constantly interacting with and influenced by the environment. This experience makes him to change or modify his behaviour in order to deal effectively with it. Therefore, learning is a change in behaviour, influenced by previous behaviour. As stated above the skills, knowledge, habits, attitudes, interests and other personality characteristics are all the result of learning.

All learning involves activities. These activities involve either physical or mental activities. They may be simple mental activities or complex, involving various muscles, bones, etc. So also the mental activities may be very simple involving one or two activities of mind or complex which involve higher mental activities.

Definitions

- **Gales and others**: "Learning is the modification of behaviour through experience and training."

- **J.P. Guilford**: "Learning is any change in behaviour, resulting from behaviour".
- **Colvin**: "Learning is the modification of our readymade behaviour due to experience".
- **Crow and Crow**: "Learning is the acquisition of habits, knowledge and attitudes".

H.J. Klausmeir: "Learning is a process whereby a change in, behaviour results from some of experience, activity, training, observation and the like".

- **Morgan and Gilliland**: "Learning is some modification in the behaviour of the organism as a result of experience which is retained for at least certain period of time."

Characteristics of Learning:

On the basis of analysis of various definitions of learning Yokam, Simpson and Mursel have given the following characteristics of learning:

- Learning is Growth.
- Learning is Adjustment.
- Learning is Intelligent.
- Learning is Active.
- Learning is the product of Environment.
- Learning is both individual and social.
- Learning is Purposeful.
- Learning is organizing Experience.
- All living is learning.
- True Learning affects the conduct of the learner.
- Learning is Universal.
- Learning is Change.
- Learning is a Process not a product.
- Learning is transferable.
- Learning is total reaction of the individual to total situation

Types of Learning

What activities are learned by the individual refer to types of learning. For example, habits, skills, facts, etc. There are different types of learning. Some of the important and common learning activities are explained here.

- <u>Skill Learning</u>:

Right from the birth, the child acquires skill. His bodily organs learn to handle the things. He moves his legs and begins to crawl. In source of time, he learns other motor, skills, like walking, speaking, drawing, writing, reading, playing music, cycling and swimming etc.

- Associative Learning:

Conceptional learning is helped by associative learning in amassing a wealth of knowledge. New concepts are tagged with the past concepts through association, and as such knowledge.

- Motor learning:

Most of our activities in our day-to-days life refer to motor activities. The individual has to learn them in order to maintain his regular life, for example walking, running, skating, driving, climbing, etc. All these activities involve the muscular coordination.

- Verbal learning:

This type of learning involves the language we speak, the communication devices we use. Signs, pictures, symbols, words, figures, sounds, etc, are the tools used in such activities. We use words for communication.

- Concept learning:

It is the form of learning which requires higher order mental processes like thinking, reasoning, intelligence, etc. we learn different concepts from childhood. For example, when we see a dog and attach the term 'dog', we learn that the word dog refers to a particular animal. Concept learning involves two processes, viz. abstraction and generalization. This learning is very useful in recognizing, identifying things.

- Discrimination learning:

Learning to differentiate between stimuli and showing an appropriate response to these stimuli is called discrimination learning. Example, sound horns of different vehicles like bus, car, ambulance, etc.

Theories of Learning

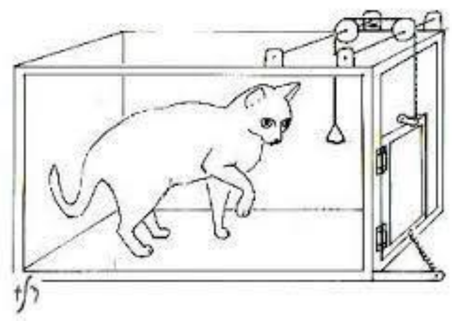
There are three important theories of learning. The theories are: 1. Trial and Error Theory of Learning 2. Theory of classical conditioning 3.Theory of insightful learning

Theory # 1. Trial and Error Theory of Learning:

E.L. Thorndike, an American Psychologist was the pro-pounder of this theory. It is the theory of connectionism. To Thorndike the basic unit of behaviour is S.R. Connection. Learning is forming of bonds (connections) between S (Stimulus) and R (Response).

This S-R connection depends on recently, frequency, intensity and vividness of the experiences, capacity and readiness of the learner. These bond connections are formed through Trial and Error.

It means one learns by making trials, making errors or mistakes during the trials and making further trials, eliminating the wrong responses. So learning takes place, slowly by the process of trial and error. In order to learning something a learner makes several trials where some responses do not give satisfactory results, but he goes on making further trials till he gets satisfactory responses.



Experiment:

A hungry cat of 24 hours was placed inside a Puzzle box or iron cage. Where a knob was connected to open the door. A fish was placed outside the box. Seeing the sight of fish the cat made several trials in-side the cat in order to get the fish.

After making several jumping or trials her leg was put on the knob. As it is connected by knob which helped the cat to open the door. The door was opened and the cat came to outside and ate the fish. Again the same cat was put inside the cage that was 24 hours hungry on the next day. She took less time and put the leg on the knob and door was opened.

Then he came out and ate the fish. After doing one after one day then the cat within no moment he put his leg on the knob and the door was opened. He came out suddenly and ate the fish. This is his learning which is made on trial and error method.

On the basis of the data gathered by him from his experiments on the learning of animals formulated certain laws of learning. Thorndike has highlighted three important laws of learning.

A brief summary of these laws is given below:

i. Law of Readiness
ii. Law of Exercises
iii. Law of Effect

(I)Law of Readiness:

It emphasizes on readiness to learn. The law of readiness states that "When any conduction unit is not in readiness to conduct, for it to conduct is annoying. When any conduction unit is in readiness to conduct for it not to do so is annoying.

On the other hand it means, when a learner is ready to get (learn) he can learn quickly and effectively. This implies that the learner must be mentally prepared to learn. Readiness means preparedness both physical and psychological.

Physical readiness is closely related to the physical growth and sound health free from diseases. Psychological readiness refers to the interest, zeal, inclination, enthusiasm and willingness to learn.

Readiness depends on three main factors such as:

- Maturation
- Experiences—training or previous learning
- Favorable physical, psychological and environmental elements conducive for

learning. Educational implication:

The law of readiness has a number of educational implications:

- Curriculum, syllabuses are to be prepared as per the learner's age, ability, and standard.
- Appropriate methods of teaching are selected suiting to the mental maturity of the students.
- Teacher has to use audio-visual aids in teaching learning when learners are ready to learn.
- Teachers and parents should not be over ambitious; rather they should wait till the child becomes ready to learn.
- Teacher is to motivate the child before starting this teaching work.
- Learners should be engaged in curricular activities observing their readiness and curiosity for new things.

(ii) Law of Exercise:

Law of exercise tells that learning takes place by doing or by actively participating or by exercising any work. In actual practice a man learns when he does and one does not learn, if he does not do. Learning is permanent. When one does drill, practice or repeat through exercise .This law is divided into two parts such as law of use and law of disuse.

Law of use:

It is called law of practice. This gives emphasis on practice which makes a man perfect. This is associated with intensity and recently.

Law of disuse:

When a thing is not repeated or practiced over a long time it is slowly forgotten because the strength of the connection between S and R decreases. It has negative value of lack of practice.

Educational implications:

a) This law creates interest with pleasant result among the students.
b) Problems related to behaviour can be solved easily by this law.
c) It gives reward and punishment.
d) Undesirable behaviour or attitude can be removed by associating with this law.
e) Students from good habits after getting reward and punishment.
f) It makes learning functional and permanent.
g) Learning is more effective through drill, repetition, review, discussion, practice revision etc.
h) Forgetting can be diluted.
i) Bad habits can be removed.

(iii)Law of Effect:

As per the view of Thorndike law of effect is "When modifiable connection is made between a situation and a response and is accompanied or followed by a satisfying state of affairs the strength of connection is increased and when such a connection is made and accompanied or followed by an annoying state of affairs its strength is decreased."

This law says that if our efforts are accompanied by a feeling of achievements or satisfaction, we are further inspired to learn and therefore, effective learning takes place. If our efforts are not accompanied by a feeling of satisfaction, not much of real learning will take place.

In other words it is said that a response which gives achievement of the goal will give pleasure and thus provides satisfaction, will be stamped in, while those which are accompanied by dissatisfaction will be stamped out. This law has an important bearing on learning.

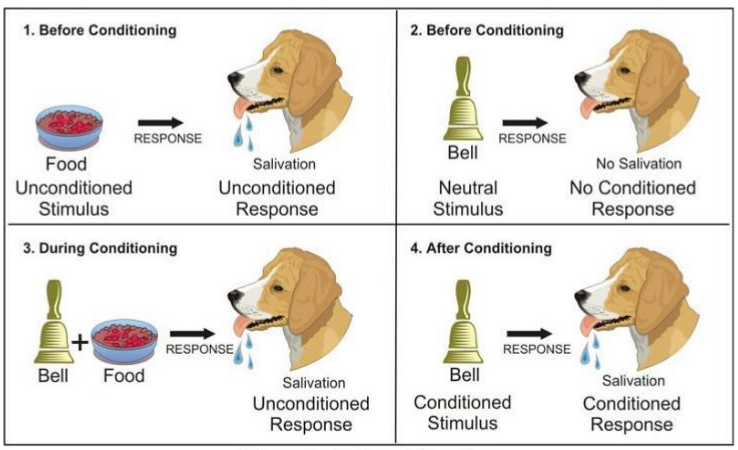
Educational implications:

- The learning situation provided by the teacher is enjoyable.
- It creates school activities interesting.
- Each practice will definitely gives result.
- Good practice will give good effect and bad practice will give bad result.
- Without seeking incentives, repetition and motivation. Learning is ineffective.

Theory # 2: Theory of classical Condition:

This theory was advocated by Pavlov, a Russian doctor and psychologist. For his contribution Pavlov was placed a prominent place of fame. Conditioning implies modification of natural response. Natural stimulus comes in a natural process.

But in absence of natural stimulus if artificial stimulus is given then natural response comes out which is known as S.R. Theory of Stimulus Response Theory of Learning. So that when natural stimulus is substituted by an artificial stimulus, then a new connection between artificial stimulus and natural response is created. In this way, conditioning learning takes place.



Classical Conditioning

Experiment:

- Sound proof room having a small hole
- Hungry dog of 24 hours
- Meat
- Ringing Bell
- Light.

A dog of 24 hours hungry was put inside a sound proof room having a small hole where the dog could see the outsiders. At a particular time when meal was brought to serve the dog then the dog saw the sight of food from a high distant through the hole.

Seeing the sight of meat/food dog started salivating and the salivating responses were recorded. On the next day when meat/food was supplied at that time a bell was rung. Listening the sound of the bell and sight of food the dog began to salivate.

In the third day the food was supplied with ringing bell and showing a torch light. Seeing this torch light, listening the ringing bell sound with the sight of food the dog began to salivate. After a number of repetitions of it the dog's salivation was made conditioned to bell, light and food. Next the food was not supplied but it was found that simply by ringing of the bell and light the dog responded to it by secreting saliva

From this experiment Pavlov came to conclude his opinion that food (meat) is the natural stimulus and salivation is natural response. It is natural that a dog would salivate when food is served to it. Salivation comes automatically through a natural process which is known as natural responses.

It is innate and reflex action. Ringing of bell and torch light both are artificial or unnatural stimulus. In absence of natural stimulus i.e. food when unnatural stimulus, i.e., ringing bell and showing a torch light were served then the dog naturally expressed his natural responses, i.e. salivation.

This could be possible by associating Cs1 (bell) + Cs2 (light) with unconditioned stimulus or natural stimulus i.e., food for a number of time. Then dog begin to salivate in a natural way. Thus conditioning is a process by which the natural stimulus (UCS) is substituted by an artificial stimulus (Cs) to create same response.

This theory of classical conditioning or conditioned reflex is known as conditioned response because the response of the organism is conditioned by a new stimulus or conditioned stimulus.

Important points to be noted:

Conditioned Stimulus Proceeds towards Unconditioned Stimulus:

a. No wide gap is seen is presenting C.S and U.C.S.

b. Conditioning depends upon the intensity of the stimulus.

c. The environment for conditioning is appropriate.

<u>Educational Implications</u>:

a. Conditioned response theory has some educational implications. The following points are noted in this connection.

b. Conditioning learning helps in developing desirable habits and interest of the children.

c. It removes fear and phobias among children.

d. The use of audio-visual aids makes better responses of students through conditioning learning.

e. The repeated use of any learning materials/teaching helps in positive conditioning.

Theory # 3. Theory of insightful learning:

This insightful learning theory is known as Gestalt theory. M. Wertheirmer, Kurt Koffka and Wolfgang Kohler are the chief exponents of Gestalt theory by rejecting S.R. theory and Trial and Error theory of learning. Gestalt psychologists are of views that human mind is not the connecting system but a transforming system.

Responses are not mechanical in nature bent they are adoptive because mind is the organism part where stimuli is created. Reaction comes automatically. When one faces a problem in his daily life. So Gestalt psychology gives emphasis on totality of the situation. Gestalt is a German word which means 'whole' or 'total pattern' or configuration or total form.

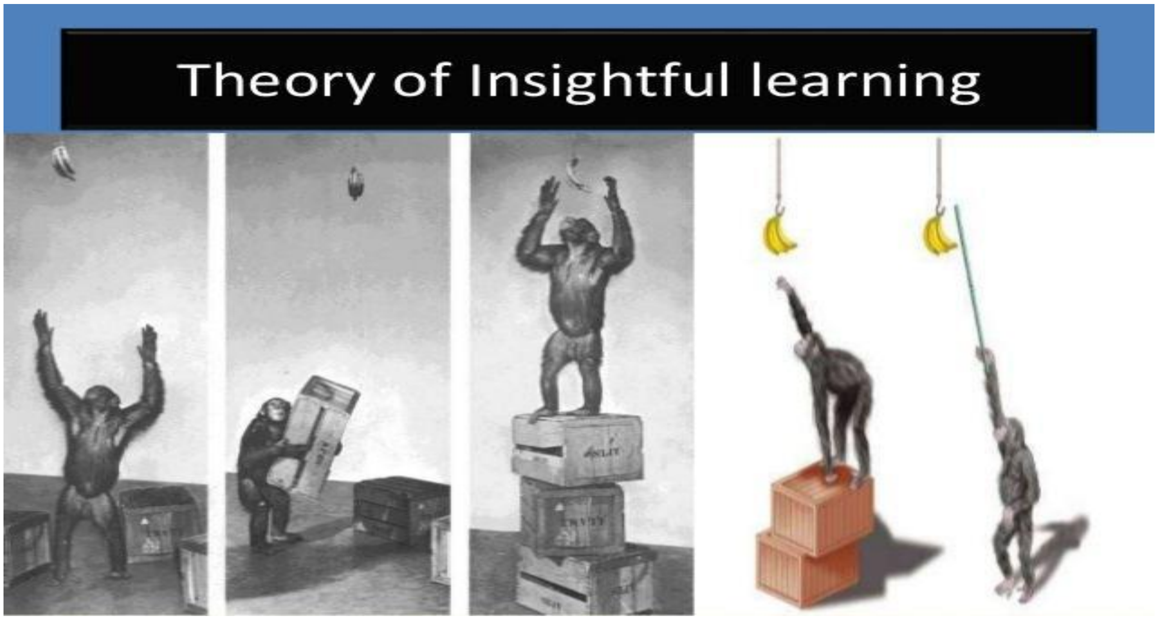
Gestalt Psychologists are atone that configuration of experience is more important than division of elements. Seeing the flag of a temple from a long distance can conceive the idea of a temple which is the whole thought process of human being. In this connection whole is more important than the parts. So learning takes place as a whole.

This theory is the modern theory which tells that whole is grasping knowledge is the real learning. So man/learner should try to grasp and understand the whole situation-first by utilizing his intelligence and insight.

Thus learning by insight implies sudden grasping of the solution, a flash of understanding without any process of Trial and Errors. It is seen that almost all discoveries and inventions have taken place all of a sudden through insight. Of course the inventor bears a complete knowledge of the whole situation.

<u>Experiment</u>:

- Chimpanzee
- Two sticks
- Bananas
- 2 Boxes



A Chimpanzee was kept in a cage. He was given two sticks of bamboo, one of which could be fitted into the open end of the other to make a long stick. A banana has hanged in the roof of the room at such a distance that it could not be reached with single stick. The Chimpanzee first extended his hands and one stick but could not get the banana to eat.

He brought the stick and played with the sticks. After sometime, by chance he put the two sticks end to end, pushed the smaller one into the longer and made a long stick. Then he stretched the joining stick to the banana. He brought the banana and ate it.

In another experiment a banana was hung from the top of the cage. One small box and big box were there. A banana was hanged in the roof. The Chimpanzee could not get the banana by stretching his hands. After a few attempts it could put the boxes one upon another to reach the banana. He learnt the trick by insight.

The following steps are connected in insightful learning:

a. The organism reacts the situation as a whole and not merely a part.

b. The organism perceives the whole situation.

c. The goal in this theory is clearly visible.

d. It establishes relationship between whole and part.

e. It brings quick solution of any problem through insight.

Following one some factors which are responsible for insightful learning:

a. It depends on age and mental ability of the learner.

b. Clarity of zeal.

c. It depends on previous experiences of the learner.

d. Initial efforts help the learner to reach the final goal.

e. It brings clear understanding of the whole situation.

f. It determines the relationship between means and end.

Educational Implications:

a. It proceeds from whole to part.

b. It is an intelligent way of learning.

c. It helps the children to acquire knowledge by using understanding, intelligence and insight.

d. Meaningful material is better retained and learnt.

e. It helps to solve the problem easily.

INDIVIDUAL DIFFERENCES

No two persons are alike. All the individuals differ from each other in many aspects. Children born of the same parents and even the-twins are not alike. This differential psychology is linked with the study of individual differences. This change is seen in physical forms like in height, weight, and colour, and complexion strength etc., difference in intelligence, achievement, interest, attitude, aptitude, learning habits, motor abilities, and skill. Each man has an intellectual capacity through which he gains experience and learning. Every person has the emotions of love, anger, fear and feelings of pleasure and pain. Every man has the need of independence, success and need for acceptance.

Definitions of Individual Difference

- **Drever James**:“Variations or deviations from the average of the group, with respect to the mental or physical characters, occurring in the individual member of the group are individual differences.”

- **Good, C.V**“The variation or deviations among individual is regard to a single characteristics or a number of characteristics, those differences which in their totality distinguish one individual from another.”

- **Skinner, C.E**.:"Today we think of individual differences as including any measurable aspect of the total personality."

- **Woodworth, R.S. and Marquis, D.G**.:"Individual differences are found in all psychological characteristics physical mental abilities, knowledge, habit, personality and character traits."

FIG – INDIVIDUAL DIFFERENCES

Types of Individual Differences:
They are mainly two types: Inter – individual difference and Intra-individual difference. Inter-individual differences are differences that are observed between people, whereas intra-individual differences are differences that are observed within the same person when they are assessed at different times or in different situations. Good examples of inter-individual differences are gender, age, ethnic background, anxiety levels or attachment style. Attention or effort are good examples of intra-individual differences.

Causes of Individual Differences:

Some of the main causes of individual differences are as under:

- Heredity:

One of the most significant and chief causes of individual differences is heredity. Individuals inherit various physical traits like face with its features, colour of eyes and hair, type of skin, shape of skull and size of hands, colour blindness, baldness, stub-finger and tendency to certain diseases like cancer and tuberculosis, mental traits like intelligence, abstract thinking, aptitudes and prejudices. Now it is an admitted fact that heredity differences result in the quantity and rate of physical as well as mental development being different and different individuals.

- Environment:

Environment significantly influences individual differences. Changes in child's environment are reflected in the changes in his personality. Psychologically speaking, a person's environment consists of sum total of stimulation which he receives from conception until his death.

Environment consists of physical, intellectual, social, moral, political, economic and cultural forces. All these forces cause individual differences. Modern psychologists believe that individual differences are caused by both heredity and environment. Personality is the outcome of mutual interaction between heredity and environment.

3. Influence of caste, race and nation:

Individuals of different castes and races exhibit very marked differences. It is generally seen that son of a Kshatriya has a more of courage in him while the son of a trader has the traits of business. Similarly individuals of different nations show differences in respect of their personality, character and mental abilities. These are the outcome of their geographical, social and cultural environment. Many studies have shown the existence of differences between Americans and Negroes, Chinese and Japanese, English and Indian individuals.

4.Sex differences:

Development of boys and girls exhibits differences due to difference in sex. The physical development of the girl takes place a year or two earlier than the boys. Between the age of 11 and 14, girls are taller and heavier than the boys. After 15, boys start winning the race. Girls are kind, affectionate, sympathetic and tender while the boys are brave, hard, choleric, efficient and competent.

5.Age and intelligence:

Physical, intellectual and emotional development is caused by the growth in age. Many individuals differ because of the differences in intelligence. Individuals who are below the average in intelligence and mental age find much difficulty in learning and the average intelligent persons can learn quickly.

6.Temperament and emotional stability:

Some people are by temperament active and quick, while others are passive and slow, some humorous and others short tempered. Emotional stability of the individual is differently affected by physical, mental and environmental factors. Differences in emotional stability cause individual differences.

SHORT ANSWER QUESTIONS:

1. Define learning and mention types of learning?
2. Define individual difference?
3. What are the causes of individual differences?
4. Write the types of individual differences?

ESSAY ANSWER QUESTIONS:

1. Write in detail about Trial and Error theory of learning?
2. Write in detail about Classical conditioning theory?
3. Write in detail about theory of insightful learning?

UNIT- 5

MEMORY – REMEMBERING and FORGETTING APTITUIDE

Contents:

MEMORY - REMEMBERING

Memory is one of the important cognitive processes. Memory involves remembering and forgetting.

These are like two faces of a coin. Though these two are opposed to each other by nature, they play an important role in the life of an individual.

Remembering the pleasant experiences makes living happy, and on the other hand remembering unpleasant experiences makes living unhappy and miserable. So here forgetting helps individual to forget unwanted and unpleasant experiences and memories and keeps him happy.

Fein: memory means "meant of processing and storing information which an individual receives, and later retrieves or recalls them when necessary"

Vernon: memory means "A form of storing meaningful information so as to become useful experiences in future"

In this way, remembering the pleasant and forgetting the unpleasant both are essential for normal living. In the case of learners, remembering is very important, because without memory there would be no learning.

If learning has to progress, remembering of what is already learnt is indispensable, otherwise every time the learner has to start from the beginning.

The memory is defined as 'the power to store experiences and to bring them into the field of consciousness sometime after the experience has occurred'. Our mind has the power of conserving experiences and mentally receiving them whenever such an activity helps the onward progress of the life cycle. The conserved experience has a unity, an organisation of its own and it colours our present experience.

However, as stated above we have a notion that memory is a single process, but an analysis of it reveals involvement of three different activities- learning, retention and remembering.

- Learning:

This is the first stage of memory. Learning may be by any of the methods like imitation, verbal, motor, conceptual, trial and error, insight, etc. Hence, whatever may be the type of learning, we must pay our attention to retain what is learnt. A good learning is necessary for better retention.

- Retention:

Retention is the process of retaining in mind what is learnt or experienced in the past. The learnt material must be retained in order to make progress in our learning. Psychologists are of the opinion that the learnt material will be retained in the brain in the form of neural traces called ‘memory traces’, or ‘engrams’, or ‘neurograms’.

When good learning takes place –clear engrams are formed, so that they remain for long time and can be remembered by activation of these traces whenever necessary.

- Remembering:

It is the process of bringing back the stored or retained information to the conscious level. This may be understood by activities such as recalling, recognising, relearning and reconstruction.

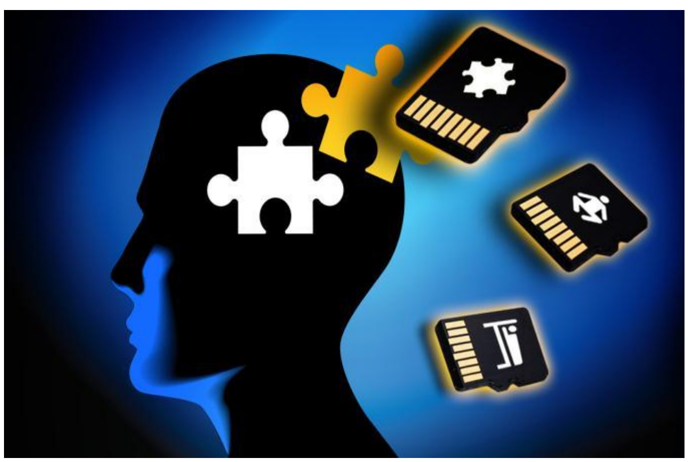


FIG - REMEMBERING

Types of Memory:

There are five kinds of memory. These are classified on the basis of rates of decay of the information.

a. Sensory memory:

In this kind of memory, the information received by the sense organs will remain there for a very short period like few seconds. For example, the image on the screen of a TV may appear to be in our eyes for a fraction of time even when it is switched off, or the voice of a person will be tingling in our ears even after the voice is ceased.

b.Short-term memory (STM):

According to many studies, in STM the memory remains in our conscious and pre-conscious level for less than 30 seconds. Later on this will be transferred to long-term memory.

c. Long-term memory (LTM):

LTM has the unlimited capacity to store information which may remain for days, months, years or lifetime. Ex-date of birth, names of family members

d. Eidetic memory:

It is otherwise called photographic memory in which the individual can remember a scene or an event in a photographic detail.

e. Episodic memory:

This is otherwise called semantic memory which is connected with episodes of events. The events are stored in the form of episodes and recalled fully in the manner of a sequence.

Methods used for improving memory.

- Mnemonic Devices: Some Mnemonic devices are easily memorized rhymes whereas others use visual images or verbal associations.

- Mental Stroll Method: A favorite method is to remember a list of items by taking a mental stroll through one's house, forming a visual image of each item at a particular location

- Pay Attention: Attention is important for encoding. Impairment in attention e.g., in depression may result in impaired encoding causing pseudo dementia.

- Encode Information in more than One Way, The more elaborate the encoding of information, the more memorable it is. Elaboration can be in many forms e.g., remembering a telephone number by sound of the individual digits.

- Add Meaning: The more meaningful material is, the more likely it is to link up with information already in long term memory. Meaningfulness also reduces the number of chunks of information one has to learn.

- Use Visual Memory: Memory for pictures is often better than the memory for words.

- Take Your Time: If one has to remember large amounts of verbal material, leisurely learning, spread out over several sessions will produce better results than rapid cramming

- Take Time Out: If possible, minimize interference by using study breaks for rest or recreation. Sleep is the ultimate way to reduce interference.

- Over learn: Studying information even after you think you know it – is one of the best ways to remember it.

- Planning to Learn: Plan a study schedule, regular rehearsal, subjective organization and retrieval cues, testing oneself (feedback) and review help in memorizing (i.e., "PRC-Planning, Rehearsal, Organization and "FRO" – Feedback, Review and Over-learning).

- Avoiding Use of Drugs: Alcohol, benzo-diazepines, antihistaminics and other CNS depressants may impair the memorizing process. Nootropics (Brain tonics) are not useful in normal persons.
- Intelligence: More intelligent person will have better memory than a dull person.

- Interest: If a person has more interest, he will learn and retain better.

- Over learning: Experiments have proved that over learning will lead to better memory.

- Speed of learning: Quicker learning leads to better retention

- Meaningfulness of the material: Meaningful materials remain in our memory for longer period than for nonsense material.

  - Sleep or rest: Sleep or rest immediately after learning strengthens connections in the brain and helps for clear memory.

FORGETTING

In simple terms, forgetting is the inability to remember. Psychologists generally use the term forgetting to refer to the apparent loss of information already encoded and stored in long- term memory.

Munn (1967) defines forgetting is "the loss, permanent or temporary, of the ability to recall or recognize something learned earlier"

Drever-Forgetting means "failure at any time to recall an experience, when attempting to do so or to perform an action previously learned"

It is true that we cannot retain all that we have learnt, much is forgotten. But sometimes what we think is forgotten may not be true, because the information due to lack of attention may not have reached STM from the sense organs. It may also be due to inadequate encoding and rehearsal, or else the information may not have been transferred from STM (short term memory) to LTM. (Long term memory)

FIG - FORGETTING

Causes

- Inadequate Impression at the Time of Learning: The reason for inadequate impression is lack of attention and inadequate learning which is necessary for good memory. Forced learning results in no learning because forced learning distracts our attention.

- Laps of Time: With the passage of time what is learned or experienced is for-gotten. This is a passive decay. The memory traces formed in the brain gets faded and becomes weather with the passage of time.

- Interference: One type of learning interface with the learning of another type is called theory of interference.

There are two types of interface, proactive interface and retroactive interface:

Proactive interference: When something learnt earlier distrusts recall of something you are learning now. In other words, it can be explained as the interference of past-learnt material in recalling the newly learnt material.

Retroactive interference: When learning now makes it harder to recall something you learned earlier. Here recently learnt material interferences in recalling of past-learnt material.

- Lack of Rest and Sleep: Continuous learning without rest and sleep may lead to greater forgetting due to inefficient consolidation. Experimental studies have shown that sleep following learning favors retention, it has also been found that saving is definitely greater after sleep especially with 8 hours interval. Forgetting is slow during sleep.

- Poor Health and Defective Mental State: Memory traces are essential for remembering only when we pay attention to the information that has to be stored can be saved but poor health and mental tension effect own attention, which in turn affects the effective learning and receiving.

Nature of the Material Learned: Mount of forgetting also varies with the nature of the material learned. Ebbing Hans and others have verified the fact that humans remember things that are meaningful better than things that are not.

- Methods Used to Learn: Part from the nature of the material we learn, systematic and efficient methods used in learning also influence our rate of forgetting.

Raise in Emotion: Emotion plays an important role in learning and forgetting. Sudden rise of emotions blocks the recall. During the high emotional state, blood sugar level is impaired. To maintain the balance internal gland produces cartisole that disturbs memory cells.

Hence we experience mental block leading to description in thinking, reasoning and perception, etc. For instance, students having the fear of examination cannot recall anything. Emotional shocks that occur during, before or after learning also have an impact on retention.

Apart from the external causes, internal causes, that is functional and organic factors, also causes forgetting. They are nothing but the condition that disturbs memory referred to as **amnesia**.

Amnesia is a condition in which memory is disturbed. The causes of amnesia are organic or functional. Organic causes include damage to the brain through trauma or disease or use of certain drugs. Functional causes are psychological factors such as defense mechanisms.

Amnesia may also be spontaneous, in the case of transient global amnesia. This global type of amnesia is more common in middle-aged to elderly people, particularly makes and usually lasts less than 24 hours. Types of amnesia are dissociative amnesia, childhood amnesia, psychogenic amnesia, global amnesia, etc.

TYPES OF FORGETTING:

- Natural forgetting: forgetting occurs with the lapse of time in a quite normal way without an intension of forgetting on the part of individual.
- Morbid or Abnormal forgetting: one deliberately tries to forget something which he does not want to remember.
- General forgetting: the total loss of once recalling the previous learning.
- Specific forgetting: individual forgets only one or other specific part of his earlier learning.
- Physical or psychological forgetting: individual losses his memory on account of the factors of age, disease, accidents, intoxication etc is said to be physical or organic forgetting.
- Psychological forgetting: individual losses his memory due to factors like stress , anxiety, conflicts, lack of interest, aversion, apathy, repression etc.

EBBINGHAUS FORGETTING CURVE

Ebbinghaus forgetting curve describes the decrease in ability of the brain to retain memory over time. The issue was hypothesized by Hermann Ebbinghaus in 1885, which is why it's called Ebbinghaus forgetting curve.

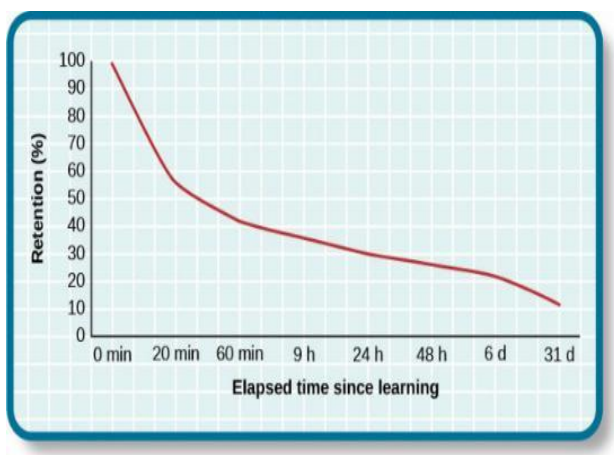
The theory is that humans start losing the memory of learned knowledge over time, in a matter of days or weeks, unless the learned knowledge is consciously reviewed time and again. A related concept to the forgetting curve is strength of memory, which states that the time period up to which a person can recall any memory is based on the strength of the particular memory.

The first study to hypothesize the forgetting curve was done in 1885. Mathematically, the formula that can describe the phenomenon is

- = **e-t/s**

Here, R refers to memory retention, S refers to relative strength of memory and t refers to time.

Hermann published is first study about the forgetting curve in German, which was later translated to be called Memory. A contribution to Experimental Psychology. Ebbinghaus



Ebbinghaus found the forgetting curve to be exponential in nature. Memory retention is 100% at the time of learning any particular piece of information. However, it drops rapidly to 40% within the first few days. After which, the declination of memory retention slows down again.

In simple words, forgetting curve is exponential because memory loss is rapid and huge within the first few days of learning. But, the rate of memory loss decreases and the rate of much forgetting are much slower from then on.

Ebbinghaus also discovered another phenomenon called over learning during his study on forgetting curve. The basic idea is that if you practiced something more than what is usually required to memorize it, the effect of overlearning takes place. This means that the information is now stored much more strongly and thus the effects of forgetting curve for overlearned information is shallower.

Rate of Forgetting

There are various factors that can affect the rate of forgetting. Some of which are

-Meaningfulness of the information

-The way it is represented

-Physiological actors (stress, sleep, etc)

The rate of forgetting isn't same between every one. Herman Ebbinghaus pointed out that different in memory performance between two different individuals can be explained by mnemonic representation skills.

Increasing Memory Strength

Ebbinghaus hypothesized that difference in memory strength between individuals could be somewhat triumphed over by simple training in mnemonic techniques. Two of the methods he asserted to be among the best ways to increase strength of memory is:

-Better memory representation (e.g. with mnemonic techniques)

-Repetition based on active recall (esp. spaced repetition)

He believed that each repetition in learning leads to increase in the interval for when the next repetition is required. It was later discovered that higher original learning also lead to slower loss in memory for instance, taking time to repeat information every day during exams decreases the effects of the forgetting curve. According to research, information should be repeated within the first 24 hours of learning to reduce the rate of memory loss.

Note: Not all memories follow the forgetting curve as there could be various other factors in play, such as noise and other environmental factors. Because of their influence on what information is remembered, not all memories are affected by detrimental effects of interference.

APTITUDE

Next to intelligence, aptitude is considered to be another important characteristic of an individual which can predict success in a course of study or career. It is asserted that aptitudes are related to vocational success as intelligence is related to success in life in general. Along with the measurement of general intelligence, the measurement of aptitude is also necessary because both these measures provide sufficient information about the potentialities of an individual.

Before thinking about aptitude tests it is obvious to know about the meaning of aptitude. The word aptitude is derived from the word “Aptos” which means ‘fitted for”.

FIG - APTITUDE

To explore the meaning and nature of aptitude few definitions are cited below:

Dictionary of Education – Aptitude is defined as a “Pronounced innate capacity for or ability in a given line of Endeavour such as a particular art, school subject or vocation.”

Van Dusen has defined the term in a rather strict manner. “Aptitude is a measure of the probable rate of learning which results in interest and satisfaction and is relatively specific and narrow.”

English and English – “Aptitude may be regarded as the capacity to acquire proficiency with a given amount of training.”

Traxler – “Aptitude is a condition, a quality or a set of qualities which is indicative of the probable extent to which an individual may be able to acquire, under suitable training, some knowledge, understanding, or skill.”

Characteristics:

- Aptitude is symptomatic or indicative of one’s potentialities.
- An understanding of one’s aptitude helps us to know what he can do in the future.
- It is the combination of both inborn capacities and developed abilities and skills etc.

- Aptitude can be developed by practice and training.
- It is considered to be unique or unusual potential of an individual.
- Aptitude opens the ways of interest and satisfaction in life,
- It connotes more than potential ability in performance,
- It is a present condition but with a forward reference.

Measurement of Aptitude

A number of aptitude tests have been developed. Apart from general aptitude batteries, aptitude tests in special areas, aptitude tests for different professions and tests of artistic aptitude (or talent) are now available for us.

Aptitude tests can be broadly categorized under two heads viz.:

- **Differential Aptitude Test**

Battery (B**) Special Aptitude tests**.

- **DIFFERENTIAL APTITUDE TEST BATTERY:**

This is a comprehensive and carefully developed Battery. It has been developed by George K. Bennett, Harold G. Seashore and Alexander G. Wesman. It was developed principally for use in educational and vocational counseling of high school students. The Battery consists of 7 subtests.
These subtests are:

- **Verbal reasoning test**: This type of test may be employed to gauge your understanding of written texts and how factual your drawn conclusions are from the written material. You may be given a small passage of text and asked to give a False, True or Cannot Say reply to every statement. Verbal reasoning tests may help recruiters identify those candidates who can understand, analyze and make their own accurate conclusions from written materials, no matter what the industry they are working in.

- **Numerical ability test**: Numerical reasoning tests are standardized psychometric assessment tests that provide the employing organization with information about a candidate's general numerical aptitude. These tests are designed to measure a candidate's ability to make correct decisions or inferences from numerical or statistical data. It is intended to measure the ability to work with numerical data in a realistic workplace context.

- **Abstract reasoning test**: Abstract reasoning is a broad category that includes tests which ask you to draw logical conclusions based on information expressed through shapes, patterns and words. The major abstract reasoning tests used and discussed below are inductive, diagrammatic reasoning and deductive

- **Space relations tests** : Spatial reasoning tests are non-verbal, standardized psychometric assessment tests. These tests are often used in technical sectors (such as engineering) but also in the military. Spatial reasoning is essential for solving everyday problems, such as using a map and compass, merging into high-speed traffic, and orienting yourself in your environment.

- **Mechanical reasoning test**: Mechanical reasoning tests usually target and assess your depth of ability and competency with mechanical concepts. Also, they may help measure your innate capacity to make use of application engineering principles in order to come up with the correct answer. Usually, mechanical reasoning tests are used in the recruiting process of technical and engineering job positions. These tests may include problems relating to mechanical and engineering concepts and may be designed to gradually increase in difficulty while maintaining the same amount of time limitation.

- **Language usage test**: While verbal reasoning is language based, language aptitude or literacy skills tests are an assessment of your level of language and your ability to communicate clearly to others through writing. The test structure focuses on the applicant's knowledge in areas such as spelling, grammar, sentence structure and the general ability to use language proficiently.

- **Clerical speed and accuracy test**: The Clerical Speed and Accuracy Test is one of our many online pre-employment aptitude tests. Also known as the "Perceptual Speed & Accuracy Test", it uses a classic approach to measuring a candidate's ability to read quickly, compare sets of information, and make simple decisions.

(B) SPECIAL APTITUDE TESTS:

We shall discuss the different Special Aptitude Tests under following headings:

- **Mechanical Aptitude Test:**

Mechanical ability is an ability involved in manipulating concrete objects, such as tools, and in dealing mentally with mechanical movements.

A number of tests are available for measuring mechanical aptitude for a fairly large field of occupations rather than for a single occupation.

- Minnesota Mechanical Assembly Test.
- Minnesota Spatial Relations Test.
- Minnesota Paper Form Board.
- Johnson O'Connor's Wiggly Blocks.
- Sharma's Mechanical Aptitude Test Battery.
- Stenguist Mechanical Aptitude Tests.

- **Clerical Aptitude Tests:**

Different opinions are held regarding the term clerical aptitude. Super copines that it refers to the ability of routine clerical work. Bills points out clerical duties "include the gathering, classification, and presentation of data of all sorts, and analysis and use of these data in planning, executing and determining the results of operation."

A number of tests are available for measuring clerical aptitude:

  - Minnesota Clerical Aptitude Test.
  - General Clerical Aptitude.
  - The Detroit Clerical Aptitude Examination.
  - P.R.W. Test.
  - Orissa Test of Clerical Aptitude.
  - Clerical Aptitude Test.

- **Artistic Aptitude Tests:**

Some tests have been devised to measure the artistic aptitudes. They are

- Graphic Arts Test: These tests measure the art and aesthetic aptitudes.
- Musical Aptitude Tests: These tests measure the various components of musical talent.
- Literary Aptitude Tests: Some examples of such tests are Abbot Traube Test, Rigg Poetry `Judgment Test.

- **Professional Aptitude Tests:**

These tests primarily measure aptitude for different professions. Such tests are administered before admission into professional institutions like medical, legal, engineering institutions. There are many tests to measure aptitude in medicine, science, mathematics, law, engineering, teaching etc.

- **Scholastic Aptitude Tests:**

These tests measure the scholastic aptitudes. Some examples of such tests are Scholastic Aptitude Tests of C.E.E. Board, Graduate Record Examination.

SHORT ANSWER QUESTIONS:

1. Define memory?
2. Define forgetting and mention its types?
3. Define aptitude?
4. What is meant by Amnesia?
5. Mention the causes of forgetting?

ESSAY ANSWER QUESTIONS:

1. Mention the types of memory and write various methods used to improve memory?
2. Write in detail about aptitude tests?

UNIT- 6

INTELLIGENCE

Contents:

INTRODUCTION

Intelligence is understood as the ability to acquire knowledge, to think and give reason effectively and to deal adaptively with the environment. This mental capacity helps him in the task of theoretical as well as practical manipulation of things, objects or events present in his environment in order to adapt or face new challenges and problems in life as successfully as possible.

Intelligence derives from ability to learn and utilize what has been learned in adjusting to new situations and solving new problems. The concept of intelligence owes much to early studies of animal learning. About a century ago, following publications of Darwin's "Origin of Species", there was a flurry of interest in the evolution of intelligence and many tests were devised to measure intelligence in animals ranging from ants to chimpanzees.

These were tests of learning ability. The general procedure was to block a customary access to food or to introduce a disturbing element from which escape was possible. Intelligence is the capacity to understand the world, think rationally, and use resources effectively when faced with challenges.

Intelligence represents a focal point for psychologists; they intend to understand how people are able to adopt their behaviour to the environment in which they live. It also represents a key aspect of how individuals differ from one another in the way in which they learn about and understand the world. Psychological tests are used to measure individual differences that exist among people in abilities, aptitudes, interests and aspect of personality.

Definitions:

- **Terman:** "An individual is intelligent in proportion as he is able to carry on abstract thinking".
- **Thorndike:** Intelligence as "the power of good responses from the point of view of truth or fact".
- **Wagnon:** "Intelligence is the capacity to learn and adjust to relatively new and changing conditions".
- **Wechster:** "Intelligence is the capacity to understand the world, think rationally, and use resources effectively when faced with challenges".

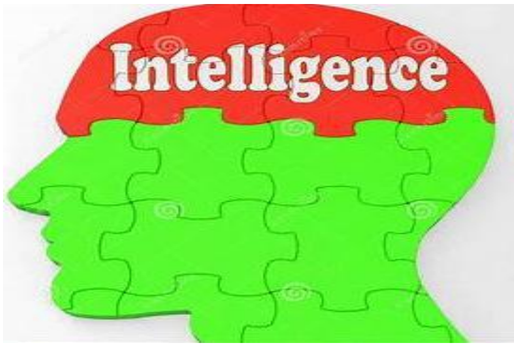


FIG - INTELLIGENCE

Measuring of Intelligence

Intelligence is a person's capacity to (1) acquire knowledge (i.e. learn and understand), (2) apply knowledge (solve problems), (3) engage in abstract reasoning. It is the power of one's intellect, and as such is clearly a very important aspect of one's overall well-being. Psychologists have attempted to measure it for well over a century.

The attempt to measure human intelligence had begun in the 19^{th} century itself. Alfred Binet in collaboration with Theodore Simon developed the first intelligence test in 1905. The Binet-Simon Scale contained 30 items. The scale was revised many times by Binet. In 1916, the scale was revised by Lewis M. Terman of Stanford University and is known as Stanford Binet Intelligence Scale.

Another important event in the development of intelligence test was the formation of the Wechsler Adult Intelligence Scale (WAIS) published in 1955 and Wechsler Intelligence Scale for Children (WISC). During the First World War time A.S. Otis developed a group test of intelligence known as Army Alpha Intelligence Examination.

Intelligence being only a concept or an abstraction can't be measured in physical units like a length of cloth or temperature of the body rather we measure an individual's intelligence by means of what we call **Intelligence Tests**.

The most commonly known intelligence tests fall into three categories. Namely: 1. Individual Tests, 2. Group Tests, and 3. Performance Tests of Intelligence.

Intelligence tests may also be classified as Verbal Tests and Non-verbal tests. In verbal tests, the person is asked to read or write. In Non-verbal tests, the person is required to perform some acts or to do some practical work.

The Concept of C.A, M.A and I.Q:

Some of the basic expressions for the measurement of Intelligence are i) Chronological Age (C.A), ii) Mental Age (M.A) , iii) Intelligence Quotient (I.Q).

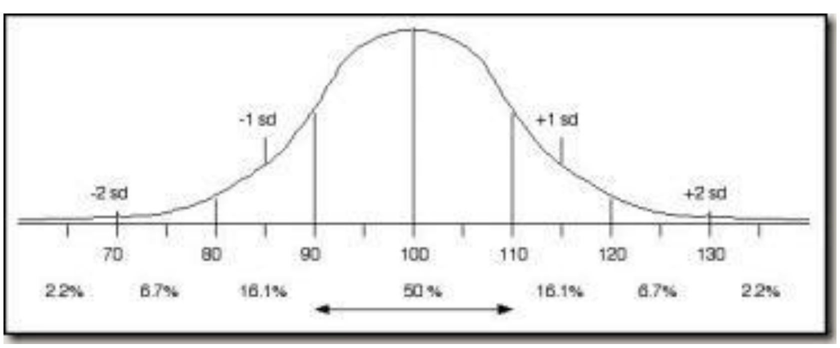
1. Chronological Age (C.A):

This is the physical age of a person counted from the date and time of his birth. It is counted in terms of years, months and hours etc.

2. Mental Age (M.A):

Binet conceived the idea of Mental Age (M.A.) to measure intelligence. Tests were made for different age levels. This is an index of intelligence rank. A child's mental age can be measured from his performance on an intelligence test. If a test was passed by 60-90% of children of given age, Binet accepted it for that age level. A child who successfully performs all the tasks thus accepted for the five year old child is taken to have a mental age of five, whatever his Chronological Age (C.A.) may be. If he is five years old chronologically too he is rated as normal or average. A seven year old child having a M.A. of six is considered as mental deficient, but if he has a M.A. of eight then he is said to be above average in intelligence.

3.Intelligence Quotient (IQ) is the score you get on an intelligence test. Originally, it was a quotient (a ratio): IQ= MA/CA x 100 [MA is mental age, CA is chronological age]. Today, scores are calibrated against norms of actual population scores.



IQ	**Classification**
Below 70 (2.2%)	Mentally Retarded or Feeble Minded (50-69: Morons, 25-49: Imbeciles, Below 25: Idiots)
70 – 79 (6.7%)	Borderline
80 – 89 (16.1%)	Dull – low average
90 – 109 (50%)	Average
110 – 119 (16.1%)	Superior
120 – 139 (6.7%)	Very Superior
140 and above	Genius

INTELLIGENCE TESTS

Verbal and Non-verbal Tests

- **Verbal tests.** This denotes tests in which questions are asked or oral or in written form of a given language, for which answers also have to be given in oral or written language. These tests are not intended for, and cannot be used in the case of illiterates and small children, since such people lack linguistic ability.

- **Non-verbal tests / performance tests**. These include tests that do not require the use of language, but could be manipulated using figures, pictures, blocks or even other objects. Examples of it are Army Beta Intelligence Test, Pidgon's non-verbal tests and Raven's Progressive Matrices. Their advantage is that they can be used for testing subjects who lack language ability

INDIVIDUAL VERBAL TESTS.

These tests are administered to one individual at a time. These cover age group from 2 years to 18 years. The tests involving use of language and administered to an individual at a time to this category. An example of such test we can quote is Binet-simon scale

- **<u>THE BINET - SIMON SCALE</u>**

The Stanford-Binet test is an examination meant to gauge intelligence through five factors of cognitive ability. These five factors include reasoning, knowledge, quantitative reasoning, visual-spatial processing and working memory. Each of the five factors is given a weight and the combined score is often reduced to a ratio known commonly as the intelligence quotient, or IQ. The Stanford-Binet test is among the most reliable standardized tests currently used in education. It has undergone many validity tests and revisions throughout its century-long history, and while there are undoubtedly a few issues with the assessment, most results are treated as accurate. That is, individuals with high scores are usually gifted, and those with low Stanford-Binet test scores often face some sort of cognitive disability.

INDIVIDUAL PERFORMANCE TEST:

The complete non-verbal or non-language tests of intelligence for testing an individual one at a time come into this classification. In this test the contents and responses are in the form of performance and language is not used at all. Some of the tests include

- **<u>KOHS BLOCK DESIGN TEST</u>** is a cognitive test for children or adults with a mental age between 3 and 19. It is mainly used to test persons with language or hearing handicaps but also given to disadvantaged and non-English-speaking children. The child is shown 17 cards with a variety of coloured designs and asked to reproduce them using a set of coloured blocks. Performance is based not just on the accuracy of the drawings but also on the examiner's observation of the child's behaviour during the test, including such factors as attention level, self-criticism, and adaptive behaviour (such as self-help, communication, and social skills). The Kohs block test is sometimes included in other tests, such as the Merrill-Palmer and Arthur Performance scales.
- **<u>TRACING A MAZE</u>**: Test material consists of a series of mazes of increasing difficulty, each printed on a separate sheet. The subject is required to trace with pencil, the path from entrance to exit. Porteus maze test is an example involving such type of activities

GROUP VERBAL TESTS:

Group tests are administered to a group of people Group tests had their birth in America – when the intelligence of the recruits who joined the army in the First World War was to be calculated. One of the major tests is army alpha test

- **THE ARMY ALPHA TEST:** The Army Alpha is a group-administered test developed by Robert Yerkes and six others in order to evaluate the many U.S. military recruits during World War .It was first introduced in 1917 due to a demand for a systematic method of evaluating the intellectual and emotional functioning of soldiers. The test measured "verbal ability, numerical ability, ability to follow directions, and knowledge of information". Scores on the Army Alpha were used to determine a soldier's capability of serving, his job classification, and his potential for a leadership position. Soldiers who were illiterate or foreign speaking would take the Army Beta, the nonverbal equivalent of the exam.

GROUP PERFORMANCE TESTS

These tests are administered to the illiterate persons and no need to use language. These can be applies to a group of individuals at a time. One of them is

- **ARMY BETA TEST**: The Development of the beta test and of the performance test for the examination of the foreign speaking and illiterate presented special problems. The use of demonstration charts and mime to convey the instructions to the persons being examined proved successful. The new type of the test in the beta, using geometrical designs, mutilated pictures, etc., required different principles in its construction

Difference between Verbal test and Non-verbal test

S.No	Verbal Test	Non-verbal Test
1.	It makes use of language	It makes use of pictures and designs
2	The abilities measured are verbal reasoning, memory and numerical reasoning	The abilities measured are spatial ability, speed and induction
3	It cannot be used for testing individuals who lack language ability	Individuals who lack language ability also can be tests by it.
4	It is less expensive	It is more expensive
5	The results of the tests are much affected by schooling	The results of the tests are less affected by schooling
6	Standardization is easy	Standardization is difficult
7.	Administration and scoring are easy	Administration and scoring are difficult

Difference between Individual and Group Tests

No.	Individual Test	Group Test
1.	Tests intelligence of an individual at a time	Tests intelligence of a group at a time
2.	Useful for children of every age	Not useful for children of lower age groups
3.	Time consuming	Time saving
4.	Uneconomic in terms of money and labour	Economic in terms of money and labour
5.	Administration is not easy	Administration is easy
6.	Interest of the individual is assured	Interest of the individual is not assured
7.	Results can be judged then and there	Results cannot be judged them and there

Advantages of Intelligence Tests

- Intelligence tests are used for the purpose of making selection of suitable candidate for admission to courses that demand different levels of intelligence.
- Intelligence tests help the teacher to classify students into homogeneous groups for providing individualized instruction.
- Scores obtained in intelligence tests can motivate individuals to reach higher levels in the ladder.
- Intelligence tests help in revealing the potentialities of an individual and in this way make possible the prediction of one's success in a particular field.
- Intelligence tests help to detect the exceptional children such as gifted, backward and mentally retarded. This in turn helps the teacher organize appropriate compensatory services.
- Intelligence tests help in the diagnosis of problematic behavior of the child.
- Intelligence testing has been proved to be very useful in psychological, sociological and educational research.

Limitations of Intelligence Tests

- Intelligence tests label some students as superior and the others as inferior. This type of knowledge may create so many psychological problems.

- A teachers' knowledge of the intelligence of his pupils may result in slackness on his part. He may put the entire responsibility of a pupil's failure on his inferior intelligence, while an intelligent student may be left to work for himself.
- Intelligence tests results have been misused to uphold the theory of royal blood, segregation and sectarian outlook.

Abilities measured by intelligence tests

- Numerical reasoning
- Analogies
- Classification
- Spatial relations
- Logical selection
- Synonyms
- Practical judgement
- Verbal comprehension
- Memory
- Problem solving

MENTAL RETARDATION

Mental retardation (**MR**), is a generalized neuro developmental disorder characterized by significantly impaired intellectual and adaptive functioning. It is defined by an IQ score under 70 in addition to deficits in two or more adaptive behaviors that affect every day, general living.

It is defined as an intellectual functioning level (as measured by standard tests for intelligence quotient) well below average and significant limitations in daily living skills (adaptive functioning Description of MR.)

Page- "mental retardation is a condition of subnormal mental development present at birth or early childhood and characterized mainly by limited intelligence and social inadequacy"

- According to the 'Centre for Disease Control and Prevention', in the 1990s, mental retardation occurred in 2.5 to 3 percent of the general population. Mental retardation begins in childhood or adolescence before the age of 18.
- It persists throughout adulthood. Intellectual functioning level is defined by standardized tests (Weschsler-Intelligence Scales) that measure the ability to reason in terms of mental age (intelligence quotient or IQ). Diagnosis of mental retardation is

made if an individual has an intellectual functioning level well below average and significant limitations in two or more adaptive skill areas.

- Mental retardation is defined as IQ score below 70 to 75.
- Adaptive skills are the skills needed for daily life. Such skills include the ability to produce and understand language (communication); home-living skills; use of community resources; health, safety, leisure, self-care, and social skills; self-direction; functional academic skills (reading, writing, and arithmetic); and work skills.
- In general, mentally retarded children reach developmental milestones such as walking and talking much later than the general population.
- Symptoms of mental retardation may appear at birth or later in childhood. Time of onset depends on the suspected cause of the disability.
- Some cases of mild mental retardation are not diagnosed before the child enters pre-school.
- These children typically have difficulties with social, communication, and functional academic skills.

Children who have a neurological disorder or illness such as encephalitis or meningitis may suddenly show signs of cognitive impairment and adaptive difficulties

Categories of mental retardation

Mild Mental Retardation

Approximately 85 percent of the mentally retarded population is in the mildly retarded category. Their IQ score ranges from 50 to 75 and they can often acquire academic skills up to the sixth grade level. They can become fairly self-sufficient and in some cases live independently, with community and social support.

Moderate Mental Retardation

About 10 percent of the mentally retarded population is considered moderately retarded. Moderately retarded individuals have IQ scores ranging from 35 to 55. They can carry out work and self-care tasks with moderate supervision. They typically acquire communication skills in childhood and are able to live and function successfully within the community in a supervised environment such as a group home.

Severe Mental Retardation

About 3 to 4 percent of the mentally retarded population is severely retarded. Severely retarded individuals have IQ scores of 20 to 40. They may master very basic self-care skills and some communication skills. Many severely retarded individuals are able to live in a group home.

Profound Mental Retardation

Only 1 to 2 percent of the mentally retarded population is classified as profoundly retarded. Profoundly retarded individuals have IQ scores under 20 to 25. They may be able to develop basic self-care and communication skills with appropriate support and training. Their retardation is often caused by an accompanying neurological disorder. The profoundly retarded need a high level of structure and supervision

Causes of Mental Retardation:

Anytime something interferes with normal brain development, intellectual disability can result. However, a specific cause for intellectual disability can only be pinpointed about a third of the time.

The most common causes of intellectual disability are:

Genetic conditions: These result from abnormality of genes inherited from parents, errors when genes combine, or from other disorders of the genes caused during pregnancy by infections, overexposure to x-rays and other factors. Inborn errors of metabolism which may produce mental retardation, such as PKU (phenylketonuria), fall in this category. Chromosomal abnormalities have likewise been related to some forms of mental retardation, such as Down syndrome and fragile X syndrome.

Problems during pregnancy: Use of alcohol or drugs by the pregnant mother can cause mental retardation. Malnutrition, rubella, glandular disorders and diabetes, cytomegalovirus, and many other illness of the mother during pregnancy may result in a child being born with mental retardation. Physical malformations of the brain and HIV infection originating in prenatal life may also result in mental retardation.

Problems at birth: Although any birth condition of unusual stress may injure the infant’s brain, prematurity and low birth weight predict serious problems more often than any other conditions.

Problems after birth: Childhood diseases such as whooping cough, chicken pox, measles, and Hib disease which may lead to meningitis and encephalitis can damage the brain, as can accidents such as a blow to the head or near drowning. Substances such as lead and mercury can cause irreparable damage to the brain and nervous system.

Poverty and cultural deprivation: Children in poor families may become mentally retarded because of malnutrition, disease-producing conditions, inadequate medical care and environmental health hazards. Also, children in disadvantaged areas may be deprived of many common cultural and day- to-day experiences provided to other youngsters. Research suggests that such under-stimulation can result in irreversible damage and can serve as a cause of mental retardation.

Illness or injury: Infections like meningitis, whooping cough, or the measles can lead to intellectual disability. Severe head injury, near-drowning, extreme malnutrition, exposure to toxic substances such as lead, and severe neglect or abuse can also cause

Symptoms of Mental Retardation:

There are many different signs of intellectual disability in children. Signs may appear during infancy, or they may not be noticeable until a child reaches school age. It often depends on the severity of the disability. Some of the most common signs of intellectual disability are:

- Rolling over, sitting up, crawling, or walking late
- Talking late or having trouble with talking
- Slow to master things like potty training, dressing, and feeding himself or herself
- Difficulty remembering things
- Inability to connect actions with consequences
- Behavior problems such as explosive tantrums
- Difficulty with problem-solving or logical thinking
- In children with severe or profound intellectual disability, there may be other health problems as well. These problems may include seizures, mental disorders, motor handicaps, vision problems, or hearing problems.

Diagnosis of Mental Retardation:

Mental retardation is diagnosed by looking at two main things. These are:

- the ability of a person's brain to learn, think, solve problems, and make sense of the world (called IQ or intellectual functioning); and
- Whether the person has the skills he or she needs to live independently (called adaptive behavior or adaptive functioning).

Intellectual functioning, or IQ, is usually measured by a test called an IQ test. The average score is 100. People scoring below 70 to 75 are thought to have mental retardation. To measure adaptive behavior, professionals look at what a child can do in comparison to other children of his or her age. Certain skills are important to adaptive behavior.

These are:

- Daily living skills, such as getting dressed, going to the bathroom, and feeding one's self;
- Communication skills, such as understanding what is said and being able to answer;
- Social skills with peers, family members, adults, and others.

Treatment of Mental Retardation:

The primary goal of treatment is to develop the person's potential to the fullest. Special education and training may begin as early as infancy. This includes social skills to help the person function as normally as possible.

It is important for a specialist to evaluate the person for other affective disorders and treat those disorders. Behavioral approaches are important for people with mental retardation.

The methods are: 1. Education 2. Trainable Mentally Retarded Children 3. Residential Placement 4. Psychotherapy 5. Individual Psychotherapy 6. Group Therapy 7. Behaviour Modification 8. Observational Learning 9. Prevention 10. Secondary and Tertiary Prevention.

Method # 1. Education:

- Educating parents
- Educating the mentally retarded.

(a) Educating parents:

Mental retardation strikes the parents much harder than it does the retarded child itself. Because of the personality difficulties and problems of adjustment of the retarded child, many parents consider their life to be miserable.

However, while some parents ignore the mentally retarded child, others go out of their way to help him to the extent of overprotecting him. This, on the contrary, makes one child completely unfit to learn or achieve anything.

The parents therefore should be properly trained as how to handle the mentally retarded child. No doubt the mentally retarded child should be given proper love and affection. But this should not amount to something like overprotection and overindulgence. The parents must be sympathetic but at the same time they should be strong on certain points.

Their child rearing practices, values and ideas should not be inconsistent and paradoxical. Their attitude towards the subnormal child should not be conflicting or rigid either. He should be given all opportunities for adequate play, open space and toys which are attractive, safe and strong.

He should also be encouraged to help in the household chores so that he can develop some sort of self confidence and sense of achievement. He should be praised for his accomplishment, whatever it may be.

(b) Educating the mentally retarded :

Special education provides reasonable help to educate the mentally retarded children.

For the purpose of special education, retarded people may be classified into two groups:

- The educable mentally retarded (EMR) and
- The trainable mentally retarded (TMR).

EMR children have the I.Q. range of 55—70. They can go up to the 3rd to 6th grade by the time they complete school education. The aim of their education is to take care of them independently.

Special small classes are conducted for EMR children where they are taught to learn social competence and occupational skills rather than academic achievement as is usually done in normal schools. Specially structured teaching materials are also prepared for the mentally retarded.

Robinson and Robinson (1976) have reported special classes and programmes are conducted for people of different age groups. Students are taught vocational and domestic skills. They are taught to deal with everyday problems such as use of money, reading newspapers, application for jobs etc.

Method # 2. Trainable Mentally Retarded Children:

TMR children are much more retarded than EMR children and so their educational structure and curriculum are different. They have I.Q. in the range of 25-55. They are mainly taught to take care of themselves and to do simple occupational jobs. Regular schooling is difficult rather impossible for TMR children because of the physical problems in the severely retarded group such as seizures, lack of control over elimination etc.

In fact, the aim of TMR classes is to teach them basic skills that normal and EMR children learn as they grow. The basic aim of TMR education is to teach these severely retarded children how to do their daily work like washing and dressing themselves, eating properly, doing simple jobs, toilet training etc.

Retarded children placed in regular classrooms may be less disturbed than those forced to remain in special classes. It is also a fact that regular classes bear a greater resemblance to the real world. It is more reality-oriented. Finally, mentally handicapped children help other children to understand and accept them. Consequently the retarded child gets better scope for emotional security and adjustment.

Method # 3. Residential Placement:

Earlier it was also known as institutionalisation. Residential places deals with the total control of the retarded person's life, his private and personal experiences. It removes the retarded persons from their home environment and places them in an artificially made environment suitable for their personality development.

Here they may reside either permanently for a period of time till they are cured. Usually majority of the severely and profoundly retarded persons need institutionalization.

One alternative to the residential treatments is the 'group home.' It is a type of boarding house in which a fixed number of retarded people stay together with some professional staff who look after them. They live here as normally as possible learning simple vocational tasks, taking part in group therapy.

The group home is much better than the large institutions and it has many of the facilities of real home for the retarded person. There are also day care centres and sheltered workshops. The day care centres train the children who are too young and too retarded to remain in institutions or to be trained in other community programmes.

Compensatory education is another type of training aid for the mentally retarders. It attempts to prevent the developmental psychological defects which interfere with educational progress.

It specially helps in the prevention of cultural familial retardation by imparting structural programmes on sensory and language stimulation for the development of achievement motivation, problem solving skills and interpersonal relations. The mothers of children also receive training in understanding, caring and managing the retarded children adequately.

Method # 4. Psychotherapy:

Psychotherapy deals successfully with the emotional problems and problems of maladjustment, as well as psychological symptoms. It is a well established fact that mentally subnormal people demonstrate a number of psychological problems and complexes which can be reduced by psychotherapy alone.

True, they face greater amount of stress in their day to day life in comparison to other normal people. Thus, they show symptoms of anxiety, irritation, anguish and finally aggression and violence.

On other occasions, they show depression and anxiety which aggravates their already retarded mental condition. Sometimes, the psychological problems become so acute that education, special training or institutionalization has no impact upon them.

Under these circumstances, psychotherapy becomes a very effective method of treatment. Usually, individual psychotherapy, group psychotherapy, behaviour modification and observational learning are included under psychotherapy.

Method # 5. Individual Psychotherapy:

It includes one to one relationship between a trained psychiatrist in the area of mental retardation and the retarded person. It may be verbal or non-verbal depending upon the subnormal person's age, capacity for reception and degree of retardation.

Nonverbal individual therapy includes play therapy, where structured and unstructured play materials are combined to match the necessity of the retarded person. While structured material is useful for mild cases, non-structured play therapy is effective for severely retarded person.

Besides play therapy, occupational therapy, music therapy and art therapy may be included. Verbal psychotherapy is applicable to those retarded persons who are capable to communicate in words with the therapists. They usually are mildly retarded adults. For the success of individual psychotherapy the rapport and the relationship between the therapist and the client is the most paramount factor.

Method # 6. Group Therapy:

Proofs are there to show the advantages of group therapy over individual therapy. Group therapy is said to be a more economical method of treatment. Secondly, the group atmosphere is conducive to safe practice of the technique relating to peers and friends which may be ignored in individual therapy.

Lastly, group therapy provides individual members with models and examples for better adjustment. It also recreates a sense of safety, we feeling and togetherness which can be of great help psychologically speaking to the retarded person who is in-secured, frightened and depressed.

Method # 7. Behaviour Modification:

During the recent years behaviour modification has proved to be a very effective technique in treating the mentally retarded persons. It involves, to be more precise, the principles of reinforcement and punishment for modification of behaviour. By applying suitable reinforcements the behaviour modifier can change the behaviour of the mentally retarded person in the desirable direction.

Method # 8. Observational Learning:

By this technique new models or examples are presented to the retarded persons and the retarded persons are to change themselves according to these models. Researches show that it has been possible to teach moderately and severely retarded subjects the basic skills of using the telephone through observational learning communicating simple ideas to peers. Studies as well as observation show that with attractive models and clear instructions almost all retarded children can learn through imitation.

Method # 9. Prevention:

It has been observed that prevention is better than cure and the best treatment of mental retardation is prevention. On the whole, by preventing metabolic disorders, toxins and alcohols from pregnant mother's birth and environmental hazards can be prevented to a great extent.

SHORT ANSWER QUESTIONS:

1. Define intelligence?
2. Write about I.Q ?
3. Define mental retardation?
4. Write the symptoms of mental retardation?
5. What are the advantages of intelligence tests?

ESSAY ANSWER QUESTIONS

1. Explain in detail about intelligence tests?
2. Explain causes, categories, symptoms and treatment of mental retardation?

UNIT- 7

PERSONALITY

Contents:

Introduction

“Personality” can be defined as a dynamic and organized set of characteristics possessed by a person that uniquely influences his or her cognitions, emotions, motivations, and behaviors in various situations.

Personality may also refer to the patterns of thoughts, feelings and behaviors consistently exhibited by an individual over time that strongly influence our expectations, self-perceptions, values and attitudes, and predicts our reactions to people, problems and stress. An individual’s personality is an aggregate conglomeration of the decisions they have made throughout their life and the memory of the experiences to which these decisions led. There are inherent natural, genetic, and environmental factors that contribute to the development of our personality.

According to **process of socialization**, “personality also colors our values, beliefs, and expectations. Hereditary factors that contribute to personality development do so as a result of interactions with the particular social environment in which people live.”

Cattell-“Personality is that which permits a prediction of what a person will do in a given situation”

Eysernck-“Personality is the more or less stable and enduring organisation of a person character temperament, intellect and physique which determine his unique adjustment to the environment”

Nature of Personality

- Each person is first an individual by inheritance and then acquires a personality by growing in a social world.
- Personality is one’s total integrated behaviour and not just one or more aspects of behaviour.
- The word ‘personality’ stands for a concept which is determined by a person’s social stimulus value.
- Personality is not something static like colour or height, but the totality or unity or an individual’s actions.
- Personality does not merely unfold, a person uses his capabilities to make adaptations in the social world
- Personality is a social concept.

- Personality is a dynamic concept. Imagine the type of person you were while in school, the type while in college, and again the type you are now.
- Personality is all that a person is.
- As personality is the end-product of one's heredity and environment, which is different in each individual; it is something unique and distinct

THEORIES OF PERSONALITY

A. Type and Trait approach

The earliest attempt to categories personality was made by Hippocrates (400 BC).

He categorized people on the basis of four body humours and prominent personality characteristics associated with them .Recently, psychologists have attempted to study personality in their own way. They have formulated various theories to explain personality. These are divided into two types, viz., types and traits theories. Both these theories of personality focus on people's personal characteristics. However, 'type' theorists and 'trait' theorists differ in the ways they use characteristics to describe people.

i) Type Theories:

Type theorists have explained personality on the basis of physique and temperament. Temperament refers to emotional aspect of the personality like changes in mood, tensions, excitement, etc

Three important 'Type theories' of personality are explained here:

- CG Jung's Classification:

CG Jung has classified personality on the basis of sociability character as Introverts and Extraverts.

Introverts are described as people who share characteristics such as shyness, social withdrawal, and tendency to talk less. Because of these characteristics these people appear to be self-centered, unable to adjust easily in social situations. They are not easily suggestible. They are future oriented, very sensible and rigid in ideas.

Extraverts share a tendency to be outgoing, friendly, talkative, and social in nature. They prefer social contacts, generous, sportive, and courageous. They are happy-go-lucky persons and show interest in present reality than future. They express their feelings openly. Take decisions quickly and act upon quickly. They are not affected easily by difficulties.

2.Ernest Kretschmer's Classification:

German psychologist Kretschmer has attempted to correlate physique and character. From his studies on mental patients, he found that certain body types are associated with particular types of mental disorders. He has classified personalities into three types

Pyknic type: These people will have fat bodies. They are sociable, jolly, easy going and good natured

Athletic type: These people will have strong body. They are more energetic and aggressive. They will be strong enough, determined, adventurous and balanced

Leptosomatic type: These people will have lean and thin body and are un ociable, reserved, shy, sensitive and pessimistic.

3. William Sheldon's Classification:

Sheldon has proposed a theory of personality correlating temperament and body type. He has divided people into three types:

Endomorph: These people will have soft, fat and round body, having predominance of abdominal region. They are sociable and relaxed (can be compared to pyknic type).

Ectomorph: These are the people who are tall, thin and flat chested, having the skin, bones and neural structure predominantly. They are shy, reserved and self-conscious (can be compared with leptosomatic type).

Mesomorph: These people are well built with heavy and strong muscles appear predominantly. They are physically active, noisy; adventurous by nature (can be compared to athletic type).

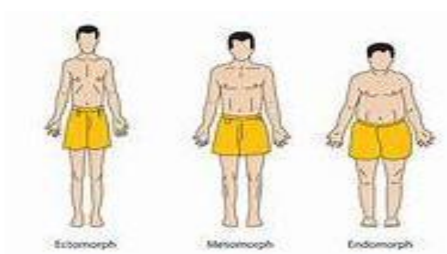


FIG - SHELDON CLASSIFICATION

ii) Trait approach:

Traits are tendencies to behave in relatively consistent and distinctive ways across situations. These are the measurable aspects of personality. The most common way to describe people is to list these traits or qualities possessed by them. For example, friendliness, social, honesty, perseverance, submissiveness, dominance, etc.

The groups of personality traits are known as personality factors or dimensions of personality. Allport and RB Cattell are famous for their work on personality studies using traits.

GW Allport was the first person to adopt the trait approach against the type approach for the description of personalities. According to him the traits are the basic units of personality. Every person develops a unique set of organised tendencies called traits.

Allport has identified three types of traits—cardinal, central and secondary. **Cardinal traits** are primary and they cover all aspects of an individual's behaviour and attributes.

Central traits represent few characteristics which can be used to describe a person such as kindness, honesty, etc. **Secondary traits** appear in only a relatively small range of situations. These are not strong enough like cardinal traits and hence they are not regarded as integral parts of one's personality.

RB Cattell has identified two types of traits. They are **source traits** and **surface traits**. Source traits are the underlying structures or sources that determine our behaviour. Surface traits are influenced by source traits and are manifested in our behaviour.

Cattell, by adopting a method called factor analysis has recognised 16 'Source traits' as building blocks of our personality. The 'Sixteen personality factor test' developed by him includes these factors. This test is widely used, because these personality characteristics can be measured and described more objectively.

B. Psychoanalytical Theory:

This theory was developed by famous psychologist Sigmund Freud. This theory has three major parts: (a) The personality structure which includes Id, Ego and Super ego (b) Topography of mind and (c) Psychosocial stages of development.

Personality structure:

Freud constructed a model of personality with three interlocking parts: the Id, the Ego and the Super ego.

-The Id:

This is the most primitive part, develops with the birth of the child. It can be thought of as a sort of store house of biologically based urges, the urge to eat, drink and eliminate.

According to Freud the Id operates on a 'pleasure principle'. That is-left to itself, the id would satisfy its fundamental urges immediately and reflexively as they arose without regard to rules, the realities of life or morals of any kind.

-The Ego:

This part usually develops from the school year of life of the child—as a result of social contacts. The ego consists of elaborate ways of behaving and thinking which constitute the executive function of the person.

The ego delays motives of Id and channels behaviour into more socially acceptable outlets. It keeps a person working for a living, getting along with people and generally adjusting to the realities of life. Freud characterized the ego as working in the service on the 'reality principle'.

That is, the ego tries to satisfy the id's urge for pleasure, but only in realistic ways. The ongoing tension between insistent urges of the id and the constraints of reality helps the ego develop certain skills to safeguard the self-image. These skills are called ego defense mechanisms.

-The Super ego:

This part of personality corresponds closely to what we commonly call the conscience. It consists mainly of prohibitions learned from parents and other authorities. The super ego may condemn as ‘wrong’ certain things which the ego would otherwise do to satisfy the id.

However, super ego is guided by ‘ego ideal’- a set of values and moral ideals that are pursued because they are perceived to be worthy. In other words the super ego operates on the ‘moral principal’.

Topography of mind:

It is understood that there will be constant conflicts going on between id, ego and super ego. These conflicts may occur in the conscious, subconscious and unconscious levels of human psyche. Freud refers to the unconscious, the subconscious and the conscious as the ‘topographical’ aspects of the self, also called as the level of consciousness. The functioning of these levels is as follows:

The conscious:

According to Freud the conscious part of mind is that part which is ready to receive the stimuli from the external world. It helps to perform the functions like eating, drinking, reading, writing, talking, thinking and such other activities and also helps us to behave in an appropriate way.

It will be functioning only when the individual is in a wake up state. At the conscious level we will be aware of certain things around us and of certain thoughts.

The preconscious:

This is also known as subconscious. At this level are memories or thoughts that are easily available with a moment’s reflection. For example, what we had for breakfast or what class was held today morning.

Preconscious will be functioning between conscious and unconscious parts. In character it resembles conscious to greater extent and will have better adjustment with it. Its contents can be recalled easily. It prevents the suppressed thoughts and other prohibited motives in the unconscious from entering the conscious part. Hence, it is also called as ‘Censor’.

The unconscious:

This part of mind contains memories, thoughts and motives which we cannot easily call up. It is the largest and also the powerful part of mind. It contains the natural instincts, thoughts inappropriate desires, irrational motives and painful experiences. All the experiences suppressed by conscious part will remain here. These forces will be trying to come to conscious part for satisfaction. But their entry is prevented by preconscious.

Hence, they try to come out when preconscious part is at rest. They appear in the form of dreams, or in the form of slip of tongue, slip of pen, automatic writing, amnesia, etc..

Personality Assessment

Assessing personality can be divided into following categories:

- Subjective methods.
- Objective methods.
- Projective methods.
- Psycho-analytical methods.
- Physical Test methods or Physiological methods.

Each one of these categories refers to a number of measuring tools or techniques.

The Subjective Methods:

The Subjective Methods are those in which the individual is permitted to disclose what he knows about himself as an object of observation. They are based on what the subject himself has to say about his traits, attitudes, personal experiences, aims, needs and interests.

Some of the important subjective methods are:

i. The autobiography,
ii. The case history,
iii. The interview, and
iv. The questionnaire or the inventory.

i.**The Autobiography**:

The autobiography is a narration by the individual, given either freely or according to certain subject headings provided by the examiner, of his experiences throughout life, of his present aims, purposes, interests and attitudes. The subject has freedom in selecting experiences which are of significance to him and these reveal his personality. The disadvantage is that what the subject out of his life is that part of his experience which he is willing to reveal.

ii. The Case History:

The case history is dependent to a great or less extent upon the autobiography. In a case history, we integrate the information that we obtain from various sources about the individual. This requires many interviews with individual and other persons who know the individual. The case-study technique gives information about the individual's parents and grand-parents, his home background, his medical history, his educational career, his friendships, his marital life, his profession and others. This method is more useful in understanding the personality-patterns of an individual who is a problem or is maladjusted

iii.The Interview:

The interview is the most common method of judging personality. The interviewer questions or lets the individual speak freely so as to get a clear picture of the individual. From what he says, the interviewer knows about his interests, problems, assets and limitations. The chief dimension in respect to which the interview may vary is the rigidity or flexibility with which the interviewer holds to a pre-decided outline or schedule of questions or topics. At times, it is useful to have a definite list of points to be covered consecutively. Greater skill is needed in free interviews which are not restricted by a list of definite points or questions. The interviewer evaluates personality traits not only from the content of answers to questions asked, but also from the dogmatism with which the news are expressed, by the interest shown, by vocabulary or incidental references which the subject employs unwittingly in his conversation, and by observing his hesitations, his fidgeting, his emotionality and the like. The limitation of the method is that it is subjective and is less valid than one believes it to be.

iv.Questionnaires:

Questionnaires are a series of printed or written questions which the individual is supposed to answer. Ordinarily, the subject is expected to answer each question by checking or encircling or underlining 'yes' or 'no' provided against the question. The investigator counts the number of yes's, No's and thus is in a position to state whether a certain individual possesses certain traits or not. The questions or statements provided describe certain traits emotions, attitudes or behaviours in situations revealing personality. The yes's or no's are counted in certain groups or sections depending on the traits to be indicated by positive or negative answers. The limitation of this device is that the subject may not be willing to reveal correct facts about himself or may not be in conscious possession of these facts. The method, at its best, reveals that part of personality which is explicit or available to the subject's scrutiny. Some of the well- known personality questionnaires are the Bernrenter Personality Questionnaire, The Bell Adjustment Inventory, and The Washbume Social-Adjustment inventory. The Indian Statistical Institute has also released a short personality inventory. Recently, other research centers have also developed their own or adapted some of the well-known inventories.

The Objective Methods:

The Objective Methods do not depend on the subject's own statements about himself but on his overt behaviour as revealed to others who serve as observers, examiners or judges. The subject, as far as possible, is observed or studied in certain life situations where his particular traits, habits, needs and other characteristics are brought into play and can thus be observed directly by the examiner. Some of the objective methods are miniature life situations, unobserved observation, physiological measures and rating scales.

- **In miniature life situations**: In miniature life situations, artificial situations resembling real life situations, are created and the subject's reactions and behaviour are observed and evaluated. Situations involving honesty, cooperation, persistence, and team-work can be created and the subject's behaviour may be noted and judged accordingly. For selection of leaders in the army, this method is often used with great advantage. Reactions to failure and success may also be evaluated by putting subjects in situations where they fail and get frustrated or gratified.

- **The method of unobserved observation**: The method of unobserved observation is quite popular in child development centers of guidance clinics. The individual is asked to perform some task or is left himself and his behaviour is observed through a one-way mirror, screen or other device and he is overheard by a concealed microphone setup. One modification of this method is prolonged observation of an individual in the same situation for several days together. Or the subject is observed by more than one person and the observations are pooled together. Of course, before observation is started, certain decisions must be arrived as to what to observe. One great case that is to be taken in this method is the distinction between what is observed and what is interpreted.

- **In rating scales**: In rating scales we rate an individual of the possession or absence of certain traits on a certain scale. The individual is given a place on the scale or a score which indicates the degree to which a person possesses a given behaviour trait. For example, if we want to rate students on their sociability, we might ask three or four supervisors or teachers to point out the place of each student on the scale which may be as follows. This scale has five degrees of the trait to be rated i.e., this is a five-point scale. Some scales have three or seven degrees.

The Projective Methods:

In these methods or techniques, the examiner does not observe the overt behaviour of the subject as in miniature life situations; nor does he ask the subject to state his opinion of his own behaviour or his feeling about certain experiences. Instead, the subject is requested to behave in an imaginative way i.e., by making up a story, interpreting ink-blots or constructing some objects out of plastic material and drawing what he wants.

Thus the subject is encouraged to ‘project’ or throw his thoughts, emotions, wishes and other reactions freely in some situations which are provided. These methods are, thus, intend to reveal the underlying traits, moods, attitudes and fantasies that determine the behaviour of the individual in actual situations. The assumption that underlies the use of projective method is that in what he perceives in his unstructured and indefinite environment and what he says about it, an individual is revealing his innermost characteristics or his personality.

The projective techniques have in common the following features:

The stimulus material is generally neutral, ambiguous or more or less undefined so that the subject can easily leave an impression of his personality on it.

The psychological reality, rather than the actual reality of the subjects world is important – his wishes, his attitudes, beliefs, ideals, conflicts and fantasies.

Implicit or unconscious aspects of the personality are revealed in these techniques – and psycho-dynamic principles, therefore, play an important part in the interpretations.

An untrained interpreter is likely to project his own biases and fantasies into his interpretations of the subject’s productions.

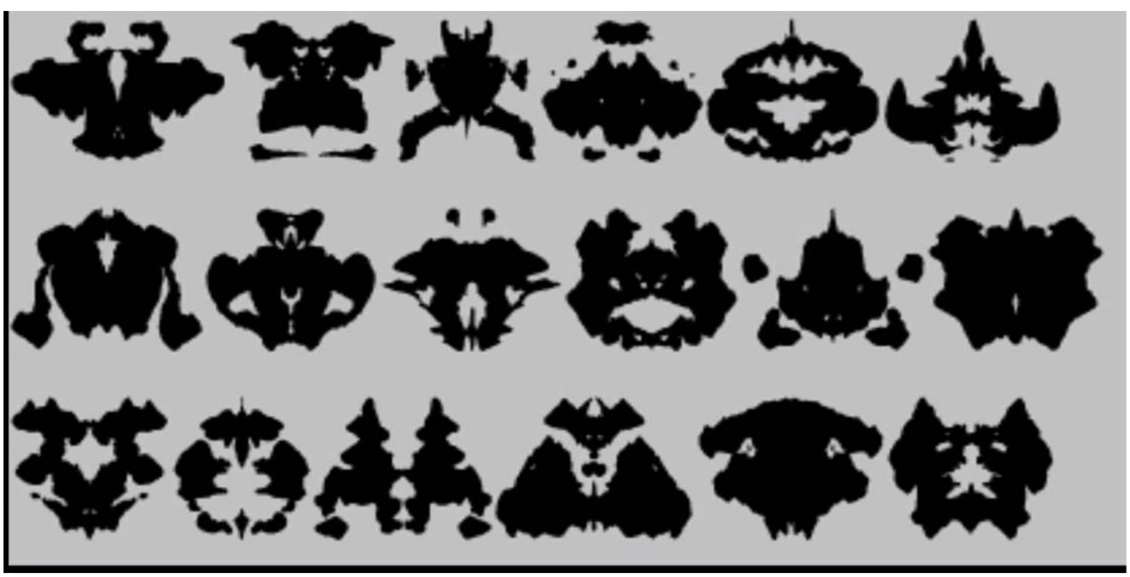
Some of the important projective techniques are the Roareschach Test, the TAT or the Thematic Apperception Test, the Sentence Completion Tests, the Tantophone, the play techniques, the word-association method or the picture association method.

1. The Rosschach Ink Blot Test:

Developed by a Swiss psychologist Herman Rosschach (1921), consists of 10 inkblots having symmetrical designs. Five of these cards are in black and white, two with splashes of red and three in other colours. The test is usually administrated individually.

When the card is shown or placed before the client he is asked to tell what he sees in the inkblot or what it means to him or what this might be. In the second phase, called the enquiry the examiner as certains more fully not only what the person sees, but also what and how he sees it.

In the third phase, called "testing the limits", the examiner tries to ascertain whether the subject responds to the colour, shading and other meaningful aspects of the inkblots, or whether the whole or parts of the blots are used by the subject in his responses. All these responses are then subjected to a scoring system, designed either by Beek or by Klopfer and Kelley. Then the interpretation follows. The scoring categories of the test such as movement and colour, are interpreted as signifying different functions of the personality intellectual creativity, outgoing emotionality, practical mindedness and the like From norms based on work with subjects in various well- characterised groups, normal individuals, neurotics, and psychotics – the pattern of the subject's scores may be interpreted as belonging to one or another personality make-up. We need highly trained personnel to administer and interpret Rosschach; and it is a time consuming test there are its limitations.



2. The Thematic Apperception Test: (TAT)

(TAT) developed by Murray and Morgan (1935) consists of a series of 20 pictures. The person is asked to tell the story that each one suggests to him. These pictures are arranged in appropriate groups for male and female adults and for children. On each picture, the subject tells the story by identifying the characters, explaining their relationships to each other, describing what preceded the situation shown in the picture, and stating an outcome.

The record of story is analyzed according to major theories – the hero, sexual interests, vocational ambitions, family conflicts and social status etc. The recurrence of a given topic or the theme is to be noted carefully.

These theme projects implicit attitudes, habits of thought, ideals and drives of the subject, as well as the characteristics of the other characters- father, mother, brother, sister, husband and wife. The Rosschach Test throws light on the structures of personality whereas the TAT throws light on the functioning of personality.

3. Children's Apperception Test (C.A.T.):

This test was constructed Bellack in 1948. It is used to assess the personality of children up to twelve years of age. Young children are very much interested in listening to stories about animals and in playing with animals.The examiner uses 15 cards. Before administering the test, Psychologist establishes rapport with the child so as to win his cooperation. CAT brings to light the child's repressed desires. The CAT, which takes 20–45 minutes to administer, is conducted by a trained professional psychiatrist, psychologist, social worker, teacher or specially trained pediatrician in a clinical, research, or educational setting. The test may be used directly in therapy or as a play technique in other settings.

.After carefully establishing rapport with the child, the examiner shows the child one card after another in a particular sequence (although fewer than ten cards may be used at the examiner's discretion) and encourages the child to tell a story with a beginning, middle, and end about the characters. The examiner may ask the child to describe, for example, what led up to the scene depicted, the emotions of the characters, and what might happen in the future.

Scoring

In a projective test such as the CAT, there is no right or wrong answer. Thus there is no numerical score or scale for the test. The test administrator records the essence of each of the stories told and indicates the presence or absence of certain thematic elements on the form provided. As in the TAT, each story is carefully analyzed to uncover the child's underlying needs, conflicts, emotions, attitudes, and response patterns. The CAT's creators suggest a series of ten variables to consider when interpreting the results. These variables include the story's major theme, the major character's needs, drives, anxieties, conflicts, fears, and the child's conception of the external world.

4. Play Techniques:

Play techniques are more applicable to children than to adults. The subject is allowed or encouraged to construct scenes by using dolls, toys, blocks and other building materials. This technique has both diagnostic and therapeutic value and is frequently used in Child guidance clinics.

5. Word Association Test:

Another commonly used technique is the word-association method in which the subject is presented with a list of words, one at a time, with the instruction to respond with the first word that enters his mind. The examiner notes the time required for giving each response and the responses themselves. Departures from the average amount of time and the content of unusual responses help us to identify certain attitudes, anxieties or sentiments.

6. Picture Association Test:

A recent projective technique is the picture- association method in which pictures of social situations are substituted for words as the stimulus material. The picture-frustration study of Rosensweig is a well-known technique of this type. Recently, it has been adapted in India by Dr. Udya Parik.

It consists of 24 cartoons like drawings depicting everyday situations of frustration or stress involving his individuals, one of whom is usually shown as frustrating the other. The subject is asked to write or say in the blank caption box, above the head of the frustrated individual, the first association that comes into his mind as appropriate. Then associations reveal areas of conflict, anxieties and stress in the life of the individual.

7. The Incomplete Sentence Technique:

The incomplete sentence technique given by Rotter, Stein and many others is a type of paper-and-pencil personality inventory which has features of an association test as well as of a projective technique. The subject is represented with a number of incomplete sentences which he finishes in any way that he likes. It is said the portions supplied reveal wishes, anxieties conflicts, healthy or unhealthy attitudes. The examiner tries to see the total pattern of attitudes and a feeling revealed in the series of responses and uses it as part of the total study of the individual.

I am worried over..........

My hope is............

My hero is......................

SHORT ANSWER QUESTIONS:

1. Define personality?
2. What is meant by Id, Ego and Super ego?
3. What do you mean by introverts and extraverts of personality?
4. What do you mean by ectomorph and endomorph of personality?

ESSAY ANSWER QUESTIONS:

1. Explain the theories of personality?
2. Write in detail about projective methods of personality assessment?
3. Write in detail about subjective methods of personality assessment?

UNIT- 8

ABNORMAL PHYCHOLOGY

Contents:

Introduction

Psychopathology, also called abnormal psychology, the study of mental disorders and unusual or maladaptive behaviours.

Abnormal psychology is the branch of psychology that studies unusual patterns of emotion and thought, which may or may not be understood as precipitating a mental disorder. Although many behaviors could be considered as abnormal, this branch of psychology generally deals with behavior in a clinical context.

Page-Abnormal psychology is a "sub division that is limited to the study of the mental processes and behavior of abnormal people"

Rosen- abnormal psychology is an" attempt to understand and explain the abnormal within the frame work of the normal and general"

FIG – ABNORMAL PSYCHOLOGY

Causes:

i.Genetics

Investigated through family studies, mainly of monozygotic (identical) and dizygotic (fraternal) twins, often in the context of adoption. Monozygotic twins should be more likely than dizygotic twins to have the same disorder because they share 100% of their genetic material, where as dizygotic twins share only 50%. For many disorders, this is exactly what research shows. But given that monozygotic twins share 100% of their genetic material, it may be expected of them to have the same disorders 100% of the time, but in fact they have the same disorders only about 50% of the time

ii. Biological factors

- Neurotransmitter [imbalances of neurotransmitters like norepinephrine, dopamine, serotonin and GABA (Gamma aminobutryic acid)] and hormonal imbalances in the brain.
- Genetic vulnerabilities
- Constitutional liabilities [physical handicaps and temperament]
- Brain dysfunction and neural plasticity
- Physical deprivation or disruption [deprivation of basic physiological needs]

iii. Socio-cultural factors:

- Effects of urban/rural dwelling, gender and minority status on state of mind
- Generalizations about cultural practices and beliefs may fail to capture the diversity that exists within and across cultural groups, so we must be extremely careful not to stereotype individuals of any cultural group

iv. Systemic factors:

- Family systems
- Negatively Expressed Emotion playing a part in schizophrenic relapse and anorexia nervosa.

v. Biopsychosocial factors

- Illness dependent on stress "triggers".

The scope of abnormal psychology:

Abnormal psychology is a study for people who have not only psychological disorder or disabilities, but also people who have superiority above normality. Abnormal psychology refers to the normal curve of statistic, which the middle of the curve is the normal part, and the left and right side of the curve is an abnormal side. There are two side of abnormalities, the positive side, and also negative side. Positive side refers to people who have more abilities, specialty, and also superiority beyond normal people. The negative side of the normal curve refers to people who have some defection, disabilities, and kind of psychological disorders. If we're talking about the scope of abnormal psychology, we're not only talking about mentally defective, intellectual disabilities, psychological disorder, but we're also talking about superior people, with more than 120 on IQ's, sixth sense person, and others

- **Intellectual disabilities**

  Intellectual disability refers to people who have low intellectual score, such as IQ score.

Most people call it as mental retardation, or some people just known it as an idiot. Intellectual disabilities not only have disturbance in their cognitive area, but also have some disturbances in psychosocial area.

- **People with psychological disorder**

People with psychological disorder can be diagnosed through the DSM manual for mental disorder. There are many kind of psychological disorder written on DSM manual. People, who have some psychological disorder, can be known as abnormal people. So, abnormal psychology also learns about people who have a psychological disorder. Some psychological disorder, such as psychosocial disorder, personality disorder, or maybe kind of psychotic disorder such as schizophrenic disorder can be learned in abnormal psychology.

- **Superior people**

Superior people also became part of abnormal psychology. Superior people usually came with high IQ and intellectual capacities. Superior people can't be treated same as normal people with average intellectual level or IQ's. They'll have to be taught different and special. That's why people with superior and high intellectual capacity became the scope of abnormal psychology.

- **Extra sensory perception**

Have you ever heard about indigo, or people who have a six sense? People who have this gift are categorized as people with extra sensory perception. In psychological way, this phenomenon is categorized as abnormal psychology. Not all people can have these abilities, and not all of the people who have these abilities can accept or control it. So, that's why people with extra sensory perception are part of the abnormal psychology. They need special treatment, so they can control themselves.

Those four scopes of abnormal psychology are the usual scope. Beside those 4 points mentioned above, there is many other kind of abnormal psychology. The most important thing is, all of condition of people that doesn't sound like normal, we can call it abnormal psychology

Importance of Studying Psychopathology

- To know the nature and the cause of abnormality it leads us to understand the mechanism of abnormal mind, diagnose the disease and predict the progress of the disease. Hence abnormality no longer stands as a mystery or a curse.
- A correct understanding of abnormality can check, prevents and cure the disease. Probably, at sometime or other it is expected that most of the students may need some sort of psychological counseling and advice because of the competitive situation of the college campus and academic life.
- In view of the above facts, abnormal psychology has been of tremendous importance for modern people. The implications and significance of abnormal psychology lies in studying the maladjusted and abnormal personality.

- It is also of value to the so called normal people of the society. This supports Freud's view that nobody is cent per cent normal and everybody needs some sort of guidance, counseling and advice to overcome anxiety, depression, worries and other major/minor mental illness arising out of the stresses, strains and competitiveness of modern society.
- Modern psychopathology is also of great need and importance to medicine. In fact, it is predicted that 50 per cent of the medicines in future will be psychological medicines. It is of tremendous importance to common man as over 10 per cent of the total population is expected to suffer from severe mental illness and tentatively every one of the population is likely to suffer from at least mild mental illness or depression during his life time.

SHORT ANSWER QUESTIONS:

1. Define abnormal psychology?
2. Write the causes for abnormal psychology?

UNIT- 9

FRUSTRATION, CONFLICTS, DEFENCE MECHANISM AND STRESS-MANAGEMENT

Contents:

FRUSTRATION

In psychology, frustration is a common emotional response to opposition. Related to anger and disappointment, it arises from the perceived resistance to the fulfillment of individual will. The greater the obstruction, and the greater the will, the more the frustration is likely to be.

Carroll: A "frustration is the condition of being thwarted I the satisfaction of a motive."

Good: Frustration means "emotional tension resulting from the blocking of a desire or need".

FIG- FRUSTRATION

Sources of Frustration:

There are three important sources of frustration:

- Environmental forces:

Environmental obstacles can frustrate the satisfaction of motives by making it difficult or impossible for a person to attain a goal.**An obstacle** may be physical- such as heavy rain, disruption in electric supply, auto strike, famine, earthquake, war, floods, etc., or it may be people such as parents or society who obstruct the fulfillment of wants. For example, Inter-caste marriage, change of religion, etc. Even the social norms, codes of conduct may cause frustration.

- Personal inadequacies:

Unattainable goals or too high goals which are beyond the ability level of a person can be important sources of frustration. These are learned goals. **For instance**, a student with average level of intelligence aspires to score 90% of marks in the examination will definitely face frustration. A physically handicapped person cannot aspire to compete against a normal person in running race.

Thus, people are often frustrated because they aspire for goals which are not attainable by them, or the goals are beyond their abilities.

- Conflict produced frustration:

A major source of frustration is found in motivational conflict, in which the expression of one motive interferes with the expression of other motives. Some common conflicts are between independence and affiliation need, or career aspiration and economic realities. **For example**, a person is motivated to be independent but at the same time he cannot neglect his affiliation motive. A student may have high aspiration to pursue higher education, but too much expenditure comes in between.

In this way we come across many frustrations due to conflict- as is said 'life is full of conflicts and the frustrations arising from them'.

Reaction to Frustration

Frustration, depending on its intensity and nature, results in various types of reactions of the individual. Some may bear the consequences with little injury to oneself and the society, while, the others react aggressively to the situation. The reactions to frustration may be classified into two major categories,
Simple and **Violent** reactions.

A. **Simple Reactions** Simple reactions may include the following:

- Increasing Trials or Improving Efforts: During the period of frustration, some individuals go through introspection and increase their efforts or bring about improvement in their behavior or processes.
- Adopting Compromising Means: Repeated failure in one direction may lead the individual to change the direction of his efforts. An IAS aspirant, for example, after his failure, may direct his energies to pass Group-I services.
- Withdrawal: The individual learns to move away from the situation that causes him frustration. For example, a child withdraws from a game that he does not know.
- Submissiveness: The individual sometimes, surrenders and accepts his defeat, before the conditions causing frustration.

B**. Violent Reactions** The individual at times, become emotionally tense and reacts aggressively.

The aggression is of two types.

- External Aggression: According to Carrol -This aggression may be directed towards either the person or persons who caused the frustration or towards the substitute or substitutes. For example, a boy experiencing frustration in the playground may try to hit the boy denying him the chance of carrying the ball or may use his younger brother or parents as substitute for relieving his tension.
- Internal Aggression: it is a reaction directed towards oneself. Instead of releasing one's emotional tensions by attacking others, the individual blames himself. Eventually, the person becomes neurotic or tries to escape through suicide. For well being of the individual, the internal aggression is far more dangerous than external aggression.

CONFLICTS

The phenomenon of conflict is probably known to everyone. From time to time everyone has various disagreements. Psychologists define conflict to be a state of opposition, disagreement or incompability between two or more people or groups of people, which is sometimes characterized by physical violence.

Conflicts mostly refer to the existence of the clash, which can be interests, values, actions or directions. Psychologically, a conflict appears when one motivating stimulus reduces and another increases, so that a new adjustment is demanded.

Definition:

Acc**. DOUGLAS and HOLAND**, conflict means a painful emotional state which results from a tension between opposed and contradictory desires.

Acc. **COLEMAN**, conflict is the anticipated frustration entailed in the choice of either alternative.

There are many types of conflict. The most common conflicts are emotional, interpersonal, group, organizational, military, workplace and others

Types of conflicts

1 Approach -Approach conflict

In this type of conflict individual will have two desires with positive goals which are equally powerful. **For example**, a person has two attractive job offers and he has to choose any one of them- tension arises.

Such conflicts are not so harmful, because after selecting one, the other one automatically subsides or loses its importance to him. But in some situation choice will be very difficult. **example-**a girl has to choose either loving parents or a boy friend for inter-caste marriage, the individual will be psychologically torn and may lose equilibrium.

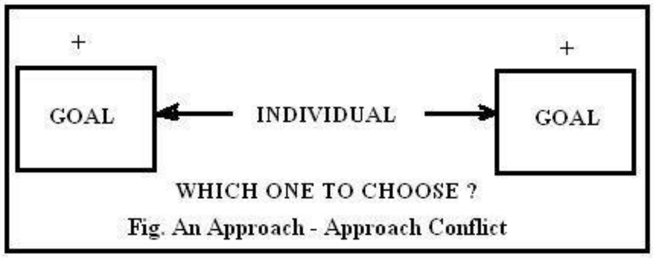


Fig. An Approach - Approach Conflict

• <u>Avoidance-Avoidance conflicts</u>

This conflict involves two goals with negative goals At times the individual is forced to choose one among two negative goals. In such conflicts, both are unwanted goals, but he cannot keep quiet without opting also. **Example-**a child does not want to study and at the same time does not wish to displease his parents by failing in the final exams, a boxer may have to choose between his fears of defeat at the hands of his rival or if he does not fight the loss of the respect of his admires

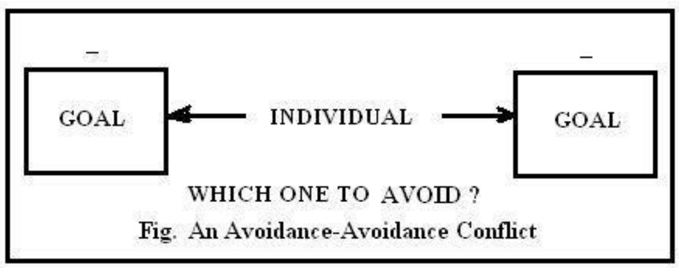


Fig. An Avoidance-Avoidance Conflict

3 <u>Approach-Avoidance conflicts</u>

This is also a most complex conflict and very difficult to resolve. Because in this type of conflict a person is both attracted and repelled by the same goal object. Here the goal object will have both positive and negative valences. The positive valence attracts the person, but as he approaches, the negative valence repels him back. Attraction of the goal and inability to approach it leads to frustration and tension.

Example- a person is approaching to accept a job offer, because the salary is attractive- but at the same time he is repelled back as the job is very risky, a man wants to marry to lead a family life, but does not want the responsibilities of family life,

Sources of Conflicts:

We have seen that conflicts are the creation of dissatisfaction felt by an individual due to the non-fulfillment of his two contradictory desires. The forces of the environment are, in fact, responsible for these conflicts as they provide necessary ground for their occurrence but at the same time the teachers, parents and society may also be responsible for them.

1. Home Environment: The faulty upbringing at home, unhealthy or unpleasant relationships among the family members is the potential sources of conflicts in children. Over-protection, dominance, submissiveness or negligence on the part of parents does not help children cope with the experiences during social contacts with other children at school and thus they become victim of theopposing desires in future. Uncongenial and unsuitable environment as well as relationship among the family members also leads to numerous conflicts in the adults. The hard necessities of life also add to the many conflicting situations in the home environment.

2. School Environment: Uncongenial school or college environment, dominant or submissive role of the teacher, faulty methods of teaching, denial of opportunities for self-expression, contradictory demands of the teachers and class-mates are some of the bases of conflicts in the youngsters.

- Occupational environment: For many adults, their occupational environment proves a source of conflict. The uncongenial and improper working environment, dissatisfaction with the working conditions and career fulfilment, unsatisfactory relationships among the colleagues or with the authorities, Dissatisfaction with the wages and salary, lack of security in old age, accidents and similar other forms of vocational maladies may prove potential sources of conflicts among adults.

- Social and Cultural Environment: The social environment and cultural values may also prove a potential source of conflicts. Chief among them are sex conflicts for the reason that the demands of our culture have not been well adjusted to the sexual needs of the individual. The taboos, inhibitions, and the negative attitude towards sex is the cause of many sex conflicts in the minds of youth as well as adults. The pattern of conflicting values existing in our society and culture is responsible for a number of other conflicts. For example- frustration suffered due to the lack of opportunities is also responsible for many conflicts.

DEFENCE MECHANISM

It is not always possible to achieve all desires in life. There are many situations when we fail in our attempts and get frustrated. our failures and frustrations ay bring injury to our ego and cause anxiety and feeling of inferiority. In such moments of frustration most of us do not like to face the reality by accepting our shortcomings and failures. But tend to resort to certain mechanisms, for defending our inadequacies or anxieties. These mechanisms or devices are called defense mechanism or adjustment mechanism. These have been defined as as follows.

Acc **CARROLL**: an adjustment mechanism is a "device resorted to in order to achieve an indirect satisfaction of a need, so that tension will be reduced and self respect maintained."

Acc **McCall**: defence mechanism may be defined as "self protective manoeuvers pertainig to perception and motivation, mental or psychic at largely unconscious designed to soften or disguise what is unacceptable in or to te self."

IMPORTANT DEFENCE MECHANISMS:

Repression: In this mechanism, the threatening or anxiety producing expression or unfulfilled wishes are pushed down to the level of conscious mind in order to forget what is painful or threatening to one's self. Eg: forgetting ones date of marriage or appointment with a friend may be associated with such repression or a person who has painful experiences attached to his school.

Regression: It is a mechanism of behaving in a manner more appropriate to earlier happier periods of life for protecting oneself from the threatening situations of the present. Eg: an older boy mar regress when his new brother is born and he feels neglected or deprived.

Isolation: it is a defense mechanism which makes an individual protect one's self by cutting off or blunting off what is unacceptable in the whole situation. Eg: a mother of a severely retarded child resorts to such mechanism when she regards a child's behavior a little different from that of other children.

Withdrawal: In this mechanism the individual tends to withdraw himself from the situation that causes frustration or failure. Eg. A child may refuse participation in games for fear of failure and may deceive himself by believing he could do well if he had participated.

Day-dreaming: In such behavior, instead of facing realities, the individual tries to seek satisfaction by roaming through the world of make-believe and imagination. Eg. An individual may turn to day dreaming or fantasy when the present living is in uninteresting and frustrating.

Negativism: It is an aggressive withdrawal. Its various forms of manifestations are refusal to eat, listen, speak, work, and at times, doing the exact opposite of what has been asked or requested. Eg. A young child or an adolescent often uses such mechanisms as a means of establishing themselves as independent persons and to make them parents or elders feel that they are right.

Displacement: It refers to a process of relieving oneself from the anxiety or frustration by transferring or displacing it to another situation or object. Eg. A little boy beaten by one of his schoolmates may kick or slap his younger brother on returning home.

Rationalization: In this mechanism, a person tries to justify his otherwise unjustified behavior by giving socially acceptable reasons for it. Eg. A child makes use of rationalization when he tries to give lame excuses for his failure. He may blame unfairness or ambiguity of the questions, teacher or parents for his failure.

Reaction Formation: Here, one strives to behave in ways that are sharply in contrast with the ways that he tends to behave for protecting one's selfesteem. Eg. A mother may hate her child but by using reaction formation as defense she may be able to inhibit or mark or overcome unworthy impulses and thus turn into an attentive and over protective in her behavior towards him

Compensation: This defence mechanism helps an individual balance or cover up his deficiency or inadequacy in one field by exhibiting his strength in another. Eg. An unattached girl who becomes a book warm and secures at opposition in the class is said to be use of such, mechanisms in order to command the respect and prestige that she's unable to win as a result of her looks

Projection: In this mechanism a person defends himself by attributing to or observing in other persons or objects his own inferior impulses, weaknesses or unacceptable motives. Eg. A student who has been caught cheating in the examination may defend himself by saying that others also have cheated.

Sympathism: In this defence mechanism a person tries to derive satisfaction by seeking sympathy and pity from others for his own failures and inadequacies. Eg. A house wife who is not nursing a children well may be satisfied with others sympathy which she may be evoke by telling them about how busy she is, how the members of her family do not cooperate with her or how her family passing through great trouble.

STRESS - MANAGEMENT

We all experience stress in our lives. Because the vast majority of health problems are caused or influenced by stress, it's important to understand how stress affects your body and learn effective stress management techniques to make stress work for you rather than against you.

What Is Stress?

Stress is your body's response to changes in your life. Because life involves constant change (ranging from changing locations from home to work each morning to adapting to major life changes like marriage, divorce, or death of a loved one), there is no avoiding stress.

This is why your goal shouldn't be to eliminate all stress, but to eliminate unnecessary stress and effectively manage the rest. There are some common causes of stress that many people experience, but each person is different.

Dr. Hans Selye, Stress is defined as "a state of psychological and physiological imbalance resulting from the disparity between situational demand and the individual's ability and motivation to meet those needs."

Causes of Stress

Stress can come from many sources, which are known as "stressors."

- The death of a loved one
- Divorce
- Loss of a job
- Increase in financial obligations
- Getting married
- Moving to a new home
- Chronic illness or injury
- Emotional problems (depression, anxiety, anger, grief, guilt, low self-esteem)
- Taking care of an elderly or sick family member
- Traumatic event, such as a natural disaster, theft, rape, or violence against you or a loved one
- beeing unhappy in your job
- Having a heavy workload or too much responsibility
- Working long hours
- Having poor management, unclear expectations of your work, or no say in the decision-making process
- Working under dangerous conditions
- Being insecure about your chance for advancement or risk of termination
- Having to give speeches in front of colleagues
- Facing discrimination or harassment at work, especially if your company isn't supportive

Effects of Stress

Common effects of stress on body

- Headache
- Muscle tension or pain
- Chest pain
- Fatigue
- Stomach upset
- Sleep problems

Common effects of stress on mood

- Anxiety
- Restlessness
- Lack of motivation or focus
- Feeling overwhelmed
- Irritability or anger
- Sadness or depression

Common effects of stress on behaviour:

- Overeating or undereating
- Angry outbursts
- Drug or alcohol abuse
- Tobacco use
- Social withdrawal
- Exercising less often

Management

Students are one of the most common victims of stress. Factors such as financial expenses, over commitment, family expectations, deadlines and workload all induce stress in students. While a mild amount of stress is very useful and acts as a motivation for students, too much stress can interfere with their daily lives.

Here are a few tips for managing stress:

Manage time.

Proper time management is one of the most effective stress-relieving techniques .Whether its relaxation, work or study, time must be spent wisely. Students must be able to design and stick to a timetable. Choose a relaxing break between work and study, even if it’s just taking out time to breathe.

Exercise and get some air.

A healthy lifestyle is essential for students, especially at university level. Instead of partying at night and being cooped up at home studying throughout the day, take out time to get some air and exercise. Stress is generally lower in people who maintain a healthy routine.

Stay positive.

If you keep focusing on the negative aspects of a situation, you will be burdened by mental stress. Instead, try to look at the glass half full, and stay optimistic through tough times. For example, instead of feeling upset over a bad grade, try to maintain a positive attitude and look at ways to improve the next time.

Organized academic life.

Organization is very important in academic life for dealing with stress. By keeping academic notes organized, turning in assignments on time, and keeping track of all deadlines, stress can be reduced to a great extent.

Take one step at a time.

Don’t put too many eggs in one basket. Instead of feeling overwhelmed about all the deadlines, it’s best to make a list and sort them out one by one. This helps you to be more efficient and productive with your time.

Spend time with friends.

A cup of coffee with family or friends is all you need to bring your stress levels back to normal. Stress can also get worse if a person feels lonely. By letting out all your thoughts to someone you trust, you immediately feel a lot better.

Water therapy.

Water therapies are effective for reducing stress and relaxing the body. By drinking lots of water and treating yourself to hot baths, you can help your body relax. By adding aromatic oils in your bath, you can double your relaxation effect and improve your academic performance.

Do something you love

If you feel extremely stressed out, take a break and do something you love. Whether it is painting or listening to music, doing something you enjoy can cheer up your mood and distract you from a stressor.

Other Techniques

- Exercise
- Starting a new a hobby
- Meditation
- Autogenic training
- Artistic Expression
- Fractional relaxation
- Progressive relaxation
- Spas
- Alternative/ natural medicine
- Social activity
- Cognitive therapy
- Conflict resolution
- Deep breathing
- Reading novels
- Prayer
- Relaxation techniques
- Listening to Music
- Yoga

SHORT ANSWER QUESTIONS:

1. Define frustration and write it sources?
2. Define conflicts?
3. Write the types of conflicts?
4. Define defense mechanism?
5. What is meant be repression?
6. What is meant by withdrawal?
7. What is meant by day dreaming?
8. What is stress and write its causes?
9. Mention the effects of stress?

ESSAY ANSWER QUESTIONS:

1. Write in detail about types of conflicts and its sources?
2. Explain in detail about defense mechanism?
3. Write in detail about stress and its management?

UNIT- 10

PSYCHONEUROTIC AND PSYCHOSOMATIC DISORDERS

Contents:

PSYCHONEUROTIC DISORDERS

Definition

"Psychoneuroses is a minor mental disorder characterized by inner struggles and disturbed social relationship."

Causes:

Essentially psychoneurosis is precipitated by emotional stresses, conflicts and frustrations and that they are most effectively treated by psychological techniques. They are NOT produced by physical disorders and do not respond to routine medical attention.

Physical factors: Since, the mind and body is in close interaction, physical factors stressing out the mind may produce a psychoneurotic effect e.g. physical exhaustion may so weaken the mental resources of the individual as to facilitate the appearance of neurotic symptoms. However, such instances are rare.

Constitution: Heredity and early environment and training are the main factors determining our constitutional make-up. Based on which development of a well-integrated sturdy personality takes place. Thus, when the individual is confronted with some disturbing or intolerable situation, our personality which is un-accusomed to such responses may result in the appearance of psychoneurotic reaction

FIG- PSYCHONEUROTIC DISORDERS

Types:
The **five types** of psychoneurosis most generally recognized are:

Anxiety neurosis: It represents a behavior dominated by a free floating anxiety interfering with individuals personal and social adjustment. Physical symptoms of generalized anxiety can be similar to or experienced as an anxiety or panic attack. Specifically, GAD symptoms felt in the body can include headaches and body aches, muscle tension, difficulty swallowing, trembling or twitching, sweating, gastrointestinal discomfort and nausea, diarrhea, feeling lightheaded or dizzy, feeling out of breath, hot flashes, and having to visit the bathroom often. In addition, sufferers of GAD can experiences sleep difficulties or insomnia, restlessness, fatigue or feeling tired for seemingly unknown reasons.

Hysterical neurosis: Hysterical neurosis is a kind of neurosis and most often manifests itself in the form of demonstrative emotional reactions (sudden crying, laughter, violent crying), as well as convulsive hyperkinesia, loss of sensitivity, hallucinations, transient paralysis, fainting, etc. At the heart of hysteria lies the increased suggestibility and self-hypnosis of a person, the desire to attract the attention of others.

Depressive neurosis: The depressive neurosis is a psychopathological disorder characterized by the presence of a state of constantly sad mood. In this way, it can be considered as a mild and permanent case of depression. People who have this disorder have a low mood for long periods of time. Likewise, they experience a high physical inactivity and a generalized lethargy. Signs and symptoms include

- Loss of interest in daily activities.
- Feelings of sadness.
- Despair.
- Lack of energy.
- Fatigue or lack of energy
- Low self-esteem.
- Difficulty concentrating.
- Difficulty in making decisions.
- Self-criticism
- Excessive anger
- Decrease in productivity
- Avoidance of social activities.
- Feelings of guilt.
- Lack or excess of appetite.
- Problems sleeping and sleep disorder

Phobic Neurosis: A phobia is a type of anxiety disorder that causes an individual to experience extreme, irrational fear about a situation, living creature, place, or object. When a person has a phobia, they will often shape their lives to avoid what they consider to be dangerous. The imagined threat is greater than any actual threat posed by the cause of terror. Phobias are diagnosable mental disorders. The person will experience intense distress when faced with the source of their phobia. Signs and symptoms include

- shortness of breath
- rapid speech or inability to speak
- dry mouth
- upset stomach
- nausea
- elevated blood pressure
- trembling or shaking
- chest pain or tightness
- a choking sensation
- dizziness or lightheadedness
- profuse sweating
- a sense of impending doo

Types

The most common specific phobias are:

- Claustrophobia: Fear of being in constricted, confined spaces
- Aerophobia: Fear of flying
- Arachnophobia: Fear of spiders
- Driving phobia: Fear of driving a car
- Emetophobia: Fear of vomiting
- Erythrophobia: Fear of blushing
- Hypochondria: Fear of becoming ill
- Zoophobia: Fear of animals
- Aquaphobia: Fear of water
- Acrophobia: Fear of heights
- Escalaphobia: Fear of escalators
- Tunnel phobia: Fear of tunnels

Obsessive-compulsive neurosis: Obsessive Compulsive Disorder or OCD is an anxiety disorder where the patient experiences intrusive irresistible thoughts (obsession) that produces anxiety, fear, uneasiness. Patient ends up doing repetitive behavior (compulsion). Patient may realize that their thoughts and actions are irrational and may become further distressed. It is also called Obsessive Compulsive Neurosis (OCN). Such as, hand washing, touching something, or counting.

Signs of obsession include:

- Repeated unwanted ideas
- Fear of contamination
- Aggressive impulses
- Persistent sexual thoughts
- Images of hurting someone you love
- Thoughts that you might cause others harm
- Thoughts that you might be harmed

Signs of compulsion include:

- Constant checking
- Constant counting
- The repeated cleaning of one or more items
- Repeatedly washing your hands
- Constantly checking the stove or door locks
- Arranging items to face a certain way

TREATMENT:

Psychiatrists and psychologists treat neuroses in a variety of ways.

The psychoanalytic approach involves helping the patient to become aware of the repressed impulses, feelings, and traumatic memories that underlie his symptoms, thereby enabling him to achieve personality growth through a better and deeper self-understanding. Those who hold that neuroses are the result of learned responses may recondition a patient through a process known as desensitization: someone afraid of heights, for example, would be gradually exposed to progressively greater heights over several weeks.

Other learning approaches include modeling more effective behaviour, wherein the patient learns by example. Cognitive and interpersonal approaches include discussing thoughts and perceptions that contribute to a patient's neurotic symptoms, eventually replacing them with more realistic interpretations of external events and the patient's internal responses to them.

Many psychiatrists prefer physical approaches, such as psychotropic drugs (including antianxiety agents and antidepressant and antipsychotic drugs) and electroconvulsive (shock) therapy.

Many psychiatrists advocate combinations of these approaches, the exact nature of which depend on the patient and his complaint.

PSYCHOSOMATIC DISORDERS

Definition

Psychosomatic is a term that combines the words mind (psycho) and body (soma). It is often combined with the term illness, which refers to the mind having influence or possibly creating a bodily illness.

The term ‘psychosomatic disorder’ is used for a physical disease that is thought to be caused or made worse by mental factors. ‘Psyche’ refers to the mind and ‘somatic’ refers to the physical signs and symptoms that are observed for the disease. Usually, most diseases are psychosomatic as they have mental and physical components.

These disorders may not be present in the same way in every individual. Depending on one’s mentality and temperament, a physical disease, like a rash or psoriasis, may bother enough to make the one depressed and sick. However, another friend with a similar condition may not feel as depressed or sick as him. The reverse can also be true. For instance, someone with depression may not eat enough or nothing at all. Thus, mental conditions can also lead to physical illness

Categories of Psychosomatic disorders:

There are three general categories:

The **first type** includes people who have both a **mental (psychiatric) illness** and **a medical illness**, and these illnesses complicate the symptoms and management of each other.

The **second type** includes people who have a **psychiatric problem** that is a direct result of a medical illness or its treatment, such as having depression due to cancer and its treatment.

The **third type** of psychosomatic illness is **'somatoform disorders'**. Somatoform disorders are psychiatric disorders that are displayed through physical problems. In other words, the physical symptoms people experience are related to psychological factors rather than a medical cause.

Causes

The first two categories may be caused by a number of problems either medical or psychological. It is the third type which is of great concern because the exact cause of somatoform disorders is not completely understood. Somatoform disorders are thought to be familial, meaning that genetics may play a role. Somatoform disorders may also be triggered by strong emotions, such as anxiety, grief, trauma, abuse, stress, depression, anger or guilt. People who suffer from somatoform disorders will generally not recognize the role these emotions play in their physical symptoms. However, they are not intentionally producing these physical symptoms or making up their physical problems. Their physical symptoms are real, but are caused by psychological factors.

Types of psycho-Somatic Disorders and their symptoms

Body dysmorphic disorder is an obsession or preoccupation with a minor or imaginary flaw, such as wrinkles, small breasts, or the shape or size of other body parts. Body dysmorphic disorder causes severe anxiety and may impact a person's ability to function normally in daily life. For example, a person with hypochondriasis may become convinced that he or she has colon cancer when having temporary flatulence after eating cabbage.

Conversion disorder is a disorder in which a person experiences neurological symptoms that affect his or her movement and senses and that do not appear to have a physical cause. Symptoms can include seizures, blindness or paralysis, blindness or double vision, difficulty swallowing, impaired balance or coordination, inability to speak (aphonia), loss of sensation, paralysis or weakness, , seizures, urinary retention,

Hypochondriasis is an obsession or fixation with the fear of having a serious disease. People with hypochondriasis misconstrue normal body functions or minor symptoms as being serious or life threatening. A person with hypochondriasis can interpret a headache as a brain tumor or muscle soreness as a sign of impending paralysis. Typical symptoms of hypochondriasis include,Anxiety and depression, Feeling that their doctor has made a mistake by not diagnosing the cause of their symptoms, Repeated doctor visits until a diagnosis is made, Seeking constant reassurance from friends and family about their symptoms,

Summarization disorder is a disorder in which a person experiences physical complaints. Symptoms of summarization disorder include, Digestive symptoms, such as nausea, vomiting, abdominal pain, constipation, and diarrhea, Neurological symptoms, such as headache and fatigue, Pain, Sexual symptoms, such as pain during intercourse, loss of sexual desire, erectile dysfunction, and extremely painful periods in women

Treatment

Treatment of somatoform disorders, which make up the majority of psychosomatic illnesses, can be challenging. After ruling out physical causes of your symptoms, it generally focuses on establishing a trusting, supportive relationship between patient and the primary care doctor. The doctor will recommend regular checkup appointments as one of the most important parts of treatment.

- Yoga
- Medication
- Fasting Therapy
- Hypnosis
- Cognitive Behavior Therapy

1. Yoga for Psychosomatic Disorders

According to Ayurveda, yoga includes meditation and relaxation exercises that can cure psychosomatic disorders. As these disorders are triggered by mental conditions like anxiety and stress, taking part in stress-busting activities like yoga can help the relieve these mental issues. Simple breathing exercises and asanas that will relax your mind can be practiced on a daily basis.

Yoga has a calming effect on the body and makes you more aware and accepting of yourself and your surroundings. Experiments have shown yoga to be as effective as drugs when it comes to psychosomatic disorders.

2. Medication For Psychosomatic Disorders

Usually, specific drugs are prescribed by general physicians to eliminate the physical symptoms. Most doctors also recommend patients to psychiatrists for therapy as the drugs only provide temporary relief. An anxious person is likely to suffer a relapse of the physical symptoms, and treatment of the psychological condition is necessary. The different types used for treatment are tricycle antidepressants (TCA), serotonin and noradrenalin reuptake inhibitors (SNRI), atypical antipsychotics, serotonin reuptake inhibitors (SRI), and herbal medications. Different combinations of drugs are prescribed by specialists depending on the age of the patient, intensity of the disease, duration, and responsiveness to treatment.

3. Fasting Therapy For Psychosomatic Disorders

A treatment well known in Japan, fasting therapy has successfully alleviated both physical and psychological symptoms in psychosomatic disorder patients. According to this therapy, the autonomic nervous system and endocrine system are regulated by the fasting process. As a result, the body re-establishes its balance for both mental health and physical health.

4. Hypnosis For Psychosomatic Disorders

Migraines, asthma, and gastrointestinal issues seen with psychosomatic disorders are often treated with hypnosis. This method of treatment aims to find the solution to the physical symptoms within the patient's subconscious. Long-term hypnotherapy can work effectively to resolve the underlying emotions and stop the psyche from affecting the body and the symptoms from developing. Anger, fear, and dependency issues have been resolved successfully with this therapy in the past.

5. Cognitive Behavior Therapy For Psychosomatic Disorders

According to the cognitive behavior therapy (CBT), how we react to a situation depends a lot on how we perceive it. An individual's thoughts are integrated with his/her emotions, physical sensations, behavior, and also the environment. And this directs how individuals behave in a particular situation and how their thought process influences their physical state. When this ideology is used to treat psychosomatic disorders, it helps the patients think holistically and relieves their health related anxieties. Great success was achieved when CBT was included with standard medical care in different sets of trials. Even cases of severe somatization were seen to shown improvement .

Your state of mind is what aggravates or calms your physical condition. Hence, psychology plays an important part in curing a disease and even during the onset of disease in the first place. So, the next time you get unnecessarily stressed, remember that stress and anxiety can lead to something more dangerous than a temporary feeling of anger, depression, or frustration. Keeping stress and anxiety at bay are the key goals.

ESSAY ANSWER QUESTIONS:

1. Explain in detail about Psychoneurotic disorders?
2. Explain in detail about Psychosomatic disorders?

UNIT- 11

GERIATRIC PHYCHOLOGY

Contents:

Introduction

Geriatric psychology is a subfield of psychology that specializes in the mental and physical health of those in the later stage of life. In this we study a variety of psychological abilities that deplete as aging occurs such as memory, learning capabilities, and coordination.

Geriatric psychologists work with elderly clients to conduct the diagnosis, study, and treatment of certain mental illnesses in a variety of workplace settings.

Definition: geriatric psychology involves "the study of behavior, psychological assessment and treatment of health, neuropsychological, adjustment, mental and nervous disorders associated with senior years."

AGING: It is a progressive and generalized impairment of body functions resulting in, or of adaptive responses to stress and increase in the risk of age. People more that 60 years considered elderly. Old age is not a disease but normal and inevitable biological phenomenon.

FIG - AGING

Common Geriatric problems:

- Health problems:

Joint problems - arthritis, osteoporosis , impairment of special senses- loss of hearing, eye problems(cataracts, glaucoma), diminished sense of taste or smell .cardio vascular diseases-stroke, breathing problems, hyperthermia, cancer, diabetes mellitus, accidental falls- which can lead to fractures, bladder control problems- lack of bladder control or urinary incontinence ,sleep problems- delirium, Parkinson's disease, weight loss.

- Social and psychological problems: poverty, loneliness, dependency, isolation, elder abuse, generation gap.

- Emotional problems, - suicidal tendencies, senile dementia, Alzheimer's disease.

Depression

Depression is a common problem in older adults. The symptoms of depression affect every aspect of life including energy, appetite, sleep and interest in work, hobbies and relationships.

FIG – OLD AGE DEPRESSION

Causes of depression in older adults

As we grow older, we often face significant life changes that can increase the risk for depression. These can include:

Health problems – Illness and disability, chronic or severe pain, cognitive decline, damage to your body image due to surgery or sickness.

Loneliness and isolation – Living alone, a dwindling social circle due to deaths or relocation, decreased mobility due to illness or a loss of driving privileges.

Reduced sense of purpose – Feelings of purposelessness or loss of identity due to retirement or physical limitations on activities you used to enjoy.

Fears – Fear of death or dying, anxiety over financial problems or health issues.

Recent incidents – The death of friends, family members, and pets, the loss of a spouse or partner.

Signs and symptoms of depression in older adults:

- Sadness or feelings of despair
- Unexplained or aggravated aches and pains
- Loss of interest in socializing or hobbies
- Weight loss or loss of appetite

- Feelings of hopelessness or helplessness
- Lack of motivation and energy
- Sleep disturbances (difficulty falling asleep or staying asleep, oversleeping, or daytime sleepiness)
- Loss of self-worth (worries about being a burden, feelings of worthlessness or self-loathing
- Slowed movement or speech
- Increased use of alcohol or other drugs
- Fixation on death; thoughts of suicide
- Memory problems,
- Neglecting personal care (skipping meals, forgetting meds, neglecting personal hygiene)

Management for depression

Talking treatments

-It can help to talk to a good listener. This could be a friend, a relative, a volunteer or a professional. If this is not enough, professionals can offer special ways of talking which include

Helping yourself

Ask for help. It's the same at any age, you don't have to put up with being depressed. Tell your GP how you feel.

Keep active:

It can be hard to get our regularly because of physical problems, but its worth doing. We know that if you keep up some regular physical activity, you tend to feel better. And if you are alone at home, you are more likely to brood on things, which can make you feel even worse.

Stay connected: It helps to keep your mood up by:

- keeping up with hobbies and interests
- staying in touch with friends and family
- Visiting your local library or local lunch clubs and day

centers. Try to eat properly:

If you lose your appetite, it's easy to lose weight and run short of important vitamins and minerals. Older bodies cannot adjust as well as younger ones - so this can really affect your health. Beware of stocking up on chocolate and biscuits - these are quick and easy to eat, but they don't have the vitamins and minerals to keep you feeling well.

Remind yourself that depression is an illness - not a sign of weakness. You are not being lazy or letting other people down.

Don't keep your feelings to yourself. Talking to somebody does help.

Watch your drinking. Alcohol can make depression worse. It can also react with any tablets you are taking.

Try not to panic about not sleeping properly. It will get better when the depression lifts.

Try not to change the tablets you are on without discussing it with your doctor. If your tablets have side-effects, tell your doctor or nurse.

Be kind to yourself - you may need to change your routine while you are unwell.

Try not to think that depression causes dementia. It doesn't.

Psychotherapy: which helps you to see how your depression may be connected with what has happened to you in the past?

SHORT ANSWER QUESTIONS:

1. Define geriatric psychology?
2. Define aging?
3. What are the common geriatric problems?
4. Define depression and write its causes?
5. What are the signs and symptoms of depression?

UNIT- 12

ALCOHOLISM AND DRUG ADDICTION

Contents:

ALCOHOLISM

Alcoholism is the most severe form of alcohol abuse and involves the inability to manage drinking habits. It is also commonly referred to as alcohol use disorder. Alcohol use disorder is organized into three categories: mild, moderate and severe. Each category has various symptoms and can cause harmful side effects. If left untreated, any type of alcohol abuse can spiral out of control. Individuals struggling with alcoholism often feel as though they cannot function normally without alcohol. This can lead to a wide range of issues and impact professional goals, personal matters, relationships and overall health. Over time, the serious side effects of consistent alcohol abuse can worsen and produce damaging complications.

The World Health Organization (WHO) has defined alcoholics as ‘‘excessive drinkers whose dependence on alcohol is attained such a degree that they show noticeable mental disturbance or interfere with their mental and bodily health, their interpersonal relations and their smooth social and economic functioning or who show the prodromal (beginning) signs of such developments.”

FIG - ALCOHOLISM

Causes of alcoholism:

Many factors can increase the risk of alcohol abuse. People may turn to alcohol for one reason and gradually develop a dependency on drinking. For example, drinking during difficult times – a death in the family or job loss – can potentially trigger long-term alcohol abuse.

Relieve stress: Relying on alcohol to reduce daily life stressors can impact the likelihood of developing alcoholism. Since alcohol is a depressant and a sedative, drinking produces feelings of pleasure. However, frequent drinking builds tolerance, requiring you to consume more alcohol in order to achieve the same effects.

Feel good: Consuming alcohol can provide some people a break from reality. It offers a sense of relief from underlying issues your mind may be trying to escape from. However, continual alcohol use to get through the day or week can turn into a serious drinking problem.

Cope with loss: Losing a family member or friend can take a toll on you emotionally, physically and mentally. Alcohol can ease the grief you are feeling and are used to get through difficult times. Depending on alcohol, even temporarily, can spiral into a drinking problem.

Overcome anxiety: Some people are naturally anxious, causing them to perpetually worry. Drinking lowers an individual's inhibitions and makes them more comfortable in social situations. Over time though, this can lead to addictive behaviors.

The Habit of Alcoholism

The habit of excessive drinking or dependence on alcoholic beverages is attained gradually. E.M. Jellinck (1971), an authority on alcoholism has pointed out the following four stages in the development of alcoholism.

- Pre-Alcoholic Phase: This initial phase lasts from two months to two years. The beginner who drinks for social reasons or merely on account of curiosity finds that it relieves him of anxiety and tension and as a result learns to use alcohol as a relief measure. Gradually, he begins to experience an increased tolerance for alcohol and needs a large amount to reach the same stage of sedation. This phase is characterized by a gradual shift from infrequent or light frequent or heavy drinking.

- Prodromal Phase: At this phase alcohol begins to be used more as a drug and less as a beverage

with dependency on it increasing and manifested through the following behavioural phenomena:

The individual becomes preoccupied with drinking, worrying about where and when he will have his next drink. He feels guilty of drinking and usually avoids references to alcohol in conversations. At the same time, he feels a strong urge to drink and thereby often resorts to drinking secretly rather than openly.There is a sudden onset of 'blackouts' for some of the periods of drinking. There is considerable memory impairment. One may remain conscious at the time of drinking but later unable to recall the events.

- The Crucial Phase:

The third stage is alarming. The dependency on alcohol increases to the extent that there is a danger of an individual losing everything that one values. He may drop friends, lose jobs and leave the members of his family including children and wife but not giving up the habit of drinking. The behavior compels one to withdraw from the social environment ending in the isolation further making him drink heavily at any time. The need for liquor becomes a constant source of worry, detrimental to diet combined with the harmful effects of alcohol deteriorates his health, lowers his sexual drive and makes him hostile towards the persons and environment completely ruining his harmony and peace.

- The Chronic Phase: This is the most crucial stage where the individual lives only to drink. His bodily systems become so conditioned that these must be supplied with alcohol or he suffers withdrawal reactions. In case alcohol is not available, he is ready to consume any liquid containing alcohol like shaving lotion, hair tonic, spirit or a medical preparation. He loses control upon his behavior. In comparison with the crucial phase, the chronic phase results in the loss of tolerance for alcohol usually, even when a small amount leads to intoxication. At a more advanced stage, the alcoholic admits defeat and unless he receives treatment, is unlikely to give up drinking

Signs and symptoms include:

- Drinking alone.
- Drinking in secret.
- Not being able to limit how much alcohol is consumed.
- Blacking out - not being able to remember chunks of time.
- Having rituals and being irritated/annoyed when these rituals are disturbed or commented on. This could be drinks before/during/after meals, or after work.
- Dropping hobbies and activities the person used to enjoy; losing interest in them.
- Feeling an urge to drink.
- Feeling irritable when drinking times approach. This feeling is more intense if the alcohol is not available, or there appears to be a chance it may not be available.
- Having stashes of alcohol in unlikely places.
- Gulping drinks down in order to get drunk quicker and then feel good.
- Having relationship problems (triggered by drinking).
- Having problems with the law (caused by drinking).
- Having work problems (caused by drinking, or drinking as root cause).
- Having money problems (caused by drinking).
- Requiring a larger quantity of alcohol to feel its effect.
- Nausea, sweating, or even shaking when not drinking.

EFFECTS OF ALCOHOL

Short term effects:
Depending on how much is taken and the physical condition of the individual, alcohol can cause:

- Slurred speech
- Drowsiness
- Vomiting
- Diarrhea
- Upset stomach
- Headaches
- Breathing difficulties
- Distorted vision and hearing
- Impaired judgment
- Decreased perception and coordination
- Unconsciousness
- Anemia (loss of red blood cells)
- Coma
- Blackouts (memory lapses, where the drinker cannot remember events that occurred while under the influence)

Long-term effects:
Binge drinking and continued alcohol use in large amounts are associated with many health problems, including:

- Unintentional injuries such as car crash, falls, burns, drowning
- Intentional injuries such as firearm injuries, sexual assault, domestic violence
- Increased on-the-job injuries and loss of productivity
- Increased family problems, broken relationships
- Alcohol poisoning
- High blood pressure, stroke, and other heart-related diseases
- Liver disease
- Nerve damage
- Sexual problems
- Permanent damage to the brain
- Vitamin B1 deficiency, which can lead to a disorder characterized by amnesia, apathy and disorientation
- Shakiness and tremors
- Ulcers
- Gastritis (inflammation of stomach walls)
- Malnutrition
- Cancer of the mouth and throat
- withdrawal symptoms
- Enlarged pupils
- Severe headaches
- Clammy, pale skin
- Loss of appetite
- Nausea or vomiting
- Rapid heartbeat
- Excessive sweating

Treatment for Alcoholism

The stages of alcoholism don't progress overnight. It often takes years of abuse before moving from one stage to the other. If you think you may be an alcoholic, consider getting addiction treatment before the disease causes you serious medical harm. Choosing to seek help for an alcohol addiction is one of the biggest decisions you will face. There are different forms of treatment available based on frequency and severity of alcohol abuse.

Recovering from alcohol addiction is a process that continues long after rehab. It takes commitment to practice and apply the techniques you learn in rehab, counseling, support groups and other types of therapy.

Although every individual will have their own recovery plan that's tailored to their specific needs, treatment generally follows a structure.

- Hospitalization: it is better to arrange hospitalization for the treatment of acute alcoholic intoxication. In many cases compulsory hospitalization is not needed but it is important to keep the alcoholics away from aversive life situations and keep their behaviour under control.

- Clinical diagnosis: it should include diagnostics like full blood count, chest and skull radiography, liver function tests, proper medical treatments.

- Detoxification: The first stage in alcohol addiction recovery is detoxification. This phase should be completed with the help of medical professionals due to the potential for serious, uncomfortable withdrawal symptoms. Many times, individuals are given a medication to help alleviate the painful side effects of a withdrawal. At this stage much care should be taken to compensate the alcoholic's dietary deficiencies.

- Aversion therapy: The patient may be given drugs like Disulfiram or citrated calcium carbimide for heeling him not to drink. These drugs cause episode of intense illness if the individual drinks alcohol and there by act a strong deterrence in preventing drinking. Shock therapy may also be used as an effective measure to cause aversion for liquor.

- Psychotherapy: when the patient has stopped drinking he may be given group or individual psychotherapy for helping him gain insight into his behavior and develop more effective adjustment techniques other than alcohol or drug addiction.

- Sociotherapy: This treatment involves the modification of environmental situations, change in attitude, and the provision of healthy social gatherings and groups. it is directed towards the counseling the patient's wife or family and helping him to readjust in the family and community setting. To heal their social contacts in the form of a religious gathering, social clubs emphasizing inspirational and spiritual elements and also useful in the treatment of alcoholics.

- Duration of treatment and follow - up: The duration of treatment in case of alcoholics depends largely on the severity of the case. If they remain away from alcohol for five years they can usually considered as cured but there are many chances and incidences for relapse which is frequent in the first two years. Great care should be taken in follow - up when treatment is over

DRUG ADDICTION

Drug addiction, like alcoholism is also detrimental to the individual and society. It concerns with an abnormal use of certain drugs like hashish, marijuana, charas, cocaine, LSD, cannabis, mandrax, valium, Dexedrine and methidrine.

FIG – DRUG ADDICTION

The most common drugs

- **cannabis** People use this by smoking, eating or inhaling a vaporized form of the drug. Cannabis often precedes or is used along with other substances, such as alcohol or illegal drugs, and is often the first drug tried.
- **synthetic drugs** — synthetic cannabinoids and substituted or synthetic cathinones — are illegal in most states. The effects of these drugs can be dangerous and unpredictable, as there is no quality control and some ingredients may not be known
- **Barbiturates**. Examples include phenobarbital and secobarbital (Seconal).
- **Benzodiazepines**. E xamples include sedatives, such as diazepam (Valium), alprazolam (Xanax), lorazepam (Ativan), clonazepam (Klonopin) and chlordiazepoxide (Librium).
- **Hypnotics.** Examples include prescription sleeping medications such as zolpidem (Ambien, Intermezzo, others) and zaleplon (Sonata).
- **Stimulants** include amphetamines, meth (methamphetamine), cocaine, methylphenidate (Ritalin, Concerta, others) and amphetamine-dextroamphetamine (Adderall, Adderall XR, others). They are often used and misused in search of a "high," or to boost energy, to improve performance at work or school, or to lose weight or control appetite.

- **Club drugs**, Club drugs are commonly used at clubs, concerts and parties. Examples include ecstasy or molly (MDMA), gamma-hydroxybutyric acid (GHB), flunitrazepam (Rohypnol a brand used outside the U.S. — also called roofie) and ketamine. These drugs are not all in the same category, but they share some similar effects and dangers, including long-term harmful effects. Because GHB and flunitrazepam can cause sedation, muscle relaxation, confusion and memory loss, the potential for sexual misconduct or sexual assault is associated with the use of these drugs.
- **Hallucinogens**: Use of hallucinogens can produce different signs and symptoms, depending on the drug. The most common hallucinogens are lysergic acid diethylamide (LSD) and phencyclidine (PCP).
- **Inhalants-** Signs and symptoms of inhalant use vary, depending on the substance. Some commonly inhaled substances include glue, paint thinners, correction fluid, felt tip marker fluid, gasoline, cleaning fluids and household aerosol products. Due to the toxic nature of these substances, users may develop brain damage or sudden death.
- **Opioid painkillers -** Opioids are narcotic, painkilling drugs produced from opium or made synthetically. This class of drugs includes, among others, heroin, morphine, codeine, methadone and oxycodone**.**

Symptoms/ Behaviours

Drug addiction symptoms or behaviors include, among others:

- Feeling that you have to use the drug regularly — daily or even several times a day
- Having intense urges for the drug that block out any other thoughts
- Over time, needing more of the drug to get the same effect
- Taking larger amounts of the drug over a longer period of time than you intended
- Making certain that you maintain a supply of the drug
- Spending money on the drug, even though you can't afford it
- Not meeting obligations and work responsibilities, or cutting back on social or recreational activities because of drug use
- Continuing to use the drug, even though you know it's causing problems in your life or causing you physical or psychological harm
- Doing things to get the drug that you normally wouldn't do, such as stealing
- Driving or doing other risky activities when you're under the influence of the drug
- Spending a good deal of time getting the drug, using the drug or recovering from the effects of the drug
- Failing in your attempts to stop using the drug
- Experiencing withdrawal symptoms when you attempt to stop taking the drug

Causes

Like many mental health disorders, several factors may contribute to development of drug addiction. The main factors are:

- **Environment:** Environmental factors, including your family's beliefs and attitudes and exposure to a peer group that encourages drug use, seem to play a role in initial drug use.
- **Genetics:** Once you've started using a drug, the development into addiction may be influenced by inherited (genetic) traits, which may delay or speed up the disease progression.
- **Changes in the brain** : physical addiction appears to occur when repeated use of a drug changes the way your brain feels pleasure. The addicting drug causes physical changes to some nerve cells (neurons) in your brain. Neurons use chemicals called neurotransmitters to communicate. These changes can remain long after you stop using the drug.

Risk factors

People of any age, sex or economic status can become addicted to a drug. Certain factors can affect the likelihood and speed of developing an addiction:

- Family history of addiction. Drug addiction is more common in some families and likely involves genetic predisposition. If you have a blood relative, such as a parent or sibling, with alcohol or drug addiction, you're at greater risk of developing a drug addiction.
- Mental health disorder. If you have a mental health disorder such as depression, attention-deficit/hyperactivity disorder (ADHD) or post-traumatic stress disorder, you're more likely to become addicted to drugs. Using drugs can become a way of coping with painful feelings, such as anxiety, depression and loneliness, and can make these problems even worse.
- Peer pressure. Peer pressure is a strong factor in starting to use and misuse drugs, particularly for young people.
- Lack of family involvement. Difficult family situations or lack of a bond with your parents or siblings may increase the risk of addiction, as can a lack of parental supervision.
- Early use. Using drugs at an early age can cause changes in the developing brain and increase the likelihood of progressing to drug addiction.
- Taking a highly addictive drug. Some drugs, such as stimulants, cocaine or opioid painkillers, may result in faster development of addiction than other drugs. Smoking or injecting drugs can increase the potential for addiction. Taking drugs considered less addicting — so-called "light drugs" — can start you on a pathway of drug use and addiction.

Complications

Drug use can have significant and damaging short-term and long-term effects. Taking some drugs can be particularly risky, especially if you take high doses or combine them with other drugs or alcohol. Here are some examples.

- Methamphetamine, opiates and cocaine are highly addictive and cause multiple short-term and long-term health consequences, including psychotic behavior, seizures or death due to overdose.
- GHB and flunitrazepam may cause sedation, confusion and memory loss. At high doses, they can cause seizures, coma and death. The danger increases when these drugs are taken with alcohol.
- Ecstasy or molly (MDMA) can cause dehydration, electrolyte imbalance and complications that can include seizures. Long-term, MDMA can damage the brain.
- One particular danger of club drugs is that the liquid, pill or powder forms of these drugs available on the street often contain unknown substances that can be harmful, including other illegally manufactured or pharmaceutical drugs.
- Due to the toxic nature of inhalants, users may develop brain damage of different levels of severity.

Other life-changing complications

Dependence on drugs can create a number of dangerous and damaging complications, including:

- Getting a communicable disease: People who are addicted to a drug are more likely to get an infectious disease, such as HIV, either through unsafe sex or by sharing needles.
- Other health problems: Drug addiction can lead to a range of both short-term and long-term mental and physical health problems. These depend on what drug is taken.
- Accidents: People who are addicted to drugs are more likely to drive or do other dangerous activities while under the influence.
- Suicide: People who are addicted to drugs die by suicide more often than people who aren't addicted.
- Family problems: Behavioral changes may cause marital or family conflict and custody issues.
- Work issues: Drug use can cause declining performance at work, absenteeism and eventual loss of employment.
- Problems at school: Drug use can negatively affect academic performance and motivation to excel in school.
- Legal issues: Legal problems are common for drug users and can stem from buying or possessing illegal drugs, stealing to support the drug addiction, driving while under the influence of drugs or alcohol, or disputes over child custody.
- Financial problems: Spending money to support drug use takes away money from other needs, could lead to debt, and can lead to illegal or unethical behaviors.

Management

Detoxification and Medically Managed Withdrawal

The process when the body rids itself of drugs is referred to as detoxification, and is usually concurrent with the side effects of withdrawal which vary depending on the substance(s) and are often unpleasant and even fatal. Physicians may prescribe a medication that will help decrease the withdrawal symptoms while the addict is receiving care in an inpatient or outpatient setting. Detoxification is generally considered a precursor to or a first stage of treatment because it is designed to manage the acute and potentially dangerous physiological effects of stopping drug use.

Long-term Residential

Treatment is structured and operates 24 hours a day. Residents will remain in treatment from usually 6 to 12 months while developing accountability, responsibility and socialization skills. Activities are designed to help addicts recover from destructive behavior patterns while adopting positive behavioral patterns. Constructive methods of interacting with others and improving self-esteem are other areas of focus. The therapeutic community model is an example of one treatment approach. Many therapeutic communities provide a more comprehensive approach to include employment training and other support services.

Short-term Residential

Short-term residential programs are on average 3–6 weeks in a residential setting. The program is intensive followed by more extended outpatient treatment to include individual and/or group therapy, 12-step group programs, or other forms of support. Because of the short duration of this modality it is even more important for individuals to remain active in outpatient treatment programs to help decrease the risk of relapse following residential treatment.

Individualized Drug Counselling

Individualized drug counseling not only focuses on reducing or stopping illicit drug or alcohol use, it also addresses related areas of impaired functioning such as employment status, illegal activity, and family/social relations as well as the content and structure of the patient's recovery program. Through its emphasis on short-term behavioral goals, individualized counselling helps the patient develop coping strategies and tools to abstain from drug use and maintain abstinence.

The addiction counsellor encourages 12-step participation (at least one or two times per week) and makes referrals for needed supplemental medical, psychiatric, employment, and other services.

Group Counselling

An outpatient treatment option facilitated by a treatment provider and used to expand on the support system the patient already has. Groups foster a non-judgmental environment allowing patients to meet and discuss difficulties and successes of their addiction while providing on-going support that is needed to be successful with recovery.

Prevention

The best way to prevent an addiction to a drug is not to take the drug at all. If your doctor prescribes a drug with the potential for addiction, use care when taking the drug and follow the instructions provided by your doctor.

Doctors should prescribe these medications at safe doses and amounts and monitor their use so that you're not given too great a dose or for too long a time. If you feel you need to take more than the prescribed dose of a medication, talk to your doctor.

Preventing drug misuse in children and teenagers:

Take these steps to help prevent drug misuse in your children and teenagers:

- Communicate: Talk to your children about the risks of drug use and misuse.
- Listen: Be a good listener when your children talk about peer pressure, and be supportive of their efforts to resist it.
- Set a good example: Don't misuse alcohol or addictive drugs. Children of parents who misuse drugs are at greater risk of drug addiction.
- Strengthen the bond: Work on your relationship with your children. A strong, stable bond between you and your child will reduce your child's risk of using or misusing drugs.
- Stick with your treatment plan: Monitor your cravings. It may seem like you've recovered and you don't need to keep taking steps to stay drug-free. But your chances of staying drug-free will be much higher if you continue seeing your therapist or counselor, going to support group meetings and taking prescribed medication.
- Avoid high-risk situations: Don't go back to the neighborhood where you used to get your drugs. And stay away from your old drug crowd.
- Get help immediately if you use the drug again. If you start using the drug again, talk to your doctor, your mental health professional or someone else who can help you right away.

SHORT ANSWER QUESTIONS:

1. Define alcoholism and write the causes of alcoholism?
2. Write the signs and symptoms of alcoholism?
3. Mention the effects of alcoholism?
4. Define drug addiction and write the causes of drug addiction?
5. What are the symptoms of drug addiction?

PHYSIOTHERAPY

Paper - III

BIOMECHANICS & EXERCISE THERAPY

INDEX

UNIT- 1

BIOMECHANICS

Contents:

INTRODUCTION

Mechanical principles:

The human is highly sophisticated machine composed of a large but finite number of components. These components can be combined to produce an infinity variety of postures and movements. It is the intention to investigate the nature of this machine with the goal of understanding how joint structure and muscle function fulfil the needs of the human body for both mobility and stability. The study of mechanics in the human body is referred to as BIOMECHANICS and consists of the areas of Kinematics and Kinetics.

KINEMATICS: DESCRIPTION OF MOVEMENT

Kinematics is the area of Biomechanics that includes description of movement without regard for the forces producing the movement**. Kinematic variables** for a given movement may include i) Type of movement ii) location of the movement iii) magnitude of the movement iv) direction of the movement.

i. Types of movements: there are four types of movements.

- Rotatory (angular) motion - is the movement of an object or segment around a fixed axis in a curved path.
- Translatory (linear) motion - is the movement of an object or segment in a straight line.
- Curvilinear motion - is the movement of an object or segment produced by the combination of rotatory and translatory motions.
- General plane motion - it is a special case of curvilinear motion where the object is segmented and free to move rather than rigid or fixed.

- **Location of movement:** motion at a joint may be described as occurring in the transverse, frontal, or sagittal planes. Motion in any one of these planes means that a body segment is being rotated about its axis in such a way that the segment is moving through a path that is parallel to one of the three cardinal planes.

- **Magnitude of movement:** the magnitude or quantity of arotatory movement can be given either in degrees or in radians. If a segment describes a complete circle it has moved through 360 degree or 6 .28 radians. A radian is the ratio of an arc to the radius of its circle. one radian is equal to 57.3 degrees. One degree is equal to 0.01745 radians. The most widely used standardized method of clinical joint range measurement is GONIOMETRY, with units in degrees.

- **Direction of Motion:** Movement may occur either in clockwise or anticlockwise direction. Flexion and extension generally occur in sagittal plane around coronal axis. Flexion refers to rotation of one or both bony levers around a joint axis so those ventral surfaces are being approximated. Rotation in the same plane in the opposite direction is termed extension.

KINETICS: ANALYSIS OF FORCES

Kinetics is the area of biomechanics concerned with the forces producing movement or maintaining equilibrium. Whether a body or body segment is in motion or at rest is dependent on the forces exerted on that body. A force, simply speaking is a push or pull exerted by one material object or substance on another. External forces are pushes or pulls on the body that arise from sources outside the body. Some of the examples of external forces are Gravity, Wind, water, other people and other objects. Internal forces are the forces that act on the body but arise from sources within the human body. Some of the example is muscles, ligaments and bones. Most importantly, internal forces serve to counteract those external forces that jeopardize the integrity of human joint structure.

PLANES AND AXIS

Human movements are described in three dimensions based on a series of planes and axis.

PLANE

A plane is surface which lies at right angles and in which movement takes place. There are three planes of motion that pass through the human body.

- The sagittal plane
- The frontal plane
- The transverse (horizontal) plane

The **sagittal plane** lies vertically and divides the body into right and left parts.
The **frontal plane** also lies vertically however divides the body into anterior and posterior parts.
The **transverse plane** lies horizontally and divides the body into superior and inferior parts.

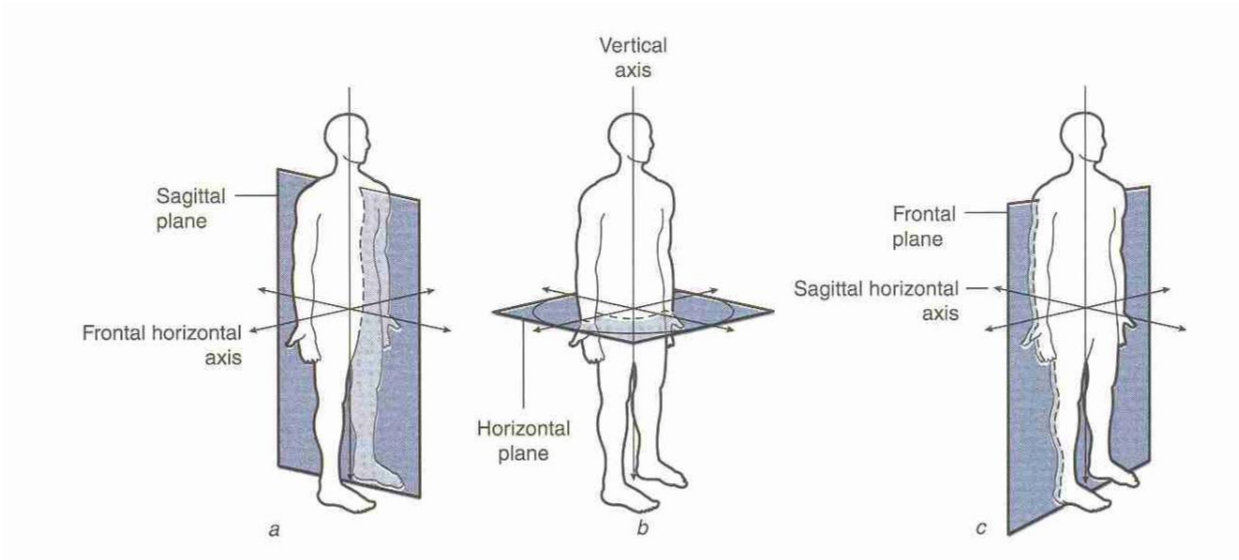


FIG - AXIS AND PLANES

AXIS

An axis is a straight line around which an object rotates. Movement at the joint take place in a plane about an axis. There are three axis of rotation.

- Sagittal axis
- Frontal axis
- Vertical axis

The **sagittal axis** passes horizontally from posterior to anterior and movement occurs in frontal plane (i.e. abduction and adduction).

The **frontal axis** passes horizontally from left to right and movement occurs ion sagittal plane (i.e. flexion and extension).

The **vertical axis** passes vertically from inferior to superior and movement occurs in horizontal plane (i.e. medial and lateral rotation).

GRAVITY

Gravity is a very important force to consider when dealing with biomechanics. It is constantly affecting the body in both static and dynamic movement. It can be looked at as the gravitational downward pull on an object. Whereas the centre of mass is the mean position of matter in a body or system. Gravity, like all forces, has a point of application, a magnitude, and a direction.

CENTER OF GRAVITY

It is an imaginary balancing point where the body weight can be assumed to be concentrated and equally distributed. Its symbol is COG or CG. It is the point of exact centre, around which the body may rotate freely in all directions. It can also be called centre of mass. In the standing position this lies at approximately the level of the second sacral vertebra. The position of the centre of gravity and the line of gravity will vary with body postures. Raising the weight distribution will raise the centre of gravity whilst moving it sideways will laterally displace both the centre of gravity and line of gravity.

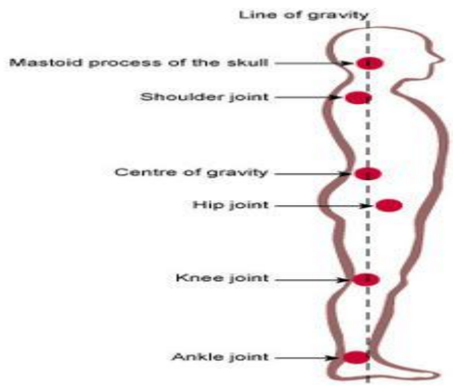


FIG – COG AND LOG

LINE OF GRAVITY

It is the vertical line through centre of gravity. When the human body is in fundamental standing position, the line of gravity (LOG) pass through vertex and a point between the feet, level with transverse tarsal joints.

The closer the line of gravity is to the centre of the base of support (your next dash point) the better balanced a person is in this position. If the line of gravity fall outside of the base of support the person must provide corrective muscle action, usually movement otherwise they will fall.

BASE OF SUPPORT (BOS)

Refers to the area beneath an object or person that includes every point of contact that the object or person makes with the supporting surface. These points of contact may be body parts e.g. feet or hands, or they may include things like crutches or the chair a person is sitting in.

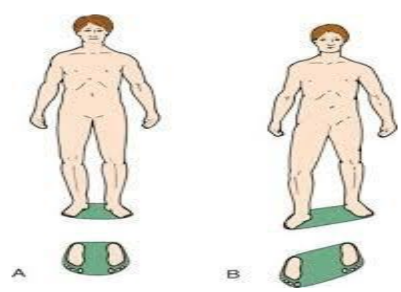


FIG – BASE OF SUPPORT

EQUILIBRIUM or BALANCE

It results when the forces acting upon a body are balanced and the body remains at rest.
Types of equilibrium are

- **Stable equilibrium:** If the forces acting upon a body at rest tend to restore it to its original position after it has been displaced, the body is said to be in stable equilibrium.

- **Unstable equilibrium:** If a body is given an initial displacement and the forces acting upon it increase this initi al displacement, the body is said to be in unstab le equilibrium.
- **Neutral equilibrium:** In spite of displacement of a body, the height and position of its centre of gravity remain t he same in relation to the base, the body is said to be in neutral position.

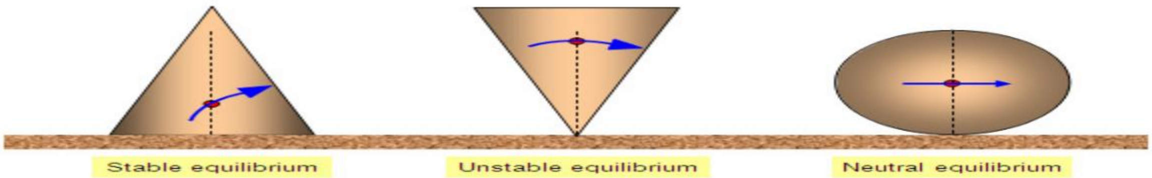


FIG - EQUILIBRIUM

FORCE

The most important aspect of bio mechanics to consider is force. Force is simply a push or a pull exerted by one object on another. For an example, when a muscle contracts it creates a force that is transferred to the tendon to pull on the bony attachment, thus resulting in moti on. An important consideration with for ce is that it is a vector quantity.

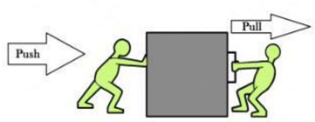


FIG - FORCE

<u>Types of Forces</u>

There are 4 types of forces to co nsider with biomechanics mentioned below:

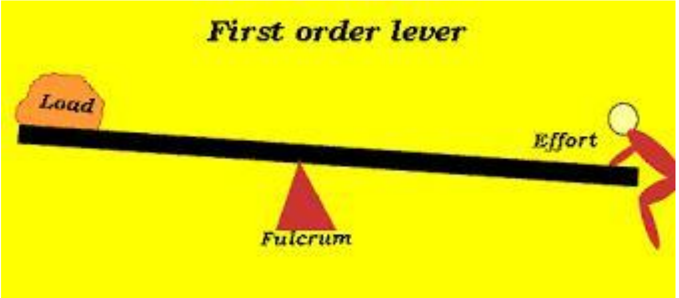
Motion Forces -Rotatory,, Translatory, Curvilinear External
Forces – Gravit y, Wind, Objects, Other People Internal
Forces – Muscle s, Connective Tissue (Elastic), Bone
Reactionary Forces – Gro und Reaction, Joint Reaction, Gliding/Shear/Friction

LEVERS AND THEIR MACH ANICAL ADVANTAGES

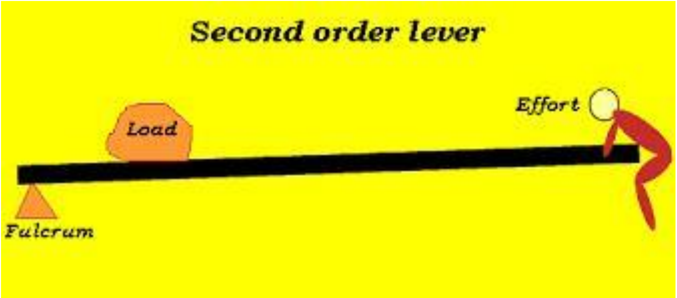
A lever is a rigid bar, which rotates about a fixed point known as the fulcrum of axis of motion. IN human body lever is represented by a bone and fulcrum situated at the joint w hich allows the movement towards it and effort i s given by muscle contraction towards its insertion and weight is situated in center of gravity or somewhere else in the lever.

Classification of Levers

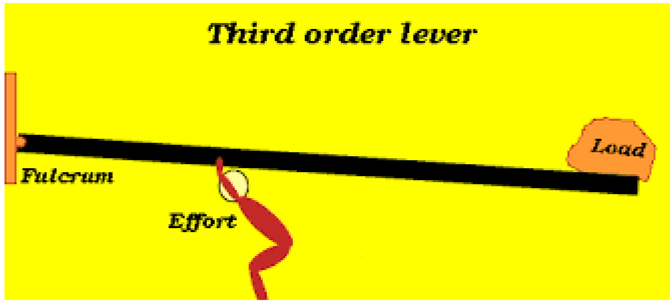
First order lever: in this fulcrum is placed between the effort and the weight. This lever is called lever of stability. Example: the action of the neck extensors balancing the weight of the neck in the standing position, the atlanto occipital joint being the fulcrum.



Second order lever: In this weight is placed between fulcrum and effort. This is called lever of power or lever of mechanical advantage. The mechanical advantage is always greater than first order lever, a small amount of effort can shift a large resistance. Example: In humans, when standing on toes by lifting the heel, the tarsals, metatarsals and phalanges are maintained by muscular action to form a lever. The fulcrum is situated in the MTP joints. The weight is passed from the ankle joint to the talus and the effort is given at tendocalcaneus, which is given by calf muscle.



Third order lever: In this effort is placed between fulcrum and weight. This is called lever of velocity. The mechanical advantage is always less than first order lever. A greater amount of effort is required to shift a resistance. Most levers in the human body are of this type. Example: Biceps brachii acting to raise the weight of the forearm about the fulcrum of the elbow joint .Deltoid acts about the shoulder joint in order to raise the arm.



PULLEYS

Pulley is a grooved wheel which rotates about a fixed axis by a rope which pass es round it. The axis is supported by a frame work or block.

Types of pulleys

- Fixed pulleys
- Movable pulleys

- **Fixed Pulleys:** These are used to alter the direction of force. The pulley block is fixed and the rope which passes round the whe el is attached to the weight at one end and the effort is applied at the other.

- **Movable pulleys:** These are u sed to gain mechanical advantage when lifting heavy weights. Commonly used for lifting the trunk for suspension exercises. The upper pulley is fixed to an overhead support, to which one e nd of rope is attached. The rope is then wound round the movable pulley, to which the weight is attached, and round the fixed pulley, the effort being applied at the free end.

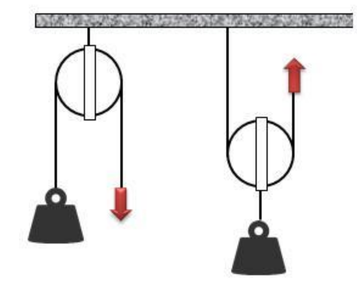


FIG - PULLEY

SPRINGS

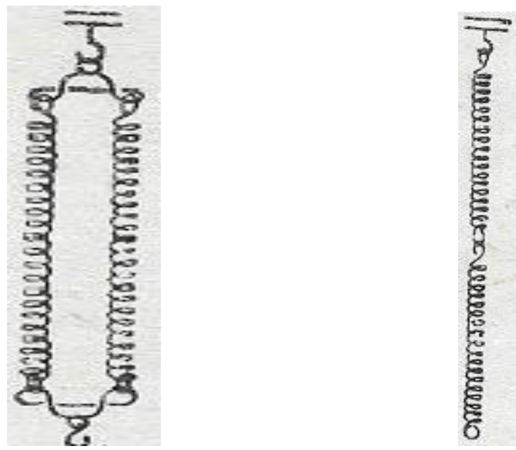
Springs are elastic and therefore may have any of the properties of elastic materials. Springs are made from a variety of elastic materials, the most common being spring steel.

- Springs in parallel: If two springs are arranged side by side attached to th e same point that is in parallel the wei ght of the resistance will be the sum of the two.
- Springs in series: When two springs are joined end to end that is in series the resistance offered is the same as if o nly one spring was used.

Types of springs:

Tension/extension spring – the s pring is designed to operate with a tension load, so the spring stretches as the load is applied to it.

Compression spring – is designed to operate with a compression load, so the spring gets shorter as the load is applied to it.



Springs in parallel springs in series

FIG - SPRINGS

ELASTICITY

Elasticity is the property of solid materials to return to their original shape and size after the forces deforming them have been removed. Elasticity is the property of a body to regain its original shape and size when deforming forces are removed. It exhibits an opposition to change. Solid objects will deform when adequate forces are applied on them. If the material is elastic, the object will return to its initial shape and size when these forces are removed. Examples: Springs, rubber elastic and sorbo rubber all posses the properties of elasticity.

FIG – ELASTICITY

SHORT ANSWER QUESTIONS:

1. Define Biomechanics?
2. Define kinematics and mention the types of movements seen in kinematics?
3. Define kinetics ?
4. Define axis and write its types?
5. Define plane and write its types?
6. What is meant by COG?
7. Write about LOG?
8. What is base of support?
9. Define equilibrium and its types?
10. Define force and its types?
11. Define lever and its types?
12. Write about pulleys and mention its types?
13. Write about springs and mention its types?
14. Write about elasticity?

UNIT- 2

GAIT ANALYSIS

Contents:

INTRODUCTION

Gait

One of the most distinctive features of human gait is the fact that it is individualistic. Each person has his/her own characteristic gait pattern. Gait pattern may reflect person's occupation, personality, and many other physical and psychological attributes. For example: The rolling gait that is used to describe a sailor's movement reflects the wide base of support needed to maintain balance at sea.

Human locomotion or gait may be described as a translatory progression of the body as a whole produced by coordinated rotatory movements of body segments. Normal gait is rhythmic and characterised by alternating propulsive and retropulsive movements of the lower extremities. The alternating movements of the lower extremities essentially support and carry along the head, arms and trunk (HAT). HAT constitutes about 75% of the total body weight. The head and arms combined constitute about 25% the total body weight while the trunk accounts for remaining 50%.

Definition: Normal gait is a series of rhythmical, alternating movements of the trunk and limbs which result in the forward progression of the centre of gravity. Gait is style, manner or a pattern of walking. Walking pattern may differ from individual to individual.

Gait is an extremely complex activity to analyze. Therefore gait has been divided into a number of segments that make it possible to identify the events that are taking place. Generally gait is described by using the activities of one lower extremity (referred to as the reference extremity) from the beginning to the end of one gait cycle.

PHASES OF GAIT CYCLE:

The gait cycle includes the activities that occur from the point of initial contact of one lower extremity to the point at which the same extremity contacts the ground again. During one gait cycle each extremity passes through two phases a single **stance phase** and a single **swing phase.** The **stance phase** begins at the instant that one extremity contacts the ground (heel strike), and continues only as long as some portion of the foot is in contact with the ground (toe off). During the stance phase of gait some portion of the foot is in contact with the supporting surface at all times. The stance phase makes up approximately 60% of the gait cycle during normal walk.

The **swing phase** begins as soon as the toe of one extremity leaves the ground and ceases just prior to heel strike or contact of the same extremity. When the reference extremity is in the swing phase it does not contact the ground at any time. Swing phase makes up 40% of the gait cycle.

A period of double limb support occurs in walking when the lower extremity of one side of the body is beginning its stance phase and the lower extremity on the opposite side is ending its stance phase. Therefore they are two periods of double support in a single gait cycle. During double support both lower extremities are in contact with the ground at the same time.

Subdivisions:

The stance and swing phases of gait have been divided into the following sub units. Stance phase consists of Heel strike, Foot flat, mid stance, Heel off and Toe off. Swing phase consists of Acceleration, Mid swing and Deceleration.

STANCE PHASE:

I. stance phase: the stance phase begins at the instant that one extremity contacts the ground and continuous only as long as some portion of the foot is in contact with the ground.

- **Heel strike**: the beginning of the stance phase when the heel contacts the ground.
- **Foot flat:** It occurs immediately following heel strike, when sole of the foot contacts the floor.
- **Mid stance**: the point at which the body passes directly over the reference extremity.
- **Heel off:** the point following midstance at which time the heel of the reference extremity leaves the ground.
- **Toe off:** the point following heel off when only the toe of the reference extremity is in contact with the ground.

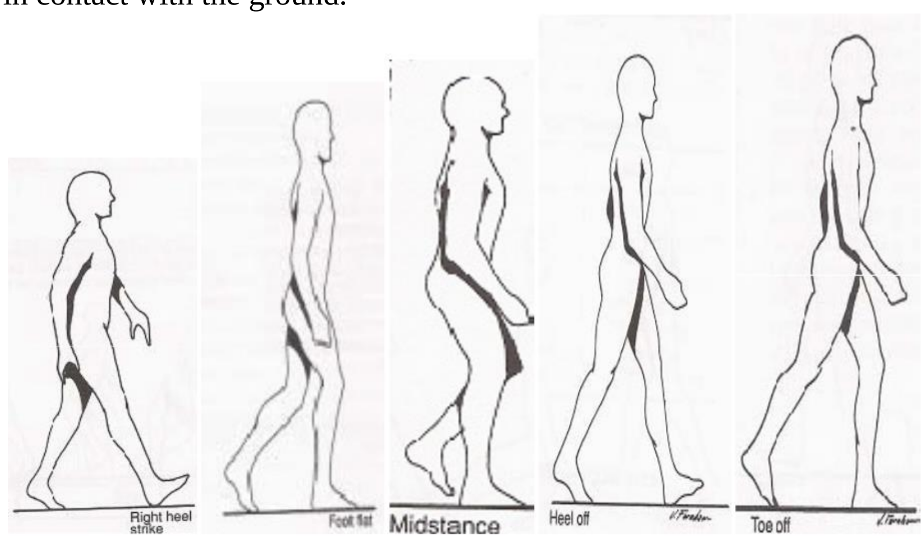


FIG – STANCE PHASE

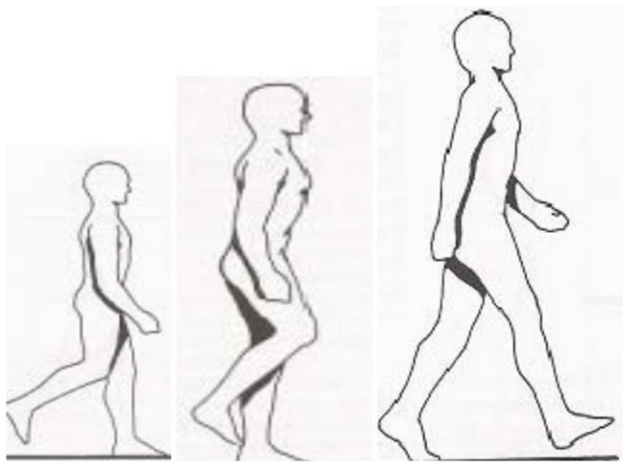
SWING PHASE:

The swing phase begins as soon as the toe of one extremity leaves the ground and ceases just before heel strike or contact of the same extremity.

Acceleration: the portion of beginning swing from the moment the toe of the reference extremity leaves the ground to the point when the reference extremity is directly under the body.

Midswing: portion of the swing phase when the reference extremity passes directly below the body. Midswing extends from the end of acceleration to the beginning of deceleration.

Deceleration: the swing portion of the swing phase when the reference extremity is decelerating in preparation for heel strike.



Acceleration Mid swing Deceleration

FIG – SWING PHASE

The **parameters** taken into account for the gait analysis are as follows:

Step length: is the linear distance between two successive points of contact of opposite extremities. It is usually measured from heel strike of one extremity to heel strike of opposite extremity

Stride length: is the linear distance between two successive events that are accomplished by the lower extremity during gait. It is usually measured from heel strike of one extremity to the next heel strike of same extremity

Cadence: is the number of steps taken by a person per unit of time (per second or per minute).

Speed: is measured in centimetres per minute. Speed of gait usually is referred to as slow, free and fast.

Stance time: is the amount of time that elapses during the stance phase of one extremity in a gait cycle.

Stride duration: refers to the amount of time takes to accomplish one stride, so its also known as gait cycle duration.

Step duration: refers to the amount of time spending during a single step. Measurement is usually taken in seconds per step.

Base width: it is the distance measured between the two feet.

PATHOLOGICAL GAIT

Pathological gait: Any deviation from the normal gait pattern are considered to be abnormal or pathological gait. It is an altered gait pattern due to deformities, weakness or other impairments, for example, loss of motor control or pain.

Pathological Gait Patterns

Pathologic gait patterns can be broadly divided into either neuromuscular or musculoskeletal etiologies. Gait deviations may result from structural abnormalities of a bone, joint, or soft tissue. Other causes of pathologic gait include neuromuscular and myopathic conditions.

Common Musculoskeletal causes

- Knee pathology
- Foot and ankle pathology
- Leg length discrepancy

Common neurologic causes

- Cerebrovascular conditions
- Central nervous system conditions
- Cerebellar conditions

Common motor weakness causes

- Hip extensor weakness
- Hip flexor weakness
- Quadriceps weakness
- Ankle dorsiflexor weakness
- Triceps surae weakness

ANTALGIC GAIT

Causes

Pain in limb

Characteristics

A limping gait, indicative of pain upon weight bearing. The stance phase is significantly shortened relative to the swing phase to minimize closed chain loading and reduce pain.

ATAXIC GAIT

Causes

Injury to the cerebellum

Sensory deficits in lower limb

Characteristics

An unsteady, uncoordinated walk with a broad standing base. Movements appear exaggerated, leg placement is variable and reproducibility is lost.

CHOREIFORM (HYPERKINETIC) GAIT

Causes

Sydenham's chorea
Huntington's
disease Athetosis

Dystonia

Characteristics

Irregular, jerky, and involuntary movements occur in all extremities. Walking may accentuate the base line movement disorder.

DIPLEGIC GAIT

Causes

Cerebral Palsy

Characteristics

Bilateral involvement and spasticity in all extremities. Patient will walk with an abnormally narrow base, dragging both legs and scraping the toes. Adductor tightness may cause legs to scissor.

FOOT DROP GAIT

Causes

Weak dorsiflexors

Paralyzed dorsiflexors

Damaged common fibular nerve

Characteristics

Gait in which the forefoot cannot be actively raised. The advancing leg is lifted high in order to clear the toes and in some cases the foot may audibly slap the ground due to lack of eccentric dorsiflexion.

GLUTEUS MAXIMUS / LURCH GAIT (Inferior Gluteal Nerve)

Causes

Hip extensor weakness

Characteristics

A backward trunk lurch persists throughout stance phase to maintain center of mass behind the hip axis, locking the hip in extension. The hamstring muscles may compensate in some cases.

GLUTEUS MEDIUS (TRENDELENBURG) GAIT

Causes

Hip abductor weakness

Characteristics

When there is an abductor weakness as muscular dystrophies or in poliomyelitis, the pelvis drops instead of rising on the unsupported side.

In an attempt to lessen this effect, a child compensates by leaning over the affected hip. It means that the centre of gravity is over the hip and so it reduces the degree of the pelvic drop.

MYOPATHIC GAIT

Causes

Hip abductor weakness

Characteristics

If uncompensated, during stance phase on the affected side there is a drop in the pelvis on the unaffected side greater than the normal 5 degrees (Trendelenburg sign). There is also a lateral protrusion of the affected hip.

If compensated, there is a lateral trunk lurch over the affected hip during stance phase. This maintains the centre of gravity over the hip, reducing the muscle force required to stabilize the trunk and pelvis.

HEMIPLEGIC GAIT

Causes

Cerebrovascular accident

Characteristics

Patient has unilateral weakness on affected side, with leg in extension and foot plantar flexed. During swing phase, affected limb circumducts to clear ground due to foot drop and extensor hypertonia in the lower limb.

PARKINSON'S GAIT

Causes

Parkinson's Disease

Other disorders of the basal ganglia

Characteristics

Patient presents observable bradykinesia, tremor, and rigidity.

Gait consists of many small, shuffling steps also known as *marche a petis pas*. There may be difficulty initiating steps and once moving there may be an involuntary inclination to increase cadence, which is known as festinating gait.

QUADRICEPS GAIT

Causes

Weak or paralysed quadriceps muscle

Characteristics

The locking is done by passively pushing the knee backward by the patient putting his hand over the front of the lower thigh. This results in a limp and may even cause genu recurvatum.

ESSAY ANSWER QUESTIONS

1. Define Gait and explain its phases in detail?
2. Define pathological gait, and explain the causes and different types of pathological gaits?

UNIT-3

EXERCISE THERAPY

Content:

Introduction

Exercise Therapy means of accelerating the patient's recovery from injuries and diseases which have altered his normal way of living. Loss or impairment of function prevents or modifies his ability to live independently, to carry on with his work and enjoy recreation. He may react to the demands of his environment either by rejecting them and remaining inactive or by meeting them to the best of his ability by altering his pattern of activity. Therapeutic exercise programs designed by physical therapists are individualized to the unique needs of each patient or client. A patient is an individual with impairments and functional limitations diagnosed by a physical therapist and is receiving physical therapy care to improve function and prevent dysfunction who engages in physical therapy services to promote health and wellness and to prevent dysfunction.

The following are the **common physical impairments** managed with Therapeutic exercise.

Musculoskeletal

- Pain
- Muscles weakness / decreased muscular endurance
- Limited range of motion due to
- Restriction of the joint capsule
- Restriction of periarticular connective tissue
- Decreased muscle length
- Joint Hyper mobility
- Faulty posture
- Muscle Imbalances

Neuromuscular

- Pain
- Impaired balance, postural stability or control
- In coordination, faulty timing
- Delayed motor development
- Abnormal tone (hypotonia, dystonia)
- Ineffective / inefficient functional movement strategies

Cardiovascular / Pulmonary

- Decreased aerobic capacity (cardiopulmonary endurance)
- Impaired circulation (lymphatic, venous, arterial)
- Pain with sustained physical activity (intermittent claudication)
- Skin hypo mobility (ex. immobile or adherent scarring)

The aims of exercise therapy

- To promote activity whenever and wherever it is possible to minimize the effects of inactivity.

- To correct the inefficiency of specific muscles or muscle groups and regains normal range of joint movement without delay to achieve efficient functional movement.

- To encourage the patient to use the ability he has regained in the performance of normal activities and so accelerate his rehabilitation.

The Techniques of Exercise therapy

Techniques are classified as follows:

- Passive movements
- Active Movements
- Relaxation techniques
- Mobility of joints
- Muscle strengthening
- Stretching
- Breathing exercises
- Gait training
- Postural drainage
- Co-ordination
- Suspension therapy
- Hydrotherapy.
- Postural correction
- Massage.

<u>Assessment of the patient condition</u>

Some methods of testing

Record charts are dated and kept for use each time the test repeated.

Some of the tests in common use are as follows:

1. Functional Tests

These are used to assess the patient's needs and abilities with regard to functional activities, e.g. mobility (in bed, transfers, ambulation, etc.), personal care (eating, dressing, washing etc.), household or garden jobs (cooking, washing up, sweeping, lifting, etc.), work recreation.

2. Tests of Joint Range

Measurement of the limitation of joint range presents many difficulties in practice. A suitable position is selected for the patient so that he is stable, to make sure that any structures which would limit the normal range of movement are relaxed, e.g. calf muscles must be relaxed by flexing the knee to measure full range of ankle movement. As the normal range of movement varies considerably in individuals, the contra lateral joint always be measured first when possible.

3. Tests for Neuromuscular Efficiency

These may be carried out electrically, manually or mechanically.

- <u>Electrical Tests</u>: These may be carried out by the doctor with the useof the electro-myograph or by means of the strength-duration curve. They are particularly valuable for diagnostic purposes.

- <u>Manual Muscle Testing</u>. To be accurate and efficient manual muscletesting requires a standardized technique and considerable experience. The classification of the findings at examination, however, are usually recorded according to the Oxford Classification, on a scale 0-5, i.e.,

0. No contraction
1. Flicker of contraction
2. Weak / Small movement with gravity counterbalanced.
3. Fair / Movement against gravity
4. Good / Movement against gravity with minimal resistance.
5. Normal / Movement against gravity with maximal resistance.

- Circumference Measurement. This test relies on the fact that there is a relationship between the development of power and that of hypertrophy. A tape measure made from some inextensible material is used to measure the circumference of the limb at a predetermined level. Experiment on normal limbs indicates that this method is unreliable even in experienced hands,although it is still used.
- Endurance Test. Endurance maybe calculated by recording the drop in the maximal power of the muscles when their effort of contraction is repeated at given intervals for a specific period of time.
- Speed Tests. The successful performance of functional activities can be timed by the use of a stop-watch, e.g. time taken to dress or walk a measured distance.

4.Tests for Co-ordination

Co-ordination of movement, or the lack of it, is observed in the patient's gait, his performance of purposeful movements or during specific movement such as bringing the finger to the tip of the nose or moving the heel up and down along the opposite shin bone.

5. Measurement of Vital Capacity and Range of Respiratory Excursions

A spirometer is used to measure vital capacity. The patient is instructed to breath is as much as possible and then breath out through the mouthpiece of the spirometer which registers the volume in cubic centimetres.

6. Measurement of Leg Length

True shortening of the leg is measured from the anterior superior iliac spine or the upper margin of the great trochanter to the lateral malleolus, and apparent shortening from the umbilicus or xiphisternum to the level of the knee joint or the tip of the medial malleolus.

7. Measurement of the Angle of Pelvic Inclination

Antero-posterior inclination of the pelvis may be measured by means of a pelvic inclinometer.

GONIOMETRY

The goniometer is an important tool in physical therapy used to measure a client's joint range of motion (ROM). The measurement of range of motion in a joint with the help of goniometer is called Goniometry. The joints have certain degrees of freedom of movement. It means that movement is limited by structures in and around the joint including ligaments, joint capsule, muscles and tendons. Sometimes, joint range of motion can be limited by abnormal growths in or around the joint, damage to the joint, tightness of surrounding muscles and pain due to an underlying condition.

FIG - GONIOMETER

Goniometer Parts

The parts of Goniometer are:

- proximal arm
- distal arm, and
- Fulcrum.

Proximal Arm: The proximal arm extends from the central disc. It is sometimes called the stationary or fixed arm. This is the part of the goniometer that does not move during joint measurement. The numbers of degree increments are written on the central disc.

Distal Arm: The distal arm, also called the moveable arm, is the moveable part of the goniometer that rotates on the circular disc.

Types of goniometer

- Universal goniometer
- Electro goniometer
- Finger goniometer
- Gravity goniometer

Principles of Measurement

When performing goniometric measurement, one arm is usually stationary while the other arm moves. The axis of rotation of a joint must be located for accuracy. A 3-5 degree error is common in most trained therapists/physicians. The motion of the extremity being evaluated must be compared to the other side. With the patient in the anatomical position, 0 is used as a starting point unless otherwise noted. For example measuring ankle, 90 is anatomical position so that's 0. Distinction should be made in terms of extension/flexion or hyper-extension/flexion.

GONIOMETRY PROCEDURE

Position joint in zero position and stabilize proximal joint component. move joint to end of range of motion (to assess quality of movement) determine end-feel at point where measurement will be taken (at the end of available range of motion) identify and palpate bony landmarks align goniometer with bony landmarks while holding joint at end of range read the goniometer record measurement (e.g. elbow flexion = 130°).

Positioning and Stabilization

POSITIONING

Start with zero position - This is the reference point for the measurement. If zero position can't be achieved, this must be documented .permit complete range of motion If you are assessing joint ROM, be sure that some other structure (e.g.. a tight muscle) doesn't interfere .If you are assessing some other structure (e.g. a tight muscle, pain limiting the motion) document exactly what is limiting the range of motion. (E.g. hamstring tightness at 65° of hip flexion)

STABILIZATION

Poor stabilization is the most frequent cause of invalid measurements. (E.g. observe a "normal" ROM of elbow extension when movement of shoulder and arm masks a limitation - actually measuring shoulder and arm movement) usually stabilize proximal joint components promote patient relaxation so voluntary muscle contraction doesn't interfere Validity and Reliability

VALIDITY and RELIABILITY

VALIDITY

Validity is a measurement concept that asks whether a measurement system actually measures what it's supposed to (i.e., joint range of motion in the case of goniometry)Goniometric measurements can be invalid, usually because of poor stabilization.(see positioning and stabilization)

RELIABILITY

Reliability is a measurement concept that asks whether successive measurements are consistent, repeatable or reproducible. Upper extremity measurements are more reliable than lower extremity measurements. Intertester reliability (same tester on different occasions) - measurement error should be less than 5 degrees. Intratester reliability (different testers) - measurements error probably greater than 5 degrees to maximize reliability always use the same goniometer, positioning, procedure, examiner

Uses of goniometer

- Determine the presence or absence of impairment
- Establish goals
- Develop prognosis, treatment goals, plan of care
- Modify treatment
- Evaluate progress or lack of progress of treatment
- Motivate the subject

MEASUREMENTS

UPPER LIMB

Shoulder joint range of motion

1. Flexion

Recommended testing position: supine lying
Normal ROM: 0-180^0
Fulcrum: acromial process
Movable arm: middle line of humerus
Fixed arm: midaxillary line of thorax

2. Extension

Recommended testing position: prone lying
Normal ROM: 0-60^0
Fulcrum: coracoid process
Movable arm: lateral midline of the humerus.
Fixed arm: midaxillary line of thorax

3. Abduction

Recommended testing position: supine lying
Normal ROM: 0-180^0
Fulcrum: acromial process
Movable arm: medial midline of humerus
Fixed arm: parallel to the midline of the anterior aspect of the sternum.

4. Adduction

Normal ROM: 180^0 -0
Rest is same as abduction

5. Medial rotation

Recommended testing position: supine lying, with the arm placed at 90^0 of abduction.
Normal ROM: 0-70^0
Fulcrum: olecranon process
Movable arm: parallel to ulna
Fixed arm: parallel or perpendicular to the floor

- **Lateral rotation** Normal ROM: 0-90^0
  Rest is same as medial rotation

ELBOW

1. Flexion

Recommended testing position: supine lying
Normal ROM: 0-135^0
Fulcrum: Lateral epicondyle of humerus
Movable arm: lateral midline of the humerus
Fixed arm: midline of the humerus

2. Extension

Normal ROM: 135^0-0
Rest is same as flexion

FOREARM

1. Supination

Recommended testing position: sitting with upper arm at the side of the body, Elbow flexed to 90 and forearm supported
Normal ROM: 0-80^0
Fulcrum: lateral to the ulnar styloid process
Movable arm: ventral aspect of the forearm, proximal to styloid process
Fixed arm: anterior midline of humerus

2. Pronation

Recommended testing position: same as supination
Normal ROM: 0-80^0
Fulcrum: lateral to the ulnar styloid process
Movable arm: dorsal aspect of the forearm, proximal to styloid process of radius
Fixed arm: anterior midline of humerus

WRIST

1. Flexion

Recommended testing position: sitting next to a supporting surface and hand facing the ground.
Normal ROM: 0-80^0
Fulcrum: lateral aspect of the wrist over the triquetrum
Movable arm: lateral midline of the fifth metacarpal
Fixed arm: lateral midline of the ulna

2. Extension

Recommended testing position: same as flexion
Normal ROM: 0-70^0
Fulcrum: at the level of capitate
Movable arm: volar midline of the third metacarpal
Fixed arm: volar midline of the forearm

3. Radial deviation

Recommended testing position: same as flexion
Normal ROM: 0-20^0
Fulcrum: at the level of capitate
Movable arm: dorsal midline of the third metacarpal

Fixed arm: dorsal midline of the humerus

- **Ulnar deviation:** Normal
  ROM: 0-30^0
  Rest is same as radial deviation

<u>LOWER LIMB</u>

HIP JOINT

1. Flexion

Recommended testing position: supine lying
Normal ROM: 0-120^0
Fulcrum: lateral aspect of the hip joint
Movable arm: lateral midline of the femur
Fixed arm: lateral midline of the pelvis

2. Extension

Recommended testing position: prone lying
Normal ROM: 0-30^0
Rest is same as flexion.

3. Abduction

Recommended testing position: supine lying
Normal ROM: 0-45^0
Fulcrum: anterior superior iliac spine (ASIS) of the extremity being measured
Movable arm: anterior midline of the femur
Fixed arm: horizontal line extending from one ASIS to other ASIS

4. Adduction

Normal ROM: 0-30^0
Rest is same as abduction

5. Medial rotation and Lateral rotation

Recommended testing position: sitting on a supporting surface
Normal ROM: 0-45^0
Fulcrum: anterior of the patella
Movable arm: anterior midline of lower leg
Fixed arm: parallel to leg

KNEE JOINT

1. Flexion

Recommended testing position: prone lying
Normal ROM: 0-145^0
Fulcrum: Lateral epicondyle of the femur
Movable arm: lateral midline of the femur
Fixed arm: lateral midline of the fibula

2. Extension

Normal ROM:145^0-0
Rest is same as flexion.

ANKLE JOINT

1. Dorsi flexion

Recommended testing position: sitting or supine
Normal ROM: 0-20^0
Fulcrum: lateral aspect of lateral malleolus
Movable arm: lateral aspect of fifth metatarsal
Fixed arm: lateral midline of the fibula

2. Plantar flexion

Normal ROM: 0-50^0
Rest is same as dorsi flexion

3. Inversion

Recommended testing position: sitting with knee flexed to 90^0 and the lower leg Over the edge of supporting surface.
Normal ROM: 0-35^0
Fulcrum: anterior aspect of the ankle midway between the malleoli
Movable arm: anterior midline of the second metatarsal
Fixed arm: anterior midline of the lower leg

4. Eversion

Normal ROM: 0-15^0
Rest is same as inversion.

ESSAY ANSWER QUESTIONS

1. Explain various Neuromuscular efficiency tests?
2. Explain in detail about Goniometry?
3. What are the common physical impairments managed with Therapeutic exercises along with various techniques of exercise therapy?

UNIT- 4

STARTING POSITIONS

Contents:

Introduction

The postures from which movement is initiated are known as Starting Positions and they may be either active or passive in character. There are five basic or fundamental starting position and all the others are derived from them, i.e. standing, kneeling, sitting, lying and hanging.

Equilibrium and stability is maintained in these positions by a balance of forces acting upon the body, and when the force of muscular contraction is used for this purpose the contraction is isometric. The strength and distribution of this contraction is normally controlled by a series of reflexes known collectively as the Postural Reflexes but, during the learning process of new patterns of posture, voluntary effort may be required.

4.1 Fundamental Positions

1. Standing

This is the most difficult of the fundamental positions to maintain, as the whole body must be balanced and stabilized in correct alignment on a small base by the coordinated work of many muscle groups. The position may be described as follows:

- The heels are together and on the same line, the toes slightly apart (so that the angle between the feet does not exceed 45°).
- The knees are together and straight.
- The hips are extended and laterally rotated slightly.
- The pelvis is balanced on the femoral heads.
- The spine is stretched to its maximum length.
- The vertex is thrust upwards, the ears are level and the eyes look straight forwards.
- The shoulders are down and back.
- The arms hang loosely to the sides, palms facing inwards towards the body.

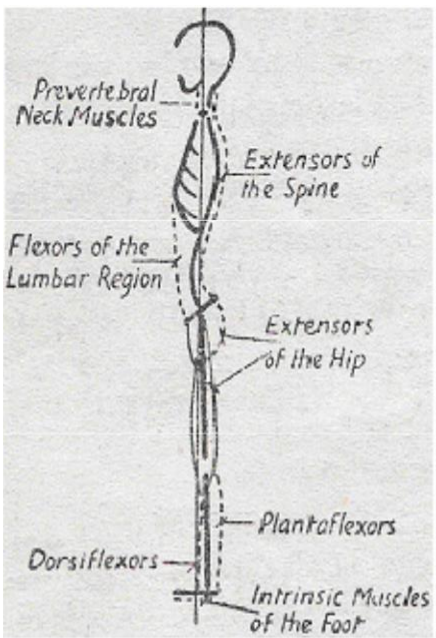
It is usually preferable to modify the position of the legs to that in which the heels are slightly apart and the inner borders of the feet are parallel, as this is the natural functional position of the foot when it is used as a lever to propel the body forwards.

Muscle Work

The muscle groups involved are

- The Intrinsic Muscles of the Feet working to stabilize the feet and to prevent curling of the toes so that the Flexors of the Interphalangeal Joints can press the balls of the toes to the ground.
- The Plantar flexors of the Ankle, working to balance the lower leg on the foot.
- The Dorsiflexors of the Ankle, working to counterbalance the action of the Plantaflexors and to support the medial longitudinal arch of the foot.
- The Evertors, working to counterbalance the action of the Invertors (Tibialis Anterior and Posterior), and in the case of Peroneus Longus, to press the ball of the great toe to the ground.
- The interaction of b, c and d may be likened to that of their guy ropes which support a flag pole, the tension in all three is reciprocal, an increase in the tension of one resulting in a slackening of the others. If the pole is perfectly balanced tension in all three is minimal.
- The Extensors of the Knee may work slightly.
- The Extensors of the Hip, working to maintain hip extension and to balance the pelvis on the femoral heads. Slight action of the Lateral Rotators of the Hip is associated with a bracing of the legs and of the arches of the foot.
- The Extensors of the Spine, working to keep the trunk upright. Where their action over the lumbar and cervical regions would result in increased curvature and consequent shortening of the spine, they are counter balanced by the Flexors of these regions to ensure maximum lengthening.
- The Flexors of the Lumbar Spine (Abdominal Muscles), working to prevent over-action of the Extensors of this region. They also assist in the maintenance of the correct angle of pelvic tilt, and support the abdominal viscera.
- The Pre-vertebral Neck Muscles, working to control excessive extension of the neck and to straighten the cervical spine.
- The Flexors and Extensors of the Atlanto-occipital Joint, working reciprocally to balance the head. The Elevators of the Mandible close the mouth.
- The Retractors of the Scapulae, working to draw the scapulae backwards so that the glenoid cavity faces more or less laterally. Contraction of the lateral muscles to maintain equilibrium.

- The arms are relaxed sometimes however it is necessary to use the lateral rotators of the shoulder to keep them in correct position



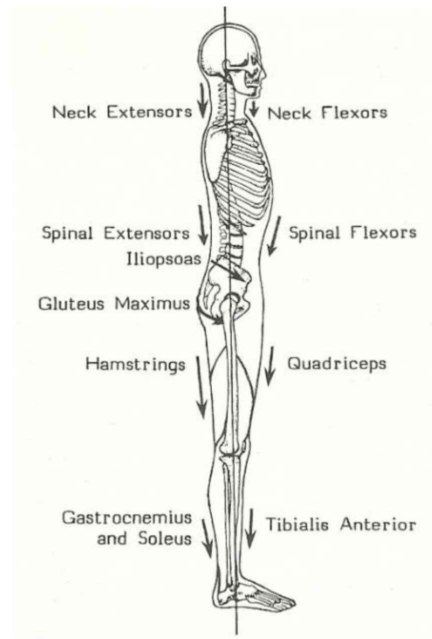


FIG - STANDING

Effects and Uses: As the base is relatively small and the centre of gravity high, the state of equilibrium of the body is relatively less stable than in the other fundamental positions; therefore the standing position is only suitable as a starting position for exercise for those who can maintain it correctly.

The muscle work is minimal when perfect balance is achieved, therefore practice in attaining and holding a satisfactory pattern of standing posture reduces fatigued and also conditions the postural reflex.

2. Kneeling:

The body is supported on the knees which may be together or slightly apart. The lower leg rests on the floor with the feet plantar flexed or, if a plinth is used, the feet may be in the mid-position over the edge. The rest of the body is held as in standing.

FIG - KNEELING

Muscle Work: The lower leg is relaxed; the body must be stabilized on the knees.

- There is interplay between the Flexors and Extensors of the Knee, to balance, the femur vertically on the knees. The muscle work of the rest of the body is as in standing position.

- The Extensors of the Hip and the Flexors of the Lumbar Spine work strongly to maintain the correct angle of pelvic tilt. A decrease in this angle and consequent increase in extension of the lumbar spine tends to occur in this position, because of the tension of the Rectus Femoris, which is stretched across the front of both of hip and knee joints.

Effects and Uses: Although the centre of gravity of the body is relatively lower than in standing, the position is only slightly more stable and is uncomfortable for most people.

It is used as a starting position for backward movement in a sagittal plane and to train control of the hip joints and lower trunk in preparation for the standing position during which the feet are pressed to the floor by the Extensors of the Knees and Dorsiflexors, so that the lower leg acts as a bracket.

3. Sitting:

The position is taken on a chair or stool, the height and width of which allow the thighs to the fully supported and the hips and knees to be flexed to a right angle. The knees are apart sufficiently to allow the femora to be parallel and the feet rest on the floor with the heels vertically below the knees.

Muscle Work: There need be no muscle work to hold the position of the legs, as they are fully supported. The Flexors of the Hips work to maintain a right angle at these joints and to prevent the tendency to slump.

The muscle work of the rest of the body is the same as in standing.

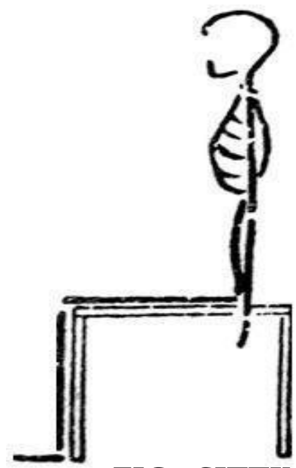


FIG - SITTING

Effects and Uses: This is a comfortable, natural and very stable position which is much used, and it particularly suitable for those who lack the necessary strength and control to maintain a more difficult position. Lateral and rotatory mobility of the pelvis is eliminated by the weight of the body and the position of the legs, so that lateral and rotatory movements can be localized to the spine. As none of the body weight is transmitted to the legs, many non-weight-bearing knee and foot exercises can be performed in the position, which is also suitable for training correct alignment of the upper part of the body in the habitual sitting position, which is used by the majority more than any other in everyday life.

4. Lying:

This is the easiest of the fundamental positions as the body can be completely supported in the supine position and is as stable as is possible.

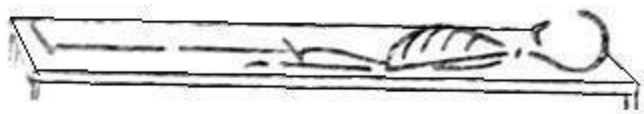


FIG -LYING

Muscle Work: This is minimal. If the body is relaxed on a hard surface, such as the floor or the average plinth, the head rolls to one side, the lumbar spine is hollowed because of the tension of structures lying anterior to the hip joints and the latter fall into a position of lateral rotation. On a soft resilient surface, however, such as a spring mattress, which gives way to the contours of the body and supports it completely, this does not occur.

When the lying position is used as a starting position for exercise it is usually taken on a firm surface and the following muscle groups work slightly

a. The Head Rotators of both sides work reciprocally to stabilise the position of the head.

b. The Extensors of the Hips and Flexors of the Lumbar Spine work to combat the tendency to hollow the back.

c. The Medial Rotators of the Hips work to keep the legs in the neutral position, so that the knees and inner borders of the fact are held together.

Effects and Uses: This is an easy position and as the trunk is relaxed and fixed by its own weight, it is a suitable position for many exercises. As the alignment of the body is the same as in standing, static posture training can be carried out in this position. The Spine is relieved of the burden of transmitting the weight of the head and shoulders when it is in the horizontal position, therefore it tends to elongate and straighten, and this is an advantage in the treatment of spinal deformities. Breathing is impeded slightly by pressure on the posterior aspect of the thorax and by increased pressure of the abdominal viscera on the under surface of the Diaphragm, often making the position unsuitable for those suffering from respiratory or heart conditions. The position hinders the return of blood from the head and so maybe unsuitable for the elderly, or those who suffer from high blood pressure.

5. Hanging:

The body is suspended by grasping over a horizontal bar, the fore-arms being pronated, the arms straight and at least shoulder width apart. The head is held high and the scapulae are drawn down and together,

so that the neck appears as long as possible. The trunk and legs hang straight, with the heels together and the ankles plantar flexed.

Muscle Work

- The Flexors of the Fingers work strongly to grasp the bar.
- All the muscles round the wrist work strongly to reduce the strain on the joints and to act as synergists and fixators for the Flexors of the Fingers.
- The Flexors of the Elbows work to reduce the strain on the joints.
- The Adductors of the Shoulders work strongly to lift the body on the arms (especially Latissimus Dorsi posteriorly and Pectoralis Major anteriorly).

e) The Depressors, Retractors and Medial Rotators of the Scapulae work strongly to fix the scapulae work strongly to fix the scapulae and to brace the upper back.

- The Pre-vertebral and Posterior Neck Muscles work reciprocally to maintain the position of the head and neck.
- The Flexors of the Lumbar Spine and the Extensors of the Hips work to correct the tendency to arch the back as the result of the over-action of Latissimus Dorsi, working on the sacrum.
- The Adductors of the Hips work to keep the legs together.
- The Extensors of the Knees may work to maintain full extension.
- The Plantaflexors work to point the toes to the floor.

FIG - HANGING

Effects and Uses. As the muscle work for the arms and upper back is extensive and strong the position is only suitable for those in whom muscular strength and body weight are well balanced. As the weight of the shoulders is taken off the spine and the weights of the legs exert traction upon it, it is straightened and elongated.

The thorax is fixed in the inspiratory position and breathing in difficult, therefore the position is unsuitable for weak patients and those suffering from cardiac or respiratory conditions. The effect of attaching the body is stimulating and much enjoyed, especially by children.

SHORT ANSWER QUESTIONS

1. What is meant by starting position and mention its derivatives?
2. Write about Standing position?
3. Write about Sitting position?
4. Write about Kneeling position?
5. Write about Lying position?
6. Write about Hanging position?

UNIT - 5

PASSIVE MOVEMENTS

Contents:

Introduction

Definition: These movements are produced by an external force during muscular inactivity or when muscular activity is voluntarily reduced as much as possible to permit movement.

CLASSIFICATION

A. Relaxed Passive Movements, including accessory movements.

B. Passive Manual Mobilisation Techniques

- Mobilisations of joints
- Manipulations of joints
- Controlled sustained stretching of tightened structures.

Specific Definitions

A. Relaxed Passive Movements, including accessory movements

(i) Relaxed Passive Movements

These are movements performed accurately and smoothly by the Physiotherapist. Knowledge of the anatomy of joints is required. The movements are performed in the same range and direction as active movements. The joint is moved through the existing free range and within the limits of pain.

(ii) Accessory movements

These occur as part of any normal joint movement but may be limited or absent in abnormal joint conditions. They consist of gliding or rotational movement which cannot be performed in isolation as a voluntary movement but can be isolated by the physiotherapist.

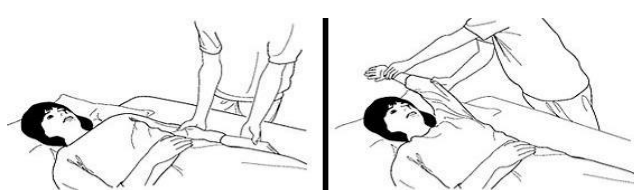


FIG – PASSIVE MOVEMENT

B. Passive Manual Mobilisation Techniques

(i) Mobilisations of joints

These are usually small repetitive rhythmical oscillatory, localized accessory, or functional movements performed by the physiotherapist in various amplitudes within the available range, and under the patient's control. These can be done very gently or quite strongly, and are graded according to the part of the available range in which they are performed.

- **Manipulations of joints performed by a. Physiotherapists**

These are accurately localized, single, quick decisive movements of small amplitude and high velocity completed before the patient can stop it.

b. Surgeon/Physician

The movements are performed under anaesthesia by a surgeon, or physician to gain further range. The increase in movement must be maintained by the physiotherapist.

(iii) Controlled sustained stretching of tightened structures

Passive stretching of muscles and other soft tissues can be given to increase range of movement. Movement can be gained by stretching adhesions in these structures or by lengthening of muscle due to inhibition of the tendon protective reflex.

Principles

Relaxation: A brief explanation of what is to happen is given to the patient, who is then taught to relax voluntarily, except in cases of flaccid paralysis when this is unnecessary. The selection of a suitable starting position ensures comfort and support, and the bearing of the physiotherapist will do much to inspire confidence and co-operation a\in maintaining relaxation through the movement.

Fixation. Where movement is to be limited to a specific joint, the bone which lies proximal to it is fixed by the physiotherapist as close to the joint line as possible to ensure that the movement is localised to that joint; otherwise any decrease in the normal range is readily masked by compensatory movement occurring at other joints in the vicinity.

Support: Full and comfortable support is given to the part to be moved, so that the patient has confidence and will remain relaxed. The physiotherapist grasps the part firmly but comfortably in her hand, or it may be supported by axial suspension in slings. The latter method is particularly useful for the trunk or heavy limbs, as it frees the physiotherapist's stance must be firm and comfortable. When standing, her feet are apart and placed in the line of the movement.

Traction: Many joints allow the articular surfaces to be drawn apart by traction, which is always given in the long axis of a joint, the fixation of the bone proximal to the joint providing an opposing force to a sustained pull on the distal bone. Traction is thought to facilitate the movement by reducing inter articular friction.

Range: The range of movement is as full as the condition of the joints permits without eliciting pain or spasm in the surrounding muscles. In normal joints slight over pressure can be given to ensure full range, but in flail joints care is needed to avoid taking the movement beyond the normal anatomical limit.

Speed and Duration. It is essential that relaxation be maintained throughout the movement, the speed must be uniform, fairly slow and rhythmical. The number of times the movement is performed depends on the purpose for which it is used.

A full description of the technique of giving relaxed passive movements to individual joints will be found.

Effects and uses*:*

- Adhesion formation is prevented and the present free range of movement maintained. One passive movement, well given and at frequent intervals, is sufficient for this purpose, but the usual practice is to put the joint through two movement twice daily.

- When active movement is impossible, because of muscular inefficiency, these movements may help to preserve the memory of movement patterns by stimulating the receptors of kinaesthetic sense.

- When full-range active movement is impossible the extensibility of muscle is maintained, and adaptive shortening prevented.

- The venous and lymphatic return may be assisted slightly by mechanical pressure and by stretching of the thin-walled vessels which pass across the joint moved. Relatively quick rhythmical and continued passive movements are required to produce the effect.

They are used in conjunction with elevation of the part to relieve oedema when the patient is unable, or unwilling, to perform sufficient active exercise.

- The rhythm of continued passive movements can have a soothing effect and induce further relaxation and sleep. They may be tried in training relaxation and, if successful the movement is made imperceptibly and progressively slower as the patient relaxes.

- Steady and sustained stretching may be used to overcome spasticity patterns of limbs, e.g. a hemiplegic patient. The slow stretch produces a relaxation and lengthening of the muscle

- A steady and prolonged passive stretch can overcome the resistance of shortened ligaments, fascia and fibrous sheaths of muscles as, for example, in controlled stretching and progressive splintage of talipes equinovarus.

ESSAY ANSWER QUESTIONS

1. Define passive movements along with its classification, principles, effects and uses?

UNIT-6

ACTIVE MOVEMENTS

Contents:

Definition

Movement performed or controlled by the voluntary action of muscles, working in opposition to an external force, is called active movement

Classification:

Free Exercise: The working muscles are subject only to the forces of gravity acting upon the part moved or stabilised.

Assisted Exercise: When muscle strength or co-ordination is inadequate to perform a movement an external force is applied to compensate for the deficiency.

Assisted-resisted Exercise: Muscles maybe strong enough to work against resistance in part of the range and not in others. This type of exercise ensures the external forces applied are adapted in every part of the range to the abilities of the muscles.

Resisted Exercise : The forces of resistance offered to the action of the working muscles are artificially and systematically increased to develop the power and endurance of the muscles.

FREE EXERCISE

Free exercises are those which are performed by the patient's own muscular efforts without the assistance or resistance of any external force, other that of gravity.

Advantage: helps in maintaining range of motion by the patient itself without relying on others for this purpose.

Disadvantage: they frequently make insufficient demands on neuromuscular system to elicit the maximal response required for redevelopment of weak muscles.

Classification

- Localized: These exercises are designed primarily to produce some local and specific effect, for example to mobilize a particular joint or to strengthen particular muscle groups.
- General: These exercises usually involve the use of many joints and muscles all over the body and the effect is wide spread.

The technique of free exercises

- The starting position is selected and taught to the patient with care.
- Instruction is given in a manner which will gain the interest and co-operation of the patient.
- The speed at which exercise is given depends on the effect required.
- The duration of the exercise depends very largely on the patient's capacity.

The effect and uses of free exercises

- Relaxation: rhythmical swinging movements assist in relaxation of hypertonic muscles.
- Joint mobility: normal ROM is maintained by exercises performed in full range.
- Muscle power and tone: it is increased by tension created by the muscles.
- Neuromuscular coordination: it is improved by repetition of exercises.
- Improves confidence of patient.

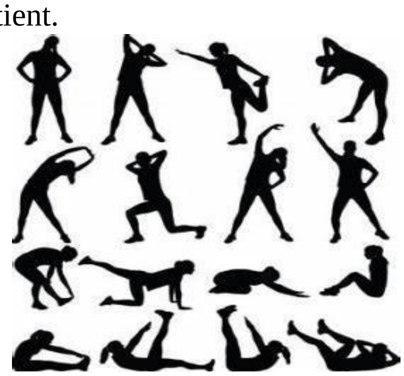


FIG – FREE EXERCISES

ASSISTED EXERCISES

When the force exerted on one of the body levers by muscular action is insufficient for the production or control of movement, an external force may be added to augment it. As the power of muscle increases, the assistance given must decrease

Techniques of assisted exercises:

- Starting position and pattern of movement: this must be well known and understood by the patient.
- Fixation: adequate fixation of the bone origin of prime movers improves their efficiency.
- Support: the part of the body moved is supported throughout to reduce the load on weakened muscles.
    - Antagonistic muscles: every effort must be made to reduce tension in the antagonistic muscles.
    - Traction: preliminary stretching of the weak muscles to elicit the stretch reflex.

- Assisting force: the force used to augment the action of the muscles is applied in the direction of the movement.
    - The character of the movement: the movement should be smooth.
    - Repetitions: the number of times the movement is repeated depends on the condition of the patient.
    - The cooperation of the patient is essential during this exercise.

FIG - ASSISTED EXERCISE

Effects and uses of assisted exercise

- There will be production of movement which they are incapable of achieving.
- The memory of the pattern of co-coordinated movement is stimulated by the correct performance.
- Patient's confidence is increased.

ASSISTED - RESISTED EXERCISE

This type of exercise constitutes a combination of assistance and resistance during a single movement and whenever it is possible it is preferable to Assisted Exercise as it meets the needs of the muscles with greater accuracy.

RESISTED EXERCISE

The external force may be applied to the body levers to oppose the force of muscular contraction and there will be increase in muscle power and hypertrophy.

Techniques of resisted exercises:

- Starting position and pattern of movement: this must be well known and understood by the patient.
- Fixation: adequate fixation of the bone origin of prime movers improves their efficiency.
- Support: the part of the body moved is supported throughout to reduce the load on weakened muscles.
- Traction: preliminary stretching of the weak muscles to elicit the stretch reflex.
- Resisting force: a variety of means may be employed to supply the force used to resist the contraction of the working muscles, e.g. manual pressure, weights etc.
- The character of the movement: the movement should be smooth and controlled.
- Repetitions: the number of times the muscles are thrown into action against a resistance varies according to the condition of the patient.
- The cooperation of the patient is essential during this exercise.

Resistances: a resisting force other than that provided by gravity and friction may be provided by

- Physiotherapist 2. The patient 3.weights 4. Pulleys 5. Springs 6. Water 7. Substances which are malleable

Effects and uses of resisted exercises

- Muscle power can only be maintained or increased by contraction.
- The blood flow to the working muscles is increased.
- There will be a general rise in blood pressure.
- Heat, which is produced as the result of strenuous muscular activity.

PROGRESSIVE RESISTANCE EXERCISE

The use of Progressive Resistance Exercise for the restoration of muscle power and volume after injury was first described by DeLorme in 1945 although this method of promoting muscle builders for a very long time.

Metal weights, which constitute the resisting force, are applied to the part of the body. The poundage is determined by testing the repetition maximum (R.M.) for a given number of repetition. Lifting of the weight may involve either static (isometric) or dynamic (isotonic) muscle work. It appears that the regime most suitable and successful in the treatment of an individual patient varies very much with his age, temperament and the condition from which he is suffering.

The following schema is all based on the test for a 10 R.M. and represents a power programmed. Imperial measures can be replaced by metric units.

__**Progressive Resisted Exercise:**__

Repetition Maximum:

The maximum amounts of the weight a person can life throughout the range of motion exactly 10 times.

3 types of progressive resisted exercise regimens are available.

- DeLorme and Watkins
- Zinovieff (Oxford technique)
- Mac queen

ESSAY ANSWER QUESTIONS

1. Classify Active movements and explain in detail?
2. Explain in detail about Progressive Resisted Exercises?

UNIT-7

RELAXATION

Contents:

Introduction

Relaxation is a state of reduced tension in the muscles or a state of recreation or diversion and a state of reduced pain.

Relaxation techniques are referring to variety of methods and manipulations used to reduce stress, muscle tension and anxiety in the body. It helps a person to relax: to attain a state of increased calmness or otherwise reduce levels of pain, stress or anger. Muscles which are relatively free from tension and at rest are said to be relaxed.

Muscle Tone

Muscle tone is the continuous and the passive partial contraction of the muscles or the muscle's resistance to passoive stretch during resting state.

Living muscles are never completely free from tension, as they retain a quality of firmness known as muscle tone.

Postural Tone

The contraction which persists in the muscles connected with the maintenance of posture (chiefly the anti-gravity muscles) is called Postural Tone.

Basic conditions for relaxation:

Support, comfort and restful atmosphere are basic conditions for general relaxation and may prove effective without additional methods.

- **Support**

Various forms and modifications of the lying position are used, to achieve full support of the body, the relative suitability of each one varying according to the condition of the patient and to individual preference. The weight of the body is thus effectively counterbalanced by the uniform upward pressure of a reciprocal surface, or by suspension, in a position of semi-flexion which remove all mechanical tension on muscles of ligaments.

- **Lying Supine***:* A firm surface is essential, and if resilient also, as in the case of a good spring mattress, it is ideal, as it will mould itself to the body contours and give even pressure and comfort. At all costs plinths or beds which sag are to be avoided as they cramp the thorax and so throw additional strain on the inspiratory muscles. A head pillow is required which is sufficiently soft to prevent the head from rolling to either side, and to be well moulded to support the neck posteriorly. A small pillow under the knees relieves tension on the Hamstrings and the ilio-femoral ligament, and consequently allows the pelvis to roll backwards so that the lumbar spine is straightened and supported. The feet are held in the mid-position by a sandbag or similar device, and each arm, slightly abducted at the shoulder and flexed at the elbow, rests on a pillow

FIG - LYING SUPINE

- **Half Lying*:*** This is similar to the previous position but breathing is easier as there is less weight on the back and abdominal pressure on the under surface of the Diaphragm is reduced. An armchair makes quite a good substitute for a plinth or bed, the thighs are fully supported and the feet rest on the floor, or a footstool, of a T-shaped footrest.

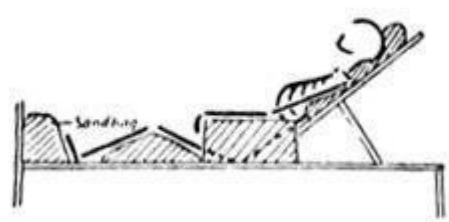


FIG – HALF LYING

- **Prone Lying:** The head is turned to one side and may rest on a small pillow, if more comfortable. A firm pillow under the hips and the lower abdomen prevents hollowing of the back, and for women it should extend higher to avoid too much pressure on the breasts; the lower leg is elevated so that the knees are slightly bent and toes free. A degree of medial rotation at the hips, causing the heels to fall apart, still further induces relaxation of the legs. Many find this position comfortable and use it for sleeping; others dislike it because of the rotated position of the head.

FIG – PRONE LYING

- **Side Lying:** The measure of relaxation obtained is governed by the efficiency with which the shoulder and pelvic girdles are stabilized. The arm and leg which are uppermost maybe rested on the supporting surface instead of pillows, but some of the weight then falls on the trunk and this impedes respiration. The head pillow supports the neck and head in alignment with the body, and must not be too high. The majority of people sleep on the side, but few are conscious of the part suitable positioning for relaxation plays in promoting it.

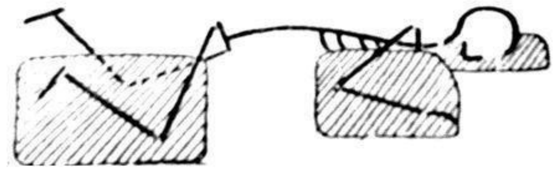


FIG – SIDE LYING

- **Comfort**

In addition to support and individual preference in positioning, for which some suggestions have already been made, the ingredients of comfort include freedom to breathe deeply, warmth, abdominal quiescence and a mild degree of physical fatigue. Removal of constrictive clothing, such as corsets and belts, is essential and any garters, buttons or suspenders liable to cause pressure must be removed. The room should be warm, but should have a free supply of fresh air; in winter additional warmth can be supplied by light but warm blankets, a covered hot-water bottle at the feet, an electric blanket or by non-luminous infra-red irradiation, but care being taken to avoid overheating, as this leads to restlessness. For home use a warm bath gives the most even and pleasing type of heat, but its soothing effect must not be ruined subsequently by vigorous rubbing with a towel. A light well-balanced meal, rhythmical physical activity of short duration, such a brisk walk in the open air, and attention to emptying the bladder before treatment are all conductive to general relaxation.

***c.* Restful Atmosphere**

As physical and mental relaxations are interdependent, an effort must be made to secure a state of mental rest. The treatment-room should be as quiet as possible, as many people for whom training in relaxation is prescribed are highly susceptible to the disturbing influence of noise.

GENERAL RELAXATION TECHNIQUES

Contrast method of relaxation: the technique consists of a sequence of contractions of muscles performed usually in a distal to proximal sequence in each limb or pair of limbs in term followed by letting go or relaxation for an equal or longer period of time. The sequence of commands is as follows:

- For the arms:
- For the legs:

  Point your foot down or pull your foot up let go.
  Tighten your knee and let go
  Tighten your hips and let go

- For the arms :
  Tighten your fist, wrist, elbow and shoulder and let go, shoulder elbow wrist and hand.
- For the leg: tighten or point your feet, knees and hips and let go your hips, knee, and feet.
- For the trunk head press your head against and let go
  Press your shoulder against your support and let go.

Reciprocal method: the physiology of this method is that the antagonistic groups of muscles always relax reciprocally and equally to the contraction of the agonist groups of muscles. The patient is allowed initially to remain in a comfortable position usually lying. Tension will be relieved by the contraction of the antagonistic muscles.

The sequence used is more usually proximal to distal, and the commands are given as follows.

- For the shoulders: push your shoulder towards your feet.
- For the arms: lift your arms outwards and slightly straighten your elbows.
- For the hands: make the whole palms of the hands and your fingers are fully supported.
- For the hips: separate the thighs.
- For the knees; straighten your legs slightly.
- For the feet: point your feet away from you.
- For the head; press your head into the support or backwards.
- For the upper trunk: press your head into the support or backwards.
- For the jaw: without necessarily opening your lips push the lower jaw away from the upper jaw or towards your feet.

Consciousness of Breathing. Under conditions of quiet and comfort the patient's mind may remain active and turn to mundane problems and anxieties, with associated physical tension; in this case it may help him to concentrate on his own rhythm of breathing, which must be deep with a slight pause at the end of expiration. Expiration is a phase of relaxation and should be accompanied by a feeling of 'letting go' in the whole body.

Progressive Relaxation. A method by which relaxation may be achieved progressively was devised and practiced by Jacobson of Chicago, and something similar appears in modern literature on the Yoga System as the 'Savasana' or 'Still Pose.'

FIG - SAVASANA

Local relaxation techniques

General relaxation takes time and is not always essential or desirable. Methods of obtaining local relaxation depend to some extent on the cause and distribution of the tension.

Massage and **passive movement** both presuppose relaxation of the area under treatment.

For the Relief of Spam

Spasm due to pain is protective and is most effectively reduced by the relief of a pain which caused it. However, if it persists because of fear of pain, techniques which ensure pain-free movement are often successful. **Hold-relax** is applicable in these circumstances, or **pendular movements** which start in the free range and gradually increase in amplitude may restore confidence and achieve relaxation.

SHORT ANSWER QUESTIONS

1. Define Muscle tone?
2. Define postural tone?
3. What is meant by relaxation?
4. Mention the names of general relaxation techniques?

UNIT-8

MOBILISATION

Contents:

Introduction

Joint mobilization is the careful use of skilled graded forces to move a joint in a desired direction. Unlike stretching of a muscle joint mobilization is specific to the capsule of the joint itself. Gliding of the joint is usually used to improve motion and normalize joint function. Joint mobilization also has the added benefit of controlling pain.

Joint mobility is defined as: the degree to which an articulation (where two bones meet) is allowed to move before being restricted by surrounding tissues (ligaments, tendons, muscles etc.). It is a type of training which actively moves the joints and brings endogenous energy (outside energy) to the joints, which brings with it lubrication and therefore helps the joints heal and regenerate. Not only this but it restores posture and improves your movements as control over the nervous system is re-in forced.

Skeletal movement occurs at the joints, the type and range of movement possible depending on the precise anatomical structure of the joint and the position of the muscles controlling it.

The slightly movable or cartilaginous joints all lie in the median plane and permit a limited degree of movement by compression of a fibro-cartilaginous disc interposed between the bony surfaces, e.g. the pubic symphysis and joint of the vertebral bodies.

The free movable or synovial joints predominate in the body and, with one exception, include all the joints of the limbs.

Classification of joins

Joints may be classified according to the movement they permit.

Uni-axial. Movement takes place about one axis: in a hinge joint it is flexion and extension (e.g. inter-phalangeal joints), in a pivot joint it is rotatory (e.g. atlanto-axial joint).

Bi-axial. Movement takes place about two axes: an ellipsoid joint allows the four angular movements, flexion, extension, abduction and abduction and adduction, and a combination of these four called circumduction (e.g. wrist), and a saddle joint such as the carpo-metacarpal joint of the thumb is similar.

Poly-axial. Movement about many axes occur in ball and socket joints. They are four angular movements, circumduction and rotation (e.g. hip).

Limitation of the range of joint movement

Injury or disease may affect each or all the structural components of a joint and lead to a reduction in the normal range of movement. The factors which commonly cause limitation are:

- Tightness of skin, superficial fascia or scar tissue. This limits both the active and passive range.
- Muscular weakness or inefficiency: Weakness or flaccidity of muscles limits active range if the power of the muscles is insufficient to overcome the resistance offered by the weight of the part moved. Tightness or spasticity of muscles limits or prevents both active or passive movement, as the muscles antagonistic to the movement are unable to relax and allow it to take place
- Displacement or tearing of an intra capsular fibro cartilage or the presence of a foreign body in the joint. Limitation of both passive and active movement may be present in this case, when either is accompanied by intense pain as the result of which the joint becomes locked by muscular spasm.
- Cartilaginous or bony destruction. The pain which arises may limit both active and passive movement and the articular surfaces will not slide easily upon one another. Bony of fibrous ankylosis limits movement altogether. Bony obstruction, such as in myositis ossificans, limits range in the direction of the obstruction.
- Sometimes no organic cause can be found when the patient is unable to move a joint.

The prevention of joint stiffness

Whenever possible it is the physiotherapist's duty to prevent a joint from suffering, and thereby save the patient pain and the possibility of a permanent disability. The period of rehabilitation can be considerably reduced in many cases and a return to work made possible. The motto that 'Prevention is better than cure' was never more apt than when applied to stiff joints.

Methods of prevention vary to some extent with the cause of the potential stiffness. Tightness of skin, fascia and scars must be combated by hot pack, soaking or massage. Muscular efficiency must be maintained by resisted exercise in prevent atrophy from disuse. Suitable strong muscles working against maximal resistance can be utilized to secure overflow of effort and ensure contraction of muscles working across immobilized joints, e.g. after knee injury or surgery Quadriceps and Hamstrings can be activated by strong contraction of hip and foot muscles of either leg. In addition the patient must be taught to initiate and practice voluntarily static contractions of these muscles at frequent intervals. "Five minutes in every hour" is the slogan. Coarse muscles such as Quadriceps, Deltoid, Gastrocnemius and glutei waste very rapidly without sufficient resistance to their contraction. In case of flaccid paralysis passive movement maintains joint range and the extensibility of muscles one or two full range movements, within physiological limits, performed twice daily being sufficient for the purpose. Where muscular imbalance is present splintage may be required. Joint range can be maintained in spastic paralysis by initiating reflex movement. Any forcing of passive movement or strong resistance is contra-indicated following recent injury to the elbow region because of the danger of myositis ossificans.

The formation of adhesions in the collagenous tissues of tendons, ligaments and fascia must be prevented by attempting to control the level of serofibrinous exudates. This may be achieved by reducing circulation in the area, by removing the cause of the increased exudation, or by increasing the removal of exudate. From bandages, rest, chemotherapy, cold packs or cooling lotions are effective means of treatment. The position of rest is of some importance, as it is designed to ensure an equal degree of tension of all fibres of the capsule. If a portion of the capsule is slack and prone to fall into folds, adhesions form very readily and glue these folds into tucks, therefore the knee joint is rested for example in 20 degrees of flexion and the shoulder joint is partially abducted.

Except in cases of bacterial infection, persistent effort must be made to assist the removal of the exudate or swelling before adhesions become organized, even if the affected joint has to be rested for a time to prevent further exudation. Elevation of the part, elastic bandaging and rhythmical active exercise of muscles and joints in the vicinity assist the venous return and ensure the free movement of tendons passing over the affected joint. Other methods of improving the circulation, such as contrast, baths, massage and heat, may also be employed if required. Careful active movements of the affected joint are begun as soon as possible and should progress rapidly. These movements maintain the power of the working muscles, ensure the freedom of tendons, and enable the pattern of movement to be remembered. Passive movements can also be used but they are more likely to give rise to minor trauma of the affected joint with consequent further output of exudation, and their effect on the circulation is minimal.

MOBILIZATION TECHNIQUES

SHOULDER JOINT:

Gleno humeral joint:

Resting position: shoulder abducted 55^0, horizontally adducted 30^0 and rotated. So that the forearm is in horizontal plane.

Joint traction

- Indications: to control pain, general mobility
- Patient Position: supine with arm in resting position, support the forearm between your trunk and elbow.
- Hand Placement: place the therapist hand nearer the part being treated and place it in the patient's axilla with therapist thumb just distal to the joint margin anteriorly and fingers posteriorly. Therapist other hand supports the humerus from the lateral surface.

- Mobilizing Force: with the hand in the axilla move the humerus laterally.

FIG – GLENOHUMERAL JOINT TRACTION

Caudal glide :

- Indications: to increase abduction, to reposition humeral head if superiorly positioned.
- Patient position: supine with arm in resting position, support the forearm between your trunk and elbow.
- Hand placement: place one hand at the patients axilla to provide grade I distraction, the web space of therapist other hand is placed just distal to the acromion process.
- Mobilizing force: with the superiorly placed and glide the humerus in an inferior direction.

FIG – GLENO HUMERAL CAUDAL GLIDE

ELBOW JOINT

Humero ulnar articulation:

Resting position: elbow flexed 70^0, forearm supinated $10^{0.}$

Distal Glide

- Indications: To increase flexion.
- Position of the patient and hand placement: supine, elbow over the edge of the treatment table or supported with padding just proximal to the olecronon process. The wrist rests against the therapists shoulder allowing the elbow to be in the resting position.
- Mobilizing force: use a scooping motion in which distraction is applied to the joint first. Then pull along the long axis of the ulna.

FIG – HUMERO ULNAR DISTAL GLIDE

HumeroRadial articulation:
Resting position: elbow extended, forearm supinated
Joint traction:

- Indication: To increase mobility of the radius, to correct a pushed elbow.
- Patient Position: supine or sitting, with the arm resting on the treatment table.
- Hand Placement: Stabilize the patient's humerus with therapist superior hand , grasp around the distal radial with the fingers and thenar eminence of therapist's inferior hand .
- Mobilizing Force: pull the radius distally.


FIG – HUMERO RADIAL JOINT TRACTION

KNEE JOINT
Resting position: flexion 25^0
Tibio femoral articulation:
Traction:

- Indications: to control pain, general mobility
- Position of the patient: sitting, supine or prone. Beginning with the knee in resting position
- Hand placement: grasp around the distal leg, proximal to the malleoli with both hands.
- Mobilising force: pull on the long axis of the tibia to separate the joint surfaces.


FIG – TIBIO FEMORAL JOINT TRACTION

Patella femoral articulation:
Distal glide:

- Indications: to increase patellar mobility for knee flexion

- Position of the patient: supine with knee extension
- Hand placement: stand next to the patient's thigh, facing the patient's feet, place the web space of the hand that is closed to the thigh around the superior border of the patella. Use the other hand for reinforcement.
- Mobilizing force: glide the patella in a caudal direction parallel to the femur

FIG - **PATELLA FEMORAL DISTAL GLIDE**

ANKLE JOINT
Resting position: plantar flexion 10^0
Talocrural (upper ankle joint) articulation:
Traction

- Indications: to control pain, general mobility
- Position of the patient: supine with the lower extremity extended and the ankle in resting position.
- Hand placement: wrap the fingers of the both hands over the dorsum of the patient's foot just distal to the mortis. Place therapist's thumbs on the plantar surface of the foot to hold it in resting position.
- Mobilizing force: pull the foot away from the long axis of the leg in a distal direction by leaning backward

FIG – **TALOCRURAL JOINT TRACTION**

Dorsal glide(posterior):

- Indications: to increase dorsi flexion
- Position of the patient: supine with leg supported on the table and heel over the edge
- Hand placement: place the palmar aspect of the web space of the therapist hand over the talus just distal to the mortis. Wrap therapist's fingers and thumb around the foot to maintain the ankle in resting position.

- Mobilizing force: glide the talus posteriorly with respect the tibia by pushing against the talus.

FIG –TALO CRURAL DORSAL GLIDE

SHORT ANSWER QUESTIONS

1. What is joint mobilisation?
2. Define joint mobility?
3. Define joint and write the classification?
4. Mention the limitations of joint range of movement?

UNIT-9

MUSCLE STRENGTH

Contents:

Introduction

Muscle strength is defined as the ability of a muscle group to develop maximal contractile force against a resistance in a single contrartction. (or) The amount of force a muscle can produce with a single maximal effort.

Types of Muscle work

Muscle contractions during exercise can be divided into three categories, **Isotonic** (meaning same tension throughout the contraction), **Isometric** (meaning same length during contraction), also known as a static contraction and **Isokinetic** muscle contractions which are performed with a constant speed throughout the movement.

Isotonic Contractions: Isotonic contractions are those which cause the muscle to change length as it contracts and causes movement of a body part. There are two types of **Isotonic** contraction:

- <u>Concentric</u>

Concentric contractions are those which cause the muscle to shorten as it contracts. An example is bending the elbow from straight to fully flexed, causing a concentric contraction of the Biceps Brachii muscle. Concentric contractions are the most common type of muscle contraction and occur frequently in daily and sporting activities.

- <u>Eccentric</u>

Eccentric contractions are the opposite of concentric and occur when the muscle lengthens as it contracts. This occurs when lowering the dumbbell down in a bicep curl exercise. The muscle is still contracting to hold the weight all the way down but the bicep muscle is lengthening

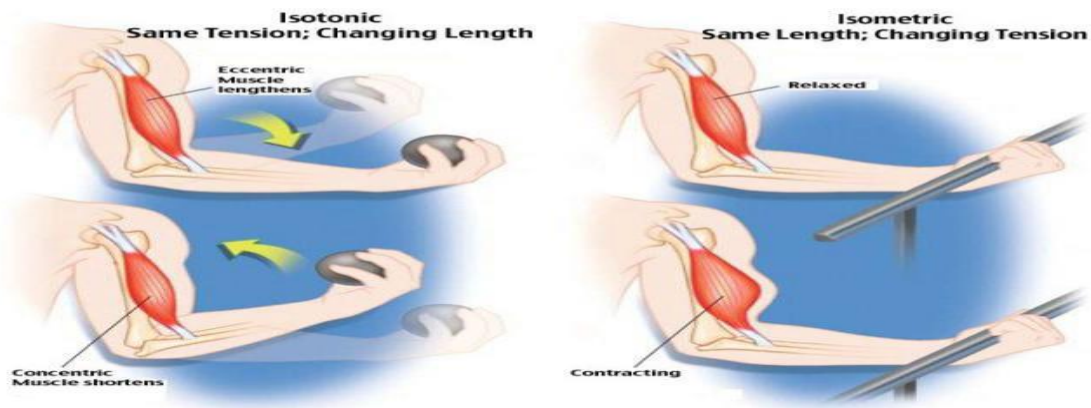


FIG – ISOTONIC (CONCENTRIC AND ECCENTRIC) AND ISOMETRIC CONTRACTION

Isometric Contractions: Isometric contractions occur when there is no change in the length of the contracting muscle. This occurs when carrying an object in front of you as the weight of the object is pulling your arms down but your muscles are contracting to hold the object at the same level. Another example is when you grip something, such as a tennis racket. There is no movement in the joints of the hand, but the muscles are contracting to provide a force sufficient enough to keep a steady hold on the racket.

The amount of force a muscle is able to produce during an isometric contraction depends on the length of the muscle at the point of contraction. Each muscle has an optimum length at which the maximum isometric force can be produced.

Isokinetic Contractions:

Isokinetic contractions are similar to Isotonic in that the muscle changes length during the contraction, where they differ is that Isokinetic contractions produce movements of a constant speed. To measure this is a special piece of equipment known as an Isokinetic dynamometer is required. Examples of using Isokinetic contractions in day-to-day and sporting activities are rare. The best is breast stroke in swimming, where the water provides a constant, even resistance to the movement of adduction.

Ranges of muscle work

The range of muscle work is the extent of the muscular contraction which results in joint movement.

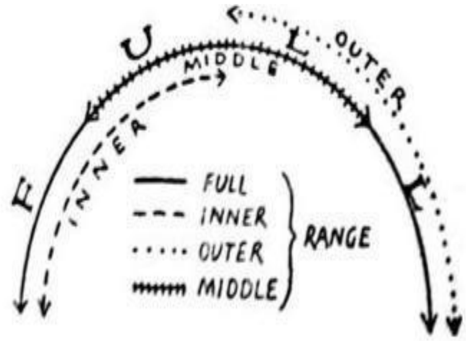
Full Range

The joint is moved as the muscles work from the position in which they are fully stretched, to the position in which they are fully contracted, concentrically, or, from the position of full contraction, to the position of maximum extension, if they are working eccentrically.

Under ordinary circumstances muscles are rarely required to work in full range, but in emergencies they may have to do so. Active full range exercise is used for patients as they maintain joint mobility, increase the circulation and ensure that the emergency reserve of power of mobility is preserved.

Inner Range

The muscles works either concentrically from a position in which it is partially contracted (approximately half-way between the limits of full range) to a position of full contraction, or vice versa if it works eccentrically.



Exercise in inner range is used to gain or maintain movement of a joint in the direction of the muscle pull, and to train some extensor muscles movement responsible for stabilizing joints.

Outer Range

The muscles work concentrically from the position in which they are fully stretched to a position in which they are partially (half) contracted, or vice versa if working eccentrically.

The outer range of muscle work is used extensively in muscle re-education as a contraction is initiated more easily from stretch in most muscles. ***Middle Range***

The muscles are never either fully stretched or fully contracted. This is the range in which muscles are most often used in everyday life and in which, generally speaking, they are most efficient. Exercises in this range maintain muscle tone and normal power, but full joint movement is never achieved.

GROUP ACTION OF MUSCLES

Each movement at a joint is brought about by a coordinated activity of different groups of muscles. These muscle groups are classified and named according to their function.

Prime movers (agonists) bring about the desired movement. When a prime mover helps opposite action by active, controlled lengthening against gravity, it is known as action of paradox. For example, putting a glass back on the table is assisted by gravity but controlled by a gradual active lengthening of biceps (paradoxical or eccentric action).

Antagonists (**opponents)** oppose the prime movers. They help the prime movers by active controlled relaxation, so that the desired movement is smooth and precise. Thus, the antagonists cooperate rather than oppose the prime movers. This is due to reciprocal innervation of the opposite groups of muscles, regulated by the spinal cord through stretch reflex.

Fixators: Fixators are the groups of muscles which stabilize the proximal joints of a limb, so that the desired movement at the distal joint may occur on a fixed base. Muscles acting on shoulder joint fix it for better movement of fingers.

Synergists: When the prime movers cross more than one joint, the undesired actions at the proximal joints are prevented by certain muscles known as synergists. For example, during making a tight fist by long digital flexors the wrist is kept fixed in extension by the synergists (extensors of wrist). Thus, the synergists are special fixators and partial antagonists to the prime movers. Two or more muscles causing one movement are synergist.

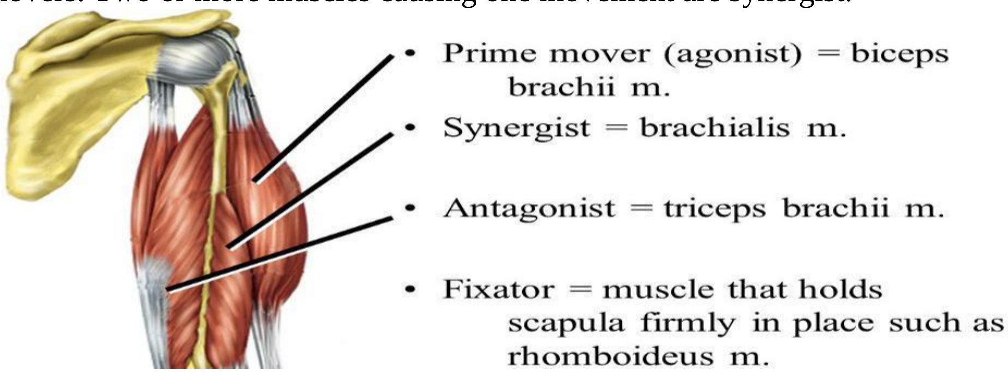


FIG – GROUP ACTION OF MUSCLES

Manual Muscle Testing (MMT) Grading

Manual muscle testing (MMT) is an important part of a physical therapy examination and grading strength is a skill that every therapist should know and enhance, or even perfected. It is done to assess muscle strength of a patient, which can provide the Therapist details that can assist him or her in planning appropriate interventions or therapy.

Below are the different MMT grades.

Grade 5 (Normal; 100%)

The patient or subject can complete the whole range of motion (movement) against gravity with maximum resistance applied by the therapist at end-of-range.

Grade 4 (Good; 75%)

The subject can complete the whole range of motion against gravity with moderate resistance applied by the physical therapist (PT) at end-range. Testing the uninvolved limb should always be considered to know whether you are applying too much force on the involved limb or not.

Grade 3+ (Fair+)

The patient can complete the motion against gravity with minimal resistance applied by the examiner at end-range.

Grade 3 (Fair; 50%)

The patient can only complete the range of motion against gravity. When external (outside) force is applied by the PT, the patient gives way.

Example: Let's say, you're going to test the muscle strength of your patient's/client's left knee extensors (quadriceps femoris). Tell the patient to sit on the edge of a bed or treatment table with his or her legs dangling. Tell him to straighten his or her left knee. If he can perform the movement fully, then the grade is at least 3

Grade 2+ (Poor +)

In grade 2+, subject can move his or her joint at a certain range but cannot complete the motion against gravity. When gravity is eliminated, such as performing the motion in side-lying, your client can perform the movement at full range of motion with ease. However, muscles being tested give way immediately when you apply some resistance.

Grade 2 (Poor; 25%)

Your patient cannot perform the movement against gravity. But patient can do complete range of motion when pull of gravity is eliminated. No resistance is applied.

Grade 2 - (Poor)

Initiation of movement can be done only as gravity is eliminated. That is, only a partial movement is observed. Here, full range cannot be completed.

Grade 1 (Trace)

Patient is not able to move the joint even with gravity eliminated. However, closer examination by the therapist would reveal slight muscle contraction through palpation.

Grade 0 (Zero; No trace)

No contraction is noticed, even with physical therapist's palpation (touch).

FIG - MMT (EXAMING KNEE FLEXORS)

MUSCULAR WEAKNESS -PARALYSIS- PREVENTION OF MUSCLE WASTING

Causes:

Muscular Weakness and Paralysis

Weakness or paralysis in any muscle or group of muscles not only results in loss of movement or stability of a particular joint, but creates a state of muscular imbalance which affects all the groups concerned in the production of co-ordinated movement. If the weakened muscles are to recover their full function, they must be protected while they are ineffective and encouraged by re-education, until they are able finally to take their place once more as effective members of the teams of muscles, which work together to perform natural and skilled movements.

As contraction is the only means by which muscle power can be maintained or increased, any lesion or habit which prevents or limits contraction will result in muscle wasting. Complete loss ability to contract is known as paralysis, partial loss as paresis, or a muscle may be merely weak.

-Lesions affecting the Anterior Horn Cells

Destruction of the Anterior Horn Cells results in permanent inactivity of the motor unit, i.e. flaccid paralysis. Damage to these cells, short of their destruction, may increase their threshold to such an extent that they remain dormant.

-Lesions affecting the Motor Pathways

Interference with the passage of impulses along motor pathways causes paralysis. Spastic paralysis results from upper motor neurone lesions and flaccid paralysis from lower motor neurone lesions.

-

Lesions affecting the Muscle Tissue

Degeneration of the muscle tissue results in loss of strength which is usually progressive, i.e. muscular dystrophy. Ischemia causes structural changes, i.e. Volkmann's ischaemic contracture, and extensive scar tissue may replace contractile tissue as the result of deep flesh injuries.

-Disuse of Normal Nerve and Muscle Tissue

Loss of strength and wasting from disuse is by no means uncommon. A patient may not use his muscles—

- Because he cannot, as contraction is inhibited by pain or protective spasm of antagonistic muscles.
- Because he does not need to, joints fixed by splintage are stable and unable to move, therefore there is no necessity for the patient to contract his muscles unless he is compelled to by strong resistance offered to other strong muscles in the same series or by his own voluntary effort. Static muscle work is essential to maintain circulation, muscle power and the movement of tendons passing over the temporarily immobilised joints, which are essential for recovery of function when splintage is removed.
- Because he will not; some patients resist all efforts to make them do sufficient muscular contraction to prevent disuse atrophy.

<u>The Prevention of Muscle wasting</u>

-In Flaccid Paralysis

Muscles deprived of their motor nerve supply are limp, hypotonic and unable to contract. Rapid wasting takes place and cannot be prevented, although it is thought that it can be arrested by improving the blood supply to the area by stimulation of the muscle fibres by electrical means. Although little can be done to prevent wasting in these cases measures are taken to keep both muscles and the joint structures in as good a condition as possible in preparation for a return to normal function.

- **The Affected Muscles must be protected from prolonged Overstretching by adequate Support and Splintage.**

Normal muscles protect themselves from overstretching by a reflex contraction, but those suffering from flaccid paralysis are unable to do so, as they are incapable of contraction; consequently, they may become stretched beyond their physiological limit and injured by the force of gravity or the unopposed action of healthy antagonistic muscles.

Example: A lesion affecting the Anterior Tibial Nerve results in a dropped foot, as gravity and the unopposed action of the Calf Muscles plantar flex the foot. To prevent injury to the Anterior Tibial Muscles a splint or toe-spring must be worn until their power of contraction is sufficient to restore muscle balance.

- **The Circulation to the Area must be maintained to ensure Adequate Nutrition to the Paralysed Muscles by Active Exercise for Other Normal Muscles in the Area, Contrast Baths etc.**

Paralysis leads to coldness and blueness of the area, indicating poor circulation. The arterial blood flow to muscles is much increased during active work to supply the oxygen and nutrition essential for repair and, at the same time, the local venous return is assisted by the intermittent pressure exerted on the vessels, by the contracting muscles, and by the movement of joints.

- **The Range of Movement in Joints Immobilised by the Paralysis and the Extensibility of the Affected Muscles must be Maintained by Passive Movements**

The fibrous tissue which constitutes the sheaths of muscles, ligaments of joints and fascia, undergo adaptive shortening if subjected to prolonged immobilization. One full-range movement at frequent intervals is sufficient to prevent this and, in practice, two full-range passive movements performed twice daily are found to be adequate.

Where muscles work over more than one joint they must be stretched over these joints at the same time. Example – wrist and finger flexors: wrist and fingers must be fully extended in one movement.

- **Remembrance of the Pattern of Movement must be stimulated and kept alive by Passive Movement while Active Movement is impossible**.

Movement is associated in the brain with numerous sensory impulses from the joints, muscles, skin and eyes. In the absence of voluntary movement, stimulation of these sensory impulses by passive movement may remind the brain of the pattern of movement, in preparation for the time when the motor pathway will once more be intact. In this way co-ordinated movement, made possible again by the return of power to the affected muscles, is remembered and does not require be re-learning or re-developing.

The passive movements used this purpose must obviously follow the natural pattern of movement with regard to the group movement of joints.

- **The Strength and Use of Normal Muscles in the Area must be maintained by Resisted Exercise**

Unless the limb is flail (all muscles paralysed) all possible activity is encouraged. Thus wasting from disuse is prevented and circulation to the part is improved.

Example: A man with Anterior Tibial paralysis is able to walk about provided he wears a toe-spring, and the advantage of his being able to work is obvious.

-In Spastic Paralysis

Muscles which receive a motor nerve supply only by means of a spinal reflex, since they are cut off from the higher centres by a lesion affecting the upper motor neurone, are tense, hypertonic and incapable of voluntary contraction or relaxation. This condition is known as spastic paralysis and wasting is not marked. When a limb or segment of the body is ‘locked’ in spasm circulation is impeded and muscle and joint contractures may develop over a period of time.

The aim of treatment is to initiate movement to maintain normal joint range and muscle extensibility and at the same time improve the circulation. While the limb remains immobile any potential for voluntary control is masked by the spasm. Reflex movement initiated by means of Neuromuscular Facilitation techniques, i.e. the stretch stimulus coupled with a command for voluntary effort, develop any voluntary control which remains and may lead to a permanent reduction in spasm. Controlled sustained passive stretching also inhibits spasm sufficiently to permit movement. Active or passive mobilization may be preceded by massage or packing with ice to reduce spasm and make movement easier.

-In Primary Lesions of the Muscle Tissue

In this case loss of power cannot be arrested, although a temporary improvement often follows light exercise in cases which have not previously received treatment. This is probably the result of making the best use of fibres which still function.

-In Disuse Atrophy

Provided there is no constitutional disease, e.g. Rheumatoid Disease, muscle atrophy from disease can be prevented or controlled by strong and frequent contraction against resistance as wasting occurs because an insufficient demand is made to elicit a strong enough contraction. Exercise must be carried out within the limits of the disability but with skill and imagination this can be organized. Any type of active work is suitable provided the right muscles are activated sufficiently to maintain or improve their normal strength and endurance. Exercises with manual resistance is advisable in the early stages to make sure that the contraction is pain-free and satisfactory and to give the physiotherapist the opportunity to assess the patient's capacity for activity and to give instruction in those activities he must practice on his own. It is important that the patient should fully understand and appreciate the need for his own effort to ensure his co-operation in carrying out a regime of *free exercise,* the slogan for which is, 'Five minutes in every hour'. If his co-operation is doubtful or his ability to exert voluntary effort is reduced he will require constant supervision or individual treatment. Whenever possible the patient should continue with his normal work, when this is impossible other *occupational activities* suited to his abilities can be substituted. Suitable games and sports of a competitive nature supply a demand for activity but need careful supervision and control to avoid development of 'trick' movement, e.g. development of a faulty pattern of walking in order to move rapidly.

The wasting of muscle in Rheumatoid Disease is not entirely due to disease. Isometric muscle work in the pain-free range helps to prevent atrophy and often leads to increased pain-free movement which can be used for functional activities.

ESSAY ANSWER QUESTIONS:

1. Define muscle strength and explain in detail about types of muscle work and Manual Muscle Testing?
2. Write in detail about causes and prevention of muscle wasting in flaccid and spastic conditions?

UNIT - 10

STRECHING

Contents:

Introduction

The ability of an individual to initiate, controls, or sustain active movements of the body to perform simple to complex motor skills. Stretching is general term used to describe any therapeutic manoeuvre designed to increase mobility of soft tissues and subsequently improve ROM by elongating (lengthening) structures that have adaptively shortened and have become hypo mobile over time.

Flexibility is the ability to move a single joint or series of joint smoothly and easily through an unrestricted, pain-free ROM. Dynamic flexibility refers to the active Rom of a joint. This aspect of flexibility is dependent upon the degree to which a joint can be moved by a muscle contraction and the amount of tissue resistance met during the active movement. Passive flexibility is the degree to which a joint can be passively moved through the available ROM and I dependent upon the extensibility of muscles and connective flexibility is a prerequisite for but does o tenure dynamic flexibility.

Hypo mobility

Hypo mobility refers to decreased mobility or restricted motion.

Contracture

Contracture is defined as the adaptive shortening of the muscle-tendon unit and other soft tissues that cross or surround a joint, which results in significant resistance to passive or active stretch and limitation of ROM.

Deformity: It is a major abnormality in the shape of a body part or organ compared to the normal shape of that part.

Types of stretching

Self stretching: any stretching exercise that is carried out independently by a patient after instruction and supervision by a therapist is referred to as self stretching.

Static stretching: it is most common term used to describe a method by which soft tissues are lengthened just past the point of tissue resistance and then held in a lengthened position for an extended period of time with a sustained stretch force.

Static progressive stretching: the shortened soft tissues are held in a comfortably lengthened position until a degree of relaxation is felt by the patient or therapist. Then the shortened structures are lengthened even further and again held in the new end range position.

FIG - DIFFERENT TYPES OF STRTCHING

Cyclic (intermittent) stretching

A relatively short-duration stretch force that is repeatedly but gradually applied, released, and then reapplied is described as a cyclic stretching.

Ballistic stretching

A rapid, forceful intermittent stretch, that is, a high speed and high intensity stretch is commonly called ballistic stretching.

Mechanical stretching

There are many ways to use equipment to stretch a contracture and increase joint ROM. The equipment can be simple as a cuff weight or weight pulley system or as sophisticated as some orthosis or automated stretching machines.

Manual stretching

A therapist applies an external force to move the involved body segment slightly beyond the point of tissue resistance and available ROM.

Overstretching is a stretch well beyond the normal ROM of a joint and the surrounding of tissues, resulting in hyper mobility. Creating elective hyper mobility by overstretching may be necessary for certain healthy individuals with normal strength and stability participating in sports that require extensive flexibility. Overstretching becomes detrimental and creates joint instability when the supporting structures of a joint and the strength of the muscles around a joint are insufficient and cannot hold a joint in a stable, functional position during activities.

Indications for stretching

- When ROM is limited due to adhesions, contractures etc.
- Structural deformities.
- When there is muscle weakness and shortening of opposing tissue.
- Muscle soreness.

Contraindications

- Recent fracture.
- Acute inflammation.
- Bony blocks joint motion.
- When a hematoma exist.
- Hyper mobility exists.

Uses

1. Greater Strength. Stretching increases strength by improving circulation and blood flow to the muscles.

- More Flexibility. Stretching is the most effective way to improve flexibility.
- Good for Circulation
- Reduced Stress.
- Increased Range of Motion.

SHORT ANSWER QUESTIONS

1. Define stretching and mention its types?
2. What is meant by contracture?
3. Define deformity?
4. What is over stretching?
5. Mention the indications and contra indications of stretching?
6. Write the uses of stretching?

UNIT- 11

NEURO- MUSCULAR COORDINATION

Contents:

Introduction

Neuromuscular co ordination also known as "motor control" or "muscle memory". It is defined as the ability of central nervous system to control the muscles in multi-limb functional movements.

Coordination: The ability to use different parts of body together smoothly and efficiently. Co-ordinated movement, which is smooth, accurate and purposeful, is brought about by the integrated action of many muscles, superimpose upon a basis of efficient postural activity. The muscles concerned are grouped together as prime movers, antagonists, synergists and fixators.

Incordination: Interference with the function of any of the factors which contribute to the production of a co-ordinated movement will result in jerky, arrhythmic or inaccurate movement, which is said to be in disturbed. The type of Inco-ordination, and the exercises designed to help in overcoming it, vary according to the location of the lesion which causes it. Four main types usually benefit from the suitable exercise therapy.

Causes for incordination:

1. Inco-ordination associated with the weakness or flaccidity of a particular muscle group.

In this case, either some lesion of the lower motor neurones prevents the appropriate impulses from reaching the muscles, or the condition of the muscle modifies their normal reaction to these impulses.

2. Inco-ordination associated with spasticity of the muscles.

Lesions affecting the motor area of the cerebral cortex, or the upper motor neurones, result in spasticity of the muscles, therefore, even when some appropriate impulses are able to reach them, the condition of the muscles is such that their response to them is abnormal.

3. Inco-ordination resulting from cerebellar lesions.

This is generally known as 'ataxia' , the prefix 'a' meaning 'without' and the greek word 'taxis' meaning 'order'. There is marked hyptonicity of the muscles, which tire is easily, and inadequate fixator action, not only of the muscles directly concerned with the group action, but of the body generally. Movement is irregular and swaying, with a marked intension tremor.

4. Inco-ordination resulting from loss of kinaesthetic sensation.

‘sensory ataxia’, or in the case of tabes dorsalis, describe this type. Without using his eyes to gain the information, the patient with this condition is completely unaware of the position of the joints. The muscles are hypotonic and tire easily, but they are unaware of this as the sensation of fatigue is not recorded.

Involuntary movements, sometimes associated with these conditions, or a state of abnormal general tension superimposed on an otherwise normal pattern of group action, may interfere with movement and reduces its efficiency.

FRENKEL’S EXERCISES

Dr. H. S. Frenkel was medical superintendent of the sanatorian ‘freihof’ in switzerland towards the end of the last century. He made a special study of tabes dorsalis and devised a method of treating the ataxia, which is a prominent symptom of the diseases, by means of systematic and graduated exercises. Since then his methods have been used to treat the Inco-ordination which results from many other diseases, e.g. disseminated sclerosis.

He aimed at establishing voluntary control of movements by the use of any part of the sensory mechanism which remained intact, notably sight, sound and touch, to compensate for the loss of kinaesthetic sensation. The process of learning this alternative method is similar to that required to learn any new exercise, the essentials being.

A. Concentration of the attention.
- Precision.
- Repetition

The ultimate aim to establish control of movement so that the patient is able and confident in his ability to carry out those activities which are essential for independence in everyday life.

Technique

- The patient is positioned and suitably clothed so that he can see the limbs throughout the exercise.
- A concise explanation and demonstration of the exercise is given before movement is attempted, to give the patient a clear mental picture of it.
- The patient must give his full attention to the performance of the exercise to make the movement smooth and accurate.
- The speed of movement is dictated by the physiotherapist by means of rhythmic counting, movement of her hand, or the use of suitable music.
- The range of movements is indicated by the marking the spot on which foot or hand is to be placed.

- The exercise must be repeated many times until it is perfect and easy. It is then discarded and a more difficult one is substituted.

- As the exercises are very tiring at first, frequent rest periods must be allowed. The patient retains little or no ability to recognize fatigue. But it is usually indicated by deterioration in the quality of the movements, or by a rise in the pulse rate.

Progression

Progression is made by altering the speed range and complexity of the exercise. Fairly quick movements require control than slow ones. Later, alteration in the speed of consecutive movements and interruptions which involve stopping and starting to command, are introduced. Wide range and primitive movement, in which large joints are used, gradually give way to those involving the use of small joints, limited range and a more frequent alteration of direction. Finally simple movements are built up into sequences to form specific actions which require the use and control of a number of joints and more than one limb, e.g. walking.

According to the degree of disability, re-education exercises start in lying with the head propped up and with the limbs fully supported and progress is made to exercise in sitting, and then in standing.

Frenkel's exercises

Exercise for the legs in lying

a. **Lying (head raised); hip abduction and adduction**.

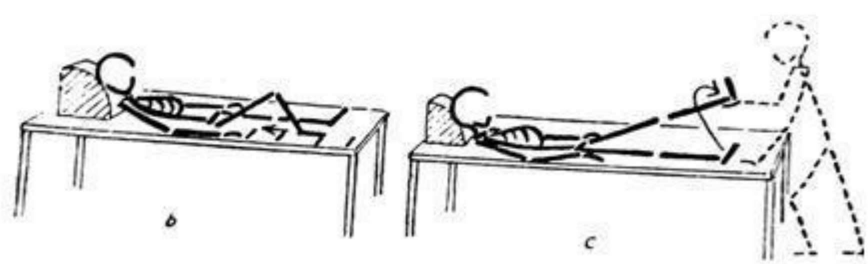
The leg is fully supported throughout on the smooth surface of a plinth or on a re-education board.

b. **Lying (head raised); one hip and knee flexion and extension**.

The heel is supported throughout and slides on the plinth to a position indicated by the physiotherapist.

c. **Lying (head raised); one leg to place heel on specified mark**.

The mark may be made on the plinth, on the patients other foot or shin, or the heel may be placed in the palm of the physiotherapist's hand.



d. **Lying (head raised); hip and knee flexion and extension, abduction and adduction**.

The legs may work alternatively or in oppositional to each other. Stopping and starting during the course of the movement may be introduced to increase the control to perform any of these exercises.

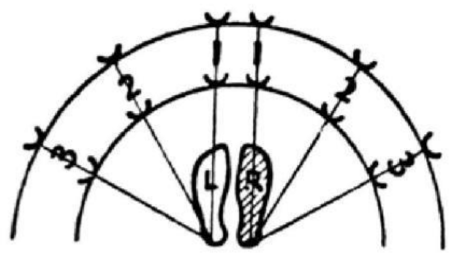
Exercise for the legs in sitting

e. **Sitting; one leg stretching, to slide heel to a position indicated by a mark on the floor.**

f. **Sitting; alternate leg stretching and lifting to place heel or toe on specified mark.**

g. **Stride sitting; change to standing and then sit down again.**

The feet are drawn back and the trunk inclined forwards from the hips to get the centre of gravity over the base. The patient then extends the legs and draws himself with the help of his hands grasping the wall-bars or other suitable apparatus.



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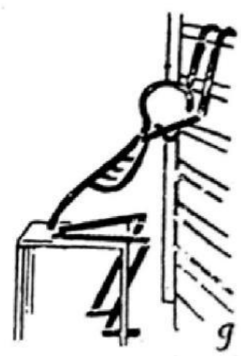


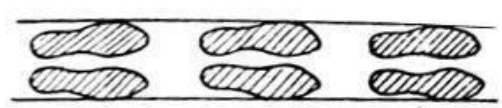
g

Exercise for the legs in standing.

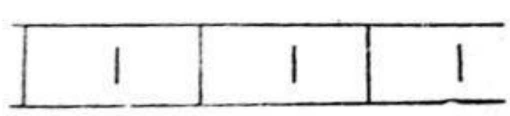
h. **Stride standing;** transference of weight from foot to foot.

i. **Stride standing;** walking sideways placing feet on marks on the floor. Some support may be necessary, but the patient must be able to see his feet.

Foot prints for walking



Lines for walking



j. **Standing;** walking placing feet on marks.

The length of the stride can be varied by the physiotherapist according to the patient's capacity.

k. **Standing;** turn round.

l. **standing;** walking and changing direction to avoid obstacles.

Group work is of great value as control improves, as it teaches the patient to concentrate on his own efforts without being distracted by those of other people. In walking, he gains confidence and becomes accustomed to moving about with others, to altering direction and stopping if he wishes, to avoid bumping into them. The ability to climb stairs and to step on and off a kerb helps to independence.

Exercise for the arms

m. **Sitting (one arm supported on a table or in lings);** shoulder flexion or extension to place hand on a specified mark.

n. **Sitting;** one arm stretching, to thread it through small hoop or ring.

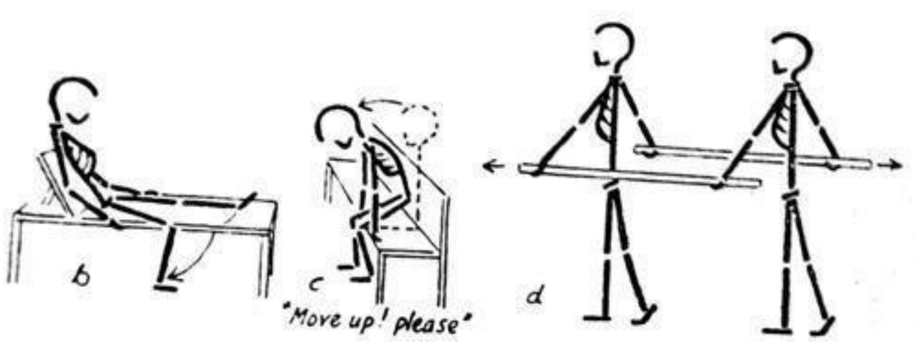
o. **Sitting;** picking up objects and putting them down on specified marks.

Diversional activities such as plaiting, building with toy bricks, or drawing on a blackboard, lead to more useful movements such as using a knife and fork, doing up buttons and doing the hair.

Exercises to promote movement and rhythm

All exercises are repeated continuously to a rhythmic count, or to suitable music.

- **Sitting;** one hip flexion and adduction (cross one thigh over the other), the movement is then reversed and repeated.
- **half lying;** one leg abduction to bring the knee to side of plinth, followed by one knee bending to put foot on floor, the movement is then reversed and repeated



- **Sitting;** lean forward and take weight on feet (as if to stand), then sit down again. Later this can be done progressing along the seat as if moving up to make room for someone else to sit.

- **Standing;** arm swing forwards and backwards (with partner, holing two sticks).

- **Standing or walking;** bounce and catch, or throw and catch a ball.

ESSAY ANSWER QUESTIONS

1. Explain in detail about Frenkle's exercises?

UNIT - 12

HYDROTHERAPY

Contents:

Introduction

Hydrotherapy is the use of water to treat a disease or to maintain health. The theory behind it is that water has many properties that give it the ability to heal. Hydrotherapy (sometimes called aquatic therapy) uses the principles of water to allow exercise and to alter exercise intensity. Increased buoyancy (opposite to gravity) allows for more exercise than is permitted on land. Increased temperature and hydrostatic pressure promote increases in circulation and flexibility and decreases in swelling. Increasing speed, turbulence and surface area can all be used to increase exercise difficulty.

A hydrotherapy pool is a swimming pool specifically designed for providing hydrotherapy treatments. The main difference is the increase in temperature. A hydrotherapy pool is heated to around 35 degrees Celsius. This allows for the patient to fully relax (and not tense up in cold water), promotes pain relief and encourages circulation. A hydrotherapy pool should be rectangular in shape and may vary in depth to allow for walking as well as deep water work. It should be easily accessible and have a hoist available to lower in those who are not able to enter the pool themselves.

FIG – HYDROTHERAPY POOL

Indications for hydrotherapy:

- **Muscular problems**: Muscular weakness, Muscle spasm, Tightness or contracture of muscles.
- **Bony or skeletal problems:** Inflammatory conditions of spine, Arthritis of various joints, Post fracture stiffness.
- **Neurological Problems:** Paralytic condition like polio, spinal cord injury, brain injury.

Goals:

- Facilitate ROM exercises.
- Initiate resistance exercises.
- Facilitate weight exercises.

- Facilitate cardiovascular exercises.
- Enhance patient relaxation

Properties of water:

Buoyancy: it is the upward force that works opposite to gravity. Buoyancy provides the patient with relative weightlessness and joint unloading allowing performance of active motion easily.
Hydrostatic pressure: it is the pressure exerted on the immersed objects. This increased pressure reduces or limits effusion, assists venous return, induces Brady cardiac, and centralizes peripheral blood flow.

Viscosity: it is friction occurring between molecules of liquid resulting in resistance to flow. It creates resistance to all active movements.

Surface tension: the surface of the fluid acts a membrane under tension. Surface tension is measured as force per unit length. An extremity that moves through the surface will perform more work than if kept under water.

Hydromechanics: Hydromechanics is the physical properties and characteristics of fluid in motion.

Uses of hydrotherapy:

- **Strengthening of muscle:** the water provides a remarkable environment to produce very fine exercise progression and it provides more resistance than air. Muscles are strengthened by resistance may be offered by upward force, turbulence force etc. Even manual resistance can be applied along with it.
- **Endurance training:** muscular endurance refers to how many times the patient can repeat a particular activity inside water. The endurance activity can be performed against buoyancy, turbulence.
- **Joint mobility**: relief of pain and muscle spasm by the warmth of the water and by the support of buoyancy can restore free movement of joint.
- **Co-ordination and balance**: the buoyancy of water relieves the patient from weight and makes the activities like walking and step climbing easy.
- **Pain relief**: hydrotherapy pool improves circulation and enable tissue fluid to flow through the tissues thus facilitates removal of metabolites and improves nutrition.

CONTRAINDICATIONS:

- Infective wounds
- Hyperpyrexia
- Cardiac failure
- Deep vein thrombosis.
- Gastro intestinal disorder
- Hypo or Hypertension
- Epilepsy
- Low vital lung capacity

PRECAUTIONS:

- **AIDS –** The person suffering from AIDS should not be allowed in pool if any have a recent cut.
- If the person is mentally retarded.

- If the person is wearing contact lens.
- If the person is wearing any hearing aids.
- Patients have fear of water.
- Cardiac dysfunction: patients with angina and abnormal blood pressure require close monitoring.
- Patients with epilepsy.

Dangers

- Drowning
- Heat exhaustion
- Fall
- Slip
- Infection
- Skin irritation
- Droplet infections
- Electric shock

SHORT ANSWER QUESTIONS

1. Define hydrotherapy and write the goals?
2. Write the indications of hydrotherapy?
3. Write the contraindications of hydrotherapy?
4. What are the precautions to be taken for hydrotherapy?
5. Mention the dangers of hydrotherapy?

UNIT – 13

BREATHING EXERCISES

Contents:

Introduction

Breathing exercise and ventilatory training are fundamental intervention for the preventions or comprehensive management of acute or chronic pulmonary disorders. For example, these interventions are frequently advocated in the literature for patient with chronic obstructive pulmonary diseases (chronic bronchitis, emphysema, asthma, and cystic fibrosis), for patients with a high spinal cord lesion, for patients who have undergone thoracic or abdominal surgery and are at high risk for acute pulmonary complications, or for patient who must remain in bed for an extended period of time.

Breathing exercises are designed to retrain the muscles of respiration, improve ventilation, lessen the work of breathing, and improve gaseous exchange and patient's overall function in daily living activities.

Indications

- Acute or chronic lung disease: pneumonia, atelectasis, COPD etc.
- After surgeries.
- Airway obstruction due to retained secretions.
- Deficits in CNS: spinal cord injury, myopathies etc.
- As relaxation procedure.

Aims of breathing exercises:

- Improve ventilation.
- Increase the effectiveness of the cough mechanism.
- Improve the strength, endurance and coordination of respiratory muscles.
- Promote relaxation.
- Improve chest and thoracic spine mobility.

Types of breathing

All the breathing patterns should be deep, voluntarily controlled and relaxed.

1. Diaphragmatic breathing:

Place the patient in a relaxed position such as reclined sitting. Place your hands on the rectus abdomen just below the anterior costal margin. Ask the patient to breathe in slowly and deeply through the nose. Then tell the patient to slowly let the air out through the mouth. Practice this for 3 or 4 times. Then ask the patient to keep his or her hand on the abdomen and practice.

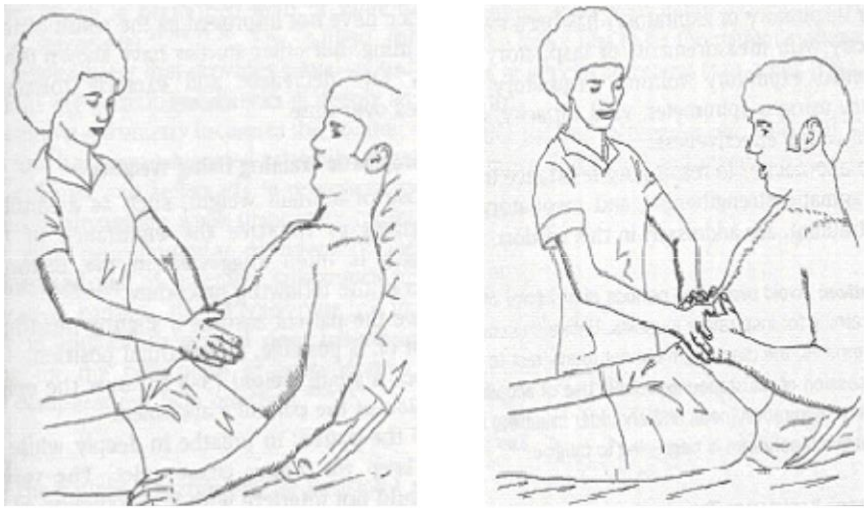


FIG - .DIAPHRAGMATIC BREATHING

2. Ventilatory muscle training

The process of improving strength and endurance of muscles of breathing is known as ventilatory muscle training (VMT). This technique usually focuses on muscles of inspiration.

a. Diaphragmatic training using weights

Have the patient assume a supine lying. Place a small weight over the epigastric region of the abdomen. Tell the patient to breathe in deeply while trying to keep the upper chest quiet.

b. Inspiratory resistance training

The patient inhales through a hand held resistive device that he or she place in the mouth. These devices are narrow tubes of varying diameters that provide resistance to airflow during inspiration and improve strength of inspiratory muscles. Gradually the time is increased to 20 to 30 minutes.

c. Incentive respiratory spirometry

It is form of low-level resistance training. The patient inhales through a spirometer that provides visual or auditory feedback as the patient breathes in as deeply as possible. Place the patient in a comfortable position. Have the patient take 3 to 4 breaths and exhale with the fourth breath.Then have the patient place the spirometer in the mouth and maximally inhale through the spirometer and hold the inspiration for several seconds.

3. Segmental breathing

a. Lateral costal expansion

The patient will be in a hook-lying position. Place your hands along the lateral aspect of the lower ribs and ask the patient to breathe out, and feel the rib cage move downward and inward.

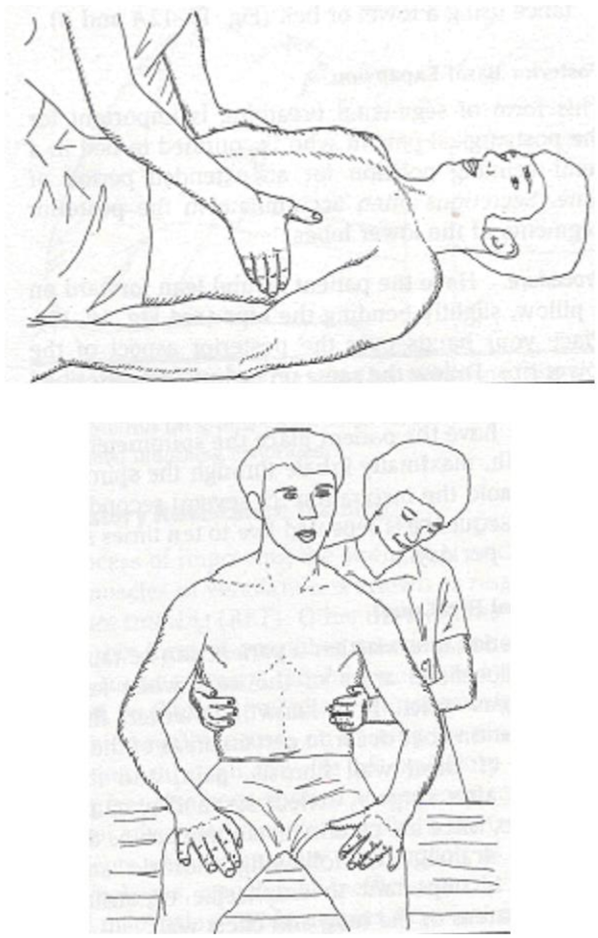


FIG - LATERAL COASTAL BREATHING

b. posterior basal expansion

Have the patient sit and lean forward on a pillow. Place your hands over the posterior aspect of the lower ribs. Follow the same procedure as above.

c. right middle-lobe or lingula expansion

Patient is sitting. Place your hands at either the right or left side of the patient's chest just below the axilla. Follow the same procedure as above.

d. apical expansion

Patient is sitting. Apply the pressure below the clavicle with the finger tips.

4. Gloss pharyngeal breathing

The patient takes several gulps of air. Then the mouth is closed and the tongue pushes the air back and traps it in the pharynx. The air is then forced into the lungs and the glottis is opened. This increases the depth of the inspiration.

5. Pursed-lip breathing

Have the patient assume a comfortable position. Explain to the patient that expiration must be relaxed and contraction abdominals must be avoided. Instruct the patient to breathe slowly and deeply then have the patient purse the lips and exhale.

Coughing

An effective cough is necessary to eliminate respiration obstructions and keep the lungs clear.

The cough mechanism

The following series of action occur when a person coughs.

- Deep inspiration.
- Glottis closes and vocal cords tighten.
- Abdominal muscles contract and the diaphragm elevates.
- Glottis opens.
- Explosive expiration of air occurs.

Additional means of facilitating a cough

Manual assisted cough

If a patient has abdominal weakness, manual pressure on the abdominal area will assist in developing greater intra-abdominal pressure for a more forceful cough.

Therapist assisted techniques

With the patient in a supine or semi-recycling position, the therapist places the heel of one hand on the patient's abdomen at the epigastric area just distal to the xiphoid process. The other hand is kept on the first. After the patient inhales as deeply as possible, the therapist manually assists the patient as he or she attempts to cough.

POSTURAL DRAINAGE

Postural Drainage removes mucus from certain parts of the lungs by using gravity and proper positioning to bring the secretions into the throat where it is easier to remove them. The lungs are divided into segments called lobes, the right lung is divided into three lobes (right upper lobe, right middle lobe and right lower lobe) while the left lung has only two lobes (left upper lobe and lower lobe)

Manual techniques used during postural drainage therapy

Percussion

Percussion is performed with cupped hands over the lung segment being drained. It is continued for several minutes or until the patient needs to alter position to cough.

Vibration

Vibration is applied by placing both the hands directly on the skin and over the chest wall and gently compressing and rapidly vibrating the chest wall as the patient breathes out.

Shaking

Shaking is a more vigorous from of vibration applied during exhalation using a intermittent bouncing maneuver coupled with the wide movement of therapist's hands.

INDICATIONS

Turning

- Inability or reluctance of patient to change body position. (e.g., mechanical ventilation, neuromuscular disease, drug-induced paralysis)
- Poor oxygenation associated with position(e.g., unilateral lung disease)
- Potential for or presence of atelectasis
- Presence of artificial airway

Postural Drainage

- Evidence or suggestion of difficulty with secretion clearance
- Difficulty clearing secretions with expectorated sputum production greater than 25-30 mL/day (adult)
- Evidence or suggestion of re-trained secretions in the presence of an artificial airway
- Presence of atelectasis caused by or suspected of being caused by mucus plugging
- Diagnosis of diseases such as cystic fibrosis, bronchiectasis, or cavitations lung disease presence of foreign body in airway

External Manipulation of the Thorax

- Sputum volume or consistency suggesting a need for additional manipulation (e.g., percussion and/or vibration) to assist movement of secretions by gravity, in a patient receiving postural drainage

CONTRAINDICATIONS

- **Haemorrhage (severe haemoptysis)**
    - Copious amounts of blood in the sputum.
- **Untreated acute conditions**
    - Severe pulmonary edema.
    - Congestive heart failure.
    - Large pleural effusion.
    - Pulmonary embolism.
    - Pneumothorax.
- **Cardiovascular instability**
    - Cardiac arrhythmia.
    - Severe hypertension or hypotension.
    - Recent myocardial infarction.

4. **Recent neurosurgery**

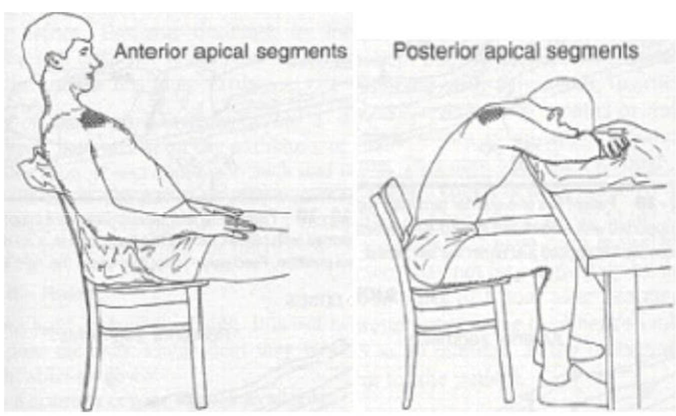
COMPLICATIONS

- Hypoxemia
- Increased Intracranial Pressure
- Acute Hypotension during Procedure
- Pulmonary Haemorrhage
- Pain or Injury to Muscles, Ribs, or Spine
- Vomiting and Aspiration
- Bronchospasm
- Dysrhythmias

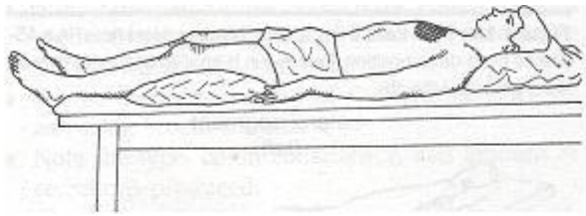
<u>POSTURAL DRAINAGE TECHNIQUES</u>

RIGHT AND LEFT UPPER LOBES

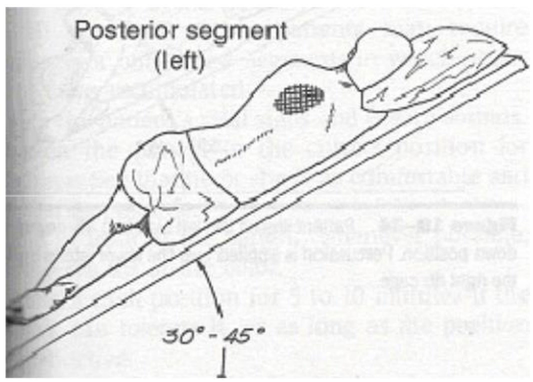
Anterior apical segments- Percussion is applied directly under the clavicle in sitting position
Posterior apical segments- Percussion is applied above the scapulae. Your fingers curve over the top of the shoulders in forward lean position



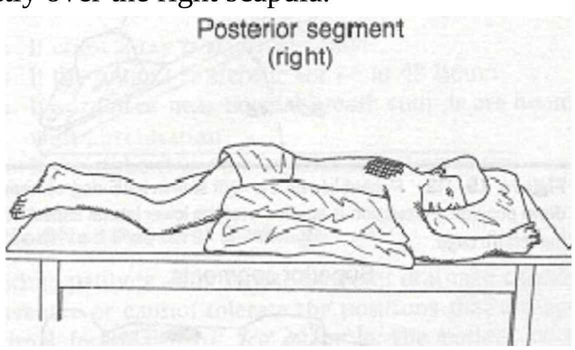
Anterior segments- Percussion is applied bilaterally, directly over the nipple or just above the breast in lying position



Posterior segment (left)- Patient lies one-quarter turn from prone and rests on theright side. Head and shoulders are elevated 45 degrees or approximately 18 inchesif pillows are used. Percussion is applied directly over the left scapula



Posterior segment (right) -Patient lies flat and one-quarter turn from prone on the leftside. Percussion is applied directly over the right scapula.



Lingula- Patient lies one-quarter turn from supine on the right side, supported with pillows and in a 30 degree head-down position. Percussion is applied just under the left breast.

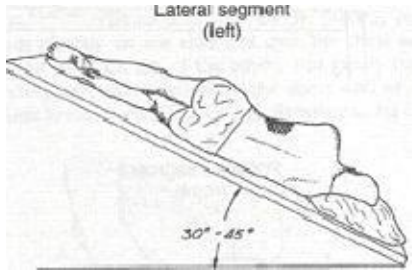
Middle lobe- patient lies one-quarter turn from supine on the left side, supported with pillows behind the back, and in a 30 degree head-down position. Percussion is applied under the right breast

RIGHT AND LEFT LOWER LOBES

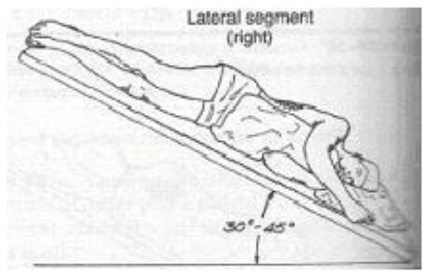
Anterior segments- Patient lies supine, pillows under knees, in a 45 degree head-down position. Percussion is applied bilaterally over the lower portion of the ribs

posterior segments- Patient lies prone with a pillow under the abdomen in a 45head-down position. Percussion is applied bilaterally over the lower portion of the ribs

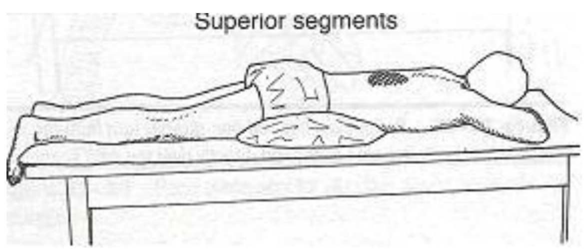
lateral segment(left)- Patient lies on the right side in a 45head-down position. Percussion is applied over the lower lateral aspect of the left rib cage



lateral segment(right)- Patient lies on the left side in a 45head-down position Percussion is applied over the lower lateral aspect of the right rib cage



Superior segments- patient lies prone with a pillow under the abdomen to flatten the back. Percussion is applied bilaterally, directly below the scapulae



ESSAY ANSWER QUESTIONS

1. Explain in detail about different types of breathing exercises?
2. Mention different postural drainage techniques used for right and left upper and lower lobes?

UNIT - 14

POSTURE

Contents:

Introduction

Posture is the attitude assumed by the body either when the body is stationary or when it is moving. Posture is attained as a result of co-ordinated action of various muscles working to maintain stability. Posture is in easy terms can be understood as the position in which you hold your body when standing or sitting.

CLASSIFICATION / TYPES OF POSTURE: The postures are basically divided into

- Active posture
- Inactive posture

- **Active posture:** These are the postures in which integrated action of many muscles is required to maintain the posture .They are basically divided into two types:

Static posture
Dynamic posture

i.Static posture: body segments are aligned and maintained in a fixed positions. This is usually achieved by co-ordination and interaction of various muscle groups which are working statistically to counteract gravity and other forces. Examples of static postures are standing, sitting, lying and kneeling.

ii. Dynamic posture: in this type of posture body segments are moving. It is usually required to form an efficient basis for movement. Muscle and non contractile structures have to work for changing circumstances. Examples are walking, running, jumping, throwing and lifting.

- **Inactive posture**: these are postures or attitudes adopted for resting or sleeping. They are require theoretically minimal muscle activity, and are usually assumed in need of relaxation.

IDEAL POSTURE

The ideal skeletal alignment is known as ideal posture or standard posture. The ideal erect posture is one in which the line of gravity (the vertical line drawn through the body's centre of gravity) when viewed from each side runs:

- Line of gravity passes through the external auditory meatus
- Then through the shoulder joint
- Approximately mid way from trunk, going through the bodies of cervical and lumbar vertebras.
- At hip joint it passes through the hip joint approximately through greater trochanter of femur.
- Anterior to the knee joint
- Anterior to lateral malleolus

When viewed from front or the back, the vertical line passing through the body's centre of gravity should be theoretically bisect the body into two equal halves, with the body weight distributed evenly between the two feet.

Postural training

Patterns of posture, both static and dynamic, are gradually built up by the integration of the many reflexes which together make up the Postural Reflex. Some of these component reflexes are inborn and some are conditioned, being developed as the result of constant repetition of postures maintained by voluntary control.

Good Posture

Posture is said to be good when it fulfils the purpose for which it is used with maximum efficiency and minimum effort.

As the physical characteristics of no two people are identical, the precise pattern of good posture must vary with the individual. It is possible, however, to generalize to some extent. For example, in the erect postures the alignment of specific parts of the body usually leads to perfect balance of one segment upon another, a state which can be maintained with the minimum of muscular effort and which is aesthetically pleasing to the eye.

Development of Good Posture

Efficient posture develops quite naturally, provided the essential mechanisms for its maintenance and adjustment are intact and healthy.

The chief factors which predispose to the health and development of the muscles and the postural reflex are

- A stable psychological background,
- Good hygienic conditions,
- Opportunity for plenty of natural free movement.

FIG – POOR POSTURE AND GOOD POSTURE

Bad Posture

Posture is poor when it is inefficient, that is, when it fails to serve the purpose for which it was designed, or if an unnecessary amount of muscular effort is used to maintain it.

Faulty alignment of the body segments in the erect positions may lead to the necessary for additional muscle work to maintain balance. On the other hand, efficient compensation may take place, in which case no additional muscular effort is required, but ligament strain or cramping of thoracic movement are disadvantages which cannot be ignored. In addition, postures which involve a marked increase in any or all of the curves of the spine are aesthetically displeasing, clothes do not fit these subjects well and this may in itself have an unwelcome psychological reaction.

Tension in muscles other than those required to act either to produce movement or to maintain posture hinders the efficiency of both and wastes energy.

Factors which predispose to Poor Posture

The causes of poor posture are often very obscure, and, even if they are known, are difficult to remove.

The factors which most often contribute to the establishment of an inefficient postural pattern are the mental attitude of the patient and poor hygienic conditions. General debility after a constitutional illness and prolonged fatigue are also contributory causes, as they reduce the efficiency of the nervous system as a whole.

Local factors such as localised pain, muscular weakness, occupation stresses, or localised tension which serves no useful purpose, lead to muscular imbalance and alter the postural pattern, but do not necessarily reduce its efficiency under the circumstances. If, however, this altered pattern of posture is continued after the cause for it is removed, it must be regarded as a postural defect.

A faulty idea of what constitutes good posture may also lead to the establishment of an inefficient pattern by repeated voluntary effort.

SHORT ANSWER QUESTIONS

1. Define posture and classify?
2. What is meant by ideal posture?
3. Mention the factors which predispose to poor posture?
4. How to develop good posture?

UNIT - 15

WALKING AIDS AND GAIT TRAINING

Contents:

Introduction

Walking aid is a mobility aid , designed to assist walking to improve the mobility.There are a number of aids to assist people who have difficulty in walking or who cannot walk independently without one. These external aids are crutches, sticks and frames.

Crutches

There are three basic types of crutches and they are used to reduce weight bearing on one or both legs, or to give additional support where balance is impaired and strength is inadequate.

1. Axiliary Crutches

They are made of wood with an axillary pad, a hand piece and a rubber ferrule. The position of the hand piece and the total length are usually adjustable.

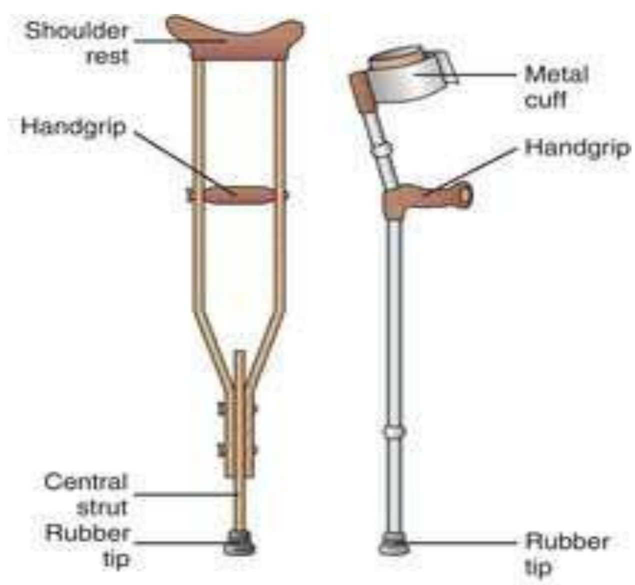


FIG - AXILLARY CRUTCH FOREARM CRUTCH

The axillary pad should rest against the chest wall approximately 5cm .below the apex of the axilla and the hand grip should be adjusted to allow the elbow to be slightly flexed when weight is not being taken. Weight is transmitted down the arm to the hand piece. The elbow is extended. On no account should weight be taken through the axillary pad as this could lead to a neuropraxia of the Radial Nerve or Brachial Plexus.

Measurement of length: There is variety of ways measuring the patient for crutches. It is usually carried out with the patient in lying.

- With shoes off - measure from the apex of the axilla to the lower margin of the medial malleolus. This is an easy measurement and is reasonably reliable.
- With shoes on - 5cm vertically down from the apex of the axilla to a point 20 cm lateral to the heel of the shoe. This tends to be less accurate than the first method.

The measurement from the axillary pad to the hand grip should be taken with the elbow slightly flexed (approximately 15°) from a point 5 cm below the apex of the axilla to the ulnar styloid. Once the patient is standing with the support of the crutches, the physiotherapist must the correct way to use the crutches and to see that they do not allow the axillary pad to press into the axilla.

2. Elbow crutches

They are made of metal and have a metal or plastic forearm band. They are usually adjustable in length by means of a press clip or metal button and have a rubber ferrule. These crutches are particularly suitable for patients with good balance and strong arms. Weight is transmitted in exactly the same way as for axillary crutches.

Measurement of length. The measurement is usually taken with the patient in the lying position with the shoes on. The elbow is slightly flexed (approximately 15°) and the measurement is taken from the ulnar styloid to a point 20 cm lateral to the heel of the shoe. Once the patient is standing with the support, the length must be checked.

3. Gutter Crutches. (Adjustable arthritic crutches; forearm support crutches)
They are made of metal with a padded forearm support and strap, an adjustable hand piece and a rubber ferrule.

These are used for patients with Rheumatoid Disease, who require some form of support but cannot take weight through hands, wrists and elbows because of deformity and/ or pain. The crutch is adjustable in length in the same way as the elbow crutch. It should also be adjustable in the length of forearm support and in the angle of the hand piece to allow for deformities.

Measurement of length

- If the patient is able to stand, it is better to assess the required length in this position from elbow to the floor.
- Measurement can be carried out with the patient lying with shoes on, and is taken from the point of the flexed elbow to 20 cm lateral to the heel.

FIG – GUTTER CRUTCH

A patient with Rheumatoid Disease may allow the hips and knees to flex in the weight-bearing position because of muscle weakness and/or pain, but with gutter crutches for support he may be able to obtain more extension. This must be taken into account in any adjustment.

Sticks

Sticks may be either of wood or metal with curved or straight hand places.

The metal ‘ones are adjustable and therefore suitable for assessment purposes.

The wooden ones are cut to the required length.

Measurement: The measurement can usually be taken with the patient in the standing position. The elbow is slightly flexed and the measurement is taken from the ulnar styloid to the floor approximately 15 cm from the heel.

Use of sticks: The patient may use two sticks in the same way as the methods described for partial weight-bearing walking with crutches. Sticks allow more weight to be taken through the leg than do crutches. One stick may be used on the unaffected side so that the stick and the affected leg are placed forward together, taking some of the weight through the stick.

FIG – TRIPOD AND QUADRIPOD

Frames

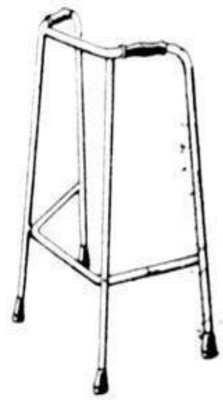


FIG - FRAME

The commonest type is the lightweight frame with four feet which may be adjustable in height. The patient lifts the frame forward, then leans on it and takes two steps. The patient should take even steps, keeping the frame well forward. A bag can be attached to the front of the frame to carry small items.

Ataxic patients who are too unsteady to lift a frame forward may be able to use a rollator frame which can be pushed or a reciprocal frame where each side moves independently.

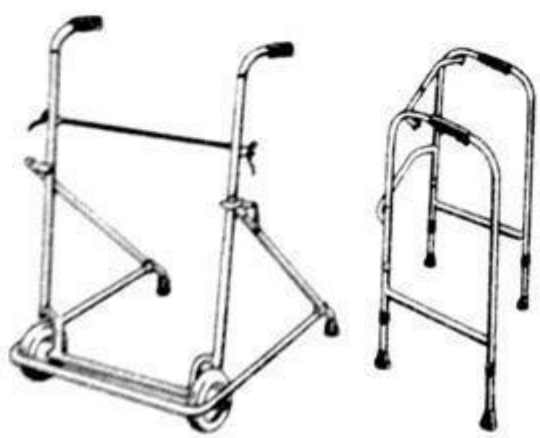


FIG - ROLLATOR

Safety: The physiotherapist must check the safety of all working aids not only when giving them to a patient, but regularly throughout a treatment programme. The patient must be taught to inspect his walking aids and know where to obtain replacement parts. Ferrules, which are made of rubber or plastic, should be rough to give a high co-efficient of friction. The general structure including screws, metal clips, press buttons, hand grips and axillary pads must all be in good condition.

GAIT TRAINING

Gait training is a type of physical therapy. It can help improve your ability to stand and walk. Gait training is recommended gait training if there is an illness or injury that affects the ability to get around. It may help to gain independence in walking, even if one needs an adaptive device.

Uses of Gait training

- strengthen your muscles and joints
- improve your balance and posture
- build your endurance
- develop your muscle memory
- retrain your legs for repetitive motion
- lower your risk of falls, while increasing your mobility

It may also lower your risk of other illnesses, such as heart disease and osteoporosis, by increasing your physical activity and mobility. Choosing gait training over immobility may help protect and improve your overall health.
Indications :

- Spinal Cord Injuries
- Broken Legs Or Pelvis
- Joint Injuries Or Replacements
- Lower Limb Amputations
- Strokes Or Neurological Disorders
- Muscular Dystrophy Or Other Musculoskeletal Disorders
- Children Who Require Gait Therapy Often Have Brain Injuries, Neurological Disorders, Or Musculoskeletal Issues.

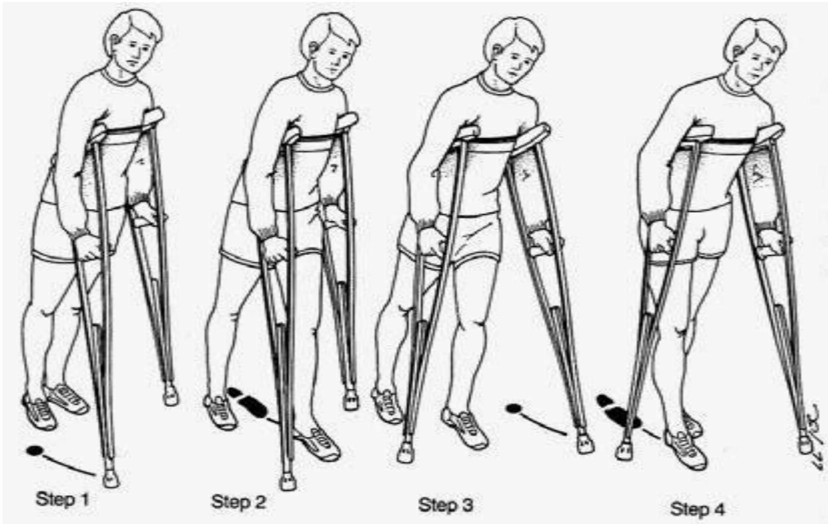
Various methods of gait training:

CRUTCH WALKING GAITS

a. The 4-point gait: is used when the patient can bear some weight on both lower extremities. Place the patient in the tripod position and instruct him to do the following.

a. Move the right crutch forward.

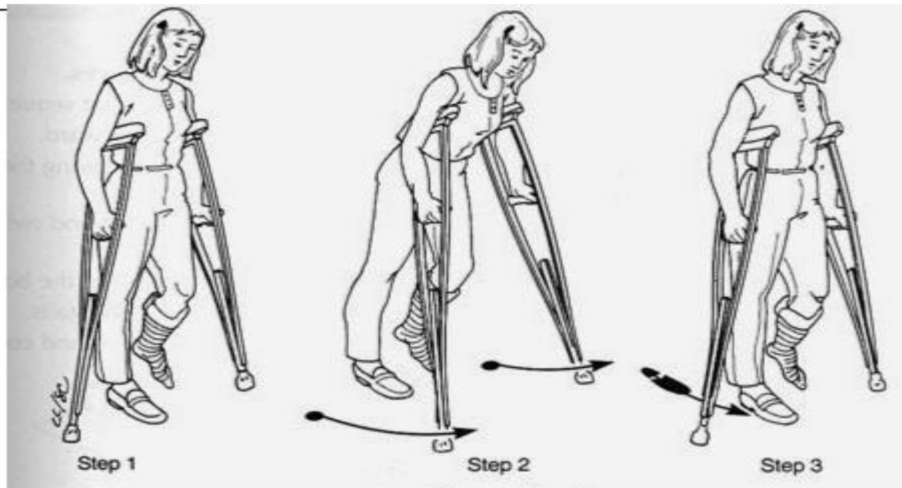
- Move the left foot forward.
- Move the left crutch forward.
- Move the right foot forward.
- Repeat this sequence of crutch-foot-crutch-foot for desired ambulation.



Four-point gait.

b. The 3-point gait: is used when the patient should not bear any weight on the affected leg. Place the patient in the tripod position and instruct him to do the following.

- Move the affected (non-weight bearing) leg and both crutches forward together.
- Move the unaffected (weight bearing) leg forward.
- Repeat this sequence for desired ambulation.



Three-point gait.

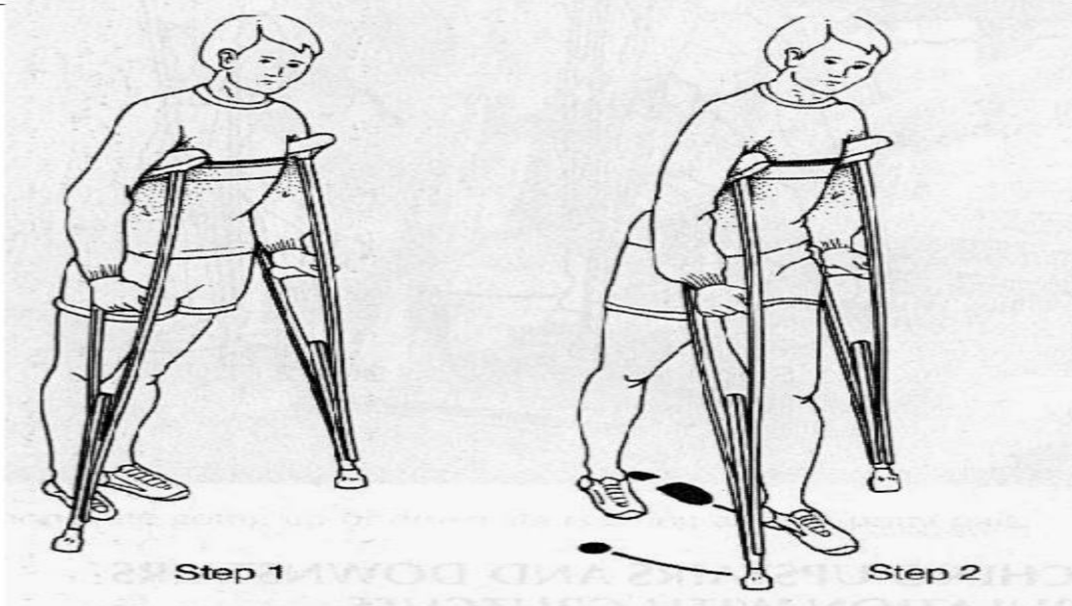
- Swing - to gait: The crutches straight in front of the supporting leg. They are lifted and placed further in front, weight is taken on them and the sound leg is bend and swung to just behind the crutches. The disable leg should be held clear of the ground and in front of the body.
- Swing through gait: The above procedure is followed but the sound leg is swung through the crutches and the foot is put down in front of them. This technique is for stronger patients.

- **The 2-point gait**: is used when the patient can bear some weight on both lower extremities. Place the patient in the tripod position and instruct him to do the following.

Move the right leg and left crutch forward together.

Move the left leg and the right crutch forward together.

Repeat this sequence for desired ambulation.



Two-point gait.

Preparation for Crutch Walking

a. Arms: The power of the extensors and adductors of the shoulder and the extensors of the elbow must be assessed and if necessary strengthened before the patient starts walking. The hand grip must also be tested to see that the patient has sufficient power and mobility to grasp the hand piece. The results of this assessment will determine the type of crutch chosen.

b. Legs

- **Non-weight-bearing:** The mobility and strength of the unaffected leg should be assessed, paying particular attention to the hip abductors and extensors, the knee extensors and the plantar flexors of the ankle. These muscles must be sufficiently strong to take weight. The patient is taught hip-hitching on the non-weight-bearing side if it is required.

(ii) Partial weight-bearing: The mobility and strength of both legs should be assessed and muscles strengthened where necessary.

c. Balance

Sitting and standing balance must be tested and trained if necessary.

SIT TO STAND WITH CRUTCHES:

- Bring yourself forward to edge of the chair.
- Place good leg underneath chair, you will use this leg to help push you to standing position.
- Place both crutches on together.
- One hand will go on surface you are sitting on and one will go on hand grips of crutches.

- When you are ready, stand, use good leg and both arms to bring yourself to a standing position.
- Once standing, transfer crutches to appropriate position (under arm pits).
- Reverse this process to sit down.

SIT TO STAND WITH WALKER:

- Bring yourself forward, to the edge of chair, place good leg under chair. You will use this leg to help push you up to a standing position.
- Place hands on the surface of which you are sitting. Once you are ready to stand, use your good leg and arms on the chair to push yourself to a standing position.
- Once you are standing, grasp walker's handgrips.

GOING UP STAIRS :(with crutches)

- Start close to the bottom step and push down with your hands.
- Step up to the first step leading with your good leg.
- Step up with your injured/surgical leg, and then move crutches up to the step you are standing on.
- Repeat for each step.

FIG-STAIR CLIMBING

GOING DOWN STAIRS (with crutches)

- Start on the edge or the step, keeping your hips beneath you.
- Slowly bring the crutches with your injured/surgical leg down to the next step. Be sure to bend at the hips and knees to prevent leaning too far forward.
- Bring your good leg down to the step to meet your bad leg.
- Repeat for each step.

Walking with sticks: the stick is held on the opposite side of the injured leg.

TRANSFER TECHINIQUES:

Moving a patient from bed to a wheelchair

Follow these steps to move a patient from bed to a wheelchair. The technique below assumes the patient can stand on at least one leg.

If the patient cannot use at least one leg, you will need to use a lift to transfer the patient.

Preparation

Think through the steps before you act, and get help if you need it. If you are not able to support the patient by yourself, you could injure yourself and the patient.

Make sure any loose rugs are out of the way to prevent slipping. You may want to put non-skid socks or shoes on the patient's feet if the patient needs to step onto a slippery surface.

The following steps should be followed:

- Explain the steps to the patient.
- Park the wheelchair next to the bed, close to you.
- Put the brakes on and move the footrests out of the way.

Getting a Patient Ready to Transfer

Before transferring into the wheelchair, the patient must be sitting. Allow the patient to sit for a few moments, in case the patient feels dizzy when first sitting up

The following steps should be followed when getting ready to transfer a patient:

To get the patient into a seated position, roll the patient onto the same side as the wheelchair.

- Put one of your arms under the patient's shoulders and one behind the knees. Bend your knees.

- Swing the patient's feet off the edge of the bed and use the momentum to help the patient into a sitting position.

- Move the patient to the edge of the bed and lower the bed so the patient's feet are touching the ground.

- **Pivot Turn** - If you have a gait belt, place it on the patient to help you get a grip during the transfer. During the turn, the patient can either hold onto you or reach for the wheelchair.

Stand as close as you can to the patient, reach around the chest, and lock your hands behind the patient or grab the gait belt.

FIG- TRANFER TECHNIQUE – BED TO WHEEL CHAIR

The following steps should be followed:

- Place the patient's outside leg (the one farthest from the wheelchair) between your knees for support. Bend your knees and keep your back straight.
- Count to three and slowly stand up. Use your legs to lift.
- At the same time, the patient should place their hands by their sides and help push off the bed.
- The patient should help support their weight on their good leg during the transfer.
- Pivot towards the wheelchair, moving your feet so your back is aligned with your hips.
- Once the patient's legs are touching the seat of the wheelchair, bend your knees to lower the patient into the seat. At the same time, ask the patient to reach for the wheelchair armrest.

  If the patient starts to fall during the transfer, lower the person to the nearest flat surface, bed, chair or floor.

Moving the patient from wheel chair to bed:

- Bring the wheelchair beside the bed. Make sure the person’s strong side is beside the bed. Lock the brakes.
- Put both feet flat on the floor. Move the footrest(s) out of the way.

- Ask the person to move forward in the wheelchair. Make sure their toes are under their knees. 4. Stand in front of the person. Ask them to sit tall, lean forward and push down on the wheelchair armrest as you help them to stand.
- Place your hands around their upper back. If they have a weak arm, place your arm around it, not under it. Do not pull on the weak arm.
- Help the person to move their feet until their bottom is over the edge of the bed. Help them sit down.
- The person should: • Reach for the bed • Bend knees • Keep shoulders forward.

ESSAY ANSWER QUESTIONS

1. Explain in detail about axillary crutches along with its measurements?
2. Explain in detail about elbow and gutter crutches along with its measurements?
3. Explain various crutch walk training methods?
4. Explain the transfer techniques of bed to wheel chair and vice versa?

UNIT - 16

MASSAGE

Contents:

Definition

Massage therapy is the scientific manipulation of the soft tissues of the body for the purpose of normalizing those tissues and consists of manual techniques that include applying fixed or movable pressure, holding, and/or causing movement of or to the body.

Indications:

Back pain, neck or shoulder pain, muscle spasm, muscle weakness, nerve injuries, carpal tunnel syndrome, sciatica, poor circulation, tendinitis, arthritis, fibromyalgia, constipation, headaches and migraines, sinus disorders etc

Classification of technique:

- **Stroking manipulation**
    - superficial stroking.
    - Deep stroking./ Effleurage
- **Pressure manipulation**
    - kneading.
        palmar kneading.
        digital kneading.
        ironing.
    - Petrissage.
        Picking up.
        Wringing.
        Skin rolling.
    - Friction.
        Circular friction.
        Transverse friction.
- **Percussion manipulations**
    - Clapping.
    - Hacking.
    - Tapping.
    - Beating.
    - Pounding.
    - Tenting.
    - Contact heel percussion.
- **Vibratory manipulations**
    - Vibrations.

ii. Shaking.

FIG – DIFFERENT TYPES OF MASSAGE TECHNIQUES

Techniques of massage

1. Stroking: The uninterrupted linear movement of hand along the whole length of segment is called stroke.

- **Superficial stroking:** It is the rhythmic movement of hand or parts there of over the skin with the lightest amount of pressure in order to obtain sensory stimulation. The strokes can be applied from proximal to the distal.
- **Effleurage or deep stroking:** It is the movement of the palmar aspect of hand over the external surface of the body with constant moderate pressure, in the direction of the venous and lymphatic drainage. It is done from distal to proximal direction.

2. Pressure manipulations: In this group of techniques, the hand of the therapist and skin of the patient move together as one and fairly deep localized pressure is applied to the body. It is divided into

- **Kneading**: In this group of techniques, the tissues are pressed down on to the underlying firm structure and intermittent pressure is applied in circular direction, parallel to the long axis of bone.
    - Digital kneading
    - Palmar kneading
    - Ironing
- **Petrissage**: In this the tissues are grasped and lifted away from the underlying structures and intermittent pressure is applied to the tissues in the direction that is perpendicular to the long axis of the bone. It is divided into
    - Picking up
    - Wringing
    - Skin rolling
- **Friction:** in this technique the tissue is subjected to small range of to and fro movement performed with constant deep pressure of the finger or thumb. It is divided in to
    - Circular friction
    - Transverse friction

3. Percussion manipulations

In this group of techniques, a succession of soft, gentle blows are applied over the body, which produce a characteristic sound. The striking hands are not in constant contact with the skin and strike the body part at regular interval. This results in the application of an intermittent touch and pressure to the body during these manipulations.

The different parts of hand are used to strike the subject's skin and accordingly the techniques are named:

- Clapping- Cupped palm
- Hacking -Ulnar border of the 5th, 4th and 3rd digits
- Beating -Anterior aspect of the clenched fist
- Tapping -Pulp of the fingers
- Pounding- Medial aspect of the clenched fist

4. Vibratory Manipulations: In this group of techniques, the mechanical energy is transmitted to the body by the vibrations of the distal part of upper limb, i.e. hand and/or fingers, which are in constant contact with the subject's skin, using the body weight and generalized co-contraction of the upper limb muscles.

This technique is mainly directed towards the lung and other hollow cavities. Depending upon the direction and frequency of vibration it is divided into two techniques:

- Vibration
- Shaking

Therapeutic uses

Massage is one of the oldest from of treatment for human ills. It has been used as a therapeutic modality in various conditions since ancient times.

- To improve mobility of the soft tissues.
- To reduce muscle spasm and pain under abnormal conditions.
- To reduce oedema.
- To increase circulation.
- To mobilize secretions in the lung.
- To induce local and general relaxations.

Contraindications

General contraindications:

- High fever
- Renal diseases
- Cardiac diseases
- Deep x-ray therapy
- Osteoporosis
- Severe spasticity

Local contraindications:

- Acute inflammation
- Skin diseases
- Recent fractures
- Varicose veins
- Atherosclerosis
- Thrombosis
- Open wound

SHORT ANSWER QUESTIONS

1. Define massage?
2. Mention various techniques of massage?
3. Write the therapeutic uses of massage?
4. What are the contraindications of massage?
5. What are the indications of massage?

UNIT - 17

EXERCISE THERAPY EQUIPMENTS

Contents:

1. Suspension therapy:

Suspension is defined as suspending a part of the body with the supported slings and pulleys.

Principles

It is working under the principle of 1) Friction 2) Pendulum, and 3) Eliminating gravity movement.

Advantages

- It reduces the burden for the therapist.
- Easy to lift the limbs.
- Active movements can be performed easily with minimum friction.

Suspension instruments:

- Suspension frame
- Supporting ropes
- Pulleys
- Slings
- S-hooks and dog clips
- Wooden chart.

Types of Suspensions

- Axial suspension
- Vertical suspension
- Pendular suspension

FIG – SUSPENSION UNIT

Axial suspension

Joint axis is taken as the point of the suspension .the limb is supported by the slings above the axis of the joint if the movement is initiated the limb moves both sides .
The part moves parallel to the floor.

Uses

- Relaxation
- maintain muscular properly
- Increase the blood circulation
- Increase the venous drainage
- Increase the lymphatic drainage.

Vertical suspension

The centre of gravity of the body part or the body is taken as the point of suspension. The body parts can be supported in this type of suspensions rather than the strengthening or performing pendular movements of the limbs.

Uses

- To support the body part
- To reduce the pressure sore

Pendular Suspension

Here at first the axis of the joint is taken as the point of suspension then depends on the strengthening of the muscle group, this axis is changing towards medially or laterally, anteriorly or posteriorly. The muscles will be getting resistance while movement if the axis is shifting opposite to that movement. if the axis is shifted towards the abducted side the adducted muscles will be getting resistance during movement.

Uses

- To strengthen the muscles
- To increase the muscle power
- To increase the endurence

2.Re education board:

It is a semi-circular board. Usually it is made up of wood. It will help in performing movement in gravity eliminated position and also against gravity.

FIG – RE-EDUCATION BOARD

Indications:

- Hemiplegia.
- Cerebral palsy.
- Weakness of muscles.

Uses:

- Assist in performing movement.
- Maintain ROM.
- Strengthening exercises

3.Shoulder wheel

The Shoulder Wheel is constructed of a 37"-diameter steel tube wheel fitted with a resistance mechanism that revolves smoothly around a drum to provide a varied arc of motion from 10° to 39°. By setting the handle to a specific position, resistance is controlled from 0 to the maximum through a calibrated sensitive resistance mechanism. The Shoulder Wheel is mounted on 3 laminated hardwood boards to easily attach to the wall. The wheel can be adjusted up to a height of 26" to fit all patients for all therapy needs.

The position of the patient should be opposite to the shoulder wheel and position also can be changed to side the patient’s shoulder should be opposite to the shoulder wheel. Then the patient has to rotate the wheel in clockwise direction and anti clockwise direction.

These movements will give the shoulders full range of motion and all the movements of the shoulder will be covered.

Indications

- Frozen shoulder
- Periarthritis shoulder
- Post traumatic stiffness of shoulder
- Weakness of shoulder muscles

FIG – SHOULDER WHEEL

Uses

- To improve the range of motion of shoulder.
- For strengthening the upper limb muscles.
- To improve neuro muscular co-ordination.

4.Finger ladder:.

It is a wooden device which gives the objective reinforcement and motivation to patient for improving shoulder range of motion. It also feed back to the patient about improvement.It is a single vertical unit with 36 steps.

Uses

- For improving range of motion
- For improving neuromuscular co-ordination of upper limb

FIG – FINGER LADDER

Indication
- Frozen shoulder
- Periarthritis shoulder
- Post traumatic stiffness of shoulder
- Weakness of shoulder muscles

5.Parallel bars :

These are medical devices specifically used in physical and occupational rehabilitation therapy to assist individuals to re-learn to walk and for gait training, as well as to regain balance, strength , range of motion and mobility. It has got two horizontal frames which are mounted on a four vertical frames and a walking platform with one central divider to prevent crossing of leg. A postural correction mirror will be placed at the end of the board. The main purpose is to improve

- Standing tolerance.
- Gait training.
- Postural correction.

Uses

- Gait training
- Postural training
- Trunk control training
- Balance training with and without support
- Strengthening and mobility management of lower limb

FIG – PARALLEL BAR

Indications
- Hemiplegia
- Cerebral palsy
- Post fracture and post traumatic gait training
- Paraplegia

6.Ankle exerciser:

Iron foot bar, springs, straps are used to make this ankle exerciser. Resistance can be given in the form of spring which can be tighten by a knob. Exercise is available with or without weight plates.

Indications

- potts fracture
- ankle sprain
- foot drop
- tendo achilis injury

Uses:

- it is ideal for lower leg and ankle exercises.
- Use for load – resisting inversion, eversion, dorsi-flexion and plantar – flexion exercises.

FIG – ANKLE EXERCISER

7.Medicine balls

It is a leather ball which has got many layers of different materials. It has got outer layer made up of thick leather and second layer made of foam and coir. Innermost layer is filled with stone chips and sands. The coir and foam is for preventing injury to patient on direct hit.

Uses

- Strengthening of upper limb muscles
- Eye hand co-ordination
- Neuro-muscular co-ordination

.

FIG – MEDICINE BALL

Indications
- Paraplegia
- Patient with stiff hip
- Hand eye co-ordination
- Maintenance of upper limb motion

8. Equilibrium board

The board encourages rhythm, balance and vestibular responses. As children develop confidence, they can use it in kneeling or standing position.

Indications
- Imbalance and co-ordination
- Stiffness of ankle
- Cerebral functioning
- Sensory ataxia.
- Hemiplegia.
- Weakness of ankle muscle.

FIG – EQUILIBRIUM BOARD

Uses
- Strengthening of ankle muscle.
- Balance and co-ordination.
- Relaxation.
- Neuro-muscular co-ordination.

9.Supination – pronation wheel:

It is designed to aid in development of pronation and supination techniques. The wheel has a non slip surface that provides stability during exercise. The wheel can accomodate any size hands with or without a flexion glove.

Indications:

- Elbow fracture
- fore arm fractures
- post immobilization stiffness

FIG – SUPINATION – PRONATION WHEEL

Uses:

- To improve the strength of supinators and pronators of fore arm
- To improve the ROM of supination and pronation

10.Theraband:

A theraband or a resistance band is a latex band or tube.They are also commonly used by athletes, but also people who are looking for low- impact strength training work out.

FIG – THERA BAND

Indications

- Peri arthritis of shoulder
- Hemiplegia
- Weakness of shoulder muscles
- Post rehab conditions

Uses:

- Used for light strength training exercises
- Used to improve muscle strength and range of motion
- It provides both concentric and eccentric resistance on the muscles

11.Shoulder pulley:

The shoulder pulley is an apparatus that's hooked over the top of a door, with a small pulley system near the top, and a rope with handles that hangs down from the pulley. Patient can use the pulleys to perform various shoulder exercises.

Indications

- Frozen shoulder
- Periarthritis shoulder
- Post traumatic stiffness of shoulder
- Weakness of shoulder muscles

Uses:

- To improve shoulder joint range of motion.
- To improve ROM in different directions in shoulder.
- To re establish the strength of the shoulder.

FIG – SHOULDER PULLEY

12.Continuous Passive motion

It refers to passive motion that is performed by a mechanical device that moves a joint slowly and continuously through a controlled range of motion. Many studies support the short term benefits of CPM use after surgery in that patients gain ROM more quickly and therefore, may experience earlier discharge from the hospital. CPM decreases postoperative pain and postoperative complications.

Indications

- Post operative knee rehabilitation
- Stiffness of knee joint
- Decreased ROM of knee joint

Uses:

- Preventing development of adhesions and contractures and thus joint stiffness
- Providing a stimulating effect on the healing of tendons and ligaments
- Enhancing healing of incisions over the moving joint
- Preventing the degrading effects of immobilization
- Providing a quicker return of ROM
- Decreasing postoperative pain.

FIG - CPM

SHORT ANSWER QUESTIONS

1. What is suspension therapy ; mention the indications and uses of it?
2. What is Re-education board; mention the indications and uses of it?
3. What is Shoulder wheel; mention the indications and uses of it?
4. What is Finger ladder; mention the indications and uses of it?
5. What is Parallel bars, mention the indications and uses of it?
6. What is Ankle exerciser; mention the indications and uses of it?
7. What is Medicine ball; mention the indications and uses of it?
8. What is Equilibrium board; mention the indications and uses of it?
9. What is Supination - Pronation wheel, mention the indications and uses of it?
10. What is Theraband, mention the indications and uses of it?
11. What is Shoulder pulley; mention the indications and uses of it?
12. What is CPM; mention the indications and uses of CPM machine?

PHYSIOTHERAPY
BLUE PRINT
I YEAR
PART B – VOCATIONAL SUBJECTS
PAPER – I: ANATOMY & PHYSIOLOGY (THEORY)

Theory: 135hours Marks: 50

S.No	NAME OF THE UNIT	No. Of Periods	Weightage in marks	Short answer questions	Essay answer questions
1	**INTRODUCTION** Anatomy ,Physiology,Anatomical position,Systems of the body, Cell structure and Functions	5	2	1	-
2.	**Osteology / skeletal system** Classification of skeletal system(axial and appendicular), Bones- Types of bones, Function, Structure of long bone, Structure of vertebral column,structure of thorax Description of upper limb,lower limb,skull and facial bones.	10	8	1	1
3.	**Arthrology** Classification of joints Construction of joints(Shoulder & knee joint) Movements of joints Articular surfaces of joints	10	8	1	1
4.	**Myology** Types of Muscle tissue& its functions Phenomenon of muscle contraction Muscles of upper extremity, lower extremity, trunk, eye and face etc.	10	2	1	-
5.	**Blood** Composition and functions of blood and plasma, cellular elements of blood coagulation phenomenon, and clotting factors blood groups	10	8	1	1
6.	**Cardio-vascular system** Structure and functions of the heart Types of blood vessels, Properties of heart muscles Cardiac cycle and heart sounds ECG, Vital signs, Lymphatic circulation	15	8	1	1
7.	**Nervous System** classification and function of Nervous System Nerve tissue- neuron,Structure and functions of Brain and Spinal cord, peripheral and cranial nerves ,synapse,cerebro spinal fluid	15	8	1	1

8.	**Respiratory System** Anatomy of respiratory organs,air passages, lungs, bronchial tree andbronchial segments Mechanism of breathing Lung volumes and capacities. Respiratory rate ,Dyspnoea	**15**	**6**	**-**	1
9	**Digestive system** gastro intestinal tract, digestive glands, process of digestion	**10**	**6**	**-**	**1**
10	**Excretory system** anatomy of urinary organs,functions of kidney,composition of urine, skin functions and temperature **r**egulation	**15**	**8**	**1**	**1**
11	**Endocrine system** structure and functions of endocrine glands	**10**	**2**	**1**	-
12	**Reproductive system** male and female reproductive organs, family planning and contraceptive methods.	**10**	**2**	**1**	-

PHYSIOTHERAPY
BLUE PRINT

I YEAR

PART B – VOCATIONAL SUBJECTS

PAPER – II: PSYCHOLOGY & ABNORMAL PSYCHOLOGY (THEORY)

Theory: 135 hours Marks : 50

S. No	NAME OF THE UNIT	No. Of Periods	Weightage in marks	Short answer	Essay/ Problem
1	**Psychology** – introduction , Definition, scope and branches (pure and applied)	09	6	-	1
2.	**Perception and Illusions Thinking, reasoning and problemsolving**	15	8	1	1
3.	**Motivation –** introduction, definition, needs, drives, motives, and theories **Attention**	10	2	1	-
4.	**Learning**- definition, types and theories **Individual differences**	15	8	1	1
5.	**Memory** -Remembering -Forgetting **Aptitude**- introduction, definition, measurement and utility	15	8	1	1
6	**Intelligence** – introduction definition , classification, intelligence tests ,I.Q, Mental Retardation	15	8	1	1
.7	**Personality**-introduction, definition ,theories and assessment	15	8	1	1
8	**Abnormal psychology** –meaning ,scope and importance	04	2	1	-
9	**Frustration , Conflicts Defence mechanism, Stress - management**	10	8	1	1
10	**Psycho neurotic disorders Psychosomatic disorder**	12	6	-	1
11	**Geriatric psychology**	05	2	1	-
12	**Alcoholism** and **Drug addiction**	10	2	1	-

PHYSIOTHERAPY
BLUE PRINT
I YEAR
PART B – VOCATIONAL SUBJECTS
PAPER – III: BIOMECHANICS & EXERCISE THERAPY (THEOR Y)

Theory : 135 hours Marks : 50

S.No	NAME OF THE UNIT	No. Of Periods	Weightage in marks	Short answer questions	Essay/ Problem questions
1.	**Biomechanics** Mechanical Principles Definition of Biomechanics, kinematics, kinetics, Axis and planes, gravity, center of gravity, line of gravity, base of support, equilibrium, force, type of forces, levers of the body and their mechanical advantage, pulleys, springs, Elasticity.	10	2	1	-
2.	Gait Analysis Definition, stages of gait, pathological gaits	10	6	-	1
3	An introduction to exercise therapy: Aims of exercise therapy, techniques exercise therapy , Goniometry in detail.	**10**	**6**	**-**	**1**
4.	Starting positions	9	2	1	-
5.	Passive Movements Definition, classification, principles effects and uses.	10	6	-	1
6.	Active Movements Definition, classification, techniques, effects and uses	10	6	-	1
7.	Relaxation Definition, techniques of general and local relaxation	5	2	1	-
8.	Mobilisation Introduction, Classification of Joints, limitation of joint range of motion, mobilizing Methods	10	2	1	-

9.	**Muscle strength**	12	6	-	1
	Introduction ,type of muscle work, MMT ,range of muscle work, muscular weakness and paralysis, prevention of muscle wasting.				
10.	**Stretching.** Definition, classification, effects and uses.	5	2	1	-
11.	**Neuromuscular coordination** co-ordination, inco-ordination ,causes for inco-ordination Frankel's Exercises.	9	6	-	1
12.	**Hydro Therapy** Definition indications, contraindications, dangers and precautions.	3	2	1	-
13.	**Breathing exercises,-** definition, types postural drainage.	10	6	-	1
14.	**Posture** Definition, classification	4	2	1	-
15	Walking aids and Gait training	6	6	-	1
16	Massage	2	2	1	-
17.	**Exercise therapy equipments -** *description and uses* Suspension therapy Re-education board, shoulder wheel, finger ladder, parallel bars,ankle exerciser,medicine ball, equilibrium board,supination-pronation wheel, therabands,shoulder pulley, CPM	10	4	2	-

MODEL PAPER
ANATOMY & PHYSIOLOGY
1ST YEAR – PAPER-I
PHYSIOTHERAPY

Marks: 50

<u>Section –A</u>

Note: [i] Answer all the questions
[ii] Each question carries 2 marks. 2X10=20

1. What are the functions of cell?
2. Mention the names of lower limb bones?
3. Name the male reproductive organs?
4. Mention any six movements occurring at joints?
5. Write the names of muscles of Eye ball?
6. What is ESR?
7. Write about heart sounds?
8. Draw the diagram of neuron and label it?
9. Write the functions of skin?
10. Write the functions of thyroid gland.

Section –B

Note: [i] Answer five questions
[ii] Each question carries 6 marks. 5X6=30

11. Classify skeletal system in detail?
12. Explain briefly about the structure of shoulder joint?
13. Explain the structure and functions of heart?
14. Write about the structure and functions of brain?
15. Explain the structure of lung along with broncho pulmonary segments?
16. Write the structure and functions of liver?
17. Write about the structure and functions urinary system?
18. Write about the cellular elements of blood.

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MODEL PAPER
1ST YEAR – PAPER-II
PSYCHOLOGY & ABNORMAL PSYCHOLOGY

Marks: 50

Section –A

Note: [i] Answer all the questions
[ii] Each question carries 2 marks. 2X10=20

1. Define motivation?
2. What is meant by illusion and mention its types?
3. Define thinking?
4. Define aging? What is meant by Id, Ego and Super ego?
5. Define individual difference?
6. What is meant by Id, Ego and Super ego?
7. Define abnormal psychology?
8. What is meant by Amnesia?
9. Write about I.Q
10. What are the symptoms of drug addiction?

Section –B

Note: [i] Answer five questions
[ii] Each question carries 6 marks. 5X6=30

11. Explain various principles of perception in detail?
12. Explain in detail about pure and applied branches of psychology?
13. Write in detail about subjective methods of personality assessment?
14. Write about theory of trail and error in learning?
15. Explain causes, categories, symptoms and treatment of mental retardation?
16. Write in detail about aptitude tests?
17. Explain in detail about Psychoneurotic disorders?
18. Explain in detail about defence mechanism?

MODEL PAPER
1ST YEAR – PAPER-III
BIOMECHANICS & EXERCISE THERAPY

Marks: 50

Section –A

Note: [i] Answer all the questions
[ii] Each question carries 2 marks. 2X10=20

1. Define axis and write its types?
2. Write about Standing position?
3. What is meant by relaxation?
4. Mention the limitations of joint range of movement?
5. Define stretching and mention its types?
6. Write the indications of hydrotherapy?
7. What is meant by ideal posture?
8. Write the therapeutic uses of massage?
9. What is Shoulder pulley; mention the indications and uses of it?
10. What is Re-education board; mention the indications and uses of it?

Section –B

Note: [i] Answer five questions
[ii] Each question carries 6 marks. 5X6=30

11. Define Gait and explain its phases in detail?
12. Explain various Neuromuscular efficiency tests?
13. Define passive movements along with its classification, principles, effects and uses?
14. Classify Active movements and explain in detail?
15. Define muscle strength and explain in detail about types of muscle work and Manual Muscle Testing?
16. Explain in detail about Frenkle’s exercises?
17. Explain in detail about different types of breathing exercises?
18. Explain various crutch walk training methods?