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BIOLOGY

3

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PREFACE

Biology is a rapidly developing branch of science. The major advances being made continuously affect our life on earth. Some of these important advances are included here.

The results of a recent survey on the attitudes towards existing literature available to high school students showed that many were unhappy with the material used in teaching and learning. Those questioned identified a lack of the following: accompanying supplementary material to main text books, current information on new developments, clear figures and diagrams.

This book aims to improve the level of understanding of modern biology by inclusion of the following: main texts, figures and illustrations, extensive questions, articles and experiments. It is the intention and hope of the authors that the contents of this book will help to bridge the current gap in the field of biology at this level.

This book has been carefully reviewed and the language is considered suitable for students for whom English is a second language.

To the students

Being curious students, you may have wondered why you resemble your parents or why you need to breathe. In this book, I try to summarize some major subjects of biology. These are the most promising and perhaps the most complicated subjects of modern biology.

Group work will greatly enhance your learning abilities as well as give you an opportunity to share your knowledge and experience with your friends. I hope that, being assiduous students, you will work hard throughout this academic year and do your best to satisfy your scientific curiosity and, of course, to pass all of your exams successfully.

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CHAPTER 1

SKELETAL SYSTEM

1

Introduction
Bone Structure
Parts of Human Skeleton
Treatment of Fracture
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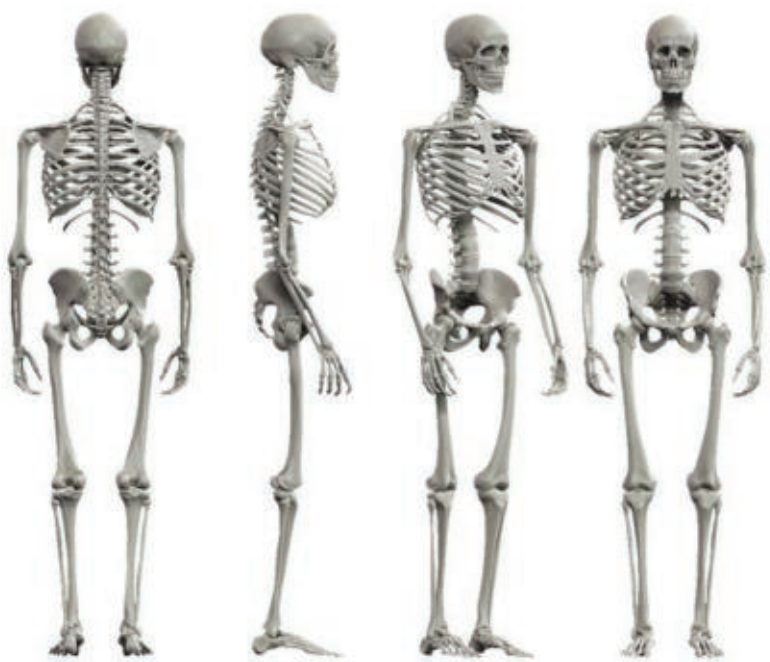
Some Diseases of Skeletal System



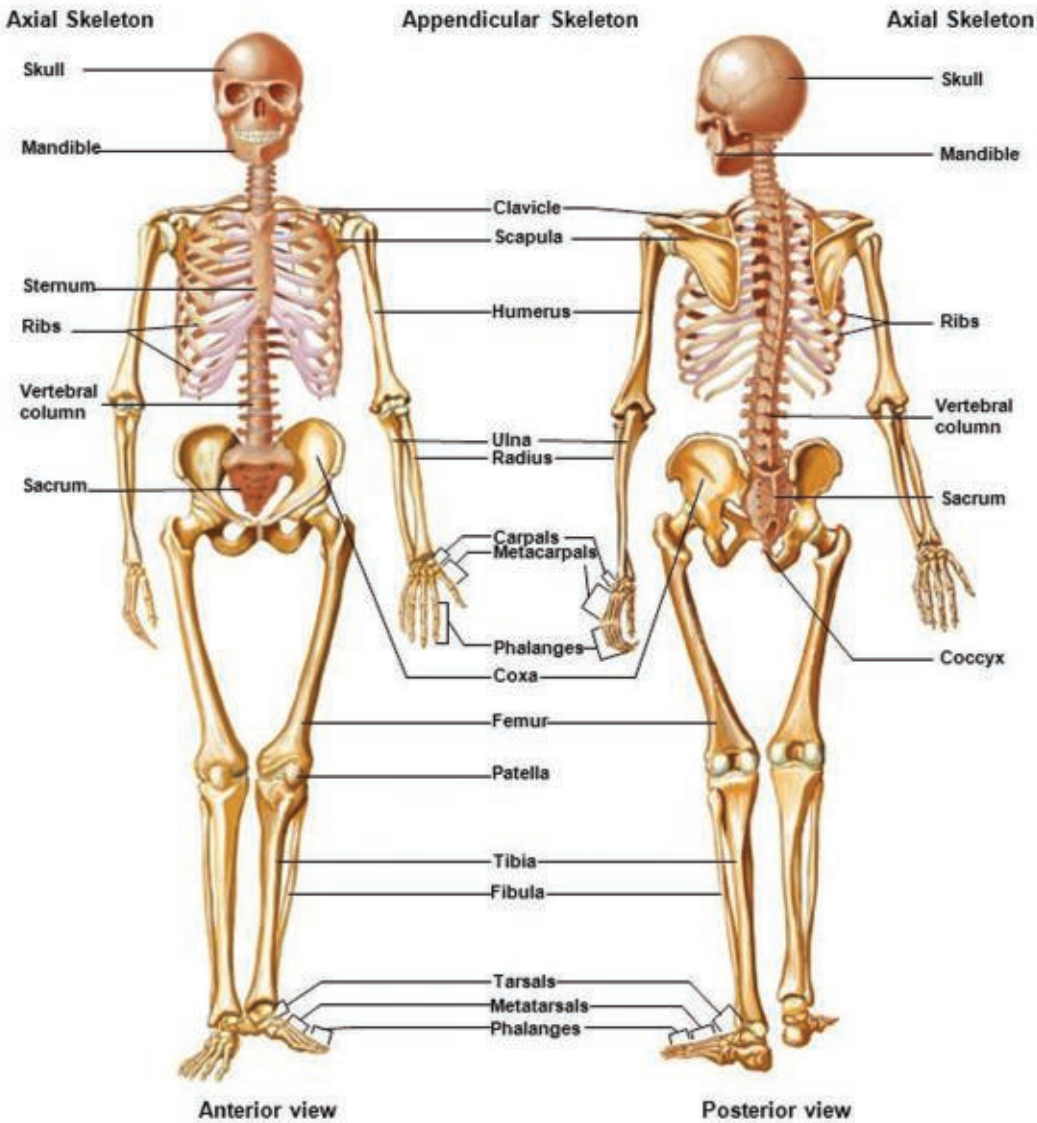
Introduction

The human body cannot keep its balance and harmony of its movements without having a hard support to its soft parts are joined. This support is called **skeleton**.

There is a strong link between the work of muscles and bones, which are together called as **movement system**. Muscles are responsible for generating power necessary for the movement. But muscles usually support the bones, and they change this power into a movement.

Skeletal system works as a rigid support, gives the shape and straightness of body. Parts of the skeletal system are connected with muscles. Besides, some of its parts protect the significant organs from external effects. Thus, the skull protects the brain and the thoracic cage protects the lungs, heart and so on.

Figure 1.1 Human Skeletal system (for study)



Bone Structure

The bone tissue is composed of star-like bone cells called **osteocytes** which are arranged in the form of circles around a central canal called as **Haversian canal**. This canal discovered by Clapton Havers (1657 - 1702). Osteocytes secretes ossein which is the solid substance of bones.

The tissue formation of any bone does not differ one from another except some bones of the head. For this reason, we shall take the femur as an example for studying the tissue formation of all bones.

Parts of bone

Bones in human body are similar in structure but vary in shape and size. As an example;
The femur bone is made up of a body and two ends. The body is covered by an external membrane which contains nerves and blood vessels to nourish the bone. This membrane is called as **periosteum**. After this membrane, the compact bone comes. Compact bone is the hardest bone layer and contains bone marrow inside it.

The two ends are distinguished from the body of bone by being spongy. Spongy bone is not surrounded by periosteum but instead of periosteum, a smooth half-solid layer called as **cartilage** covers it.

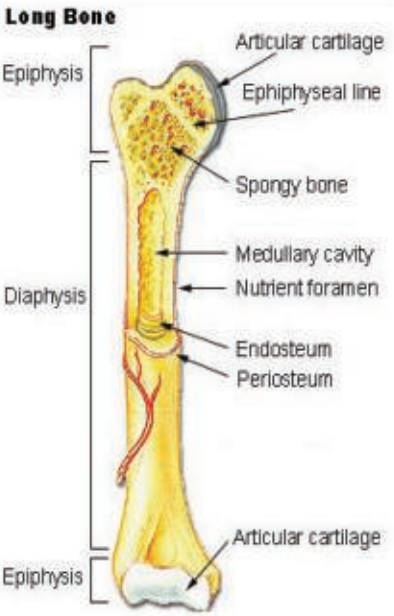


Figure 1.2 Structure of long bone

Chemical structure of bones

Chemically, a bone consists of two major kinds of material; **organic materials** and **inorganic materials**. The percentage of organic materials is %35. These organic materials are colloidal proteins known as collagen and mucous-like substance called as **mucole**. Mucole resembles the albumin (white of egg) and it is important for bone flexibility.

The percentage of inorganic materials is %65. These inorganic materials are phosphate, carbonate, calcium florid, manganese phosphate and sodium chloride (table salt). They are responsible for the hardness of bones.

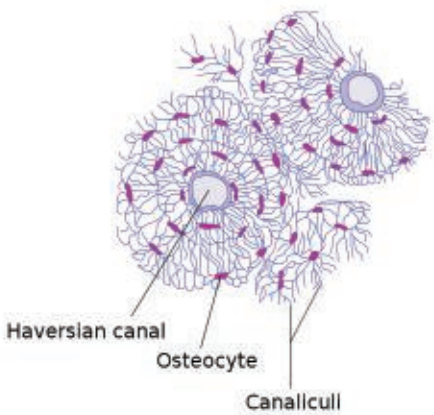


Figure 1.3 Structure of long bone
(Transverse Section)
(for study)

Parts of Human Skeleton

Human skeleton has two main parts, they are axial skeleton and appendicular skeleton.

A- Axial Skeleton

1. Skull

It includes cranial bones, facial bones and tiny bones of middle ear. Skull is composed of 29 bones.

a. Cranial bones

They are eight bones which constitute a small box to protect the brain. Edges of cranial bones are serrated and interlocked into one another. Therefore, they are called **immovable joints.** There is a relatively big hole at the bottom of cranium and this hole is called **foramen magnum** through which the spinal cord passes.

A child's skull is distinguished from an adult's skull by being big in size according to other parts of skeleton but the child's face is relatively small. Also, in the child's skull there are spaces called as **fontanelle** which are located between the bones of head and they are covered with a fibrous cartilaginous tissue.

b. Facial bones

They are 14 bones which surround the eyes (eye sockets), nasal cavity (nasal bones), mouth and also bones of ears. These bones are not moveable except the lower jaw which can move laterally and vertically in order to help cutting, crushing and chewing the food. But the upper jaw is not moveable because it is joined to cranial bones.

c. Ear bones

They are three small bones located in middle ear named as malleus, incus and stapes.

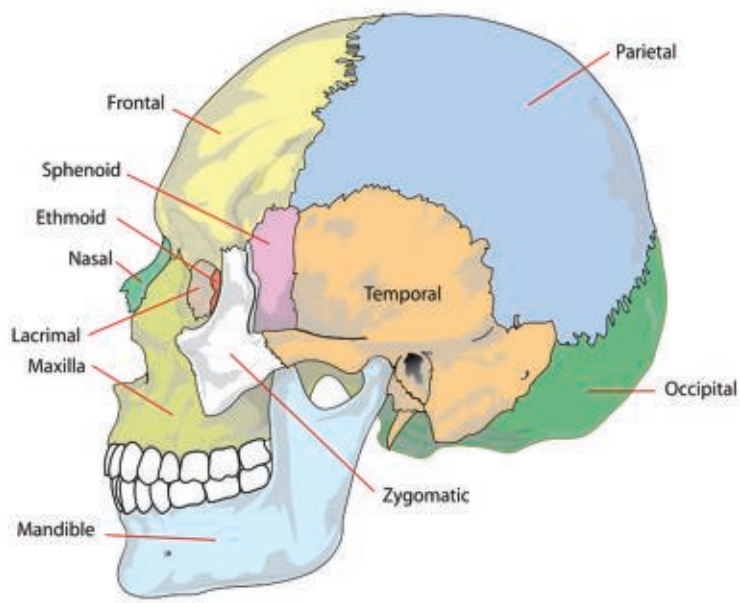


Figure 1.4 Human Skull
(For Study)

Teeth

They are conical or elongated white structures like bones. They help us to cut, tear and grind the food. The teeth are arranged on the jaws. There are 16 teeth on each jaw and the total number of teeth is 32 in an adult person. They are transplanted in the jaws and covered partially with the gums.

Regions of a tooth

A tooth contains three regions; **crown** which represents the visible part of the tooth, **root** which is transplanted in the jawbone and **neck** which is located between crown and root. Also neck is surrounded by the gum.

Structure of a tooth

A tooth is made up of a basic substance called **dentine** which is a very solid substance because it contains calcic materials. Crown is covered with a hard shining white external layer called **enamel**, whereas the regions of neck and root are covered with a rough brown solid substance called **cementum**.

Inside the tooth, there is a cavity called **pulp** in which there are a branched dental nerve and branched blood vessels therefore we can feel the pain, cold, heat and pressure. They enter the tooth through a hole called **apical foramen** located at the bottom of the root.

Types of Teeth and their numbers

a- Deciduous (milk) or Temporal Teeth

They begin to appear after sixth month and are completed after first year; then they begin to fall after sixth - seventh year . There are ten teeth in each jaw. Total number of temporal teeth is 20.

b- Permanent Teeth

They usually begin to appear after the 7th years. Their number is completed after the puberty and the last teeth may delay appearing until age of 32.

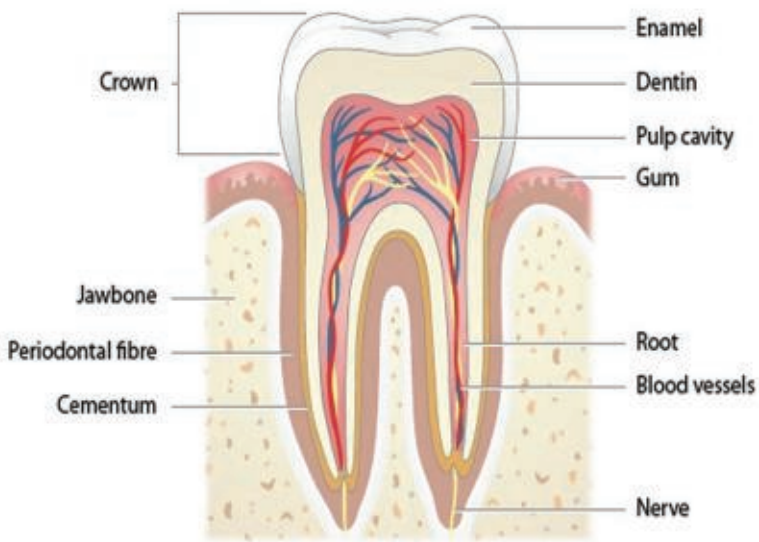


Figure 1.5 Human teeth structure

Health of teeth

1- Teeth must be brushed after eating to remove the food remains and prevent bacteria growth.
2- Visiting the physician periodically to prevent rotten in teeth.
3- Prevent damage of teeth.

Teeth implant

It a process of implanting an artificial teeth instead of a decayed teeth. It is rare because it is economically expensive and takes long time.

Gum inflammation

It is a microbial infection that causes splitting in gums and bad smell breath. Smoking, drinking alcohol and bad nutrition increases the infection probability.

Think!

1. What would happen if all bones in our body are covered by dentine and enamel?

2. Is there any relation between appearance of wisdom teeth and mental development?

2. Vertebral column

The length of vertebral column is 75 cm in an adult. It is composed of 33 bones and each one is called as **vertebra**. There is a cartilaginous disc between two vertebrae. These cartilages enable the vertebral column to bend to different sides, facilitate the movement of vertebrae and prevent the friction of vertebrae.

Structure of a typical Vertebra

Each vertebra consists of following parts:

1. **Centrum;** is a disc-like flat portion tend to the front part according to their positions in the vertebral column.
2. **Vertebral arch;** is located to the backside of the centrum. There is a foramen (hole) between arch and centrum. This hole is called **vertebral foramen**. When vertebrae are arranged vertically, a tube is formed from their rings and this tube is called as **vertebral canal**. Spinal cord passes through this tube.
3. **Processes**; are osseous appendages emerging from the vertebral. One of them is in the middle and this process stands in front of the centrum (body) called **spinous process** and muscles connect to this part. There are two lateral processes called as **transverse processes** for connection of ribs. Also, there are two pairs of processes emerging from vertebral arch articulate the vertebrae one another.

Think!

Do vertebral column become more effective if there were only one type of vertebrae?

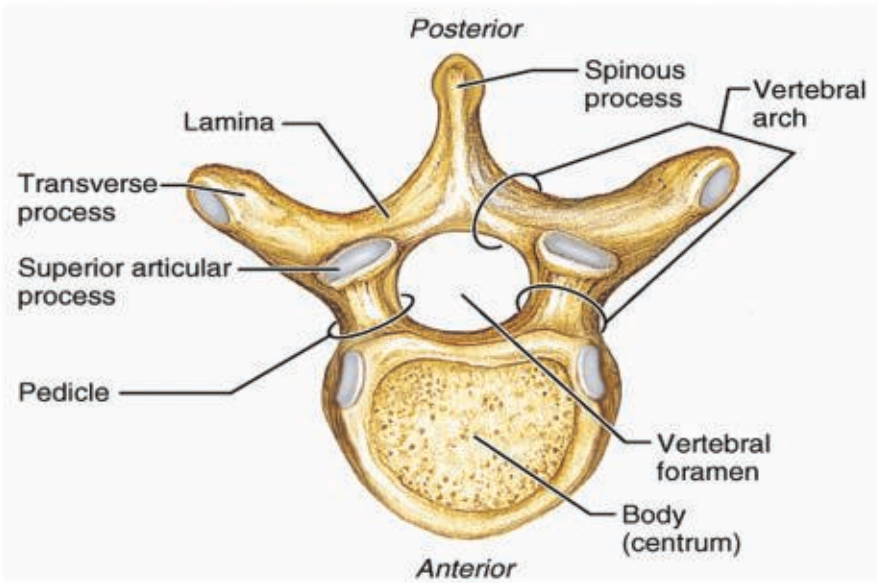


Figure 1.6 Structure of a typical vertebrae

Regions of Vertebral Column

a. Cervical Region

It consists of seven vertebrae. The first cervical vertebra is called **atlas**; it is joined to the bottom of the skull and the second cervical vertebra is called **axis**; it is joined to atlas with a long process at the top of it. Through this connection, the head can easily turn and incline.

b. Thoracic Region

It is made up of twelve vertebrae. Ribs are joined to this region.

c. Lumbar Region

It is composed of five broad vertebrae. Their sides are flat.

d. Sacral Region

It consists of five cohesive vertebrae which constitute a single bone called **sacrum**.

e. Coccygeal Region

It is made up of four vertebrae which are cohesive with one another and they make a single bone called **coccyx**.

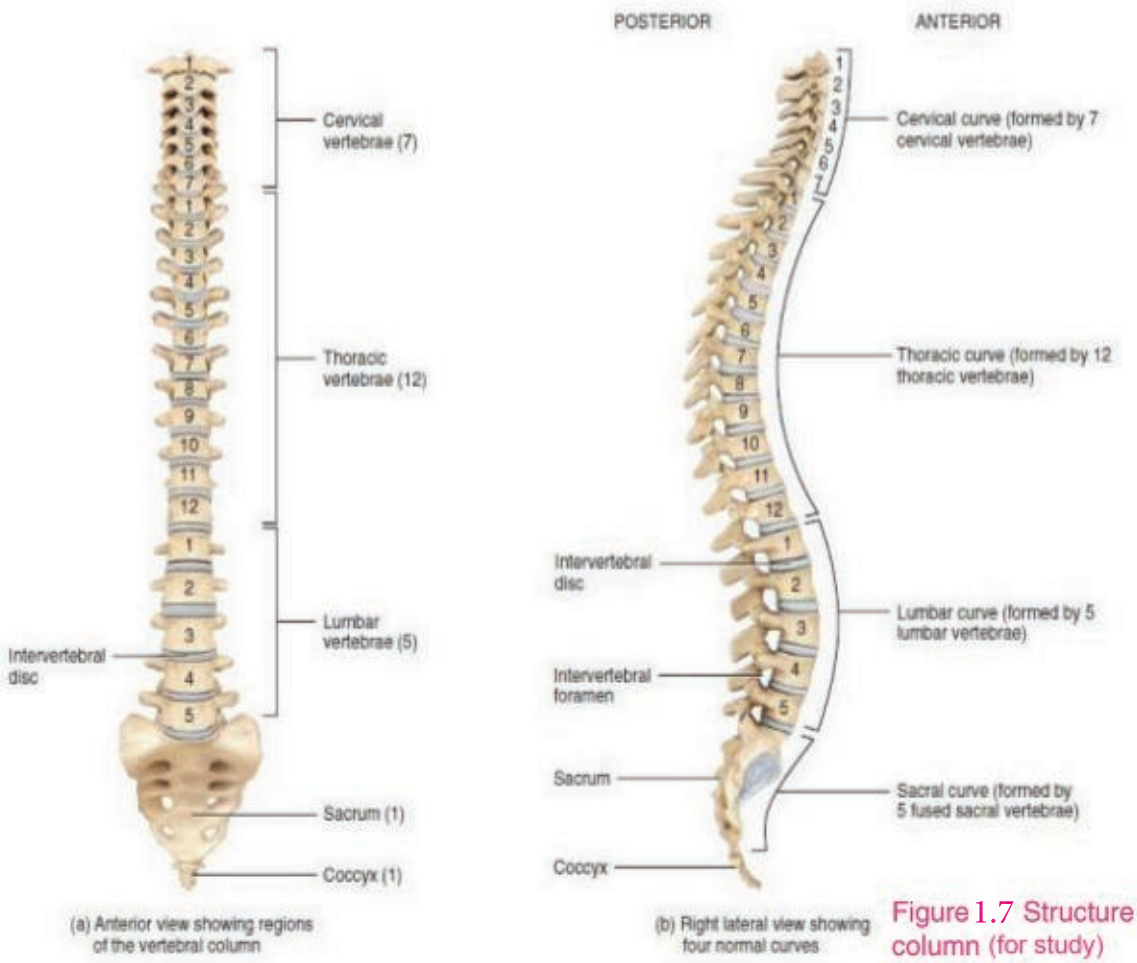


Figure 1.7 Structure of vertabral column (for study)

Thoracic Cage

It consists of **ribs** and **sternum**.

1. Ribs

Human has twelve pairs of ribs, which are articulately connected with the thoracic vertebrae (12 vertebrae) at the back side. But at the front side, the first seven pairs of ribs are directly connected with the sternum by small cartilaginous pieces. These ribs are called as **true ribs**.

There are three pairs of ribs which not connected to the sternum directly. Firstly they connect with the cartilage of the seventh rib and then they are together joined to the sternum by small cartilaginous pieces. These ribs are called as **false ribs**.

The last two pairs of ribs are not joined to anything at the front. Therefore, they are called as **floating ribs**. The cartilaginous pieces are the cartilage-like structures, which present in the front side of the true and false ribs. They are important in the process of respiration since they facilitate the movement of the thoracic cage.

2. Sternum

It is a long level structure which consists of three cohesive bones and it is found in the front of the chest. Its lower end is pointed. From the sides, the true ribs are joined to the sternum by cartilaginous pieces.

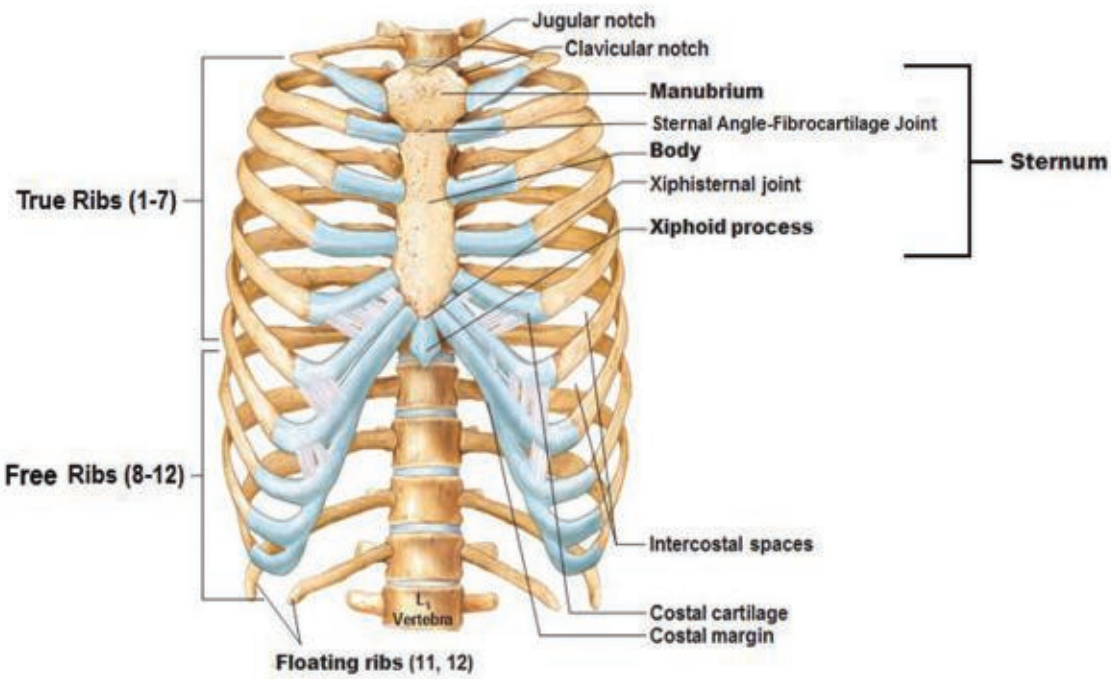


Figure 1.8 Structure of thoracic cage (for study)

B- Appendicular Skeleton

This skeleton is composed of double bones, which are located on both sides of body. Bones of the limbs are jointed to the axial skeleton by means of two girdles; **shoulder girdle** and **pelvic girdle** respectively.

Pectoral Girdle and Upper Limbs

1. Pectoral Girdle

It consists of two bones in each side they are:

a. Scapula is a level triangle-like bone. Its back surface forms a long process which extends to backside. But the front surface is soft and somewhat concave. Scapula is located in the backside of the body outside the ribs and jointed to the muscles of the shoulder.

b. Clavicle is a thin arch-like bone and its position in the body can be felt since it extends between the scapula and the top of sternum.

There is a cavity which is formed from the meeting of the bones of scapula and clavicle, in the shoulder girdle. The head of the humerus settles the cavity and they constitute the shoulder joint.

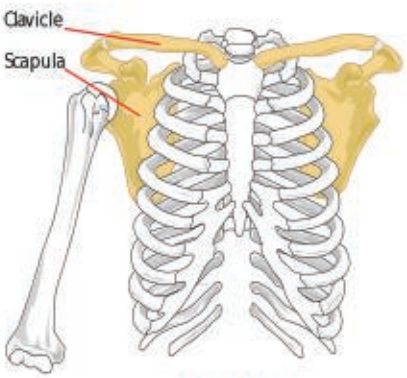


Figure 1.9 Shoulder girdle (for study)

2. Upper Limbs

The upper limb of human is composed of:

a. humerus

It is a long and strong bone. Its upper end is round and forms the head of the upper arm which is articulated with scapula by a joint from the top. The movement of this joint is approximately circular since the head of upper arm is big. From the other side, it is articulated with the bones of the forearm by the **elbow joint**.

b. Forearm

It consists of two long bones; **ulna** and **radius**. Ulna is the longest bone and located in the direction of the little finger. Radius is located in the direction of the thumb. From the top, these two bones are articulated with the humerus and from the bottom with the wrist (carpal bones).

c. Hand

It consists of 27 bones, which are divided into three parts; **carpal bones** (wrist), **metacarpal bones** and **phalanges**. The wrist is composed of eight bones which are arranged into two rows and there are four bones in each row. The metacarpal bones (palm) are made up of five bones which are relatively long. The **fingers** are composed of fourteen bones called the **phalanges**. Each finger contains three phalanges, except the thumb; it contains two phalanges.

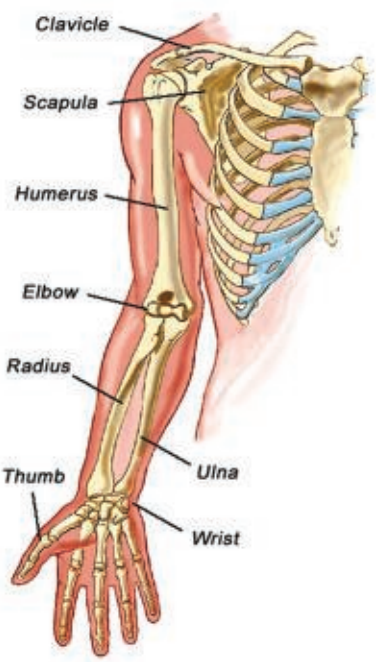


Figure 1.10 Bones of hand (for study)

Pelvic Girdle and Lower Limbs

1. Pelvic Girdle

It consists of two symmetrical halves. Each of them is composed of three cohesive bones: **ilium**, **ischium** and **pubis**.

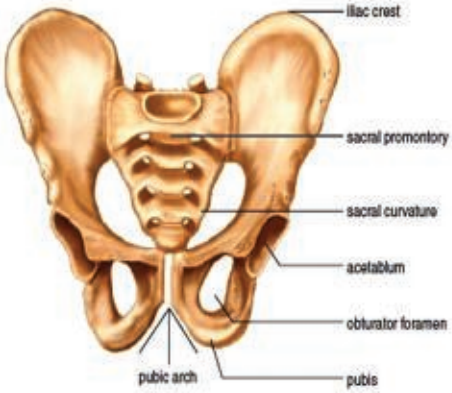


Figure 1.11 pelvic girdle (for study)

The pelvis is like a vessel on which the vertebral column rests. The pelvis is articulated with the lower limbs. Also a part of the intestines and some other internal organs are found in the pelvis. There are some differences between male and female pelvis:

1. Bones of pubis in female are lighter than in male
2. Pelvis is wider in female to facilitate the pregnancy period.
3. Pelvis in female is less deep than in male.

2. Lower Limbs

Lower limbs are made up of femur, leg and foot.

a. Femur

Femur is the longest and strongest bone of the body and it corresponds to the humerus found in the upper limbs. From its upper side, this bone contains a spherical head which enters the acetabular cavity and forms **ball and socket joint**. From the bottom, femur is articulated with tibia by knee joint.

b. Leg

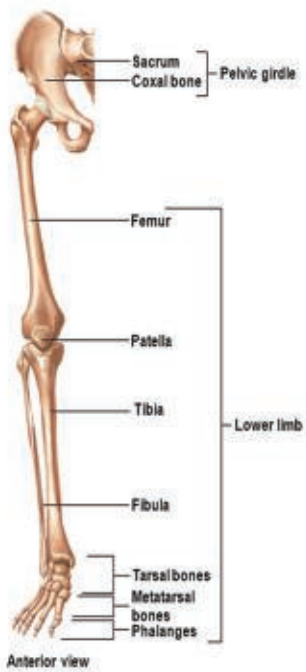


Figure 1.12 lower limbs (for study)

Leg is made up of two bones; one of them is located beside the other one. They are **tibia** and **fibula** corresponding to the ulna and radius found in the forearm, but the fibula does not turn around tibia as the radius turns around the ulna. Because fibula is thinner than the tibia and the two ends of fibula are connected to tibia. Tibia is located in front of the leg under the skin.

Leg and femur constitutes the knee joint. The type of this joint is the hinge. There is a flattened small bone called **patella** in front of the knee joint. The leg is connected to the foot by the ankle joint.

c. Foot

Foot is made up of **26** bones which are distributed into three parts, like in the palm. The first part is called **ankle** (tarsal) which corresponds to the wrist found in the hand. Tarsals are composed of **seven** bones.

The second part is the **metatarsals** which contain **five** bones. The third part is **Toes**, they are composed of **fourteen** bones (phalanges) like fingers and they are distributed in the same way.
It is noticed that the hallux (the big toe) does not move easily like the thumb. So function of foot is walking.

Treatment of Fracture

Fracture is a split of bone (the division of it into two parts or more). It happens as a result of a strong sudden contraction of muscles like the fracture of patella in case of muscle contraction which is connected to patella. Or it happens when the bone is exposed to a direct external shock such as when a hard body falls on the bone or when a bullet hits it. Fracture also happens when one of the bones faces a powerful shock or bone decaying because of a disease like bone tuberculosis, cancer etc. Thus the bone breaks by itself immediately after a natural movement due to its weak resistance.

The rapidity of treating the fracture depends on numerous factors like;

1. Fracture type which hits bone.

2. The age of the person; repair of the bone is quicker and better in younger person.

3. Nutrition; Taking food rich in vitamins and calcium accelerate the treatment.

4. Treatment method; the correct artistic orthopaedics is performed by an expert doctor in case of fracture, he brings back the bone to its right position and then he places a splint of gypsum for a period of time. Then, he monitors the case by taking x-ray photographs of the fracture in order to find out what extent the case has progressed.

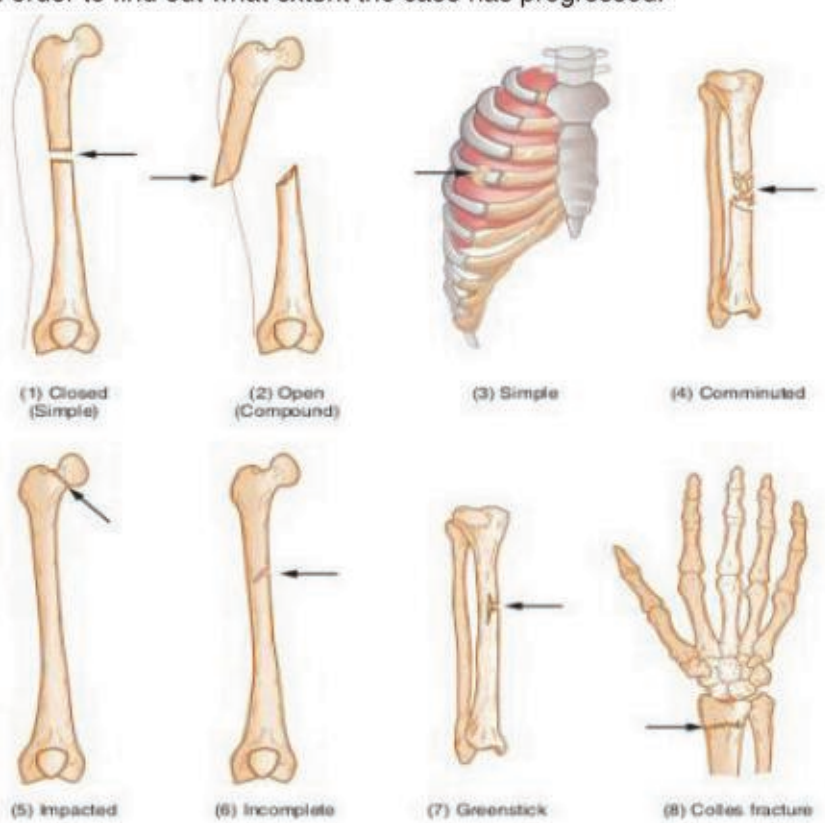


Figure 1.13 types of fractures (for study)

Dis-articulation; is the separation of two bones at their joint, either naturally by way of injury or by a surgical operation. It is different from fracture because in dis-articulation the bone is remain healthy but the fibers which connect two bones are damaged.

Structures Support the Skeletal System

Ligaments: They are strong fibrous bands which connect bones one another. They are flexible. Thus, they allow the bones to move and at the same time they protect the joints from dis-articulation.

Tendons: They are non-flexible firm fibrous cords which connect muscles with bones.

Cartilages: They are white coloured, transparent and strong structures. They can bend without breaking. They cover the heads of bone.

Joints: The meeting points of the bones in the body a joint is the connection between two bones.

Types of joints:

Ball and socket: This type of joint allows extensive movement, such as rotation in many directions. Examples include the joint of the shoulder and hip.

Hinge: This forms the junction of two bones. This type of joint allows movement about one axis. The elbow is an example of this type of joint.

Cylindrical: This also forms the joint of two bones. The junction of the atlas vertebra with the occipital bone is an example of this type of joint.

Immovable Joints: They contain structures or interconnections which hold the closely positioned bone plates together. All cranial and facial bones with the exception of the mandible are immovable.

Specialties of Human Skeleton

There are special characters, which belong to human skeleton and these special characters help straighten the human body and also help move in upright state in walking without the aid of the hands.

The most important characters are:

1- The balance of the skull over the vertebral column enable to balance the skull over the vertebral column and makes his head high. So human can see far objects.

2- The vertebral column is delicate at the neck region and wide at sacral region helps human in bearing the heavy head and the upper limbs.

3- width of pelvis in human, facilitates the balance of the trunk on the lower limbs.

4- The lower limbs are longer than the upper ones, helps human in walking with wide paces.

5- Presence of bending at the hollow of the foot, helps human in walking in a comfortable way, jumping and running easily.

Think !

The bones of arm and leg don`t decay as teeth. Why?

Remember

- Bone growth in human continue until age of twenty by affect of hormones secreted by pituitary gland (in exception of some diseases).
- There are cartilaginous disks between vertebrates.
- There is patella in front of knee joint to protect it but there is no such type of bone in elbow joint.
- Vertebra starts to bend in aging.
- Using synthetic drugs causes bone decay.
- Bone marrow is used in tissue transplant.

Think !

Do children need more calcium than adults? Why?

Activity

Extract the bones of a chicken and observe them. What are the similarities and differences between bones of chicken and human?

Some diseases of skeletal system

a. Rickets

Rickets can be seen in children between 1-2 years. Deficiency of vitamin (D)and not exposing to sunlight are causes of this disease.

Symptoms

1-Retardation in teeth grow, walking and ossification of cranial bones. Also curved legs are one of the symptoms.
2-Patient become nervous and cries much more than other children.

Remedy

1- Visiting the physician and taking necessary drugs that offered.
2- Exposing child to the enough sunlight

Prevention

1- Mother must breast feeding the child, and if necessary supporting the nutrition with enough milk.
2- Exposing the child to enough sunlight especially in winter. But keep away from too much sunlight in summer.

Figure1.14 Children affected by rickets

Review

Q.1- Define the followings:
Periosteum, Fontanelle, Joint, True ribs, Sternum; Cartilages, Dentine, Fracture, Haversian canal

Q.2 Write the causes of the followings:
a- Presence of cartilaginous discs between the vertebrae of the vertebral column.
b- Presence of the cartilaginous pieces at the front side of the real ribs.
c- The lower limbs are longer than the upper limbs.
d- Dentine is a very solid substance in the structure of teeth.

Q.3- Draw the followings:
a- Longitudinal section of a long bone
b- Longitudinal section of a tooth
c- Typical vertebrae

Q.4- Answer the followings:
a- What are the major parts of the skeletal system?
b- Numerate the regions of the vertebral column.
c-What are the parts of the thoracic cage?
d- What are the components of the upper limbs?
e- What are the components of the lower limbs ?
f-What are the specialties of the skeleton in human?
g- What are the causes of fracture?
h-Explain the chemical structure of bone.

Q.5- Complete the following sentences:
a- The vertebral column consists of vertebrae; each one is composed of a wide part called .....
b- The forearm consists of two bones; ..... and ....., the leg consists of ..... and .....
c- The joints present in the skull are .....
d- Thoracic region consists of ..... vertebrates
e- Each finger is composed of..... except the thumb which consists of .....
f- The skeleton consists of ..... and .....
g-The pectoral girdle consists of two bones , they are ..... and .....
h-The tooth is made up of three regions. They are ....., ... and .....

Q.6- Write the location of the followings:
Patella, Scapula, Haversian canal, Sacrum

Q.7- Give an example for each of the following:
Immovable joint, ball and socket joint, A bone disease,

CHAPTER 2

MUSCULAR SYSTEM

2

- Introduction
- Types of Muscles
- Muscular Contraction and Relaxation
- Muscle Fatigue

Introduction

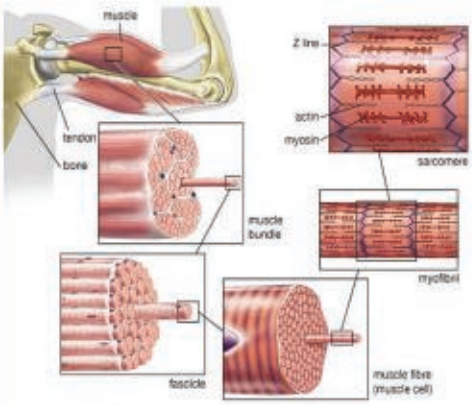


Figure 2.1 Muscle structure (for study)

You have been learned from the previous chapter; muscles are a part of movement system. Muscles and bones give the body its specific shape. There are nearly 600 muscles in the human body. The sizes and the shapes of muscles differ according to their functions.

Muscles give the outer shape of the body and help to perform different movements. Also some of them are responsible for internal body movements such as stomach, intestine and cardiac muscles.

Muscles consist of a special tissue known as muscular tissue; this tissue consists of specialized cells called **muscle fiber** and they are characterized by contraction and relaxation. Some muscles are connected to skeleton. Because of this connection, muscles help to perform total or partial body movements.

Types of Muscles

There are three types of muscles in the human body;

1-Skeletal Muscles **2**-Smooth Muscles **3**-Cardiac Muscles

Skeletal Muscles

These muscles are connected with the bony skeleton and they are responsible for the body movements. When your arm is flexed from the elbow, you will feel a big muscle located on the front upper part of the arm. At this moment, this muscle becomes enlarged and rounded because of its constriction. When your arm is stretched, it becomes longitudinal and pointed. These two conditions show that, this muscle is under your control . For this reason this muscle and others which are similar to this muscle, are called as **voluntary muscles**.

Skeletal muscles consist of many cells called as **muscle fibers**. They are elongated cells and they lie length wise along the line of muscle contraction. Each cell (fiber) contains bright and dark sections alternatively. This structure gives the cell (and consequently the muscle) striated form when it is examined under the microscope. For this reason this type of muscle is called **striated muscle**. Skeletal muscle cells contain more than one nucleus, which is not located in the centre of muscle cell.

Ends of each muscle are connected with a tough cord called **tendon**. These tendons join the muscles to the parts of bony skeleton. The connection of muscles in this form provides the human to move the parts, which are attached to these muscles.

Smooth Muscles

These muscles are found in the walls of the internal organs, such as in the muscular tissue of the bladder, intestines, stomach and uterus. Stomach works by contraction and relaxation of these muscles during food digestion. Stomach walls contain a group of muscles which are not controlled by us (we have no control on their movements). For this reason these muscles and others which are similar to these muscles, are called **involuntary muscles**.

This type of muscles is found in the structure of the internal organs, such as they are found in the structure of the circulatory system except heart. Smooth muscles consist of cells (muscle fibres) which are spindle shaped. These cells contain one nucleus located in the centre of the muscle cell. These cells have no bright and dark sections. For this reason, they are called **smooth muscles**.

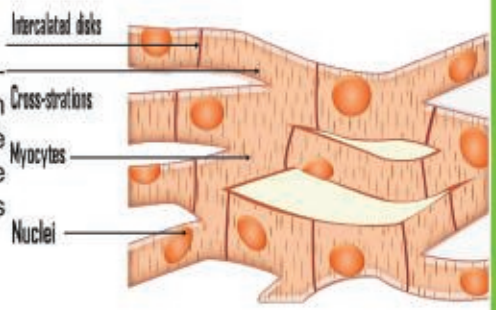


Figure 2.2 Cardiac muscle structure

Cardiac Muscles

These muscles are found in the walls of the heart and they are **involuntary muscles** that are not under our control.
Their cells are striped, short and branched into other branches which are connected with each other.
These cells contain one nucleus located in the centre of muscle cell but sometimes two nuclei may be found. The membrane between cells appears as dark lines which called intercalated disks.

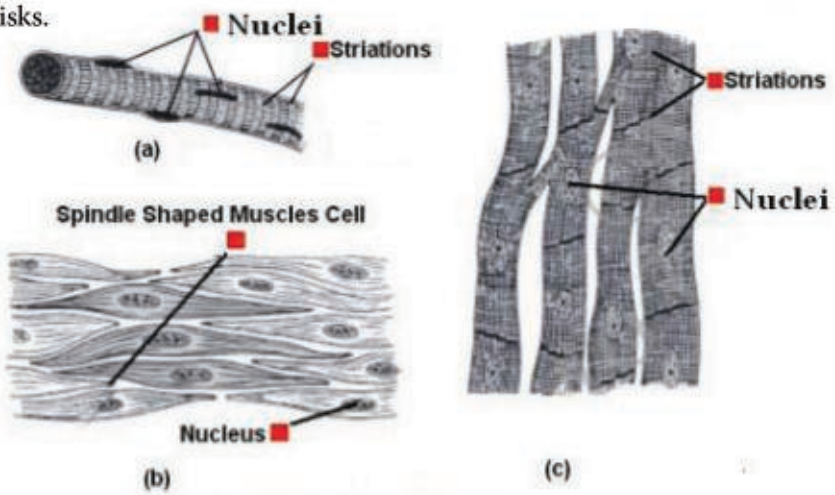


Figure 2.3

a. Skeletal muscle structure
b. Smooth muscle structure
c. Cardiac muscle structure

Activity: Take a piece of meat (muscles) from a sheep or a cow and observe its structure.

Muscular Contraction and Relaxation

When the arm bends through the humerus, the biceps muscle contracts (it is located in the front of the humerus) and the arm moves towards the humerus. When the arm relaxes, the triceps muscle contracts, (it is located behind the humerus) and the arm goes-away from the humerus.

From this example, we can conclude that; the biceps muscle is a contractor, while the triceps muscle is a relaxer. The functions of these two muscles are antagonist (when a muscle contracts, the other relaxes so that these muscles are called as **antagonistic**).

There is also a relaxer muscle when it contracts; the leg straightens in the same line of thigh. There are muscles called **adductor muscles**, which are close to body mid line. When it contracts, the arm becomes closer to the trunk. There are **abductor muscle** which works opposite the closer muscles such as deltoid muscle which surrounds the shoulder. There are **round muscles** which lie obliquely on the neck.

The heartbeats and food movements through the digestive tract (stomach, intestine), are the examples of movement which is resulted by the contraction and relaxation of muscles which are found in the walls of these organs. This operation produces a pressure or a movement on the materials located inside these cavities and this movement pushes the materials into the other parts gradually.

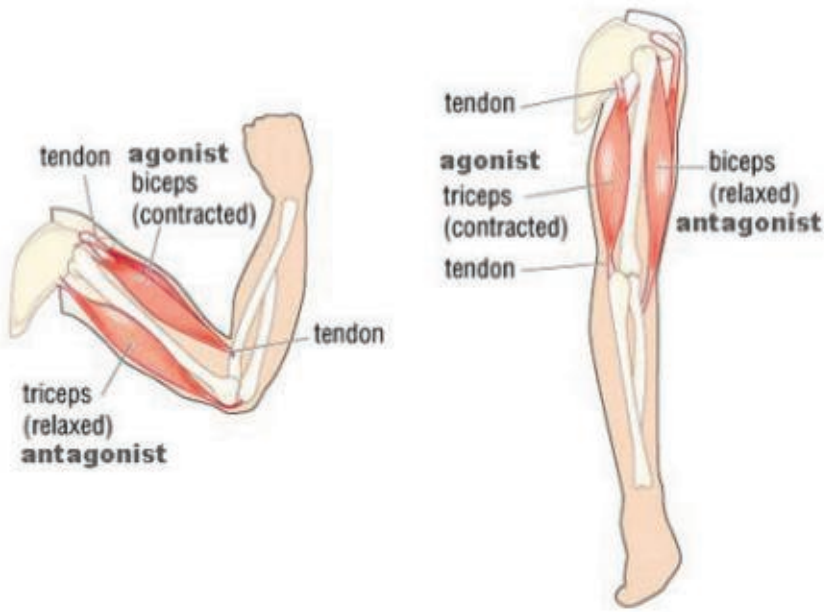


Figure 2.4 Contraction of biceps and triceps muscles (for study)

Muscles receive impulses from nervous system in order to contact and relax. Brain sends electrical impulse to the muscles via spinal nerves and peripheral nervous system. Muscle start to contract and relax depend on impulses from the central nervous system.

Muscle Fatigue

The muscles can not work continuously without stopping, only for a limited period. But if it is forced, the muscle shows weakness in its ability to contraction and relaxation. So it becomes harder and this is called as **muscle fatigue.**

Glucose + Oxygen ⟶ Carbon dioxide + Water + Lactic acid + Energy

Causes:

The muscle fatigue may caused by:

1. Nutritional deficiency in the muscles.
2. Accumulation of toxic waste-materials in the muscles.
3. Weakness of nervous system.
4. Hunger, insomnia and poor ventilation.

Prevention;

1. You should stop working.
2. Provide enough time for relaxation. This helps the body to discharge the accumulated toxic materials from the muscles, to repair the damaged cells and also store the nutrients which are necessary for working of muscles.

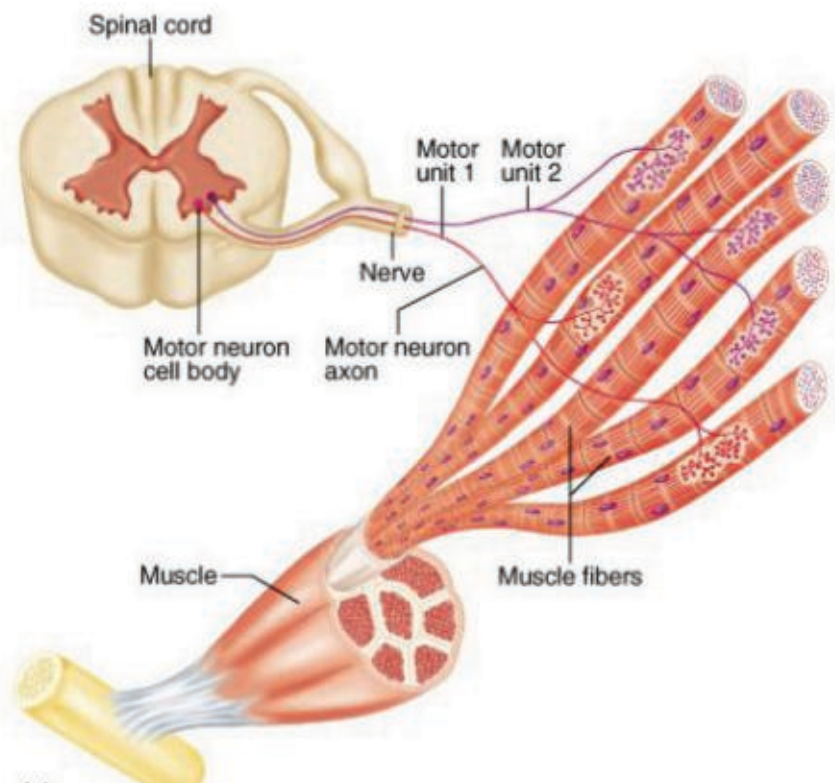


figure 2.5
Neuro-Muscle Synapse
(for study)

Review

Q.1-Define the followings:

Muscle fibers , Muscle fatigue, Tendon, Involuntary muscle, Voluntary muscle

Q.2-Draw the following and write the name of the parts:

1-Longitudinal section of cardiac muscle
2-Longitudinal section of skeletal muscle
3-Longitudinal section of smooth muscle

Q.3- Explain the following:

1-The cardiac muscle and the skeletal muscles are called as striated muscle.
2-The smooth muscles called involuntary muscles.

Q.4-Complete the followings:

1-The number of muscles in human body is ..... muscles.
2-The skeletal muscles are the muscles connected with . ..... and responsible for .....
3-There are three types of muscles in human body which are . ..... , ... and..... .

Q.5-Write the location of the followings:

Biceps muscle, Triceps muscle, Smooth muscle, Round muscle

Q.6-Answer the followings:

1-What are the characteristics of cardiac muscle?
2-What are the methods for preventing the muscle fatigue?
3-What are the differences between skeletal muscles and smooth muscles?
4- Write the differences between the cardiac muscle and the skeletal muscle?
5- Mention the muscle functions.
6- Write the muscle types and mention the characteristics of each of them?
7- Give some examples for voluntary and involuntary muscles.

CHAPTER 3

DIGESTIVE SYSTEM

3

Introduction
Structure of Digestive System
Associated Glands of Digestive System
Digestion
Absorption
Some Diseases of Digestive System

Introduction

The food is considered as a source of energy and this energy is used by human body to sustain life. Most of the ingested food is in a complex form. So, they cannot be used for utilization of body if they are not digested into smaller units. Digestive system consumes the food and break down the food into smaller units to be ready for absorption by the villi and eliminate undigested materials as faeces through defecation process.

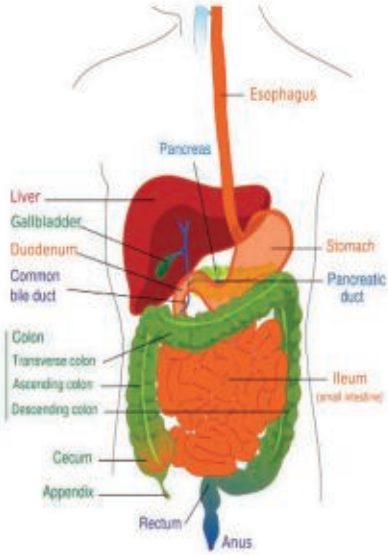


Figure 3.1 Human Digestive System (for study)

Structure of Digestive System

Digestive system is a long tube which starts with mouth and finishes anus. Its diameter becomes narrow or wide according to its position. There are associated glands on this tube such as salivary glands, liver and pancreas; these glands secrete enzymes and other materials into the digestive tract to help the digestion. Digestive system is composed of mouth, pharynx, oesophagus, stomach, small intestine and large intestine.

1. Mouth

It is a cavity surrounded by muscles of cheek, muscles of lips and bony roof covered with mucosa. It ends with pharynx. Mouth is composed of tongue, associated salivary glands and teeth. The teeth are embedded in the gum in the upper and lower jaws.

a. Tongue

It consists of a group of muscles with nerve fibers. The tongue is helps speech, detects the tastes, helps chewing and swallowing of food.

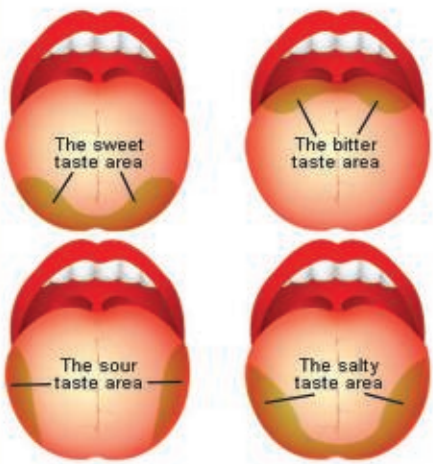


Figure 3.2 Taste Buds on Tongue (for study)

b. Teeth

The main functions of teeth are to cut the food into small pieces and to grind the food. There are three types of teeth according to their function and shape.

There are three types of teeth according to their function and shape;

1. **Incisors**: There are four incisors in each jaw. They are located in the middle of the jaw in the front part of the mouth. The function of incisors is to cut the food.
2. **Canine**: There is a pair of canines in upper and lower jaw on the each side of the incisors. Canines are long and they have pointed ends (cusp). Their main function is to tear the food.
3. **Molar**: There are ten molar teeth in each jaw. Their main functions are to chew and to grind the food.

2. Pharynx

It is a muscular cavity lined with mucosa. It is extended from the mouth to the larynx from the anterior and to the oesophagus from the posterior. Pharynx is separated from the larynx by a soft cartilage tissue called **epiglottis**. Epiglottis prevents the entering of food parts into the trachea.

There are two lymphatic glands on both sides of the pharynx. These glands are called **tonsils**. Also there are two tubes (canals) which open to pharynx near the tonsils and these two tubes connect the pharynx with the middle ear. These tubes are called **Eustachian tubes**.

3. Oesophagus

It is a muscular tube which is extended from pharynx to stomach through the neck, chest and diaphragm and then, it enters the stomach through the cardiac sphincter. It is about 25 cm long. The oesophagus is (covered) with mucosa. Its walls consist of muscular tissue. When these muscles contract and relax, the food and liquid molecules are pushed downward to stomach. This wave like motion is called **peristalsis** and it continues along the digestive tract.

4. Stomach

The stomach is located beneath the diaphragm in the left anterior region of the abdomen. It is a muscular organ which consists of many muscular layers covered with crisped mucosa. Crisped mucosa contains glands which secrete gastric juices to digest the food. Stomach is covered with a thin membrane called **periton** from outside. It has two openings; the upper opening called **cardiac sphincter** and the lower opening called **pyloric sphincter**.

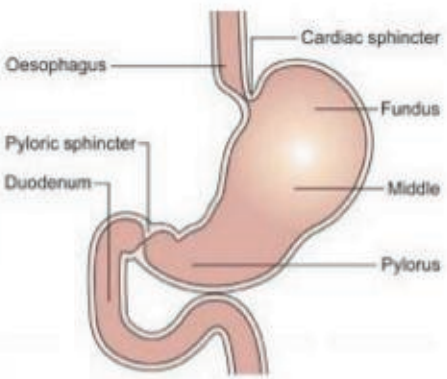


Figure 3.3 Structur e of Stomach

Cardiac sphincter prevents the food and gastric juice from returning to oesophagus. Pyloric sphincter controls the movement of the food into the duodenum and prevents the duodenum contents from returning to stomach.

Functions of Stomach

a- To mix the food by peristalsis.
b- Secretion of **pepsin** enzyme to digest the proteins.
c- Secretion of HCL (%0.2 concentration) to make stomach acidic.
d- To absorb water, some minerals and vitamins through the walls of it.

5. Small Intestine

It is a long and coiled muscular tube which lies in the middle of the abdominal cavity. It is about 6-7 meters and is attached to a special membrane called **omentum**. The small intestine is covered by mucosa from inside and covered by **periton** from outside.

Small intestine consists of muscular layers and the internal surface has tiny finger-like projections called **villi**. They resist the food movement to complete its digestion and increase the surface area for absorption. Villi contain blood vessels and lymph vessels.

Parts of Small Intestine

Small intestine consists of three parts; duodenum, jejunum and ileum.

a. **Duodenum**: It is the first part of the small intestine; it is about 30 cm. Duodenum is a C shaped and surrounds the pancreas. The pancreatic duct and bile duct both drain into duodenum.

b. **Jejunum**: The section of the small intestine situated between the duodenum and the ileum, whose main function is the absorption of nutrients from digested food. This part of the intestine is generally empty after death.

c. **Ileum**: Ileum is the biggest and the final part of the small intestine.

Functions of Small Intestine;

1-Neutralising the food coming from the stomach to small intestine, by the effect of bile.
2-Completing the digestion of the food which consists of carbohydrates, fats and proteins by the act digestive juices secreted by small intestine.
3-Absorbing the nutrients.
4-Pushing the undigested materials into large intestine by its peristalsis.

6. Large intestine

It is the final part of the digestive tract; its length is about 1.5 meters. Its structure looks like small intestine but it does not have villi in the inner surface.

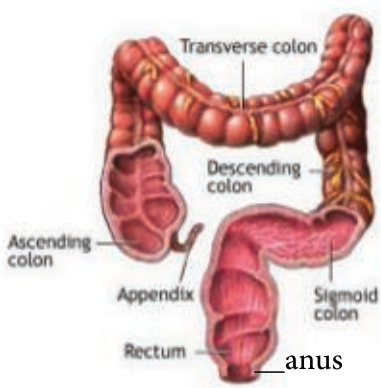


Figure 3.4 Large intestine

Parts of Large Intestine

1. Appendix (Cecum): It is a small (about 7 cm) finger like closed tube It is located in the right-hand lower part of the abdominal cavity.
When the appendix is inflamed, the person suffers from a very hard intestinal colic with coma and vomiting. In this case, the doctor must be visited as soon as possible and appendix is removed by a surgical operation.

2. Colon: It is the second part of the large intestine.
Colon is divided into three parts according to its location inside the abdominal cavity.

a) Ascending colon: In the right-hand of the abdominal cavity.
b) Transverse colon: From the right to the left in the abdominal cavity.
c) Descending colon: In the left part of the abdominal cavity. The descending colon is extended into pelvic cavity.

3. Rectum: It starts after descending colon and it is a straight tube, which is located behind the bladder.

4. Anus: Rectum continues with a short duct, which ends at anus opening.

Functions of Large Intestine

1-Absorbing the water.
2-Storing the undigested food materials for a limited time, until they are eliminated.
3-Pushing the waste materials to outside of the body from the anus by means of contractions and relaxations of intestinal walls.
4-There is no digestion process in the large intestine.

Associated Glands of Digestive System

Salivary Glands

There are three pairs of salivary glands according to their location . They are called **parotid glands**,**submandibular glands** and **sub-lingual glands** according to their locations. These glands secrete concentrated liquid called **saliva**. Saliva contains **ptyalin enzyme** which acts on starch to digest it in the mouth and to convert it into disaccharides. For this reason, the tastes of starchy food become sweet after chewing it.

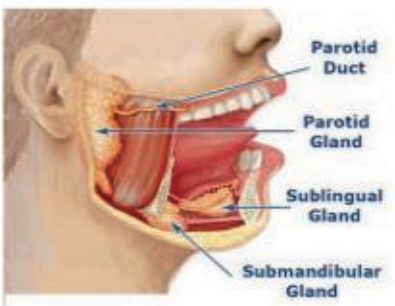


Figure 3.5 Salivary Glands (for study)

Liver

It is a dark red, spongy-like organ. It is covered by periton membrane and is located beneath the diaphragm in the right side of the abdomen, next to stomach. Liver cells produce bile liquid. Liver consists of two lobes (left and right lobes), the right one is bigger than the left one. A small sac under the liver called **gallbladder** stores the bile. It is connected to liver by a duct.

Functions of Liver

The most important functions of liver;

1-Secreting the bile: Bile is a concentrated, dark-green near to yellowish liquid and its taste is bitter. It helps the digestion of fatty materials by breaking them into small pieces.
2-Storing the excess amount of carbohydrates as **glycogen**.
3-Converting the excess amount of proteins into urea. The excess amount of protein is filtered from the blood by kidneys and excreted during urination.
4-Manufacturing the **heparin** enzyme which prevents the blood clotting in blood vessels.
5-Manufacturing the **prothrombin** and **fibrinogen**, which are important for blood clotting.

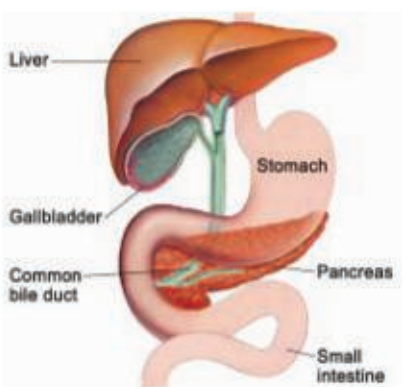


Figure 3.6 Human Liver and Pancreas

Pancreas

It is located between the stomach and duodenum and connected with them by periton membrane. It has a leaf-like shape. The right part of the pancreas is surrounded by duodenum. Inside pancreas, there are tiny ducts which are joined with each other to form the main pancreatic duct.

Digestion

After consuming the food, food undergoes a number of mechanical processes (cutting the food and mixing it with juices) and chemical processes (breaking down the food into smaller units). These processes are necessary for the continuation of life.

Digestion is the breaking down of big food molecules into smaller units to make them ready for absorption. After absorption these subunits are transported to all cells to be used.

Digestion in Mouth

The process of digestion begins in the mouth. The food molecules are cut and ground into smaller pieces by chewing. With the help of the tongue, the food is mixed with saliva which moistens and softens the food. The ground food mixed with saliva is called as **bolus**.

In addition, the saliva contains ptyalin enzyme which acts on the starchy materials and digests them into smaller sugars. By the contractions and relaxations of tongue and pharynx muscles, the food molecules are pushed into oesophagus and then into the stomach. No chemical digestion takes place in oesophagus.

Digestion in Stomach

The food is mixed with gastric juice by the peristaltic movements of stomach. Gastric juice is secreted by gastric glands and contains hydrochloric acid. It also activates the **pepsin** enzyme which converts the proteins into smaller units. After the food molecules mix with gastric juice in the stomach, the food molecules form a concentrated mass. This concentrated mass is called as **chyme**. Chyme is pushed through the pyloric sphincter into the duodenum.

Digestion in Small Intestine

When the food molecules pass into the small intestine, three types of secretions act on them. It involves the following steps.

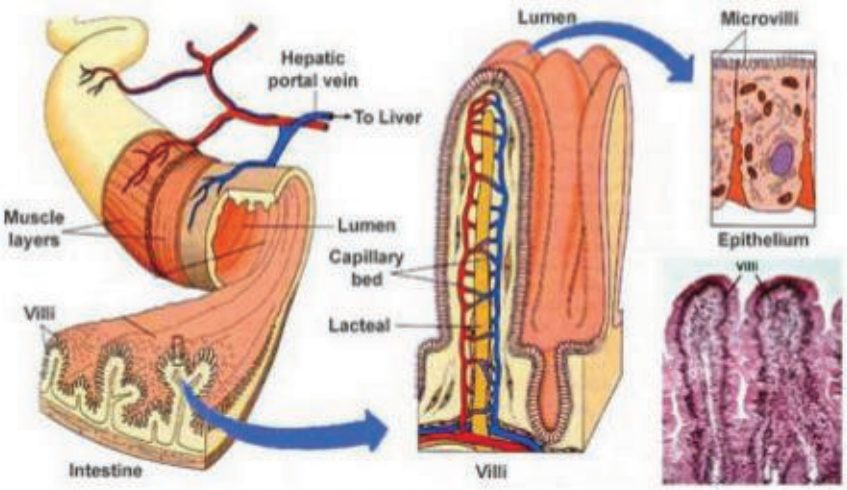


Figure 3.7 Structure of small intestine (for study)

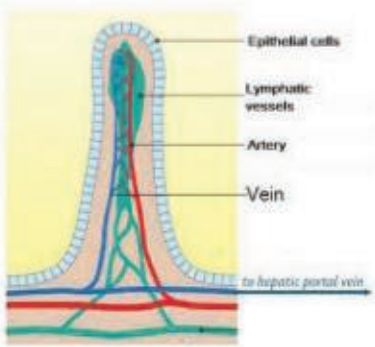


Figure 3.8 Villi

1- The bile is secreted on chyme, bile helps to digest fat.

2- Other pancreas enzymes are secreted to digest proteins and carbohydrates.

3- Food converted to thick white mass called **chyle**, which contains simple absorbed molecules.

4-Absorption: the villi on the inner surface of the small intestine absorb digested nutrients that transported to the blood or lymph then to body's cells.

Some Diseases of Digestive System

Cholera

It is a contagious disease which is spread quickly and causes epidemic cases. It is caused by special bacterium called **Vibrio cholera**. A German scientist **Robert Koch** (1883) discovered this disease in Egypt. Cholera microbes which are found in food and drinks enter the digestive system through the mouth.

Figure 3.9 Vibrio Cholera

Symptoms;

The signs of this disease appear after about two days. Patient has strong diarrhoea and vomiting. The faeces of the patient look like the rice water. In cholera disease, the diarrhoea causes the loss of a great amount of body liquid and the decreasing of body temperature. Because of this, the epidermis (skin) of patient is crisped. Acute inflammation of intestine and food poisoning are distinguished from cholera by causing very strong intestinal colic in addition to diarrhoea and vomiting.

Treatment;

The patient is isolated from residential places to prevent the infection and spreading of this disease. Liquids must be given to the patient to replace the liquids which are lost from the body and special medicines must be given.

Prevention;

The following steps are followed immediately when an infection with this disease occurs;

1- Isolating the patients in hospitals or sanitation places away from residential area and the visiting must be prevented.
2- Confining the people who are in contact with the patients.
3- Supervising the drinking water and its sterilization process .
4- Sterilization of wastes of patient with Lysol or phenol or chloride.
5- Using insecticides for controlling the insects' transporting microbes to prevent contamination.
6- Sterilizing the fruits and vegetables with chloride solution before eating.
7- Informing the people about hygiene. Also sterilization of water and food is announced before consuming these.

Typhoid Fever

It is caused by special bacterium called **salmonella typhi** which infect human by ingestion of food and drinks.

Symptoms;

1- Increasing body temperature and strong headache.
2- Inappetence and tiredness seen.

Treatment;

1- Visiting the physician and starting the necessary treatment as soon as symptoms are observed.
2- Taking large amount of sterilized water and relaxation.
3- Balance the body temperature.

Prevention:

1- Don`t use the patient`s tool and eat unhealthy food.
2- Killing the insects by insecticides because they are carrier.
3- Washing hands with soap after defecation process.
4- Keep the environment clean and taking healthy food.
5- Sterilizing the fruits and vegetables before eating.

Amoebic Dysentery

Amoeba causes this disease. This parasite generally stays inside the large intestine. Then, the parasite enters the intestinal wall. After that, the parasite is transported into the liver, lungs or any other organ. It is caused by drinking the contaminated liquids and eating the unwashed food such as lettuce, turnip, parsley which contain the cysts of parasite.

Symptoms:

The symptoms of this disease starts to appear gradually, the patients feel intestinal colic and light diarrhoea occurs, the faces of patients become soft or watery and smell bad. Also the patient feels emaciation and the body temperature increases slightly. The diagnosis of amoebic dysentery is done by the examination of the faces. This disease changes into chronic amoebic dysentery if the patient is not treated or if the body is low resistant.

Treatment:

The patient is treated by resting in the bed and supplying the light diet (semi-liquid). The patient is treated with drugs for reducing the abdominal colic visiting the physician.

Prevention:

Washing the fruits and vegetables before eating and sterilization of water.

Obesity:

If the food taken into body is more than the body requirement, excess amount of food is stored in the body and cause obesity. Especially fats, carbohydrates such as starch and sugars cause the obesity.

Obesity starts by increasing of the body weight and thickening the skin layers. The obesity increases the blood pressure, and causes diabetes, heart diseases.

The obesity can be treated by regulating the diets, reducing the fats and carbohydrates in the diets and performing the physical exercises regularly. When the body weight starts to increase, the obesity can be prevented by reducing the food intake and performing suitable sports.

Eating more food than body requirement causes many health disor-ders.

Review

Q.1. Define the followings

Ptyalin - Pepsin - Gall bladder – Cecum – Chyle – Villi - Chyme - Tongue - Epiglottis - Larynx - Digestion

Q.2. What are the pathological symptoms of the following diseases

Obesity - Amoebic Dysentery - Cholera

Q.3. Draw the followings and write the names of the parts.

1- Liver and pancreas.
2- Digestive system

Q.4. Write the causes of the followings.

1- Food absorption occurs in the villi (villus)
2- The epidermis is crisped in the person infected with cholera.
3- Presence of villi in the inner surface of small intestine.
4- The taste of bread becomes sweet after chewing it in the mouth.

Q.5. Complete the followings

1-The stomach is located under ..... at the left anterior region of the abdomen.
2-The liver produces..... which prevents blood clotting inside the blood vessels.
3-The saliva contains ..... enzyme, which digests the carbohydrates in the mouth and converts them into .....
4-Ptylin enzyme digests ..... but pepsin enzyme digests .....
5-The small intestine consists of the following parts: ....., ... and .....
6-The associated glands of the digestive system are; ....., ... and .....
7-The stomach has two openings; .....and .....

Q.6. Write the location of the followings

Villi, Liver, Gall bladder, Salivary glands.

Q.7. Answer the followings

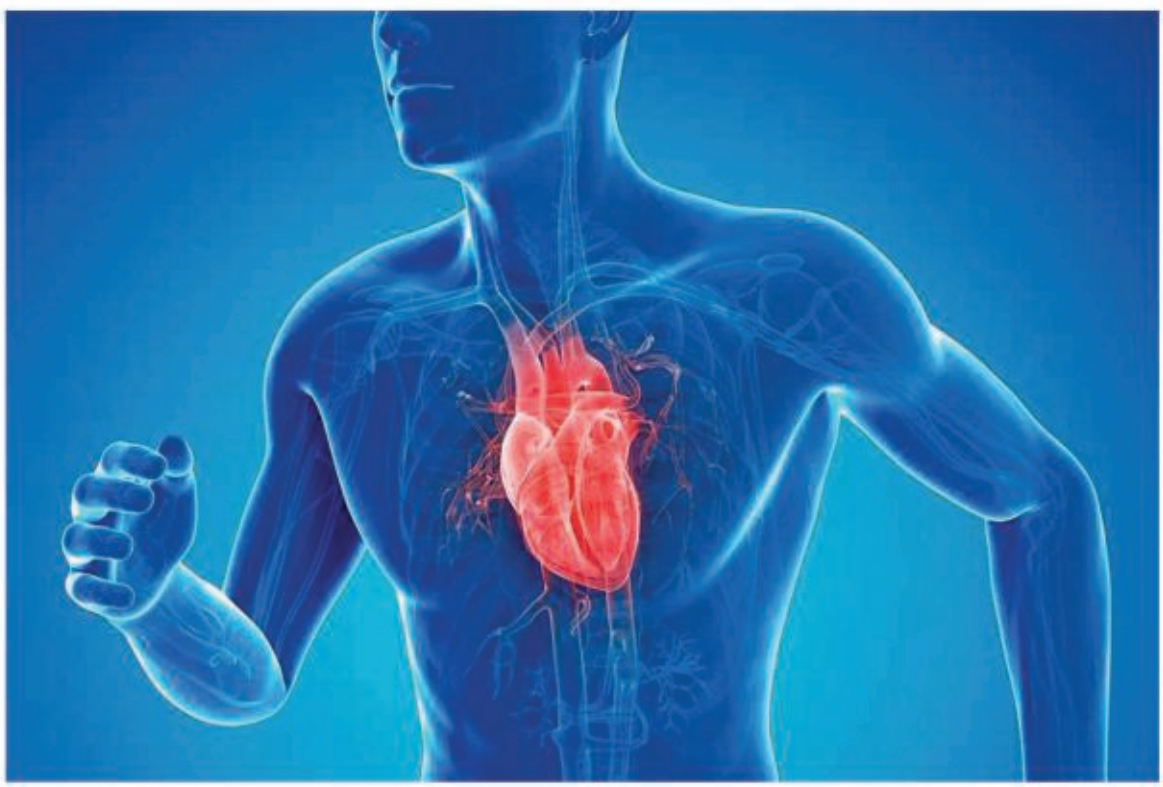
1- What are the accessory glands of digestive system?
2- Explain the digestion in the mouth briefly.
3- What are the differences between the symptoms of cholera and symptoms of typhoid?
4- How does the digestion processes happens in the small intestine?
5- Count the parts of digestive system.
6- What are the functions of liver?

CHAPTER 4

CIRCULATORY SYSTEM

4

Introduction
Blood Circulation System
Types of Blood Circulation
Blood Groups
Blood Clotting
Blood Transfusion
Lymphatic System
Some Diseases of The Circulatory System



Introduction

The human circulatory system performs different functions such as:

-Transportation of oxygen and carbon dioxide absorbed nutrients and hormones to the body tissues.
-Transportation of waste products to the excretory organs
-Distribution of heat in the body by means of blood and lymph liquids circulating in reticular vessels which are diffused in the body.
Circulatory system consists of **blood circulation system** and **lymphatic system**.

Blood Circulation System

Blood constantly flows in the closed vessels. Blood starts to circulate from the heart and returns to the heart again. The heart pumps the blood into the arteries. The ends of the arteries are branched and composed of fine capillaries distributed between the body cells. Then, these blood capillaries are accumulated in the veins that transport the blood to the heart. And this cycle repeats. Blood circulation system consists of **blood**, **heart** and **blood vessels**.

Blood

It is a red coloured, viscous liquid. It is composed of plasma and blood cells. The blood forms about 7% of total body weight and its volume is 4-6 litres in an adult.

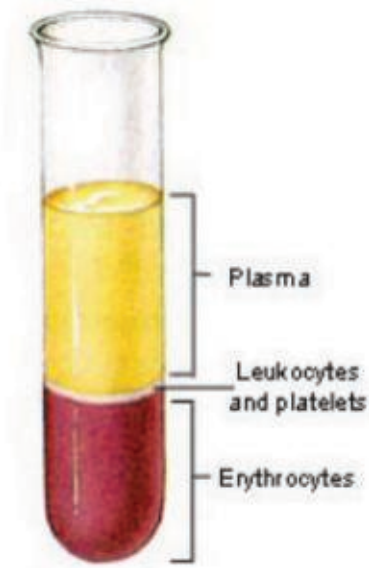


figure 4.1 Structure of Blood (for study)

Structure of Blood

1. Plasma

It is a clear yellow liquid, which makes up **55%** of the total volume of blood. It consists of 90% water and 10 % dissolved materials such as absorbed nutrients, salts, antibodies, hormones and some waste materials. Other blood contents float in the blood plasma.

2. Blood Cells

a. Red Blood Cells: Erythrocytes

They are disc shaped cells and thinner in centre. Red blood cells lose their nuclei after a short time of its formation. Its diameter is about 8 micron (1micron = 1/1000 millimetres). There are about 5.2 million red cells in $1mm^3$ of the male blood and there are about 5 million red blood cells in $1mm^3$ of female blood. The red blood cells contain red pigment called **hemoglobin** that carries O_2 and CO_2 in the body. The hemoglobin is a special protein and contains iron. Reduced of red blood cells or hemoglobin in the blood causes **anaemia**. They are formed in the spleen and liver in children before birth while they are formed in the bone marrow after birth.

The life period of each red blood cell is about 120 days. The new red blood cells are replaced instead of the old ones. The iron of worn out red blood cells are stored in the liver and bone marrow to produce new red blood cells. They transport O_2 from lungs to body tissues and CO_2 from body tissues to lungs.

b. White Blood Cells: Leukocytes

They are colourless and inconstant (amoeboid) shaped. They have nuclei. Their diameter is about (6-15) micron. There are about 6000 cells in $1mm^3$ of the female blood and there are about 8000 cells in $1mm^3$ of the male blood. They defence body by attacking invading microorganisms or by producing antibodies. The number of white blood cells increases in cases of inflammation, infection with some microbes like bacteria and blood cancer like leukemia. White blood cells are formed both in bone marrow and lymph nodes.

White blood cells found in second group have ability to penetrate the walls of blood capillaries. After its cells are elongated and forms pseudopodia, they act as scavengers and collect the last parts of dead cells and micro-organisms found between the tissue cells. They provide acquired immunity to the body against diseases.

There are two groups of white blood cells;

1-Granulocytes; they have granular cytoplasm and lobulated nuclei. They are formed in bone marrow.

2-Agranulocytes; they have non- granular cytoplasm, and unlobulated nuclei. They are formed in lymph nodes.

c. Blood Platelets: Thrombocytes

They are very tiny discs or oval shaped cells. They have no nucleus. Its diameter is about 2 micron. There are about 250000 platelets in $1mm^3$ of blood. Platelets are originated from platelet-producing cells found in the bone marrow. They provide blood clotting after an injury or a bleeding. The platelets come together and form clumps in the area of injury.

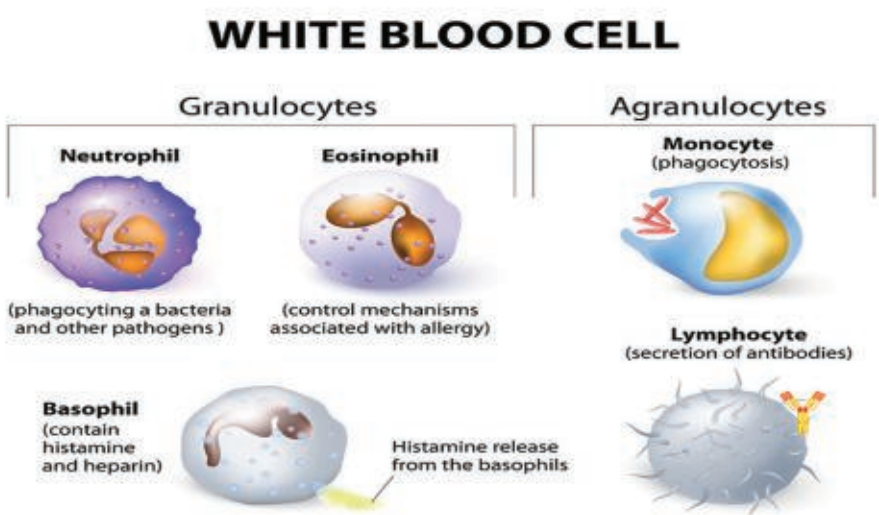


Figure 4.2 White Blood Cells Types

Heart

Heart is a conical muscular organ found in the chest cavity between the lungs, slightly to the left. You can feel heart beats in the left region between the fifth and sixth ribs. From outside, heart is surrounded by a double membrane called the **pericardium**. There is a fluid between the two membranes. This fluid decreases the friction and provides the working of heart easily.

Anatomically the heart consists of two sides, right and left. These sides are separated by a muscular wall (septum) and each side is divided into two chambers **(atrium and ventricle)**. So the heart is composed of four chambers; 2 atria and 2 ventricles.

Atria are small chambers found at the top of the heart and they have thin walls. **Ventricles** are bigger chamber found at the lower part of heart and they have thick walls. Atria and ventricles are separated from each other by valves. They are:

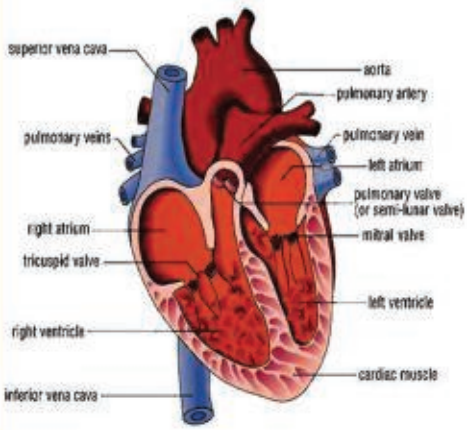


Figure 4.3 Heart Structure
(for study)

1-Tricuspid valve is found in the right side of the heart. It separates right atrium and right ventricle. It has three cusps. So that, it is known as tricuspid valve. It controls the flow of blood from atrium to ventricle

2-Mitral valve (bicuspid) is found in the left side of the heart. It separates left atrium and left ventricle. It has only two cusps. So that, it is known as mitral valve (bicuspid). It prevents the back flow of blood.

3-Semilunar valves are two valves. One of them is found between the left ventricle and aorta (aortic valve). The other is found between the right ventricle and pulmonary artery (pulmonary valve). They prevent the back flow of blood into the right and left ventricles from the aorta and the pulmonary artery.

Heart Beat

The contractions and relaxations of the heart are called as **heart beats.** The number of heartbeats in a healthy person is about **72** beats in a minute in resting.

Blood Vessels

There are three types of blood vessels in human body.

These blood vessels are;

1-Arteries.
2-Veins.
3-Capillaries.

1. Arteries

They transport blood from heart to body organs. All arteries transport oxygenated blood except pulmonary arteries. The colour of this blood is bright red. They are fibrous muscular tubes and they have thick walls. They are located deeply in the body except radial artery located at carpus which is found under the skin (physician can feel the patient's pulse from radial artery). Blood flow is provided with the pressure formed by ventricular contractions in arteries. Cutting of any artery causes loss of great amount of blood and stopping this bleeding is very difficult.

2. Veins

They transport blood from body tissues to heart. All veins transport de-oxygenated blood except pulmonary veins. Their walls are thinner and less elastic than the walls of arteries. Veins are closer to the body surface. The colour of de-oxygenated blood is bluish-red. There are small valves inside the veins to prevent back flow of blood because there is no pressure in veins which provide blood flowing. The flowing of blood in the veins is slowl. So when it is cut, the bleeding can be stopped easily.

3. Blood Capillaries

They are microscopic vessels between the ends of arteries and beginnings of veins. Their walls are very thin and they have no muscles. Also their walls are covered by single layered epithelial cells. The flowing of blood in the blood capillaries is slow and their thin walls make the material exchange easier between blood and body cells also white blood cells can move through the walls of capillaries easily.

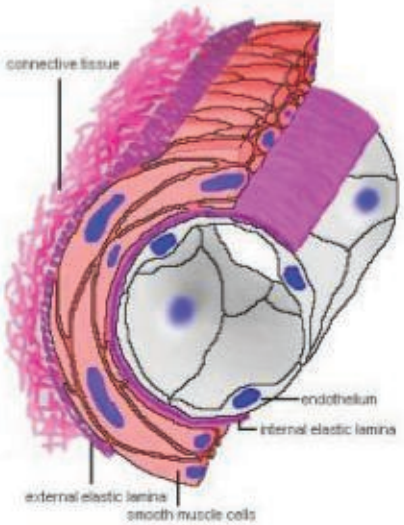


Figure 4.4 Structure of artery
(for study)

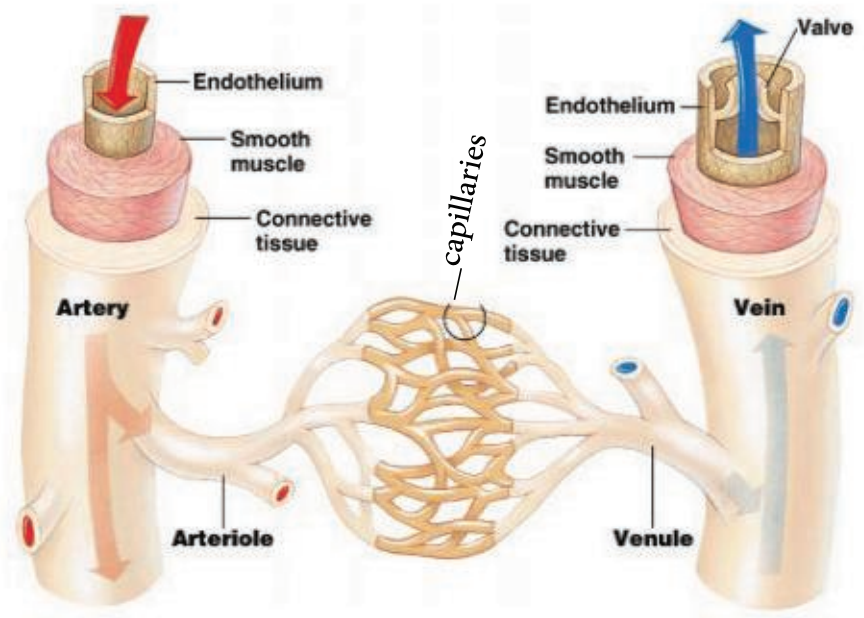


Figure 4.5 Blood vessels
(for study)

4. Blood Vessels Connected with Heart

A- Veins

1-Superior Vena Cava: It collects de-oxygenated blood from the body parts located above the diaphragm and transports it to right atrium.

2-Inferior Vena Cava: It collects de-oxygenated blood from the body parts located below the diaphragm and transports it into right atrium.

3-Pulmonary veins: There are four pulmonary veins. They collect oxygenated blood from lungs and transport it into left atrium.

4-Cardiac (coronary) veins: a group of small veins collect the de-oxygenated blood from the heart muscles. These small veins are connected with each other and form a vein which ends at right atrium.

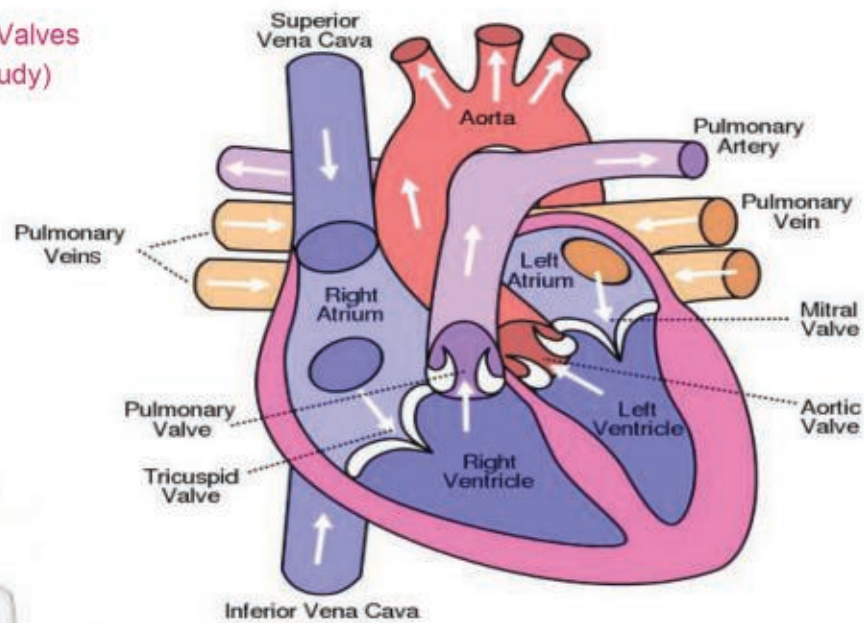
B- Arteries

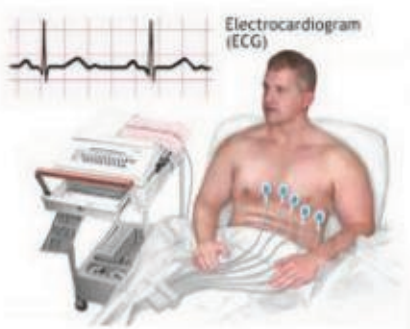
1-Pulmonary artery: It transports the de-oxygenated blood from right ventricle to lungs; it is branched into two parts and each branch goes to each lung.

2-Aorta: It is the largest blood vessel and the most branched vessel. The aorta extends from left ventricle it transports oxygenated blood from heart to all body tissues (except the lungs).

3-Cardiac (coronary) arteries: pair of small arteries branch from the aorta just as it emerges from the heart. They nourish the heart muscles.

Figure 4.6 Heart Valves and Artries (for study)





ECG (Electrocardiogram)

It is a special machine that draw the contraction and relaxation of atria and ventricles. Contains electrical poles which are positioned on chest, arms and legs of the patient. It`s importance is to give information about heart activities.

Types of Blood Circulation

There are three main types of blood circulation in body.

1- Systemic Circulation (Large Blood Circulation)

1-It occurs between heart and other body parts. The aim of this circulation is to transport oxygen to all body cells and remove poisonous carbon dioxide from these cells.

2-The aorta branches into smaller arteries, arterioles and capillaries respectively. From capillaries, oxygen and food molecules are given to body cells. Carbon dioxide diffuses into blood so blood becomes de-oxygenated.

3-The blood flows from capillaries to veins. These big veins transport the de-oxygenated blood to right atrium. Systemic circulation is completed here and pulmonary circulation follows it and these cycles are repeated again and again.

2- Pulmonary circulation (small blood circulation)

1-It occurs between heart and lungs. The aim of pulmonary circulation is to charge blood with oxygen and to remove the carbon dioxide from body. The de-oxygenated blood coming from all body cells is carried to right atrium through the superior and inferior vena cava.

2- The blood flows from right ventricle. into the pulmonary arteries pulmonary arteries divide into capillaries which surround the gas exchange units. These units are called **alveoli**. Air diffuses from alveoli into the capillaries and carbon dioxide in blood pass into alveoli to be exhaled.

3- In the lungs, blood becomes oxygenated, pulmonary veins transport oxygenated blood to heart again

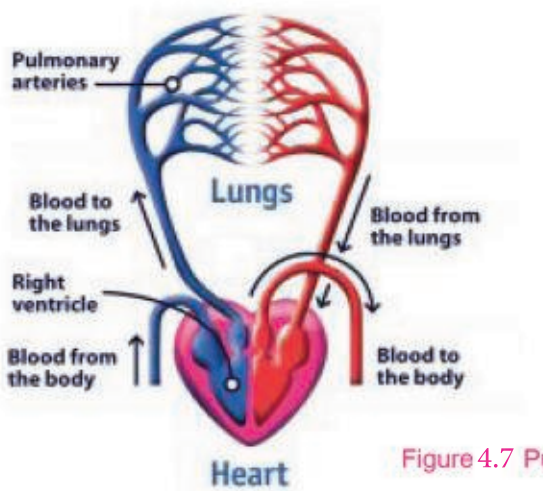


Figure 4.7 Pulmonary Blood Circulation

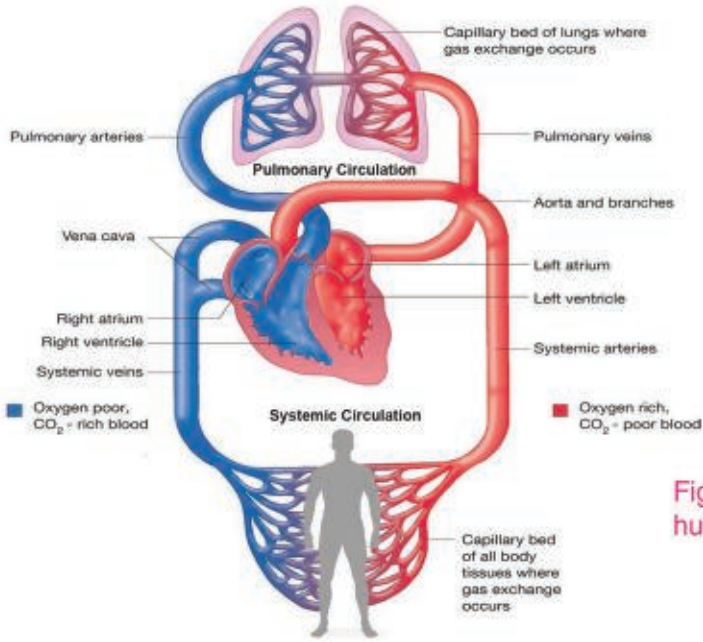


Figure 4.8 Blood circulation in human body (for study)

3- Portal Circulation

1-Portal circulation is a part of the systemic circulation.

2-The blood coming from the digestive organs **(Intestine)** which contains absorbed nutrients does not go directly into the heart.

3-Blood goes to the liver by the portal vein which enters the liver. Liver regulates the amount of nutrients in the blood.

4-hepatic vein which leaves the liver, delivered blood into the inferior vena cava which transports it to the heart.

Blood Groups

There are **four** different blood groups. Examining the blood groups is important during blood transfusion from one person to another. If the blood of **donor** (who gives blood) does not fit the blood of **recipient** (who takes blood), red blood cells will be deposit in some organs and tissues, these groups are:

1-Group (A)
2-Group (B)
3-Group (AB)
4-Group (O)

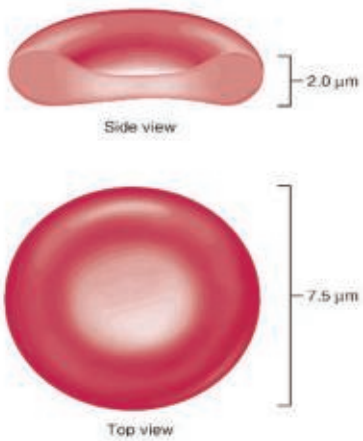
(O)blood group can give blood to all groups so it is called **general donor** and AB blood group can accept blood from all others so it is called **general recipient**.

Blood Group	A	B	AB	O
A	Can Recieve	Can't Recieve	Can't Recieve	Can Recieve
B	Can't Recieve	Can Recieve	Can't Recieve	Can Recieve
AB	Can Recieve	Can Recieve	Can Recieve	Can Recieve
O	Can't Recieve	Can't Recieve	Can't Recieve	Can Recieve

Table (5.1) Blood Transfusion Between Blood Groups

Rh factor

Some people have another protein in the surface of their red blood cells called **Rh factor**, or **lyzen** while some people do not have this factor. If the surfaces of the RBCS contain Rh factor, this blood is called as **Rh (+)**. If there is no Rh factor on the surface of the RBCS. this blood group is called as **Rh (-)**. 85% of people are Rh (+) and 15% of people is (Rh-).



This factor must be examined during blood transfusions. Rh (+) bloods can accept from both Rh (+) and Rh(-) but Rh (-) bloods can accept from only Rh (-). This factor also affects the marriages. If the blood group of mother is Rh (-) while father's is Rh (+), the Rh (+) fetus will be in danger. Because the mother's body can produce antibodies against the antigens of baby.

Blood Clotting

It is the solidification of the blood to stop bleeding to prevent blood loss from an injury. In some people, this process is not carried out properly depending on a genetic disease called **hemophilia**. In hemophilic people, a simple wound or an accident may cause death because of losing so much blood.

How does blood clotting occur?

1-When a bleeding occurs, the blood platelets are broken and release a certain enzyme called **thromboplastine**.This enzyme converts the **prothrombin** into **thrombin** by means of the calcium ions.

2-Thrombin converts the **fibrinogen** into **fibrin** which is a sticky substance.

3-Fibrin collects the red blood cells and platelets and forms a solid mass. The blood clot closes the injured area, so bleeding stops.

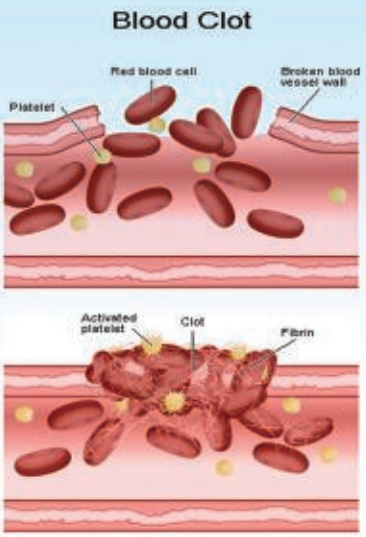


Figure 5.8 RBCs and Blood Clotting (for study)

Blood Transfusion

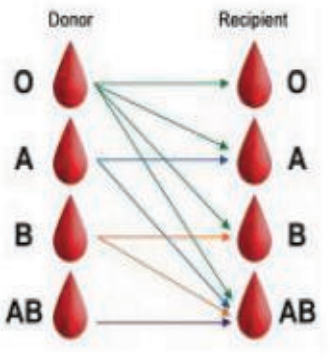


figure 4.10 blood transfusion between blood groups

Blood manufacturing is not possible in factories or laboratories, because blood contains living cells. Also all trials are failed to use the animal's blood instead of the human blood or to substitute the loss of the blood. For this reason the human can receive blood only from another human. Blood donation is a national and humanitarian serves.

There are some conditions to blood transfusion:

1- The age of person who donor blood mustn't be younger than 17 and older than 55.

2- Woman who donor blood must not be pregnant or nursing the child.

The hospitals store the blood in glass tubes or plastic containers which contain heparin. **Heparin** prevents the blood clotting during the blood storage and blood must be stored in special refrigerators. Also each container must be labelled by writing the blood group and donation date. If the blood is stored more than three weeks, this blood can not be transfused to the patients.

Lymphatic System

the lymphatics system composed of lymph, lymphatic vessels, lymph nodes (glands) and some organs. During the circulation in capillaries, the water, simple food nutrients and oxygen diffuses into the intercellular space.

Additionally, small quantity of blood plasma is filtered into the intercellular space. This plasma is called as **tissue fluid**, when this fluid is absorbed by the lymphatic vessels, it is called **lymph**. The structure of the lymph looks like the blood but it does not contain red blood cells. The lymph contains white blood cells which penetrates the walls of blood capillaries by means of amoebic motion.

Lymphatic vessels

Lymphatic vessels collect the lymph or tissue fluid and waste products from the intercellular space and transport them into the blood. Also there are valves in lymphatic vessels which provide the flowing of lymph in one direction.

Lymphatic Nodes

In the meeting points of lymph vessels, some swellings form. These swellings are called as **lymph nodes**, or lymph glands. These nodes contain a great amount of white blood cells. They clear the lymph from bacteria and other harmful materials.

The lymphatic nodes are distributed in different body parts such as limbs and neck **(tonsils)**. These nodes may swell and may be inflamed as a result of resistance against bacteria.

Lymphatic Ducts

Lymphatic ducts are distributed in different parts of the body. Their contents are secreted into two main ducts:

1- Right lymphatic duct: It collects the lymph from upper right parts of the body, head, neck, trachea and some parts of the liver and transports it into the right subclavian vein near the heart.

2- Left lymphatic duct, or thoracic duct: It is the largest lymphatic duct in the body. It collects the lymph from the other parts of body and transports it to the left subclavian vein.

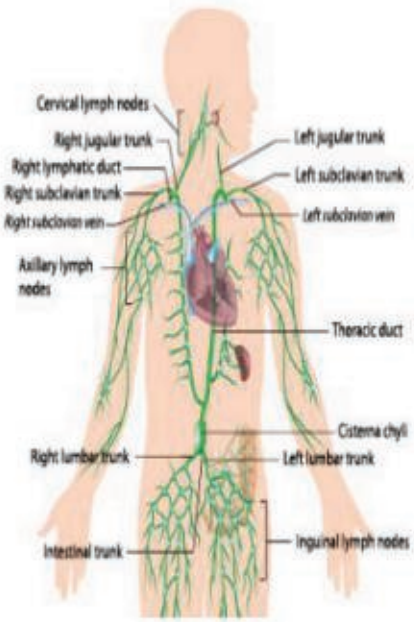


Figure 4.11 Human lymphatic system (for study)

Spleen

Spleen is the largest organ of the lymphatic system; it is a bright red organ located beneath the stomach. It looks like the lymphatic nodes but it is connected with blood instead of lymph. The spleen stores a great amount of the blood and contributes in maintaining of blood percentage in the blood vessels.

The spleen produces red blood cells when the bone marrow is not producing them It breaks down and decomposes old red blood cells, thus iron returns into the blood. Also the spleen clears the blood from debris inside it. The spleen becomes enlarged when it is infected with some diseases such as **malaria** and **anaemia**.

Stethoscope

It is an instrument used by doctors to listen to patient's heart or breathing.

Some Diseases of the Circulatory System

The circulatory system is affected with number of diseases, such as arteriosclerosis, high and low blood pressure, haemorrhage and heart diseases.

Blood Pressure

Some people suffer from high blood pressure whereas others suffer from low blood pressure. Both cases are dangerous for human. **Blood pressure** is the force of the blood on the walls of arteries due to contractions of ventricles.

The blood pressure is measured by special apparatus called **sphygmomanometer** which is fixed on the radius artery. When the ventricles contract, the blood pressure increases and when the ventricles relax, the blood pressure decreases.

The blood pressure varies according to people and also it varies in the same person depending on the mood situation. The blood pressure in children is less than adults and it is less in women than in men. The blood pressure reduces during sleeping and it increases during awakening, when working and performing sports.

The average high blood pressure is between (12-15)mm Hg but the average low blood pressure is between (8-9) mm Hg. The continuous high blood pressure (**hypertension**) causes damage on the walls of the fine arteries.

Increasing the percentage of fats and salts in the meals causes the hypertension. Also nervousness, overeat; kidney inflammation and arteriosclerosis have a great effect on the high blood pressure.

Prevention;

The person must have both body and mental health, regulate the eating times, reduce the fat level in the meals and eat more fruits and vegetables.

Heart Attack

It is a physiological heart disease. Several heart diseases and irregular heartbeats can cause a strong pain in the chest and sometimes the heart stops completely. This condition causes sudden death and it is called **heart attack.**

Arteriosclerosis and high blood pressure increase the risk of heart attack.

Prevention;

We must keep ourselves away from the causes such as smoking, drinking alcohol and hard psychical actions. Visiting the physician is important when you feel any pain in the chest or any other symptoms mentioned before.

Haemophilia;

Haemophilia is a genetic disease. The bleeding does not stop in hemophilic people in normal period and genetic structure of the blood is different. Also breaking the blood platelets is difficult when an injury occurs. This disease is generally seen in males also it can be seen in females but hemophilic females can live until puberty.

Anaemia

Deficiency of the iron in the blood causes the anaemia; also the deficiency of vitamin B12 causes the anaemia. These deficiencies reduce the formation of the hemoglobin. Different parasites such as the Ancylostoma worms and Malaria cause the anaemia. In addition, chronic bleeding causes the anaemia.

Symptoms & Treatment;

Pale face and eyes, general weakness, inappetence and indigestion are seen. The diagnosis of anaemia is done by the examination of hemoglobin percentage in the blood. The patient is treated by removing the causing factors and consuming diets which are rich in vitamins, proteins and iron. Also the pills which are given to the patient must contain iron compounds (pills, liquid or intramuscular injection).

Review

Q.1- Define the followings:

Lymph node, Hemoglobin, Tricuspid valve, Heart attack, Blood platelets, Haemophilia, Heart beat, Blood pressure, Blood plasma.

Q.2-Draw the following and write the name of the parts:

1. Longitudinal section of heart. **2**. Blood circulation in Human body

Q.3-Write the places (location) of the followings.

Heart,Spleen, Bicuspid valve, Rh factor.

Q.4-Write the symptoms of the following diseases.

Heart attack, Anemia

Q.5-Write the functions (effects, importance) of the followings.

Small blood circulation, Lymph node, Heparin, aorta

Q6-Write the differences between the followings.

1-Arteries and Veins **2**-Red and White blood cells.

Q7-Answer the followings.

1-How does blood clotting occur?

2-What is the importance of spleen for the body?

3-What are the conditions of blood transfusion?

Q8- Give the reasons of the followings:

1-The oxygenated blood does not mix with de-oxygenated blood in heart.

2-The walls of blood capillaries are very thin.

3-A person who carries the blood group (O) is called as general donor.

4-Blood clotting does not occur in blood vessels.

5-Sometimes the death occurs, when the blood is transferred to a person.

Q9- Complete the followings:

1-The person who carries blood group ..... can take blood from all other groups, while the person who carries blood group..... can give blood to all other groups.

2-The hemoglobin is responsible for transporting ..... and.....

3-The pulmonary artery leaves out from ..... and carries the blood to .....

4-The blood circulation from right ventricle into lungs and returning to the left atrium called ..... .

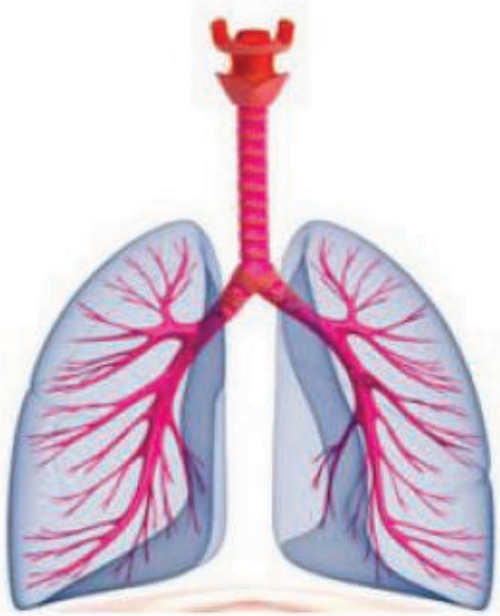
5- ..... and ..... examples for lymphatic nodes.

CHAPTER 5

RESPIRATORY SYSTEM

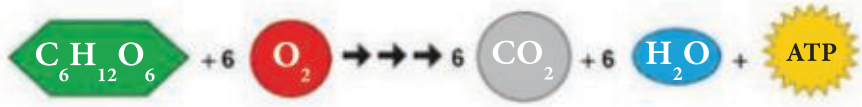
5

Introduction
Structure of Respiratory System
Respiration Mechanism
External Respiration
Internal Respiration
Some Diseases of Respiratory System



Introduction

In addition to food, all aerobic living things need oxygen to survive. Respiration is a chemical process which produces energy from food inside the living cells. In this process, food is catabolized by oxygen and energy is produced from food. The chemical equation of respiration is;



Living things use this energy to perform all life activities, such as movement, growth, reproduction and nutrition. Body cells obtain necessary oxygen from the blood which carries oxygen from lungs to body cells and also blood carries carbon dioxide from body cells to the lungs. At the end CO_2 is removed from body by lungs.

Structure of Respiratory System

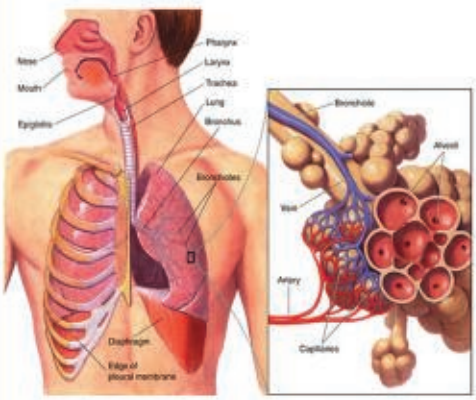


Figure 5.1 Human respiratory system (for study)

Human respiratory system consists of the followings;

1-Nasal cavity

It consists of two ducts which penetrate the skull. From inside, it is combined with inner nostrils and from outside combined with outer nostrils. Nasal cavity is covered by mucous membrane which moistens the air passing through it. Also there are small hairs at the entrance of the nostrils. Hairs and mucous layer which is secreted by special glands prevent the entering of the dust particles, microbes and large particles -such as dust- inside the lungs by trapping them. Also, the mucous membrane contains blood capillaries which warm the air that goes to lungs.

2-Pharynx

It is a common passage between the digestive system and respiratory system. Mouth and nose are connected to each other at the posterior region of pharynx. The air coming from nose or mouth passes into the larynx through the pharynx.

3-Larynx

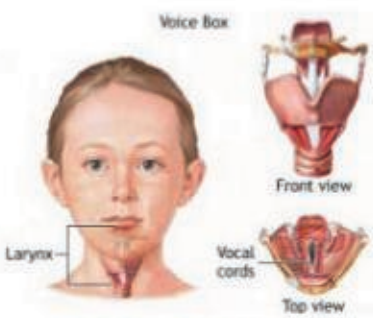


Figure 5.2 Larynx (for study)

It is a cone shaped structure which is lined with mucous membrane and located above the trachea. It consists of nine pieces of cartilages. These cartilages are combined with each other by an elastic membrane. The most important piece called **Adam's apple** is a C-shaped cartilage and can be felt in the neck. It consists of two connected pieces that can be seen in the neck. The second important cartilage is called **epiglottis**. Epiglottis is a flap which closes the larynx during swallowing. It prevents the entering of food molecules into trachea.

Inside the larynx cavity, there is a pair of membranes called **vocal cords**. They are connected with first cartilage at the top and third cartilage at the bottom. Also inside the larynx cavity, there are other two pairs of membranes called **non-vocal cords**. During the speech the vocal cords vibrate and sound is produced, because the air (exhaled air) leaving from the lungs passes over the vocal cords. For this reason the larynx is called as **voice box**.

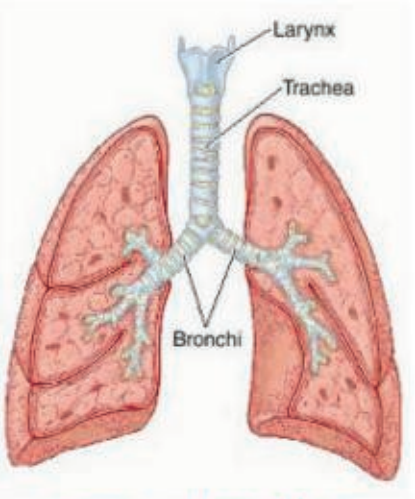


Figure 5.3 Lungs Trachea and bronchi

4- Trachea

It is a tube which is located in the chest in front of the oesophagus. Its length is 12 cm and its width is 2,5 cm. Trachea is always open so the air can enter and leave out easily. Because it is composed of (16-20) C-shaped cartilages which keep the trachea open. At the back of the trachea, these cartilages are interconnected by smooth muscles. Because of this, trachea is not circle (ring shaped) completely. This structure helps oesophagus to expand when the big food molecules pass through it.

The inner surface of the trachea is covered by ciliated mucousal membrane. The mucous glands secrete mucous which moistens the air and the cilia catch and throw out the foreign particles. Trachea is divided into two branches and each branch goes to each lung. These branches are called as **bronchi** (singular: **bronchus**). Also the left bronchus is longer than the right bronchus. The main bronchi are divided into smaller branches which are called **bronchioles** and located in the lungs. In the lungs, bronchioles are subdivided into air sacs which consist of small rooms. These small rooms are called as **alveoli**. Alveoli have thin walls surrounded by a network of blood capillaries which are branched from pulmonary artery. The exchange of gas between blood and environment occurs through the walls of the alveoli.

5-Lungs

The lungs are spongy and conical shaped organs. They are located in the chest cavity. The thoracic cavity is separated from abdominal cavity by a muscular wall called **diaphragm**. The right lung is bigger than the left lung; the right lung has three lobs and the left lung has two lobs.

Lung Membranes

Each lung is surrounded by a thin and double layer membrane called **pleura**. There is a space between these two layers, this space is called **pleural cavity**. Also this cavity contains small amount of fluid which facilitates the working of lungs during breathing. This fluid is called as **pleural fluid**. The inner layer of pleura attached to the lungs is called as visceral pleura membrane but the outer layer of the pleura attached to the walls of the chest is called as parietal pleura membrane.

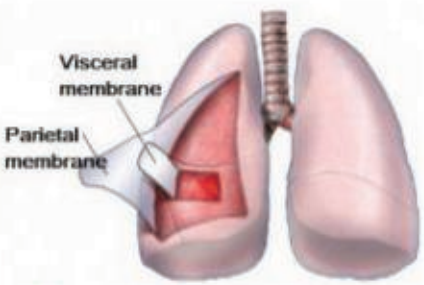


Figure 5.4 Lung membranes

Lungs perform the gas exchange between the air found in alveoli and blood capillaries found on the walls of the alveoli.

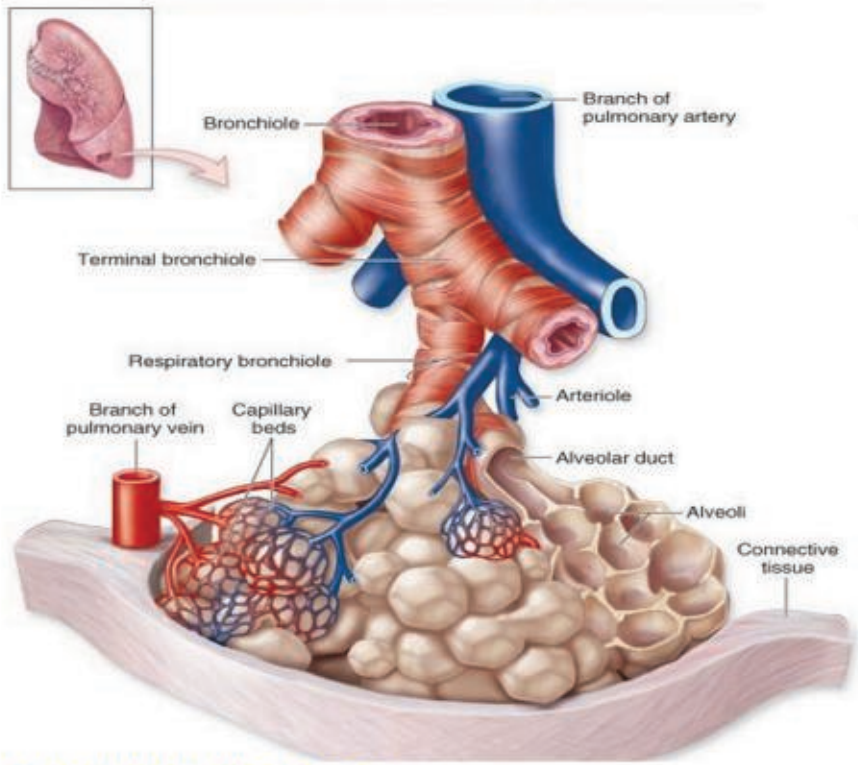


Figure 5.5 Structure of Alveoli (for study)

Respiration Mechanism

Sneezing is your body's way of removing irritants from your nose or throat. A sneeze is a powerful expulsion of air that is involuntary, which means you cannot control it. Sneezing often happens suddenly.

Inhalation, or breathing in, is the intake of air into the lungs. Exhalation, or breathing out, is the expulsion of air from the lungs.

During inhalation, diaphragm contracts and becomes flattened and intercostal muscles found between the ribs contract. So, inner pressure of the lungs decreases and the volume of chest cavity increases. At the end, the air passes through the respiratory organs and enters the lungs.

During exhalation, diaphragm and ribs return to normal position; diaphragm relaxes and intercostal muscles relax. So, inner pressure of the lungs increases and the volume of thoracic cavity decreases. At the end, the expulsion of air from the lungs to outside happens.

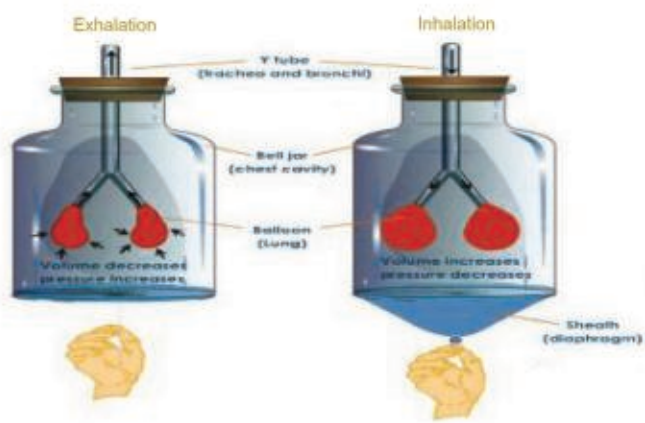


Figure 5.6 Demonstration of Breathing Mechanism (for study)

External Respiration

During the inhalation, the air enters the lungs and fills the alveoli which have thin walls. The oxygen diffuses from alveoli to the blood capillaries and blood becomes oxygenated. At the same time, the carbon dioxide and water vapour diffuse from blood to alveoli and they are removed by exhalation. This operation of gas exchange between the blood and alveoli is called **external respiration** (or pulmonary respiration). External respiration provides gas exchange between an organism and its environment.

Internal Respiration

Gas exchange takes place between body tissues and blood; the oxygen passes from blood to body cells while needed energy is produced to perform metabolic activities in the body. At the end of this energy producing process, the carbon dioxide and water vapour are produced and they pass into the blood so blood becomes de-oxygenated. This operation of gas exchange is called **internal respiration**. After that, this de-oxygenated blood is transferred into the pulmonary alveoli located in the lungs to discharge these wastes and these wastes are thrown out by exhalation. Internal respiration provides gas exchange between blood and body cells.

Some Diseases of Respiratory system

Respiratory system is exposed to much more microbial effects than other body systems. For this reason, disorders of the respiratory system are more.

Catarrhal Bronchitis

Catarrhal Bronchitis is the inflammation of the bronchi. There are different types and degrees of catarrhal bronchitis, such as simple type which is not associated with increasing body temperature and strong type which is associated with increasing body temperature. This disease affects the children and weak adults in the cases of tonsillitis and common cold.

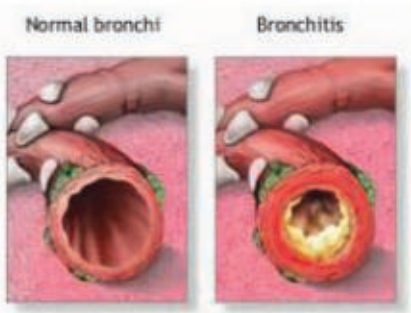


figure 5.7 catarrhal bronchitis (for study)

Symptoms;

1-The patient infected with catarrhal bronchitis, suffers from strong and dry cough. Then it changes to cough contaminated with blood Phlegm.

2-Patient's body temperature increases.

3-Sometimes, it is possible to hear strong sounds when the patient breathes because of the respiratory difficulties which last few days and then disappear; as a result, this condition changes to chronic disease and the patient becomes worse and coughs stronger.

Remedy

1- Patient must take enough rest and drink much flueids as usual.
2- Decreasing body temprature by using wet towel.
3- Using handkerchief when coughing and sneezing.
4- Wearing suitable clothes during winter.

Prevention

1- Pay high attention to self cleaning.
2- Avoid staying in bad ventillated places.
3- Stay away from patients with such diseases.
4- Excersising regeulary and eating food rich with Vitamin C.

Pulmonary Tuberculosis (T.B)

Pulmonary tuberculosis was a common disease and it spread all over the world. This disease is caused by a rod shaped bacteria called **Koch's bacillus**. Koch's bacillus was discovered by **Robert Koch** in 1882. This disease spreads out by means of some factors easily; such as very crowded places, malnutrition and lack of applied hygienic methods.

Symptoms:

This disease starts gradually with clear signs such as:
1-inappetence, losing ability to work , feeling tired.
2-patient loses weight gradually.
3-At the beginning of this disease, patient suffers from slight and dry cough.
4-body temperature and sweating increase. If the disease continues, the strength of the cough increases especially during the night and it changes into cough contaminated with bloody phlegm.

But all these symptoms are not enough for the diagnosis of pulmonary tuberculosis. For this reason, the suspected patient must sent to the hospital and some clinical tests must be done such as; x-ray of chest, examination the patient's phlegm under the microscope to look for Koch's bacillus.

Remedy

1- Taking treatments according to physician instructions.
2- Eating food rich in proteins and vitamins.
3- Don`t smoke and avoid staying in smoking and polluted areas.
4- Keep away from physical activities during infection period,

Prevention;

To prevent from tuberculosis, we must consider the following points:

1- Vaccination the children with (B.C.G) vaccine in early age.
2- Spiting on the ground must be prevented.
3- We must take care of hygienic conditions in general places.
4- We must sterilize the milk and milk products.
5- When a person feels any symptoms of this disease, he must visit the physician.
6- Smoking and drinking alcohol is dangerous because it reduces the body immunity.
7-Good living conditions are provided, like good nutrition and fresh air.

Whooping Cough

Whooping cough is a common and very contagious disease. It infects the children between the ages of 1-8 years. This disease spreads in the towns much more than in villages, because of the crowded and air pollution. The incubation period of whooping coughs microbe is one week or two weeks. This disease spreads mostly during spring and autumn. The infected person gains **permanent immunity** from this disease.

Symptoms;

This disease has two stages:

1- inflammation of pharynx. And the upper part of trachea is inflamed and simple cough is seen. This stage lasts about ten days.

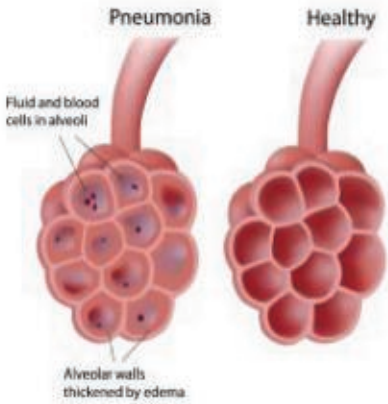
2- the coughing becomes heavier and changes to a strong attack. This attack lasts about 2-3 minutes and sometimes patients vomits. When the coughing attack increases, the patient's face become bluish or reddish, bleeding may happen in the nose and the lower regions of the eyes. The coughing attack increases when the patient expose to cold air and smoke.

Remedy

1- Visiting doctor is necessary if one of the symptoms is noticed.
2- Isolate the infected child from other children.
3- Child must be in good ventilated place.

Prevention;

1- Vaccination of the children, with triple-vaccine once a month, for three months. This vaccination starts from the third month. The vaccination is repeated after one year.
It contains the vaccines against the diphtheria, whooping cough and tetanus.
2- Keep out the children from contacting with infected patients.
3- Sterilization of the patients' tools contaminated with microbes, their rooms and beds.



Pneumonia

It is a dangerous disease and caused by a bacteria called **Pneumonia** sp. These bacteria infect the lungs and cause loss of function.

Symptoms;

1- Body temperature increases,
2- Pale face, strong headache, tiredness and increasing heart rate.
3- Contaminated cough with greenish phlegm.

Remedy

1-Visiting the physician and taking the necessary antibiotics.
2-Taking food rich in calories and vitamins.
3-Providing the fresh air for patient.

Prevention;

1- Infected patients must be isolated.
2- Doing exercises and staying away from contaminated places
3- Avoid smoking
4- using handkerchiefs while coughing

Lung Cancer

Lung cancer is seen especially in men because of smoking much. The risk of lung cancer in smokers is 15-30 times more than in non-smokers. This percentage increases in smokers who swallow the smoke and start smoking at early age.

According to the anatomical studies, some changes are seen in smokers' lungs and bronchi. The strength of these changes depends on the number of smoked cigarettes per day. In non-smokers' lungs, there is less or no changes seen in people who gave up smoking.

There are some other reasons which cause lung cancer such as the air contaminated with smoke and other materials which are produced from the factories, vehicles, trains and different mechanical engines.
These factories, vehicles, trains and different mechanical engines use different types of fuels and kerosene or its products. Because of these reasons the risk of lung cancer in towns is higher than in villages.

Symptoms:

1. Increasing body temperature and sweating at night.
2. Hard breathing and dry cough in early stages.
3. General weakness and inappetence.
4. Cough contaminated with blood in late stages.

Remedy:

1. Visiting the physician when any of the symptoms seen.
2. Treatment may be needed chemotherapy or exposing to the radiation to prevent spread of cancer cells
3. Infected part of lung can be removed by medical surgery.

Prevention:

1. stay away from polluted and bad vintellation places.
2. Avoid smoking or being around smokers in same room.
3. Avoid alchohol and non diagnosed drugs because they are weaken body immunity.

Asthma:

It is an illness that makes it difficult to breathe and infects the respiratory tract of human. Dust particles which enter the respiratory tract make it narrow because they are allergens for patient.

Symptoms:

1. Breathing difficulties.
2. Dry cough with vomiting
3. Pain in the chest.
4. Decreasing movement ability.

Treatment:

1. Visiting the physician and taking necessary drugs
2. Using special sprays which dilate the bronchi.
3. Avoid being in crowded and polluted places.

Prevention:

1. Avoid smoking.
2. Wearing a mask or using wet towels if it is necessary. Especially during sand storms which are common in Iraq.
3. Doing exercises regularly like walking in uncrowded places.

Review

Q1-Define the followings

Respiration, Vocal cords, Epiglottis, Larynx, Alveoli.

Q2-Write the causes of the followings.

1-The inner surface of trachea is covered by the ciliated mucosal membrane.
2-Presence of hair in nasal cavity.
3-Activity and ability of lung getting less because of smoking.
4-The larynx is called as voice box.
5-The food does not enter the respiratory pathway during eating.
6-The trachea consists of C-shaped cartilage rings.

Q3-Complete the followings.

1-The respiration is a chemical operation which produce..... from food.
2-The bronchi are branched in the lungs into smaller branches called ..... which are subdivided into air sacs which consist of many small rooms called .....
3-The scientist..... is considered as the first scientist who described the tuberculosis bactreia.

Q4-Write the location of the followings.

Vocal cords, Larynx, Alveolus.

Q5-Write the symptoms of the following diseases.

Pulmonary tuberculosis, Catarrhal Bronchitis, Whooping cough.

Q6- How long the incubation period for the Whooping cough disease?

Q7-Answer the followings

1-Explain the mechanism of respiration (Inspiration and expiration).
2-What are the preventive methods against the whooping cough?
3- What is the effect of smoking on the respiratory system.
4- Count the organs of human respiratory system?
5- How can you keep your respiratory system healthy?

CHAPTER 6

EXCRETION

6

Introduction
Types of Excretion in Human
Renal Excretion
Some Diseases of Urinary System
Skin Excretion

Introduction

Inside of the unicellular or multicellular organisms, harmful materials are produced as a result of food metabolism. These harmful materials are called as **wastes**. Living things must discharge these wastes. Because they cause toxicosis and obstruction of biological functions if they accumulate and not discharge. Therefore, excretion is removing of wastes which are produced in metabolic reactions. Excretion keeps the balance between the cells and environment. Also excretion regulates the water and salt balance.

Types of Excretion in Human

Excretion can be divided into four types:

1-Digestive excretion: Faeces composed of undigested food materials, water, bacteria and dead cells, are thrown out by digestive tract.

2-Pulmonary excretion: Carbon dioxide and water vapour are removed by respiratory system.

3-Renal excretion: Blood is filtered from excess amount of water and harmful materials such as urea and then these wastes are thrown out by urinary system.

4-Skin excretion: Excess amount of water, salts, urea and small amount of CO_2 are thrown out by skin.

Urinary System

Structure of Urinary System

Renal excretion is carried out by urinary system. It consists of the following organs;

1. Kidneys

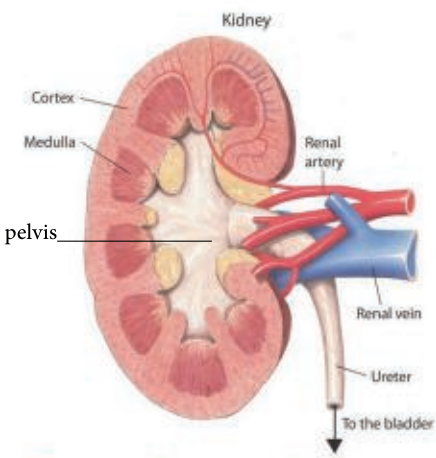


Figure 6.1 Structure of kidney

There are two kidneys; each one is located on the back wall of the abdominal cavity on the each side of the vertebral column. Each kidney is bean shaped and its concave side towards the vertebral column. Kidneys are surrounded by a thin membrane called **capsule**.

Each kidney consists of two main layers; **cortex** and **medulla** Cortex is the outer layer of the kidney and it is red coloured. Kidney consists of microscopic filtering units called **nephrons**.

Medulla is the inner part of the kidney and it is bright coloured. It is striped and similar to rays because it contains many urinary tubules. There is a cavity In the centre of the medulla called as **pelvis**. It is the beginning of the ureter which extends inside the kidney. Renal arteries nourish the kidneys and renal veins remove the wastes from kidneys.

2. Ureters

They are muscular tubes which connect the kidneys and the back wall of the bladder. They transport urine from kidneys to bladder. Each ureter consists of smooth muscles and each one is 22 cm long.

3. Urinary Bladder

It is a sac which stores urine and it consists of smooth muscles (involuntary). In the connection point of the bladder with urethra, there are circular striated (voluntary) muscles. These muscles are voluntary muscles.

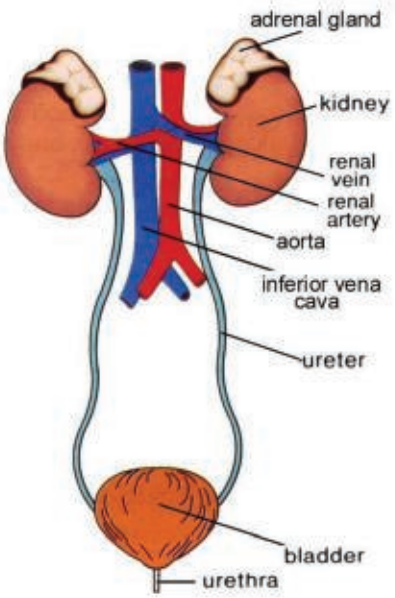


Figure 6.2 Urinary system in human

Some Diseases of Urinary System

Diabetes

We have learned that, the pancreas secretes insulin hormone which provides the storing of glucose in liver and muscle cells. In the case of some pancreas disorders, the secretion of insulin hormone decreases so the level of glucose increases in blood. Increasing sugar level damages some organs especially eyes, skin and kidneys. A great amount of glucose is discharged from body with the urine to balance glucose level in blood but this is not a normal condition. This disease is called as **Diabetes Mellitus**.

Symptoms; The important symptoms of diabetes mellitus are; getting tired very quickly, loss of weight, thirst and repetition of urination.

Treatment; Infected person is treated by injecting insulin or taking tablets which help to reduce the sugar level in the blood. So, the taken insulin substitutes the deficiency of insulin hormone which is secreted by the pancreas. Also the patients must eat food materials which contain less starch and sugar.

In a study published in Europe, researchers have shown that drinking just one can of sugary soda per day increases the chance of diabetes by over 20%.

Albuminuria

In healthy kidneys, protein particles are not filtered, because they are too large. In the case of some diseases like kidney inflammation, kidney can not perform its function normally and the protein materials like albumin are filtered and discharged from body with urine. This disease is called as **Albuminuria**.

Kidney Stones

Symptoms

1- Anemia and pale face.
2- Yellowish urine with hyper urination.
3- Burning during urination due to urinary tract inflamation.
4- Many red pumpels seen on legs.

Remedy

1- Reduce the protein and salts in food
2- Drink more water.

Kidney stones

As a result of some physiological, nutritional and pathological disorders, the amount of dissolved salts increases in the blood in some people. Increasing the amount of salts in the blood causes an increase in the salt filtration when passing through urinary units in the kidney.

If an abnormality happens in the function of the urinary system, salt precipitation happens and these salts change to stones in the kidney pelvis, ureters or urinary bladder. The most important salts precipitated in the kidney are phosphate and oxalate.

Drink enough water for your kidney health

Symptoms

1- Patient urinates frequently and feels sever pains in the lumbar region or the body sides.
2- Sometimes bloody-urination occurs because of injuries in the walls of urinary tract . These injuries are caused by stones.
3- Renal colic occurs due to the movement of stones.

Remedy

1- Patients must reduce eating the food which contain phosphate and oxalate such as tomato.
2- Advise the specialist physicion immediatly.

Skin Excretion

Skin and Its Importance

Skin is a cover which surrounds the body and protects it from external effects. In addition, it discharges the waste materials which are formed in the body. The human skin contains sweat glands which have an important role in discharging process.

These glands remove some excess water, some salts, urea and a little carbon dioxide from the body. The importance of sweat glands in discharging process is very clear when the weather becomes very hot and when the human performs a hard muscular work. In these cases, the human loses a great amount of water and salts through the skin.

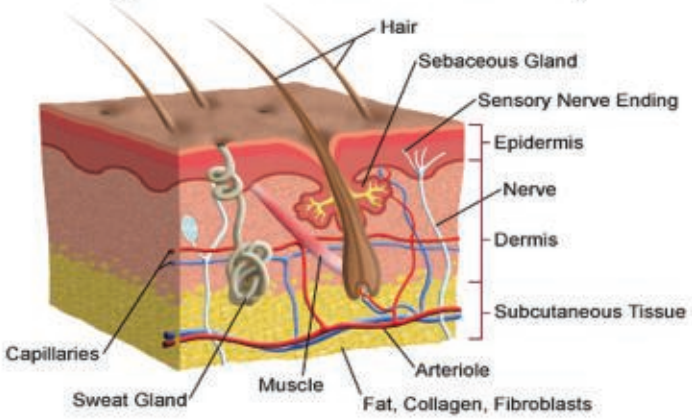


Figure 6.3 Structure of skin in human (for study)

Structure of Skin

Human skin consists of two main layers; outermost layer called **epidermis** and innermost layer called **dermis**.

1. Epidermis

Epidermis is composed of two layers; outer layer called **keratin layer** and inner layer called **germinative (Malphegian) layer**. the outer layer of the epidermis and contains no blood vessels and nerve branches. Keratin layer is a thick layer composed of dead cells connected with each other. These dead cells are removed gradually from the body surface during washing or itching and replaced by new keratinized cells pushed out from germinative layer.

Germinative layer is the second layer of the epidermis. It is found under the keratin layer. Germinative layer consists of living cells which have ability to divide and produce new cells. This layer contains the nerve fibres ends and sweat gland ducts but contains no blood vessels, for this reason it gets nutrients from blood plasma filtered from dermis layer. The colour of skin depends on pigment materials in the germinative layer. If a person exposures to the sun light, these pigments materials increased.

2. Dermis

This layer consists of living tissues and contains connective tissue, blood vessels and nerves. The connective tissue gives elasticity and strength to the skin.

The surface of the dermis layer is wavy and this wavy structure forms **dermis papillae**. The walls of dermis papillae contain blood vessels and nerve ends which represent the sense of touch in the human.

Skin Accessories

1. Hair

They are thin keratinized threads originated from epidermis layer. Each hair consists of hair shaft, hair follicle, hair root and sebaceous glands. Sebaceous glands secrete a fatty liquid over the skin surface and this fatty liquid keeps the skin from cracking and drying. Also each follicle is connected to the fibers of smooth muscle. The contraction of these fibers erects the hair and elevates the skin around the hair.

2. Nails

They are hard structures, composed of hard, horn-like, keratinized dead cells which are originated from epidermis. A nail has a root embedded in the dermis. The nails protect the fingers and toe tips. It is necessary to cut the nails periodically and length of the nails must not be long from the ends of fingers.

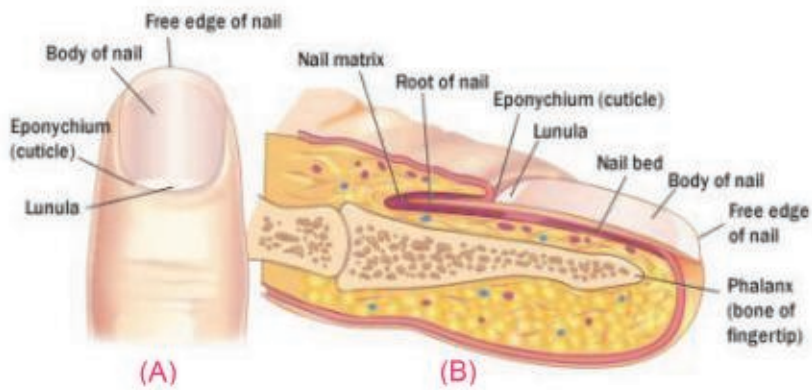


Figure 6.4 Structure of nail in human: (A) External structure (B) Internal anatomy (for study)

3. Skin Glands

a. Sebaceous Glands

The sebaceous glands are associated with hair and they secrete fatty liquids which keep the skin from cracking and drying.

b. Mammary Glands

They secrete milk that contains nutrients for infant. The necessary materials for infant are extracted from mothers blood. It is found that the probability of being infected by blood cancer is more in mothers who don`t nurse their infants.

c. Sweat Glands

Sweat gland is a thin tube coiled at the base situated in the dermis layer . Sweat glands are surrounded by blood capillaries.

The duct of glands passes through skin layers and opens to out by a minute depression called **pore**. These pores are found on the surface of the skin. In human skin, there are about two or three million sweat glands distributed throughout the body.

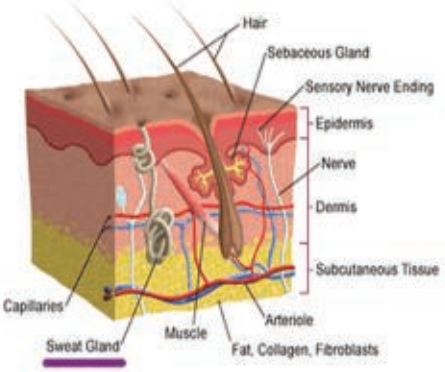
Sweating

Sweat contains 99% of water and 1% of solvent solid materials such as sodium salts , small amount of urea , some fatty acids and amino acids. Skin discharges these wastes materials so it supports the excretion process.

The most important factor that increases and reduces the sweating is environmental temperature. Sweating may happen as a result of psychological conditions such as fear . This type of sweating is called cold sweating . Muscular activity (hard exercise) increases the sweating such as running . Also, sweating increases in the case of tiredness. But, sweating decreases in the case of rest or working quietly.

In some diseases, sweating considered as important symptoms such as fever or anemia.

(A)



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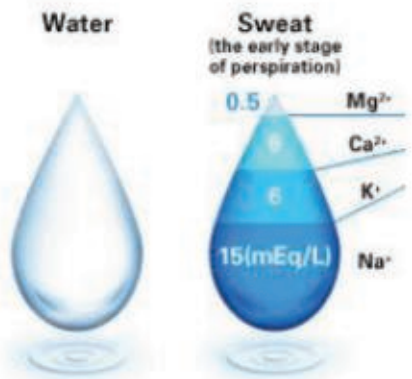


Figurs 6.2 (A) Sweat Gland position and (B) Sweat Components (for study)

Health of Skin

As you know that, skin is very important for body health; because of this, we must take care of it by following points;

1- Have bath periodically.
2- Keep your skin away from strong sun light.
3- Don`t press on adolescent acne, they are natural result of some hormones.
4- Don`t get tattoo on your skin because it can cause allergic skin reactions.
5- The clothes must not be too tight and adhere to the skin, because it limits the muscle movement and blood circulation (especially using the belt lighteners).
6- We must visit the physician when we notice the appearance of some skin diseases or appearance of abnormal symptoms on the body such as scarring or spots and others, for its diagnosis and treating it before it spreads.
7- The internal clothes which contact the skin must not be rough and harsh such as woollen clothes which irritate the skin and cause the scratching.

Review

Q1-Define the followings:

Excretion, Sebaceous glands, Sweat glands, Malphighian layer

Q2-Draw the followings and write the names of their parts:

1- Structure of kidney.
2-Human urinary system.

Q3-Write the causes of the following:

1-A person infected with albuminuria must reduce the amount of protein in food.
2-The sebaceous glands are associated with hair.
3-The skin is important for keeping and balancing the body temperature.
4-Insulin hormone is injected to patients infected with diabetes.

Q4-Complete the followings:

1-The ureter is a muscular tube; its length is ..... cm.
2-The epidermis consists of two layers; the outer layer is called ..... and the inner layer is called .....
3-The skin is composed of two layers; the outer layer is ..... and the inner layer is .....
4-The urinary system consists of the following organs; ....., ... and .....
5- The kidney consists of two main layers; ..... and .....
6- The skin accessories are ..... ,..... and .....

Q5- Write the symptoms of the following diseases:

Diabetes , Kidney stones

Q6- Write the location of the followings:

Sebaceouse glands , Pelvis , Nephrons.

Q7- Answer the followings:

1-Write the types of excretion in human.
2- What is the structure of hair?
3- What are the functions of skin?
4- How can we take care of the skin?

CHAPTER 7

REPRODUCTIVE SYSTEM

7

Contents:

Introduction

Reproduction is the production of new individuals (offspring). The main purpose of reproduction is to continue the existence of the living things. There are different reproduction methods in living things, but all of these methods increase the number of living things and transfer the characteristic from one generation to another. Human beings have reproductive organs which are different in males and females.

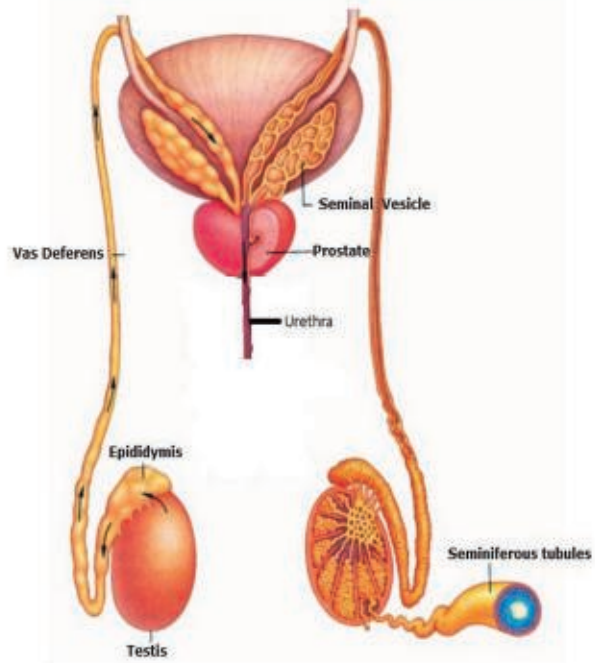


Figure 7.1 Structure of male reproductive system

Male Reproductive System

Male reproductive system consists of **glands** which produce sperms, **ducts** which pass through these glands and **additional organs** which facilitate the sperm transmission.

Testes

They are two oval shaped glands. These glands produce male reproductive cells called **sperms** and hormones which are responsible for secondary sexual characteristics in male such as beard and moustache. After the formation of sperms in each testis, sperms pass through the long coiled tubules which lead to a bigger tube to form vas deferens.

Vas-deferens ducts

They are a pair of canals (ducts) which transport sperms from testis (or epididymis) to **urethra**. **Epididymis** is a long coiled tube found at the beginning of the each vas-deferens duct. Sperms are stored here till maturation. Each Vas-deferens duct opens to urethra at the neck of bladder. Urethra opens to out by the male sexual organ.

Seminal Vesicles

There are two sacs at the end of each vas-deferens duct nearby the neck of bladder. These sacs or vesicles are called seminal vesicles. They store sperms after maturation.

Associated Glands

There are associated glands in the male reproductive system. They secrete different liquids to protect, maintain and to facilitate the movement of male reproductive cells. These glands are; **Prostate Gland** and **Cowper's Glands**. The male reaches the puberty during the age of 15 years. Male reproductive cell consists of head, short neck and long tail which helps it to move. Each testis produces millions of reproductive cells during its activity period.

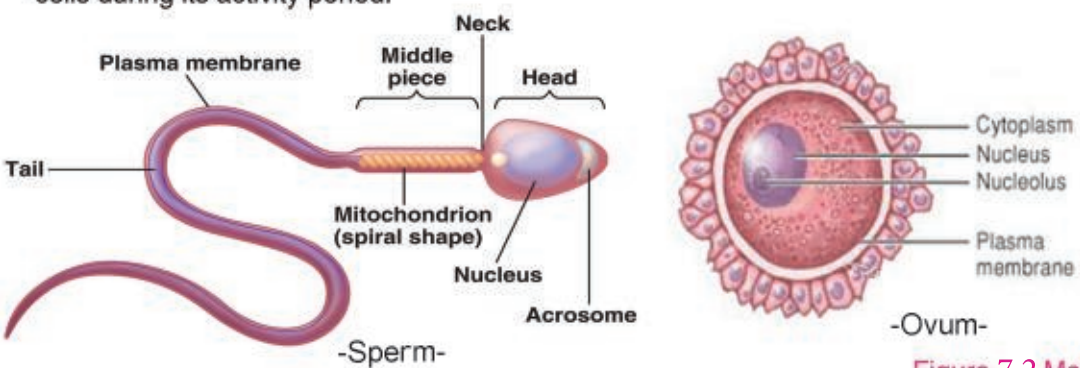


Figure 7.2 Male and female reproductive cells

Female Reproductive System

Female reproductive system is also composed of sexual **glands** which produce female reproductive cells called eggs and **ducts** which transport these cells. The female genital system is different from the male genital system. Because female genital system is adapted to store fertilized eggs, for development and nutrition of fetus till birth. Female reproductive system consists of **Ovaries**, **Oviducts** and **Uterus**.

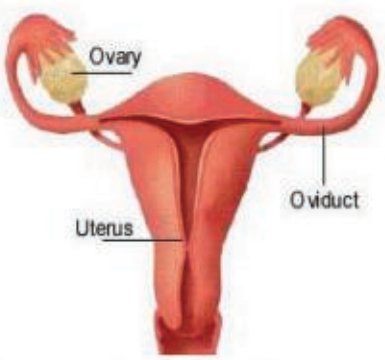


Figure 7.3 Structure of female reproductive system

Ovaries

They are two oval shaped glands located at the lower part of abdominal cavity at both sides of the uterus. Each ovary is responsible for producing egg and hormones which are responsible for secondary sexual characteristics in female.

Oviducts(Fallopian tubes)

Oviduct is a tube which transports egg from ovary to uterus. The beginning of oviduct is funnel shaped and covers ovary partially.

Uterus

It is a big pear-shaped organ with thick muscular walls. The inner uterine cavity is connected with oviducts from the upper part.

The female reaches the puberty between the age of 12-14 and the ovaries start to produce oves.The total number of the matured oves produced by a female is not more than 400 during her life.

Starting from puberty, the females produce one ova in each month until the age of 45 or 50. If the ova is not fertilized, it is discharged from body with blood, mucus and some tissues by a process called **menstruation**. It lasts from 4 to 7 days. The menstruation sometimes causes simple symptoms which are very normal in the women if the ova is not fertilized. Menstruation happens normally every 28 days. It stops during pregnancy and after the age of 45 to 50.

Secondary Sexual Characteristics

The genital glands found in the male and female secrete special hormones which are responsible for the secondary sexual characteristics in each man and woman. Abnormalities in the secretion of these hormones affect the appearance of these characteristics in normal form. These secondary sexual characteristics are different in both sexes.

We can summarize these characteristics as follows:

1. The hair density in the male body is more than the female body.
2. The breast growth and milk secretion happen in the female but these are inactive in the male.
3. The voice of male is sharper than the voice of female.

Fertilization and Pregnancy

Fertilization is the union of sperm nucleus and ova nucleus to form fertilized ova (zygote). Normally a sperm unites with an ova in oviduct to form fertilized ova.

Pregnancy

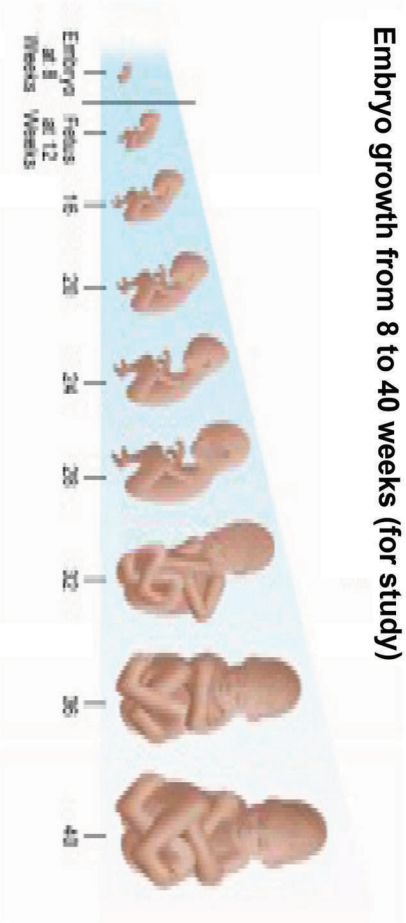
The fertilized ova passes into the uterus and attaches itself to the inner membrane of the uterus. It starts to divide and forms a fetus. Between the embryo and uterus there is an organ called **placenta** provides oxygen and nutrients to embryo from mother's blood and transports harmful materials produced by embryo to mother's blood. Embryo is connected with placenta by a special cord called **umbilical cord**. It is cut just after the birth.

Birth

Pregnancy lasts about nine months in the female reproductive system. The embryo develops in uterus during nine months and as maturation is completed in this period, it leaves the mother's body (uterus) by birth process.

Just after birth milk start to be secreted from the mammary gland. Nursing infant protects the mother from different disorders like breast cancer and supports the immunity system of embryo.

In some cases birth process doesn`t happen naturally and embryo is separate from mother by caesarean delivery. And sometimes birth process happen before nine months, about 7th month, in this case embryo is called as **premature**.



Embryo growth from 8 to 40 weeks (for study)

Twins

Normally, the women give birth to only one baby; male or female. But sometimes two babies can develop at the same time.

Identical twins

These two embryos developed from the same fertilized egg which divided into two independent cells after fertilization. These embryos have the same sex (male or female) and generally same somatic characteristics (they look like each other).

Non-identical twins

Normally one ova is mature each month but sometimes two or more oves can be matured at the same time. If these oves are fertilized, each one grows into an independent embryo. So, two or more embryos are formed at the same time. They are called **non-identical twins**. These twins can have different or same sex and different somatic characteristics.

Some Diseases of Reproductive System

Sterility

It means having no ability of producing sperm or oves in man or woman. There are different causes of sterility such as, hormonal disorder genetical diseases or disorders of reproductive organs

In Vitro Fertilization (Artificial Fertilization)

In some cases artificial fertilization performed to have baby when there is any disorder in male or female reproductive system and they are not able to do fertilization. Embryo transported to the female uterus after fertilization and mother supported by some drugs to maintain pregnancy.

Effects of smoking, drugs and alcohol on pregnancy

1. Smoking causes a decrease in oxygen levels and raises the carbon monoxide level in both the mothers and the embryos blood which causes an unhealthy environment for the embryo. Smoking also causes an increase in miscarriage and premature birth or embryo death, the effect of smoking continues beyond the birth of the baby causing infections in trachea, and asthma.

2. Avoid taking the herbal medicine without doctor's consultation.

3. Alcohol effects the embryo, it causes nervous disorder and body malformation especially in the face, also behaviour disorder.

Review

Q1-Define the followings:

Fertilization, Umbilical cord, Reproduction, Ova, Sperm, Placenta.

Q2-Draw the following:

1-The male reproductive system.
2-The female reproductive system.
3-The sperm structure.

Q3-Complete the followings:

1-The female reproductive system consists of ……, …… and ……..
2-Ovaries are two glands , …….. shaped , and located in ……
3-The associated glands of male reproductive system are …….. and ……
4-The embryo obtains the nutrients and oxygen from the mothers blood through the ..... and …….

Q4-What are the differences between the following:

1-Identical twins and non-identical twins.

Q5-What are the functions (importance) of the followings:

associated gland, Seminal vesicle, Placenta, Vas deferens duct, Umbilical cord, Testis, Oviduct.

Q6-Answer the followings:

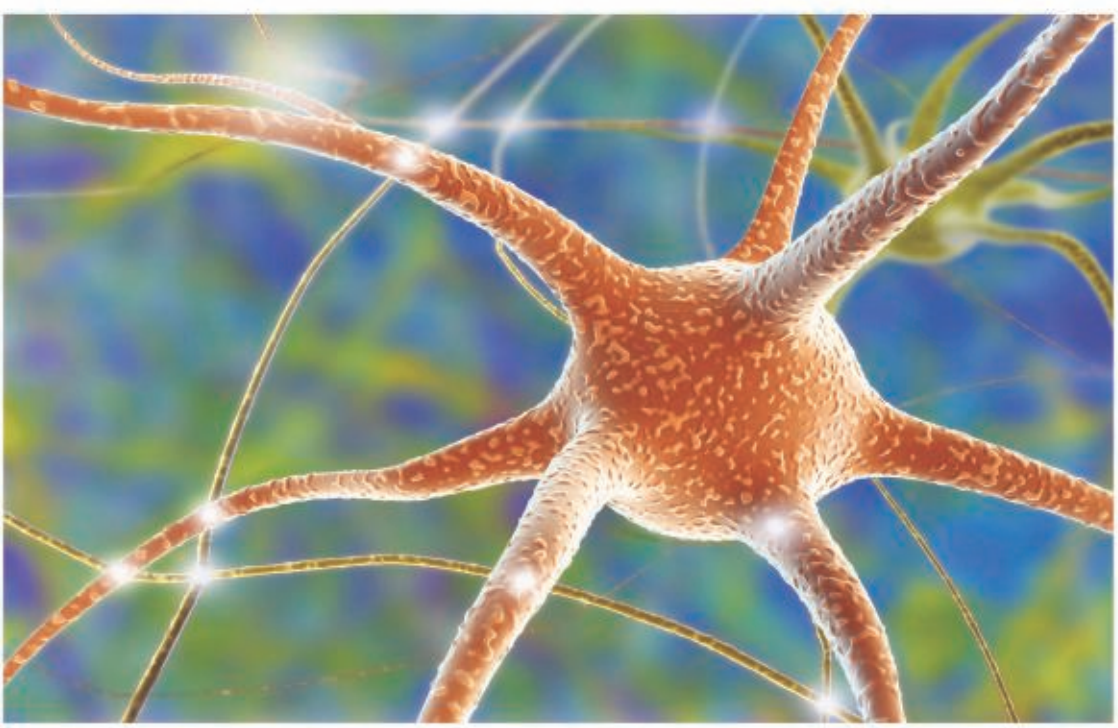
1-Write the secondary sexual characteristics in human.
2-What is the effect of smoking on the reproductive system?

CHAPTER 8

NERVOUS SYSTEM

8

Introduction
Structure of Nerve Cell
Nervous Tissue
Parts of Nervous System
Nervous Stimulation
Nervous Actions
Psychological Disorders



Introduction

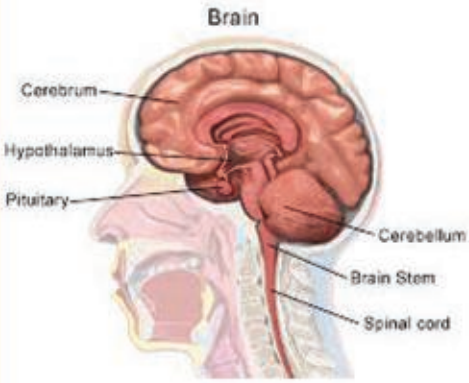


Figure 8.1 Central Nervous System

We have delicate senses and we live in different environments. Also we live different psychological periods. For example; good news make you happy, while unpleasant news make you unhappy. You feel hunger and thirst as result of internal stimuli, you feel cold, heat and pains as result of external stimuli and you produce different responses against these stimuli; you see light and things surrounding you, when you listen to music, you enjoy it. When you listen to national songs, you get excited. You keep away from the noise and unpleasant sounds. When you smell nice flowers in the garden, you enjoy it and want more but you try to go away from unpleasant smells.
When you taste food and drinks, you separate good things from unpleasant things. You feel some things by touching with fingers and when your skin is cut, you feel pain.

As a result, seeing, hearing, smelling, tasting, sensing (touching) and working of body organs are regulated and controlled by a special system called **nervous system**.

Structure of Nerve Cell (neuron)

Nerve cell is a principle unit of nervous system. The nerve cell consists of a large cell body and cytoplasmic extensions extended from cell body. Nerve cell transports neural stimuli in the nervous system. Cell body contains a large nucleus located in the centre.

The shape of the nerve cell depends on these cytoplasmic extensions; its shape may be spherical, oval or star. Some of these extensions are short, numerous and branched called **dendrites**. They transport the neural stimuli towards the cell body. And also, there is a unique, long and thick extension called **axon**. Axon transports neural stimuli from the cell body.

Axon is mostly surrounded by a sheath called as **myelin sheath**. It is formed from **Schwann cells**. Myelin sheath accelerates the transmission of neural stimuli in the axon and isolates the axon from other axons.

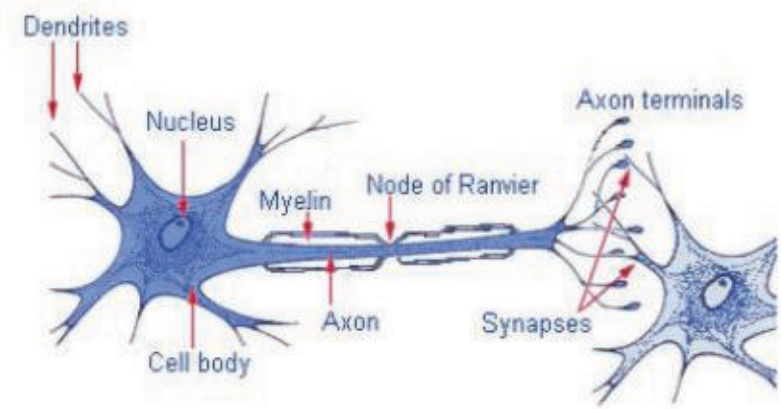


Figure 8.2 Structure of Neuron

Nervous Tissue

Nervous tissue is formed by accumulation of nerve cells. If the tissue is formed by the cell bodies, the colour of the tissue is grey such as cortex, cerebrum and cerebellum. If the tissue is formed by the axons, the colour of the tissue is white such as outer part of spinal cord and inner part of cerebrum.

Nerves

The axons of the nerve cells are accumulated by a tough fibrous tissue and form a strong bundle or cord called **nerve**. The nerves are distributed throughout the body to perform their functions.

There are two main types of nerves;

1. Sensory nerves; transmit stimuli from sensory organs such as the eye, ear and skin to the central nervous system.
2. Motor nerves; transmit the impulses from the central nervous system to muscles organs and glands.

Parts of Nervous System

Central nervous system

Central nervous system consists of **brain** and **spinal cord**.

1. Brain

Brain is located in the skull cavity and surrounded by three membranes known as **meninges**.

Brain consists of the following parts;

a. Cerebrum

It is the largest part of the brain and composed of two halves (hemispheres). These halves are connected to each other at the lower part and separated from each other by a deep fissure at the upper part. The outer layer of the cerebrum is known as **cerebral cortex** . Cerebral cortex contains the hearing centre, vision centre, smelling centre and speech centre, controls and regulates the voluntary actions.

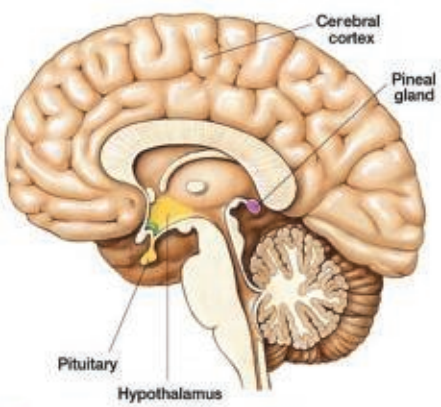


Figure Structure of Human Brain (for study)

b. Cerebellum

The cerebellum lies below the posterior part of Cerebrum. It consists of two symmetrical hemispheres. Cerebellum coordinates the movement of the voluntary muscles in the body. The damage of the cerebellum causes disorders and imbalance at muscular actions.

c. Medulla Oblongata

It is located at the posterior part of the skull cavity base. It connects the brain with the spinal cord. It controls some body systems such as respiratory system, circulatory system especially heart rate and also it contains some involuntary muscles centres.

2. Spinal Cord

It is cylinder cord is about 45cm from the end of medulla oblongata to the end of the last lumbar vertebra.

Spinal cord is passing through vertebral coloumn. If the spinal cord is damaged by some vertebral breakages, that causes muscular paralysis, loss of sense and loss of the control on the voluntary movements of the regions located under the infected part of the body.

Peripheral Nervous System

It consists of many nerve groups distributed throughout the body. Its function is to conduct the different stimuli from sensory organs to the Central nervous system and to conduct the responds from Central nervous system to all body organs such as muscles and glands. These nerves conduct the stimuli continuously from limbs to the nerve centres and from nerve centres to the limbs.

Peripheral nervous system consists of spinal nerves, cranial nerves and nerves of autonomic nervous system.

1. Cranial Nerves

There are **12** pairs of **cranial nerves**, some of them are sensory nerves, some of them are motor nerves and some of cranial nerves are mixed (both sensory and motor).

2. Spinal Nerves

Each spinal nerve includes sensory and motor nerve fibre. There are **31** pairs of spinal nerves. They emerge between the vertebrae from the spinal cord to all voluntary muscles in the body.

Autonomic Nervous System

Most of the autonomic nerve fibres are associated with peripheral nerve fibres. The autonomic nerve fibres are distributed into body organs such as heart, lungs, blood vessels, digestive system organs, glands and others. The autonomic nervous system is connected with special nervous nodes.

The function of this system is to transfer the orders from the central nervous system to the body organs that work involuntary such as regulation of heartbeat, breathing, sweating and others. Autonomic nervous system is divided into two groups; **Sympathetic** and **parasympathetic** systems.

1. Sympathetic System

The fine nerves of Sympathetic System are distributed in the internal organs and blood vessels. The sympathetic system is functional during emergency. For example; it accelerates the heart beats and respiration rate.

2. Parasympathetic System

It includes a large group of nerves; start from brain centres some of them start from lower part of the spinal cord. The parasympathetic system restores body to resting state after stressful situation. For example; it decreases the heart beats.

Nervous Stimulation

The neuron transfers the stimuli and orders from all body tissues to the central nervous system (spinal cord and brain) and vice versa. The transmission of these stimuli is done by neurons via electrical phenomenon which produces electricity that is transferred from cell axon to another adjacent cell body. The changes that happen in neurons during the transmission of stimuli through the neurons are called **nerve impulses**.

When some effects stimulate a neuron, it takes this stimulus by dendrites and transports it to the cell axon. This nervous stimulus is transferred to the dendrites of the next cell from the axon of a neuron.

By this way, the stimulus reaches the spinal cord and in the end to the brain. These nervous stimuli are transmitted in only one direction; from dendrites to axons in a neuron.

The ends of the axon branches form a junction with the next cell dendrites called **synapse**. Synapse is a point that transfers nervous stimulus between two nerve cells. The speed of the nerve impulse in the human is **90 m/sec**

Nervous Actions

Nervous actions are three types:

Voluntary Nervous Actions

These actions are under the control of the human will such as, speech, hearing, learning and different types of movements performed by different body organs (walking, sport games and doing hard works).

Involuntary Actions

Our internal organs move and work regularly and we can not control this, such as heartbeat, movements of stomach, intestines and blood circulation They are not under the control of the human will.

Reflex Actions

The spinal cord controls involuntany movements which are done by human without thinking, such as pulling the hand suddenly if it is touched by a hot object or pierced by a pin etc.

Some Psychological Disorders

Depression

There are many complicated problems in our life , such as: noises, over working, anxiety, smoking, etc.

All of these factors decrease the functional ability of nervous system.

Symptoms

1- General tirdness
2- Disenchanting with community.
3- Over reacting, anger, lose of attention.

Treatment and Prevention

For this reason, we must follow safe health directions and take care of personal health which includes body cleanliness and take care of residence, clothes and food cleanliness.We must avoid continuously hard working and weariness. We must rest and avoid sleeplessness continuously. Also we must adopt ourselves to go to bed early and have enough time for a rest and stability, because our body requires them. Also we must get rid of bad habits and stop passive practices (such as narcotics, tranquillizers, alcohol and smoking).

Schizophrenia

It is an inherited disease which caused by non-functional of an enzyme which involved in nervous functioning. And this cause abnormal functioning of nervous system.

Symptoms

1. Decreasing in concentration and memory abilities.
2. Aggressive and abnormal behaviours also lack of communication with other people.
3. Insomnia and losing ability of doing daily works.

Treatment

1.Visiting the physician and using suggested drugs.
2.Taking the drugs described by psychologist.

Prevention

Providing good living conditions and working conditions for individuals who have probability to be infected by this disease.

Review

Q1- Define the followings:

Reflex action,Nerve impulses, Nervous tissue, Meningeal membrane, Synapse.

Q2- Draw the following and write the names of the parts:

1-Nerve cell.
2-Structure of human brain.

Q3- Write the causes of the followings:
1-The nerve cell axon is surrounded by myelin sheath.
2-The cerebral cortex is gray in colour while the deeper part is white in colour.

Q4- Complete the followings:

1-The brain is located in _____ cavity which is surrounded by three membranes known as_____.
2-The autonomic nervous system is divided into two parts which are _____and_____.
3-The number of cranial nerves is about_____.

Q5- Write the location of the followings:
Medulla oblongata, Ranvier nodes.

Q6-What are the functions (importance) of the followings:
Nerve Meninges, Medulla oblongata, Cerebellum.

Q7-Answer the followings:

1- Write the composition of the autonomic nervous system.
2- Explain the spinal cord briefly and write its importance.
3- Write the parts of brain.
4- Write the types of the nervous actions and give an example for each of them.
5- Explain the transmission of nervous stimulus.
6- Write the differences between Axon and Dendrites.
7- Write the differences of sympathetic and parasympathetic nervous system.

CHAPTER 9

SENSE ORGANS

9

Introduction
Touch Sense (Skin).
Some of Skin Diseases.
Taste Sense (Tongue).
Olfactory Sense (Nose).
Vision Sense (Eye).
Hearing Sense (Ear).

Introduction

There are five senses in our body. The function of these senses is to detect the stimuli and to maintain the body. These senses are sense of touch, sense of taste, sense of sight, sense of smell and sense of hearing. Each sense keeps the body from various effects (wounds) caused by foreign bodies. Also they inform the brain by the way of nerve impulses and take action in suitable time and place. We feel the location of our organs and our body movements by senses. In specific cases, we feel hunger, thirst, tiredness, happiness and anger.

Generally, each sense organ consists of two parts:

1. **Principle part:** contains sensory neurons that receive the stimuli.
2. **Accessory part:** is a structure that transports stimuli to the ends of sensory neurons.

Sense of Touch (Skin)

In the skin, the sensory cells (receptor cells) are distributed in dermis layer. These sensory cells detect different senses such as touch, heat, cold and pain.

They diffused throughout the body but they are concentrated at the fingertips, thus fingertips are more sensitive than the rest parts of the body. When the receptor cells are stimulated, the touch, heat, cold and pain are sensed. These stimuli are transferred to the central nervous system by sensory nerves connected with receptor cells.

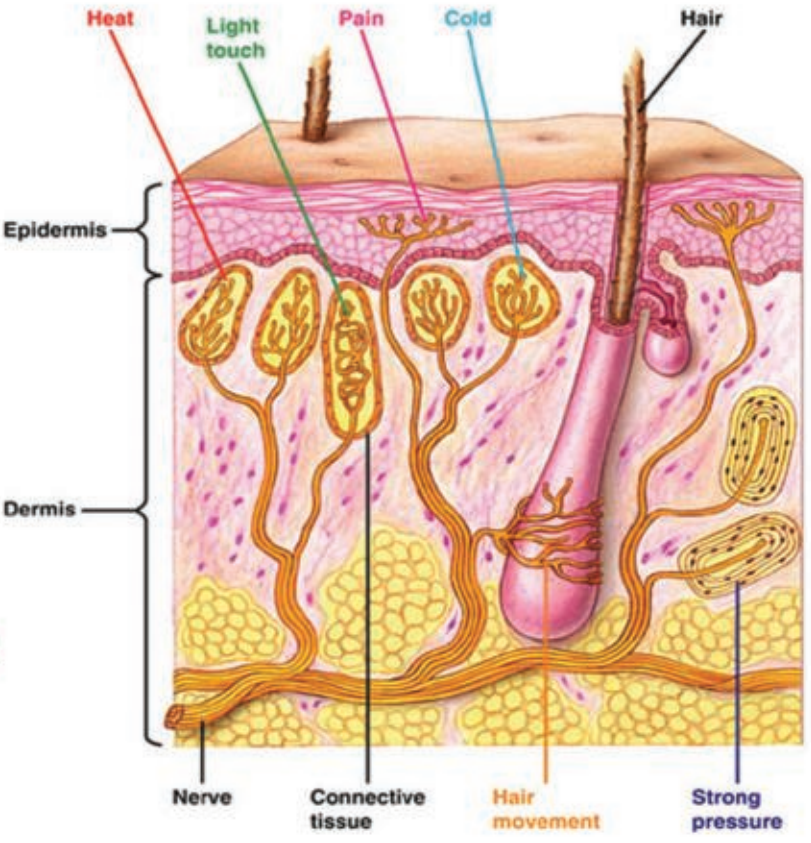


Figure 9.1 Distribution of Sense Receptors in Skin (for study)

Some skin diseases

Acne: They are temporary swellings which appear on the face due to the hormonal changes. Face must be washed daily by water and pimples mustn't be touched because they disappear gradually.

Warts: Caused by virus skin infection and generally caused by Mustn`t be touched by hand and necessary drugs must be used.

Lip vesicle: It caused by some virus and appears during some high fever diseases.

Heat spots: They are not in the form of swellings. They appear during poisoning and allergic disorders.

Albinisim: Disorders in melanin secretion cause changes in skin colour.

Skin Rush: Caused by hypersensitivity to some materials such as chemicals and drugs.

Fungus: There are many types of fungus which infect the skin. They appear in form white spots on groin regions, neck, fingers and toes.

Taste Sense (Tongue)

The taste receptors diffused on the surface of tongue are called **taste buds**. Taste buds perceive taste and consist of long ciliated cells; their sense fibers extend to the brain. The taste buds are divided into **four** kinds according to their function; sweet buds, sour buds, salt buds and bitter buds. The taste buds for each flavour are located in specific regions of the tongue.

The sweet buds are located on front tip of tongue, bitter buds are located on the end tip of tongue, and salt buds are located on the front sides of the tongue and sour buds are located back sides of the tongue.

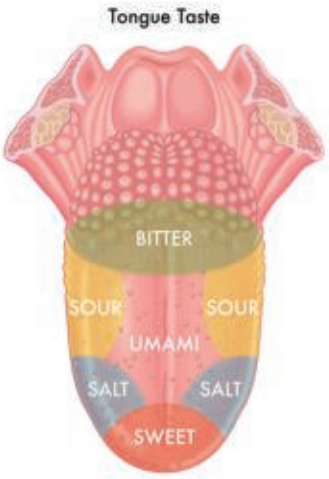


Figure 9.2 taste buds on tongue (for study)

Health of Taste Sense

This is strongly related with the health of mouth. Do not eat hot food and harmful substances which cause lesion to mucous membrane covering tongue. Because damaging of mucous membrane causes damages to the taste buds located under the mucous membrane. Also drinking alcohol and smoking are considered as harmful substances because of their damaging effects on the mucous membrane and the nerve ends. This condition weakens the sense of taste. It is advised not to use the tongue for adhering stamps and papers.

Olfactory Sense (Nose)

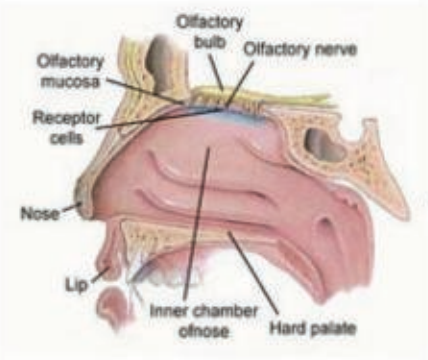


Figure 9.3 Structure of nose (for study)

There are fine nerve ends on the mucus membrane lining the internal nasal cavity. Each of these nerve ends is terminated with a group of nerve cells called **smell receptors**; these cells (smell receptors) perceive odor. Smell receptors pick up the odors of different substances and send messages to the brain by olfactory nerves. The inner surface of the nasal cavity is covered by a fine membrane called **mucous membrane**.

Health of Olfactory Sense

Olfactory sense is directly related to respiratory system, for this reason we must not be exposed to cold air current and we must clean the excess amount of mucous materials from the nose carefully. Furthermore, we must not use dirty handkerchief , this condition is considered as a source of danger for health of other people. In addition, the sneezing must be done inside a handkerchief to prevent the microbe transportation to the other people.

Figure 9.4 Sinuses (for study)

Also smoking and exposing to toxic gases weaken the sense of smell and may damage the nerve ends. Exposing to the irritative odors for a long period causes weakness of this sense and sometimes may cause loss of sense. For this reason we must not be exposed to irritative odors for a long period to protect the sense of smell.

Sinuses

They are cavities that located in skull. Frontal sinus, Maxillary sinus and Ethmoid sinus. Infection of sinus cause strong headache and temporary mucus secretion.

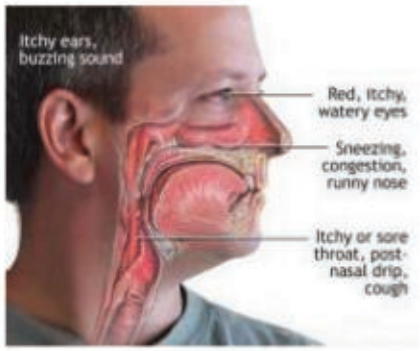


Figure 9.5 Inflammation of sinuses (for study)

Causes of sinus inflammation

1. Pollens inhalation which increases in spring season.
2. Exposure to the cold air.
3. Inhalation of dust.
4. Inhalation of the chemicals vapoures.
5. Smoking
6. Drinking alcohol.
7. Flu and respiratory tract infections.

Sneezing

It is happens by air explosion from the internal environment by nose. And it causes cleaning of respiratory tracts. It also symptom of some cold diseases. Sneezing individual must close the mouth and nose with handkerchief or forearm to prevent spreading diseases.

Vission Sense (Eye)

The eye helps the human to recognize the world around us. By the help of eyes, we can separate night and day, near and far and a lot of things which adapt the human to the environment. Without sense of sight, the life would be difficult.

Structure of Eye

Eye is a spherical structure and slightly flat at the anterior part. Its diameter is not more than 3 cm. Eye is located inside a special cavity called **eye orbit** in the frontal bone.

The eyeball is surrounded by two **eyelids** which are covered with a tiny, flexible and moistly membrane. Also this membrane covers the front part of the eye and is called as **conjunctiva**.

Also eyes are connected with **tear glands** which secrete tear to wash the eyes from dust or foreign particles that may enter and damage the eye.

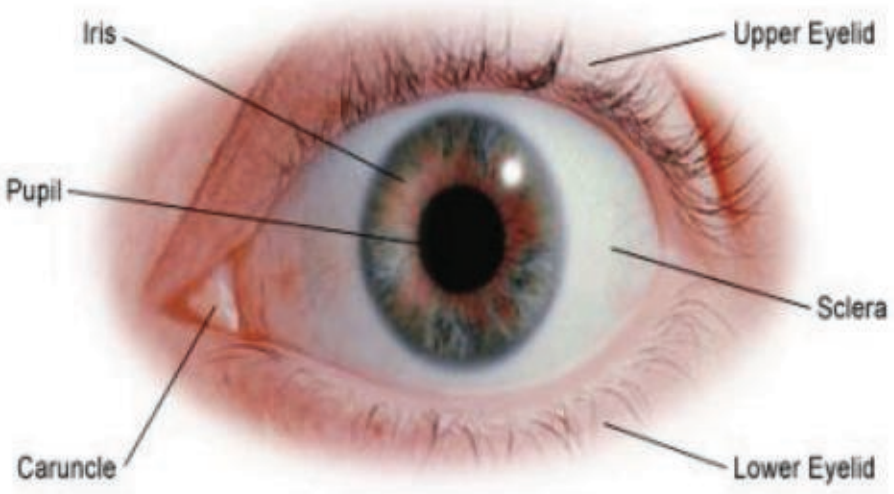


Figure 9.6 External structure of eye

Eye muscles may not have the same strength and efficiency, for this reason the weak eye that has weak muscles is directed to inside or outside, this abnormal condition is called **cross-eye**. In the case of cross-eye, the eyes do not have the same sight strength and each eye look in a different direction.

Structure of Eyeball

1. Sclera

It is the outer layer of the eye sphere and forms the white part of the eye. At the front of the sclera, the sclera becomes thinner , transparent and slightly curved. This part is called **cornea**.

2. Choroid

It is middle part of eye sphere and contain pigments. **Pupil** is made up of smooth muscles located in front of lens. A hole in centre of **iris** called as pupil allow light to enter the eye. Behind the iris, there is a structure that is elastic and transparent.
This structure is called **lens**. The posterior part of the lens is more convex than the anterior part.

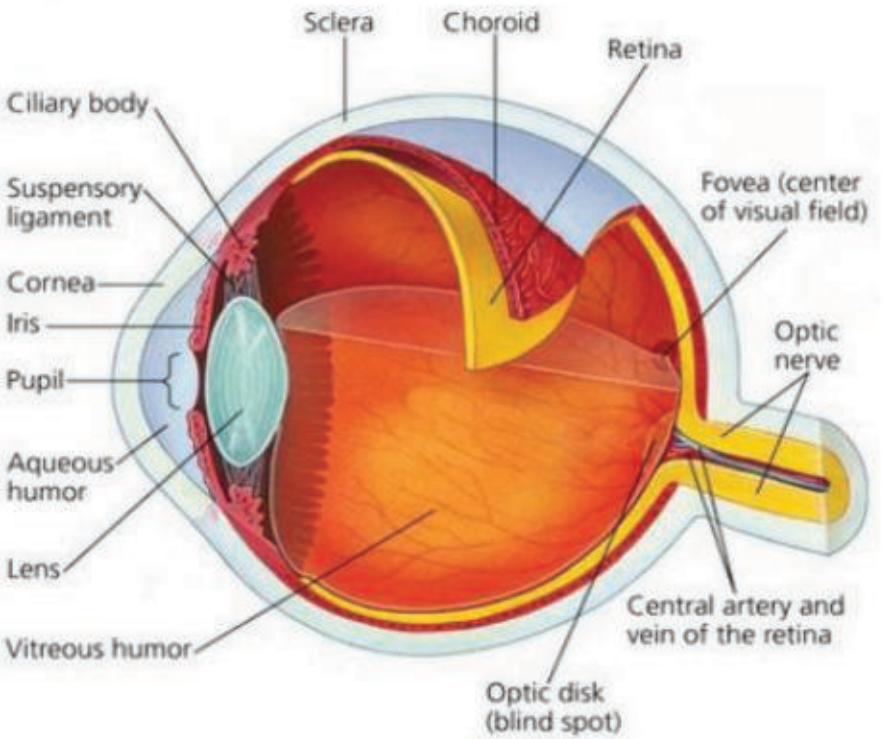


figure 9.7 Internal Structure of Eye

3. Retina

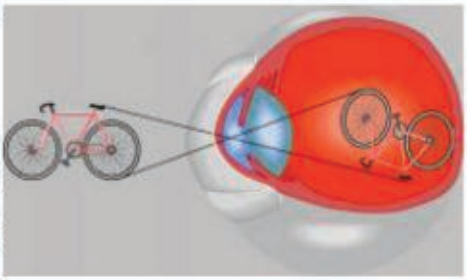
It is the inner layer of the eye and it lines the eyeball. It consists of the ends of the optic nerve and photoreceptor that are stimulated by light. There are two types of photoreceptors; **rods** and **cones**. In this part, the photoreceptors are concentrated or most closely packed. This part is called **yellow spot**.

Beneath the yellow spot there are no photoreceptors where the optic nerve leaves the retina. Since there can be no vision at this part and it is called as **blind spot**.

Inner Eye Fluids

There is a cavity which is located between the lens and cornea; this cavity is called **anterior chamber**. This chamber is filled with a liquid called **aqueous humour**. This liquid looks like the lymph.

There is also a cavity which is located behind the lens; this cavity is called **posterior chamber.** This chamber is filled with a liquid called **vitreous humour**. The aqueous and vitreous humours maintain the shape of eyeball and help the light rays from reaching the retina without dispersion.



Vision Process

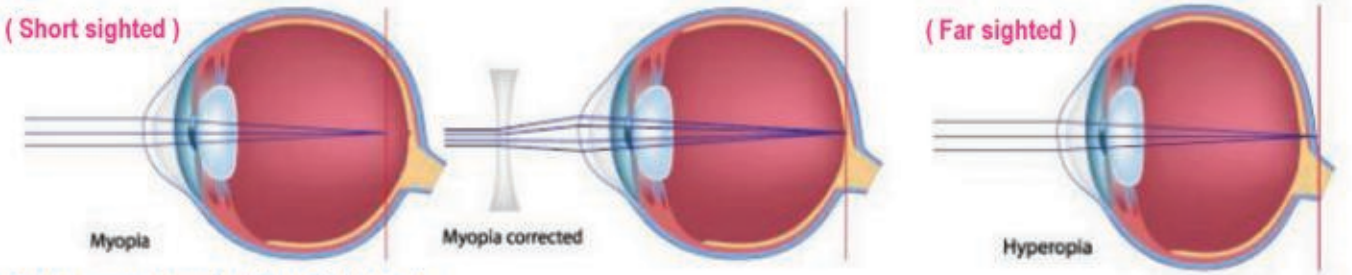
Eye is special sense organ, which is only stimulated by light. Its structure resembles a model of simple camera. The light rays are collected by cornea and focused on the retina by lens. Then, the photoreceptors diffused on the retina are stimulated by light rays and send this stimulus (visible image) to the vision centre in the brain. This image is interpreted in the occipital lobe of brain in the form of coloured photo with its normal dimensions. These all operations are called as **vision process**.

Functional Eye Diseases (Physiological)

Eye is infected by different diseases. Some of them are physiological and others are microbial. The important physiological diseases are:

1-Myopia (Short Sighted)

This disease occurs mainly in childhood. The infected person can not see the far object clearly. This bad condition may last after childhood. Myopia happens as a result of increasing the convexity of lens or the convexity of cornea or the length of eyeball. So the image forms in front the retina and the far objects cannot be seen well. Myopia is treated by wearing concave lens used for dispersing the light rays. These lenses may be in the form of the glasses or contact lenses.



2-Hypermetropia (Far Sighted)

It occurs after 40 years old. The infected person cannot read ordinary writing in normal distance. Because this person can see distant object clearly but cannot see the close objects. This disease occurs as a result of the convexity of cornea and lens or the length of eyeball. So the image is focused behind the retina. Hypermetropia can be corrected by wearing convex lens. These lenses may be in the form of the glasses or contact lenses.

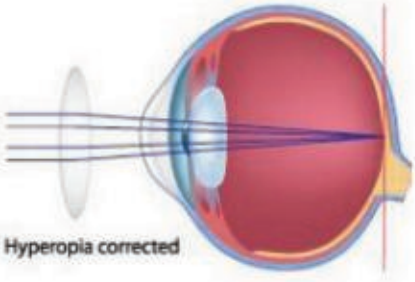
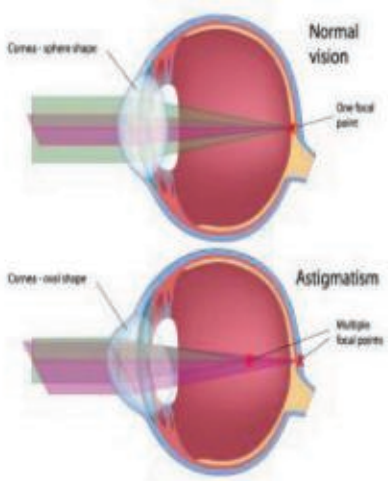


figure 9.8 Far and Short Eye Sight



3-Astigmatism

The person cannot see the vertical lines clearly, but he can see the lines that pass in one direction clearly. If the curvature of the cornea or the lens becomes irregular, all the reflected light rays cannot be focused on the retina. Therefore, some parts of the image formed on the retina will not be sharp and the infected person cannot see the objects clearly. Astigmatism is treated by wearing special lens or glasses.

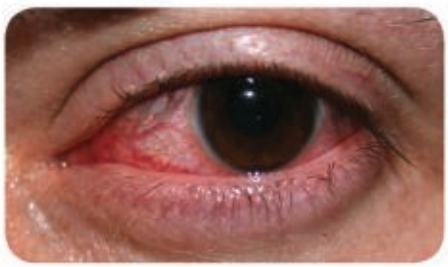
4-Cross eye (squint)

It is a congenital disease which caused by abnormalities of eye muscle when one of them shorter or longer than normal. It can be treated by medical surgery.

Microbial Eye Diseases

Pyogenic Ophthalmia

It is the inflammation of **conjunctiva**. Some pathological microbes cause this disease. There are two infection ways; directly and indirectly. Microbes of this disease are directly transmitted from hands to the eye by touching the contaminated equipment. Microbes are indirectly transmitted to the eyes by flies. These microbes are transmitted from infected eyes to uninfected eyes. This disease may be transmitted to the newborn babies while the infant passes through the genital passage of mother during the birth. This disease causes a great amount of pus secretion. Eyelids swell and become red. If this disease spreads in the eye, it causes blindness after a short period.



Remedy

1. We must clean the eye with warm water.
2. We must visit the physician immediatly.
3. hands must be washed with water and soap when touching the patient's eyes to prevent the transmission of microbes.
4. We must use clean paper handkerchiefs instead of normal cloth handkerchiefs.

Prevention

1. Elemination of flies, the major disease transmitters.
2. Taking care of personal cleaning.
3. checking newborn baby's eyes and use suitable drop for eyes described by physicion
4. We must visit the physician quickly if symptoms appear in the eyes.

Health of Eye

1. Maintain the eye clean and wash the secretions continuously.
2. Do not stress the eye by not reading in weak light or very strong light directly or under moving light or inside moving vehicle.
3. Keep the eyes from entering foreign bodies, don't rub the eyes but wash them with warm water.
4. Keep the eyes from strong sunlight and do not look directly to the sun.
5. Do not use other people's tools, which have a direct contact with eye.
6. Avoid the direct hit or shock.
7. Don't smoke because smoking weakens the optic nerve or causes sight disorders and weak vision.

Hearing Sense

Structure of Ear;
1. Outer Ear

It consists of two parts; a cartilage part called **auricle** and a central duct called **auditory canal**. The internal opening of auditory canal is covered with vibratile membrane called **eardrum**. Eardrum is located between the outer ear and middle ear. Outer ear collects the sound waves and transports them from air to the middle ear. The skin of the external auditory canal secretes a waxy-like material. Also the outer ear opening is lined by a number of hairs.

2. Middle Ear

It is unregulated cavity which extends to the inner cavities. Middle ear connects the outer ear and inner ear. Eardrum connects the outer ear and middle ear. Also, between the middle ear and inner ear, there are two openings covered with special membrane. These two openings are called **round window** and **oval window.** So these openings connect the middle ear and inner ear. Middle ear is connected with pharynx through a special canal called **Eustachian tube**. The function of Eustachian tube is to equalize the air pressure on both sides of eardrum.

Inside the middle ear, there are three small bones which transfer the sound waves into the inner ear. These bones are **malleus**, **incus** and **stapes**. The **malleus** is connected with eardrum from one side and connected with **incus** from other side. **Incus** is located between the **malleus** and **stapes**.

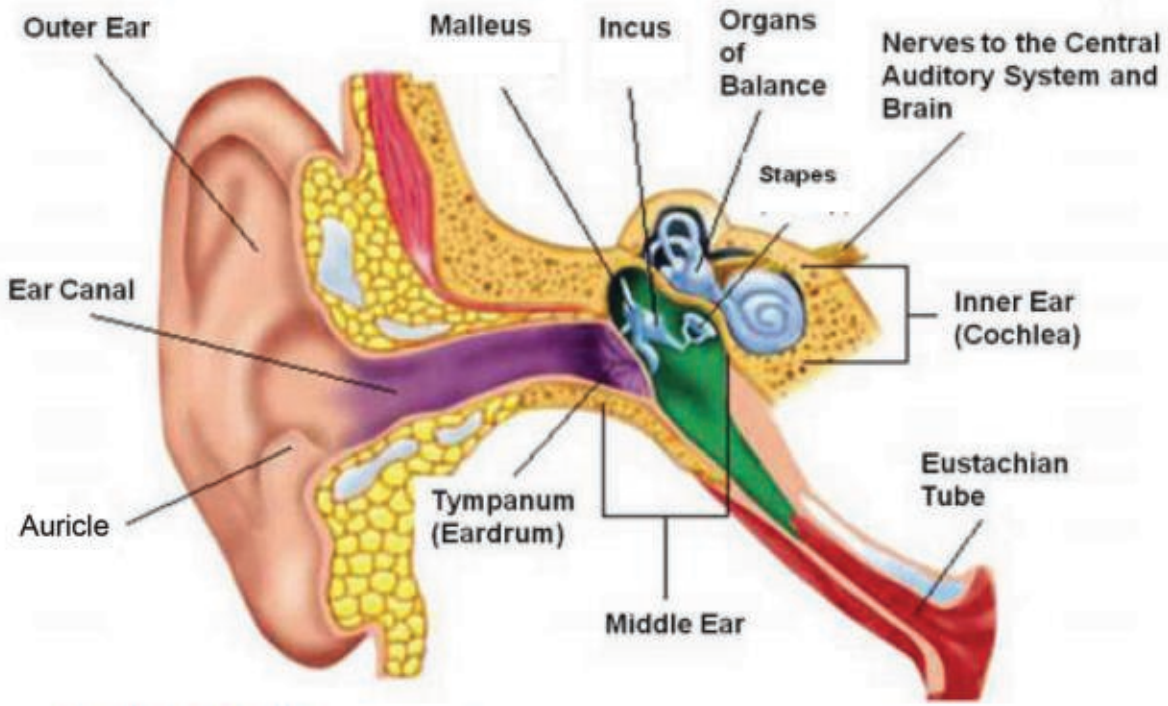


Figure 9.9 Structure of Ear (for study)

3. Inner Ear

This part is located within the temporal bone cavity. It consists of two main parts;

a. Cochlea: It is a spiral coil structure (like snail) that consists of a bony part called **basilar bone** and some membrane structures called **basil membranes.** The cavity between the membranes of cochlea is filled with liquids called **perilymph** and **endolymph**.

b. Semilunar Canals: They consist of three tubes located in three vertical planes. Each canal looks like an arched tube. The chambers of these canals are filled with **lymphatic fluid**.

Inside the semicircular canals and cavities connected with cochlea, there is a receptor organ which contains ciliated sensory cells.

The cilia are located inside a mucin layer and lymphatic liquid. The function of these sensory cells is to send required information about the body position to the cerebellum, so the body takes a proper action to maintain its balance.

Hearing Mechanisim

1- The outer ear collects the sound waves and transports to eardrum (middle ear) via auditory canal.

2-The sound waves vibrate the eardrum and move the bones of middle ear (malleus, incus and stapes).

3-This vibration passes into the oval window; it vibrates the perilymph and endolymph. After that, the sound reaches the receptor organ.

4- Receptor organ take these nerve impulses and send to the hearing centre in the cerebrum by the auditory nerve. Then, these impulses are converted to sensation like the original sound so we hear.

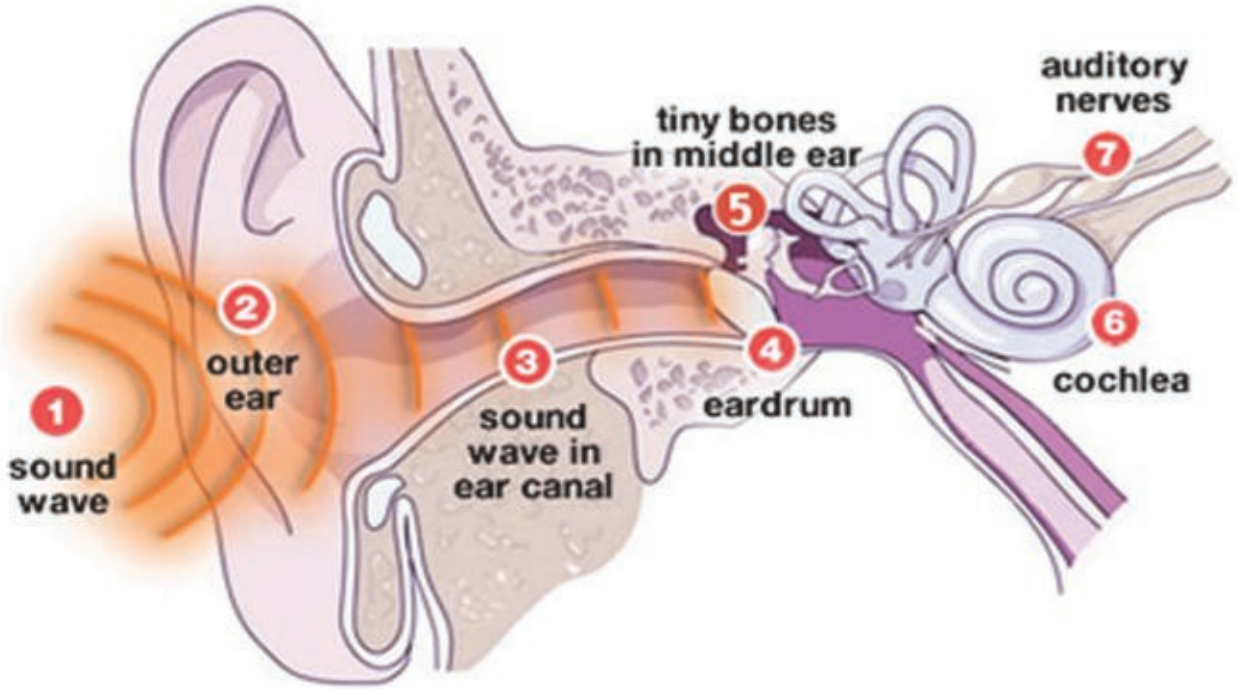


figure 9.10 Mechanism of hearing (for study)

Review

Q1- Define the followings:

Incus, Oval Window, Blind spot, Eustachian tube, Taste buds.

Q2- Draw the followings and write the names of the parts:

1-Far sighted of eye.
2-Internal structure of eye.

Q3- Write the causes of the followings:

1-The shades of the bodies are not seen, if they are located on the blind spot.
2- Occurrence of cross-eye (squint) in human.
3-When hearing high voice, the mouth must be open.
4-Presence of aqueous humour and vitreous humour in eye.
5-The necessity of presence of pain receptor cells (nerve cells specialized for pain) in the body.

Q4- Complete the followings:

1-The outer ear consists of a cartilage part called .....
2-The bitter taste buds are located at ..... of tongue, while the sweet taste buds are located at ..... of the tongue.
3-The salt taste buds are located in ..... of tongue. The bitter taste buds are located in ..... of tongue.
4-The eye is located inside a special cavity found in the frontal bone which is called. ..... .
5.The nose secretes a mucous material which helps . ...

Q5-Write the places location of the followings:

Vitreous humour, Semicircular canals, Round window, Oval window, Aqueous Malleus, Tear Glands

Q6- What are the functions (importance) of the followings:

Pupil, Tympanum, Eyebrows, Vitreous humour,

Q7-Answer the followings:

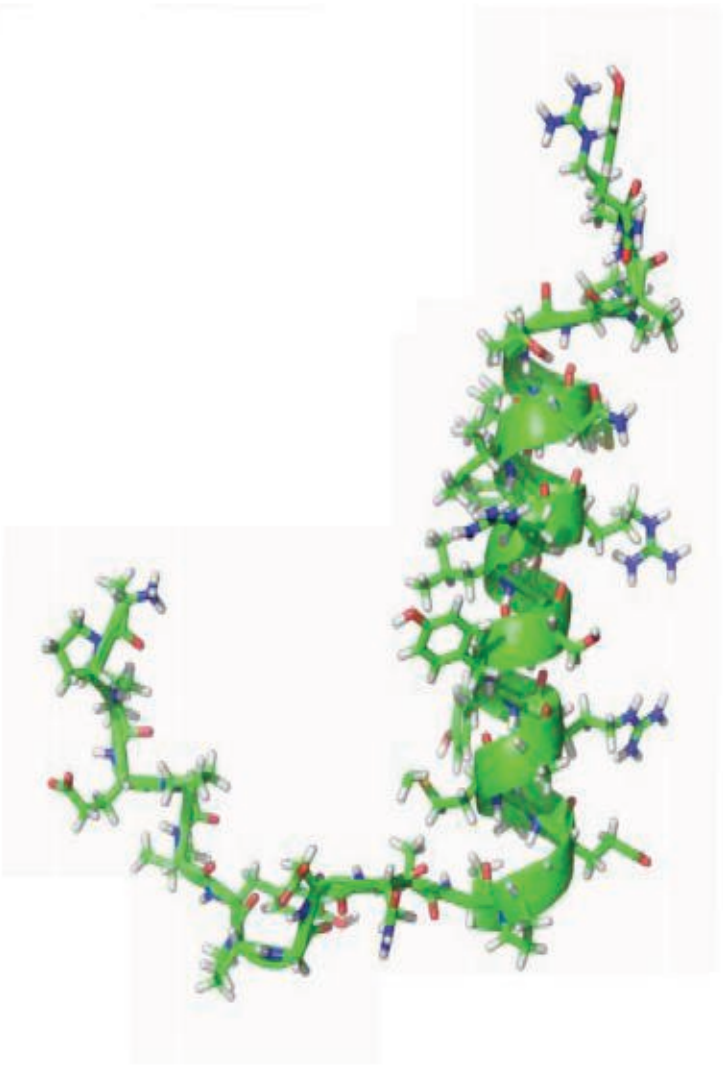
1-Explain the structure of middle ear?
2-What is the myopia? How is it treated?
3-Explain the visual process?
4-Explain the hearing operation in human?
5-What are the ear parts and which part is specialized with balance?
6-What are the general directions for maintaining the sense of hearing?

CHAPTER 10

SECRETION

10

Introduction
Glands
Endocrine Glands
Pituitary Gland
Thyroid Gland
Adrenal Glands
Mixed Glands
Testes
Ovaries
Pancreas



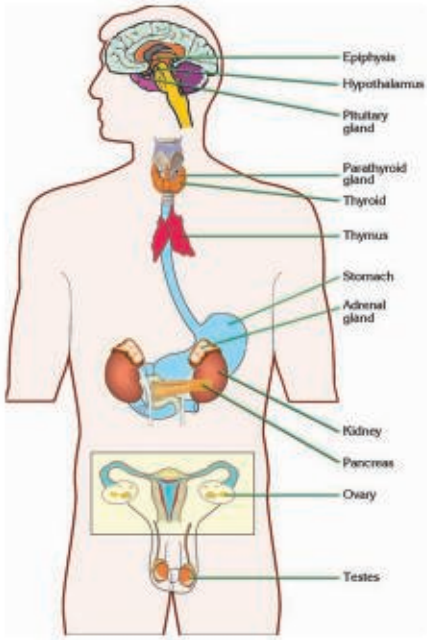


Figure 10.1 Glands in human body (for study)

Introduction

The body forms useful liquids which has complex structures. Because, human body requires these useful materials to perform its biological activities completely. This formation process is performed by special glands. These glands extract the raw materials from the blood or lymph and convert them into useful materials. This operation is called as secretion. There are other operations in the body and they are also performed by glands or special organs. These glands and special organs accumulate the harmful materials (liquid, solid or gas). The accumulated materials are not converted into other materials by glands and special organs. They are discharged from the body by glands and special organs. These accumulation and discharging operations are called as excretion.

Differences between secretion and excretion

Secretion

1-Secretion is the formation of useful materials for the living organisims to perform their biological activities

2-Secretion materials are liquid.
3-Secretion is performed by special structures called glands.

Excretion

1-Excretion is the discharging of harmful materials from the body such as CO_2 and feces.
2-Excretion materials can be solid (feces), liquid (sweat), or gas (CO_2).
3-Excretion is performed by special glands and organs such as sweat glands and some digestive system organs.

Glands

Glands are the special structures composed of a group of cells specialized for secretion or excretion in the body. Glands are classified according to the secretion methods to:

Exocrine Glands

They are glands which discharge their secretions into the ducts not into the blood or lymph. For this reason, they are also called ductile glands such as salivary glands.

Endocrine Glands

They are glands without ducts and they discharge their secretions into the blood capillaries. For this reason they are also called ductless glands.

Mixed Glands

They are glands that secrete two types of secretions; internal and external such as pancreas gland. They discharge their secretions both into the blood and ducts.

Endocrine Glands

They discharge their secretions known as hormones they are chemical messengers responsible for the regulation of body process into the blood or lymph directly. For this reason the endocrine glands are rich in blood vessels. These glands are distributed in different locations in human body such as:

1-Pituitary Gland

Pituitary gland is located under the brain. Because of its location and its hormones that control the activities of the other endocrine glands, pituitary gland is called as **master gland** (or it is called the second brain in the body). Pituitary gland is about the size of a small grape. Its diameter is about 1cm, consists of two parts; yellow **anterior lob** and white **posterior lob**.

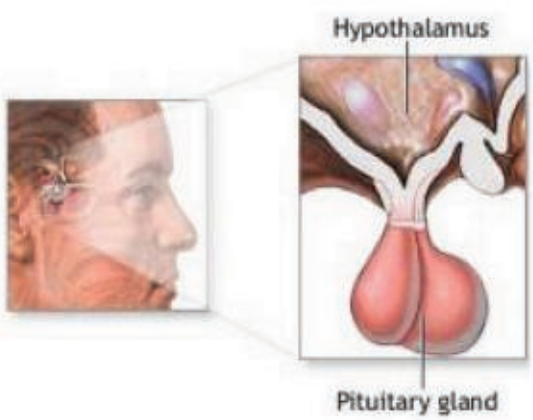


Figure 10.2 Pituitary gland (for study)

Some Hormones Secreted by Anterior Lob of Pituitary Gland

a. Growth Hormone

This hormone stimulates the body to grow. For this reason a deficiency of this hormone in childhood causes **dwarfism** and the over secretion of the hormone causes **gigantism**. If this disorder happens during the late age, the bones of the body become abnormally large especially the bones of limbs, face and skull.

b. Thyroid Stimulating Hormone (TSH)

This hormone stimulates and regulates the thyroid gland secretions.

Some Hormones secreted by Posterior Lob of Pituitary Gland

a. Oxytocin Hormone

This hormone stimulates the muscles of uterus to contract and facilitates the birth. Also it is believed that, the oxytocin hormone helps the secretion of milk from the breasts by working together with prolactin hormone.

b. Antidiuretic Hormone (ADH)

This hormone increases the blood pressure because it affects the contraction of smooth muscles found in blood vessels. Also this hormone affects the reabsorption of water from urinary tubules.

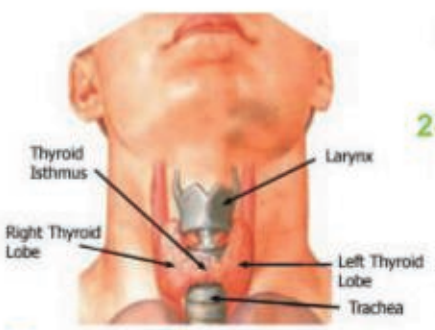


Figure 10.3 Thyroid gland and location in human body (for study)

2-Thyroid Gland

This gland is located in front of the neck below the larynx and it consists of two lateral lobs connected by a bridge, and there is third upper lobe called pyramid lobe, and there is third lob called pyramidial lob, for this reason it looks like the butterfly.

Functions of Thyroid Gland

Thyroid gland produces thyroxine hormone. This hormone regulates the rate of food metabolism in the body, so it affects the general growth. Also it affects the specialization and formation of the organs in the body. In infants, the deficiency of this hormone causes mental deficiency and delaying of sexual puberty (cretinism). But the deficiency of this hormone causes decreasing the rate of food metabolism, body temperature and heart rate during the puberty stage.

Thyroxine deficiency in the body can be resulted from the followings;

1. Thyroid gland dystrophia.
2. If the activity of thyroid gland decreases as a result of iodine deficiency in the body, the size of thyroid gland increases to replace the hormone deficiency.

Secretion too much thyroxine in the body can be resulted from the followings;

1. Increasing the size of thyroid gland.
2. Increasing the thyroid gland activity.

If the secretion of thyroxine increases, a lot of pathological symptoms appear; too much thyroxine increases the rate of food metabolism, the body temperature and the blood pressure. Also the muscular dystrophy occurs and the patient becomes nervous. The size of thyroid gland starts to increase and the eyes protrude from the eye sockets (this condition is called as exophthalmos). The exophthalmos is considered as the important symptom of the swelling of thyroid gland as a result of the secretion of too much thyroxine. Because the swelling of thyroid gland as a result of the thyroxine deficiency is not associated with any exophthalmos.

3-Adrenal Glands

Adrenal glands are pyramid like structures and there are two adrenal glands located on the top of each kidney. Each adrenal gland consists of two main regions; **cortex** and **medulla**. Cortex is the outer part of the gland. The colour of the cortex is yellow from outside and brown-red from inside. Medulla is the inner part of the gland. Medulla is thinner than cortex and the colour of medulla is brown. Each part of the adrenal gland (Cortex or medulla) has a special function. For this reason, they operate as two independent glands. A capsule that separates them from the kidney surrounds the adrenal glands.

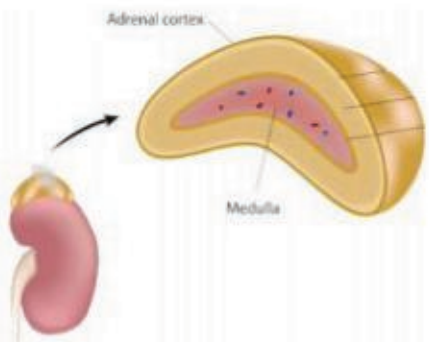


Figure 10.4 Adrenal gland

Functions of adrenal gland

A. Functions of Adrenal cortex

If the cortex is separated from the adrenal gland or if its function is stopped, Addison's disease occurs.

Symptoms of this disease are;

- Decreasing the blood pressure, muscle weakness and disorders of digestive system. Also patient's skin colour becomes golden. If the patient is not treated during early stage, it causes death. **Treatment involves replacment of missing hormones.**

Important hormones secreted by adrenal cortex;

1. Mineralized hormones: (Aldosterone) these hormones control the water and salt balance in the body.

2. Sugary hormones: (Cortisol) These hormones control the food metabolism in the body.

3. Sexual hormones

These hormones control the appearance of sexual characteristics in the body.

B. Functions of Adrenal medulla

Medulla produces two similar hormones; their structures are similar but their functions are different. The first hormone (adrenaline or epinephrine) increases the food metabolism and heart rate.

It prepares the body for critical situations, emergency and unexpected cases. Also this hormone affects the secretions of interior lob of pituitary gland. The second hormone (nor-epinephrine) maintains the normal blood pressure level in the body and also affects the food metabolism.

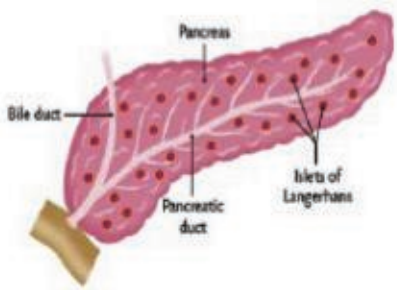


figure 10.5 pancreas (for study)

Mixed Glands

Testes

Testis is a mixed gland which produces two types of secretions;

External secretion; It is represented by producing semen liquid which contains sperms.

Internal secretion; It is represented by producing testosterone hormone that affects the appearance of secondary sexual characteristics in the male. If the internal secretion of testis increases in early age, the secondary sexual characteristics appear in early age in the male. But its deficiency causes opposite action.

Ovaries

Ovary is a mixed gland which produces two types of secretions;

External secretion; It is represented by producing the ovum (egg).

Internal secretion; It is represented by producing oestrogen and progesterone that affect the appearance of secondary sexual characteristics in female body such as soft skin ,soft voice,apperance of mamonary glands(breasts) The deficiency of these hormone causes opposite action.

Pancreas

Pancreas is a mixed gland which produces two types of secretions;

1-**External secretion;** It is represented by producing digestive enzymes. These digestive enzymes are produced by acinary cells of pancreas.

2-**Internal secretion;** It is represented by producing insulin and glucagon hormones. Insulin decreases the blood sugar level; glucagon increases the blood sugar level. These hormones are produced by **islets of Langerhans**. Islets of Langerhans are discovered by German scientist Paul Langerhans in 1869.

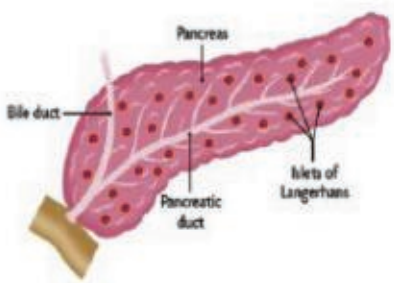


figure 10.5 pancreas (for study)

Review

Q1-Define the followings.

Endocrine gland, Exocrine gland, Mixed gland

Q2- Complete the followings.

1-The hormone which is secreted by the thyroid gland is called .....
2-Pituitary gland is located in .....
3-The thyroid gland is located in front of..... below the ..... directly.
4-The adrenal gland is located in .....
5-The ADH hormone is secreted by the posterior lob of.....

Q3- Give an example for each of the followings.

Mixed gland, Exocrine gland.

Q4- Write the location of the followings.

Pituitary gland, Thyroid gland, Adrenal gland.

Q5- Write the functions of the followings.

Thyroxine, Ovary, Pancreas

Q6-Answer the followings.

1- Write the hormones secreted by the anterior lobe of pituitary gland.
2- Classify the glands according to secretion method and give examples for each of them.
Ovary, Liver, Salivary gland, Gastric gland, Adrenal gland.
3- Write the important hormones secreted by the cortex of adrenal gland and write importance of each.
4- What are the differences between excretion and secretion?
5- Write the factors that cause the thyroxine hormone deficiency and secretion of too much thyroxine hormone in thyroid gland.
6- Draw the endocrine glands and mixed glands located in the human.
7- What are islets of Langerhans? What is thier location? What is thier importance for the body?

Q.7 -Correct the following statements.

1. Some glands secrete useful materials and other glands secrete harmful material.
2. The hormones are secreted by endocrine and mixed glands.
3. The hormones are accumulated in cavities inside the cortex of adrenal glands.

CHAPTER 11

IMMUNITY

11

Contents;

Introduction

During your life, you are exposed to many diseases. When some microbes penetrate your body, they cause some diseases. Also, you are exposed to some unexpected infections that cause some inflammations that affect your biological activities. These factors affect the human body and retard its activities. There is a sufficient force provide our body to resist the harmful and external factors, this force is called **immunity**.

Immunity is the ability of the body to resist many diseases and it has a great importance to protect our health. So, the immunity must be studied in detail, because of its importance.

Immunity is divided into two main types;

1. Natural immunity
2. Artificial immunity

Natural Immunity

It is an immunity which is formed in the body naturally. Which means the body gains natural immunity by itself.

There are three types of natural immunity;

1- Inherited Immunity

It is an immunity which is transmitted from parents to the individuals inherited by genes.

2-Congenital immunity

It is an immunity which is gained by mother's blood during the fetal growth or mother's milk during the breast-feeding. After the birth, the infants gain immunity against some diseases such as some contagious diseases like measles, smallpox, infantile paralysis and other diseases. This immunity disappears gradually after a few months.

3- Acquired immunity

It is an immunity which is gained by pathological microbes entering the body. When the microbes enter the body, the body produces antibodies against these microbes. Sometimes, when the microbes enter the human body, the amount of microbes may be insufficient to cause the disease. So, the body produces antibodies against these microbes. After a short time, the human body gains the immunity against this disease for a long period or short period such as small pox.

Artificial Immunity

It is an immunity which is gained by vaccine and serum artificially.

There are two types of artificial immunity;

1- Positive immunity

It is an immunity which is gained by vaccines. After the human is vaccinated with a vaccine that contains dead or weak microbes or toxins of these microbes, these materials enter the body and cause irritation in the body. Then, the body produces antibodies against these microbes and their toxins to prevent the infection with this disease. This immunity is for long periods (normally for few years).

2- Negative immunity

It is an immunity which is gained by serum. The antibodies are given to the body by vaccination with serum which contains antibodies. Firstly, pathological microbes are given to the blood of some animals and antibodies are produced in the blood of these animals. After that, these antibodies are taken from the blood of these animals and given to human blood. So, human body gains immunity against this specific disease such as serum against tetanus, rabies, hepatitis virus and other diseases. This immunity is called **negative immunity**.

Serums and Vaccines

Serums

It is a liquid material prepared from human blood plasma which is previously infected with a certain disease. It includes antibodies against a certain disease and it is used for protecting from a certain disease. So, it provides immunity against the diseases. It is prepared from the blood of some animals such as horses and cows.

After the certain microbes are injected to these animals, the antibodies are obtained against this disease and then these antibodies are injected to the human body by serum. So the necessary immunity is gained against this disease. These sera are prepared by special technical methods in special laboratories and stored in ampulla or tubes under the low temperature; it is then given to human in certain doses.

Vaccines

The vaccine is prepared from death or weak pathological microbes or their toxins. They are manufactured by special technical methods and then stored under the low temperature; it is then injected to the body when it is needed such as triple vaccine which is injected in many doses to gain the active immunity. Also, infantile paralysis vaccine, tuberculosis vaccine, measles vaccine and mumps vaccine are the other examples of the vaccines.

Immune system Diseases

Acquired Immune Deficiency Syndrome (AIDS)

The first diagnosis of AIDS was recorded in 1981. The number of the countries infected with AIDS was 8 countries in 1981. After that, this number increased and reached 164 countries in 1992. According to the world health organization (WHO), the number of people infected with AIDS reached about ten or eleven millions people; men, women and children in many countries in the world in 1991.

Immunity deficiency is a final stage of infection with virus which causes this disease. The incubation period of AIDS may be ten years; the infected person may look healthy for many years. During this period patient has ability to transfer the infection to other people. This disease starts by action of virus which causes this disease; it attacks and destroys the body cells which are responsible for defence against the diseases. So, it leads to the weakening of the natural immune system of the body. Because of this effect, this disease is called **acquired immune deficiency syndrome**.

Symptoms;

Before the body immune system is completely destroyed, the first symptoms of AIDS are the followings;

1- High body temperature and sweating lasts for few weeks.
2-The lymph nodes swell, especially in the neck and axillary.
3-Dry coughing and constriction of breathing appear, lasts for few weeks.
4-Chronic diarrhea occurs; this condition lasts for few weeks.

Prevention;

1-Before the blood transfusion, blood must be tested.
2-Giving correct information about the infection with AIDS.
3-Education and announcing have vital role to prevent the outbreak of this disease.

AIDS is very dangerous disease because of the following:

1-The infected person does not feel any symptoms for many years and so the virus can be transmitted to the other people.
2-There is no drug or vaccination to discharge the virus from the body.
3- Virus that causes AIDS stays in the body forever.

Examples of Vaccination against Diseases

Tuberculosis Vaccine

This vaccine is also called **BCG**. It is necessary to vaccinate the newborn infants from the first to fourth week to gain the immunity against tuberculosis disease. It provides active acquired immunity.

Triple Vaccine

Triple vaccine provides immunity against **tetanus**, **diphtheria** and **whooping cough**. This vaccine is given to the infants in three doses once a month for three months. The first dose is given to the infant during the third month of the infant's age. The strengthening dose is given at end of first year of infant's life and then the second strengthening dose is given at the entrance of pre-primary school.

Infantile Paralysis Vaccine

This vaccine is given by the mouth in the form of drops in three doses. This vaccine is given with triple vaccine at the same time. It provides immunity against **Infantile Paralysis**.

Measles Vaccine

This vaccine is given in one dose at the end of the first year of child's life. This vaccine protects the child against measles disease.

German measles (Rubella) and Mumps Vaccine

This vaccine is given in one dose and protects the body against these diseases collectively. The German measles vaccine is more important in girls according to the boys. Because, it provides immunity against the congenital heart diseases that affect the fetus.

Smallpox Vaccine

This disease is caused the death of a great number of people The vaccine is given by making a scratch on the skin surface and dropped on the scratch. After that, press on it. This vaccine provides immunity against the dangerous smallpox for three years at least. It may be repeated every three years.

Typhoid Vaccine

This vaccine protects the person against the typhoid disease. This vaccine is given to people that are exposed to the danger of infection with typhoid disease as a result of bad living conditions especially floods, wars and soldier camps. This vaccine may cause some adverse effects such as increasing the body temperature, headache, and body pains but these adverse effects disappear after two days.

Cholera Vaccine

This vaccine is used when the danger of cholera occurs.

Yellow Fever Vaccine

This vaccine is given to people infected with yellow fever, especially people traveling to the places contaminated with this disease. This vaccine is given by injection, as it is known that this disease is not present in Iraq.

Meningitis Vaccine

This vaccine is given to body during the outbreak of this disease in limited regions.

Review

Q1-Define the followings

Vaccines, Artificial immunity, Acquired immunity, Inherited Immunity, Congenital immunity.

Q2-Complete the followings

1-Triple vaccine contains the antibodies against the ..... and ..... disease.
2-The vaccine against tuberculosis disease is called .....
3-The vaccine against meningoencephalitis is given during the ....
4-The immunity is divided into two main groups which are 1..... 2.....

Q3- Answer the followings

1- What is the triple vaccine? Explain it briefly.
2- Define the natural immunity and write the types of it.
3- What are the differences between the serum and vaccine?