Chapter 13

GASEOUS EXCHANGE

Q.1 Define energy and respiration. Why is respiration is necessary? What is cellular respiration?

Ans. **ENERGY:** *The ability to do work is called energy.*

Respiration: *Exchange of respiration gases between organism and its environment, or between blood and tissues is called respiration.*

Activities require expenditure of energy and it is only possible, with the continuous supply of energy. Energy is produced by the process of respiration. In respiration, the oxidation of material takes place and energy is produced. For oxidation, oxygen is required and it is provided, while CO_2 is to be expelled out i.e., gaseous exchange has to take place.

Respiration occurs at two levels i.e. organism level and cell level.

Organism Level: At organism level, the respiration is also called ***breathing*** or ***ventilation***. Moist, permeable surface is required for breathing, as oxygen is absorbed and carbon dioxide is released.

Cellular Respiration: Cellular respiration is the ***biochemical*** part of respiration.

In cellular respiration energy is extracted from the food in the form of ATP which is further utilized during other activities.

Q.2 What are the advantages and disadvantages of gaseous exchange in air and water? OR

In what ways air is better respiratory medium than water.

Ans. During the organism respiration, the gaseous exchange is carried out only by diffusion. Exchange of respiratory gases takes place between the body fluid (blood) etc. and outside medium, the outside medium may be air or water. *Air is*

better respiratory medium than water, oxygen can be obtained more easily from air than from water because of following reasons.

(i) ***Oxygen content*** of air is much higher than the oxygen content of equal volume of water. 1 litre air contains 200 ml oxygen while water has 10 ml of O_2.

(ii) ***Oxygen diffuses*** about 8000 times more quickly in air than in water.

(iii) Water is 8000 ***times*** more dense than air, therefore its ventilation is far more difficult than the ventilation of air. In other words, water is 50 times more viscous, which makes it more difficult for exchange of gases as compared to air.

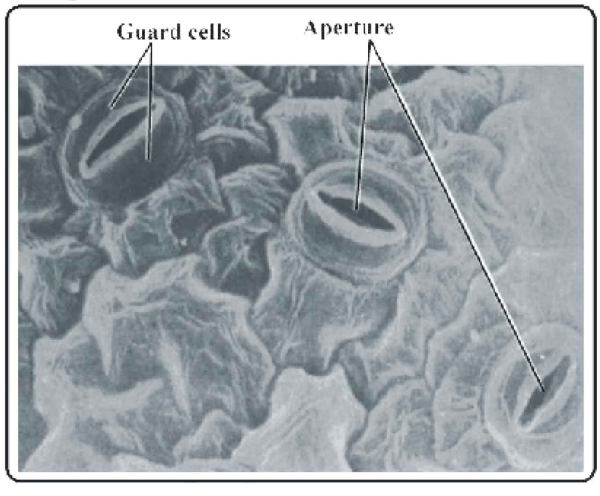
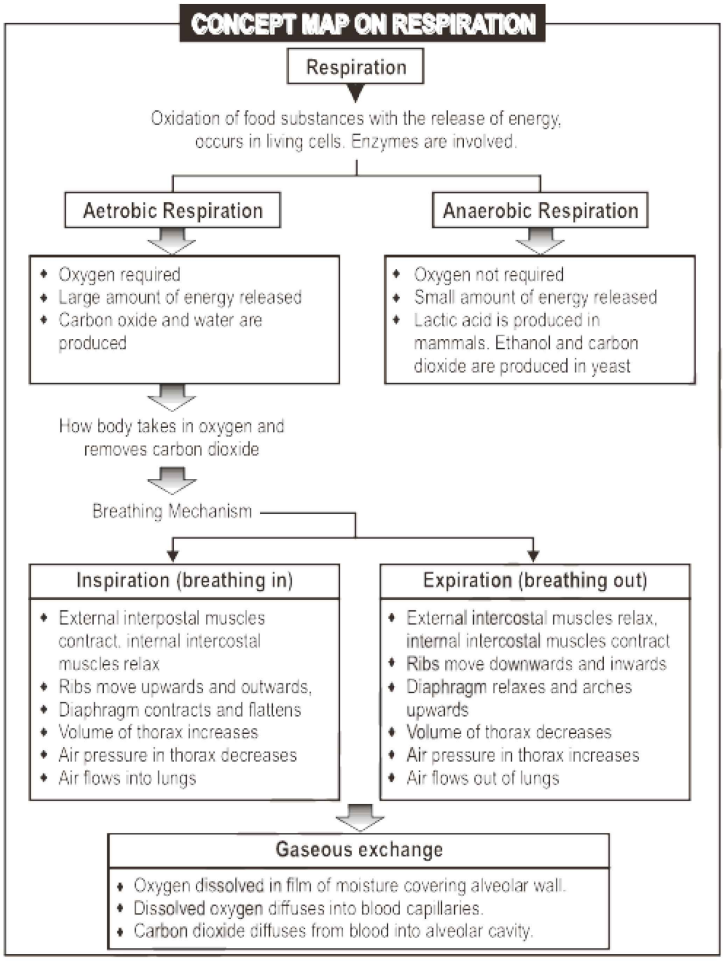


Fig. Stomata on leaf surface



(c) How does gaseous exchange occur in plants?

Ans. **GASEOUS EXCHANGE IN PLANTS**

Plants, like animals require energy for their functions and, they also get their energy from respiration.

There is no special organ or system present for gaseous exchange in plants. ***The mesophyll cells*** which are specialized for photosynthesis, have large air spaces. These air spaces are directly involved in exchange of respiratory gases. ***In plants, stomata are the main structures for the exchange of gases,*** they are largely present in the leaves and in young stems.

Cork tissue is present in the older stem which is formed of dead cells, ***Lenticels are the special pores involved in gaseous exchange present in cork tissue.***

Land plants get their oxygen directly from air through stomata

It is estimated that there are 12,000 stomata present per square centimeter of leaf surface in Tobacco plants. Between the mesophyll cells, intercellular spaces or air spaces, the exchange of gases from the moist surface of mesophyll cells takes place.

Air spaces cover about 40% area of leaf.

Roots get their oxygen from air present in the spaces between soil particles.

Aquatic plants get oxygen from water by diffusion.

Q.3 (a) Write a note on photorespiration.

Ans. **PHOTORESPIRATION**

Photorespiration is an energy dependent process during which oxygen is absorbed and carbon dioxide is released.

This process can be defined as Respiratory activity which occurs in plants during day time is called photorespiration.

The oxygen absorbed in this process is not useful to produce energy such as ATP and is derived from the early reaction of photosynthesis.

In ***photorespiration*** another enzyme ***Ribose biphosphate*** carboxylase/oxygenase (rubisco) fixes oxygen instead of carbon dioxide. It decreases the overall carbon dioxide fixation process and also plant growth.

In photorespiration. Ribulose 1,5 biphosphate (RuBP) reacts with oxygen. The ***rubisco is carboxylase*** as ***well as oxygenase***. Where ribulose adds carbon dioxide to RuBP, it act as ***carboxylase***. It is an acceptor molecule — on the other hand when rubisco acts as oxygenase it addBoth these reactions complete with each other.

Glycolate, a two carbon compound is produced when RuBP reacts with oxygen.

$$RuBP + O_2 \longrightarrow Glycolate$$

The glycolate diffuses into the membrane bounded organelles known as ***Peroxisome***, which are located adjacent to chloroplasts. These are usually present in the mesophyll cells in large converted into glycine, in the peroxisomes.

$$Glycolate \longrightarrow Glycine$$

Glycine which is smallest amino acid soon after its formation diffuse into mitchondria. In mitchondria two glycine molecules react and form serine one molecule of CO_2.

$$2\ Glycine \longrightarrow Serine + CO_2$$

Thus process in which RuBP is converted into serine is called photorespiration. In photorespiration ATP uses and NADPH produced in the light reaction just like Calvin-Bason cycle. But in fact photorespiration is reverse of Calvin cycle.

During this process carbondioxide is released instead of fixation into carbohydrates. In most plants photorespiration reduces. The amount of carbon fixed into carbohydrates by 25%.

Carboxylase Oxygenase

Rubisco *enzyme performs dual function i.e., as an* ***oxygenase*** *as well as* ***carboxylase***. The relative concentration of carbondixoide and oxygen in the leaf is the most important factor which decides that rubisco will act as oxygenase and when it will work as carboxylase. When oxygen is more than rubisco acts as oxygenase and photorespiration starts.

In a hot and dry, day the oxygen level inside the leaf rises. This is because the stomata close to prevent the loss of water. The carbondioxide level falls because it is being consumed and the oxygen level rises closed stomata do not let it go out.

Photorespiration is not essential for all plants and many plants grow normally without the process of photorespiration.

It reduces the net photosynthesis.

There is a question that why photorespiration exists?

The reason is that the active site of rubisco is evolved to bind both oxygen and carbon dioxide both together. The photorespiration starts when the quantity of oxygen become more.

Q.4 What are the properties of respiratory surface?

Ans. **RESPIRATORY SURFACE**

Respiratory surfaces in animals are the sites where exchange of gases takes place. In animals respiration takes place through ***gills*** and ***lungs***. They exhibit following features.

Surface area $\propto$ exchange of gases

(1) **Large Surface Area and Moisture:** The surface area should be large. So when there is more surface area there will be more exchange of gases.

(2) **Thin Epithelium:** The distance through which diffusion has to take place should be minimum.

In most animals the *epithelium which separates air and blood is only two celled thick.*

As a result, the distance for diffusion is very short.

(3) **Ventilation:** There is a big difference in concentration of gases in lungs and blood, which brings about ***diffusion.***

(4) **Capillary Network:** There should be an extensive network of capillary net ***through which blood should cross over all the time at an adequate speed.***

It helps in rapid diffusion of oxygen.

Q.5 ***Describe the process of gaseous exchange in following animals.***

(1)	***Hydra***	***(2)***	***Earthworm***
(3)	***Cockroach***	***(4)***	***Fish***
(5)	***Frog***	***(6)***	***Bird***

Ans. **(1)** **HYDRA**

* There are **no special organs** for respiration in hydra.
* The exchange of gases takes place *through whole of the surface of body*. Both internal and external parts are in contact with water.
* Outer cells exchange gases with the outer water, while cells lining the digestive cavity exchange gases with water coming into the body cavity.
* In this way, the surface lining of the *enteron acts as an efficient respiratory surface.*

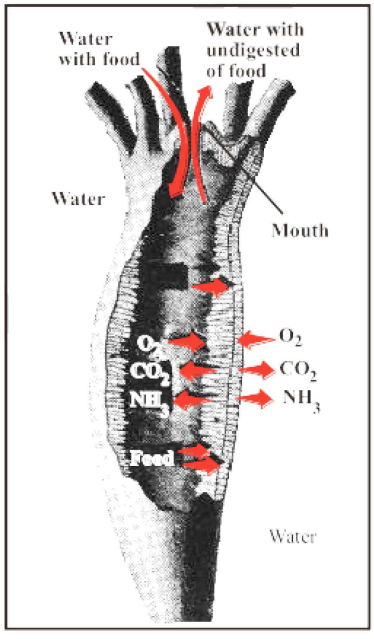


Fig. Respiration of Hydra

(2) **EARTHWORM**

Earthworm does not have any specialized respiratory organs. Gaseous exchange occurs mainly **through skin,** which is richly supplied with blood capillaries. *Skin is always kept moist* by the secretion of **epidermal mucous gland cells.**

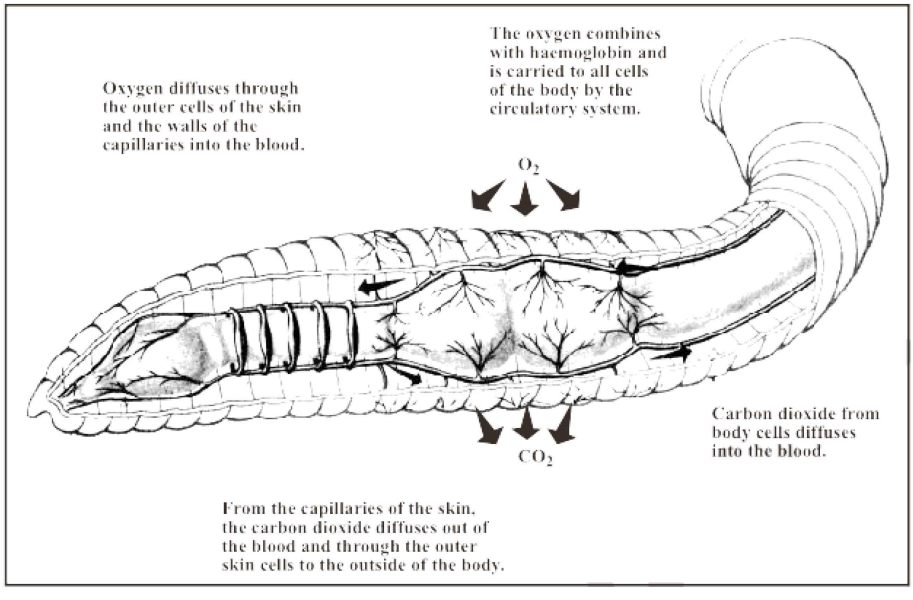


Fig. Respiration in Earthworm

Coelomic fluid also comes on the skin through the pores.

Oxygen dissolved on the wet surface and then diffuses into the blood. **In the blood oxygen combines with haemoglobin and form oxyhaemoglobin.**

As earthworms have *closed circulatory system*, blood does not come in direct contact with tissue. So oxygen must diffuse through tissue fluids and coelomic fluids.

Carbon dioxide is removed from the tissues by the blood carried in the plasma to skin, from where it is extracted.

(3) COCKROACH

The cockroach has specialized respiratory system. **It consists of branching system of air tubules which are lined by chitin and called trachea.**

Spiracles:

There are two pairs of apertures, present on the lateral sides of the body spiracles. These apertures are called spiracles, which open into air tubes or trachea.

Trachea:

Two pairs of spiracles are present in thorax while rest *eight are in each of the eight abdominal segments.* The main trachea divide and subdivide into very fine thin walled tubles called ***tracheoles***.

Tracheoles:

The tracheoles end into blind ducts which are filled with fluid, in which the oxygen dissolves. They are in close contact with cells, so air with oxygen passes through network of air tubes.

Diffusion of CO_2 and O_2:

The oxygen then diffuses to the cells and carbon dioxide goes back to tracheoles and then goes out.

Some of the carbondioxide dissolves in body fluid and passes out through soft areas in cuticle.

Expansion and Contraction of Abdominal Muscles:

By the expansion and contraction of the abdominal muscles, air is pumped in and out of the trachea. **The first four pairs of spiracles open, when abdomen expands,** as the resulting air rushes into tracheoles through these spiracles.

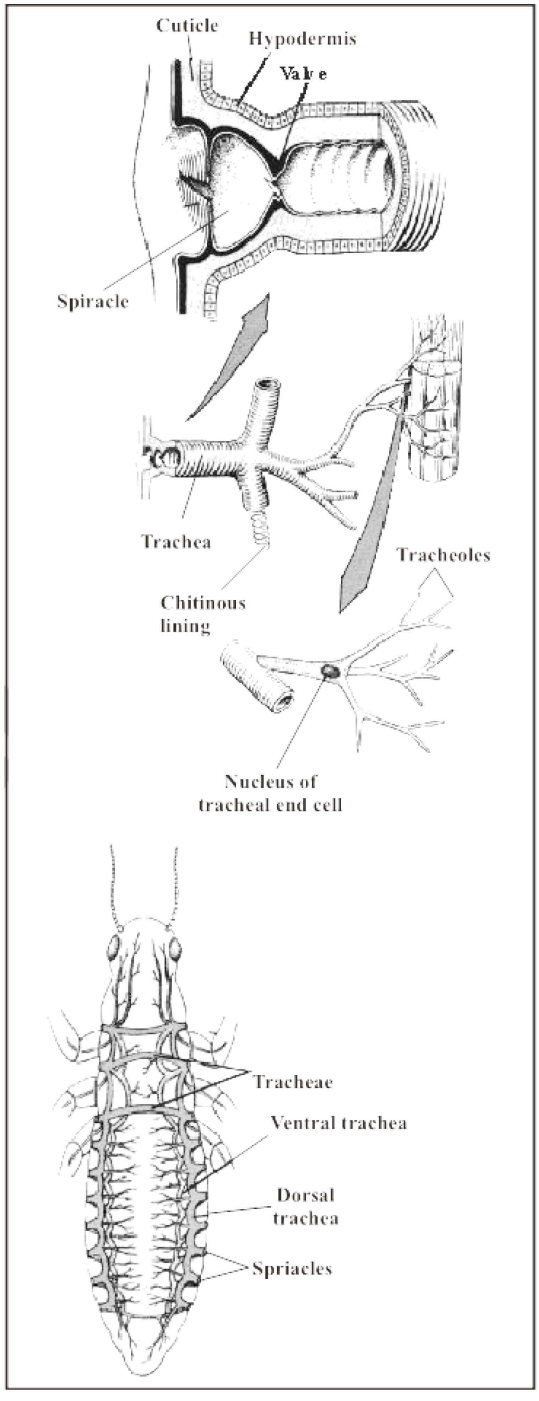


Fig. Respiration of Cockroach

The anterior four pairs of spiracles close and posterior six pairs open, when abdomen contracts.

Due to this force, air comes out of the body. In this way, ***exhalation*** and ***inhalation*** take place.

Air is directly supplied through tracheoles to the tissue cells and blood is not involved in the transport of gases.

EASY TO DRAW

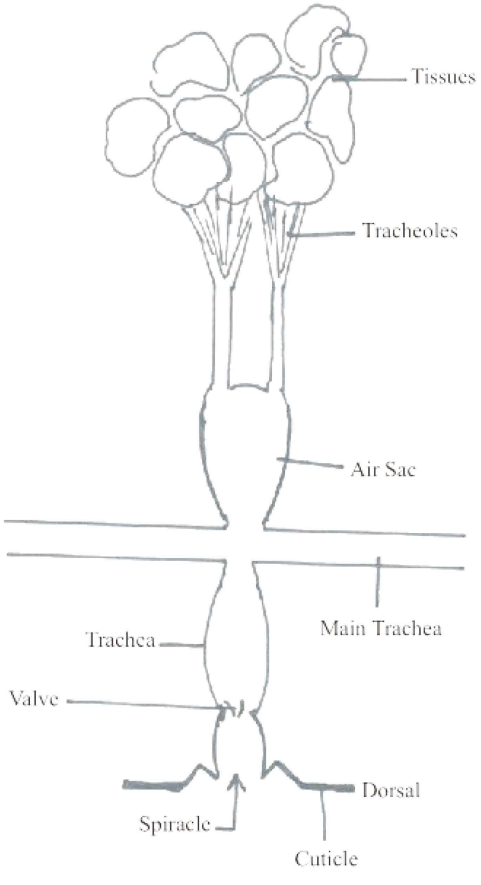


Fig. Respiration of Cockroach

THINKING ROOM

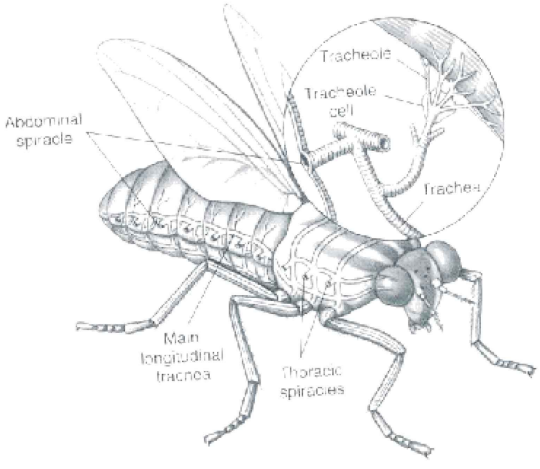


Fig. Tracheal system of insects. Air enters through the spiracles, then travels through tracheae to reach tissues at tracheoles.

(4) FISH

Gills: (at the junction of head & trunk):

In aquatic animals gills are more effective and highly modified organs for gaseous exchange. In fish, ***gills are present in pairs on either side of the body*** almost at the junction of head and trunk.

In cartilaginous fish, there are **four to five pair of gills** which open through the gill slits and they are visible on the surface of pharynx.

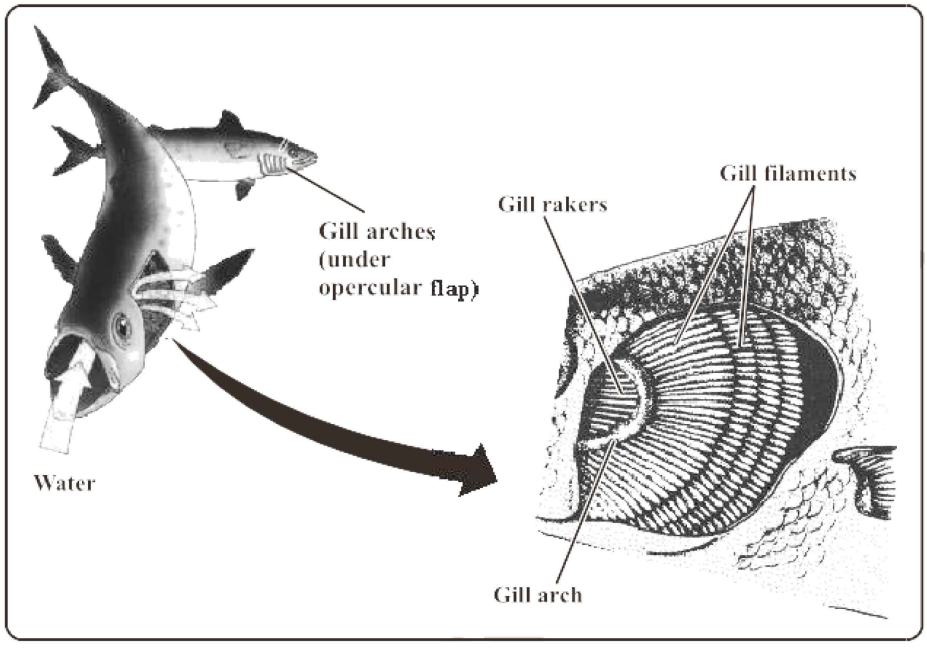


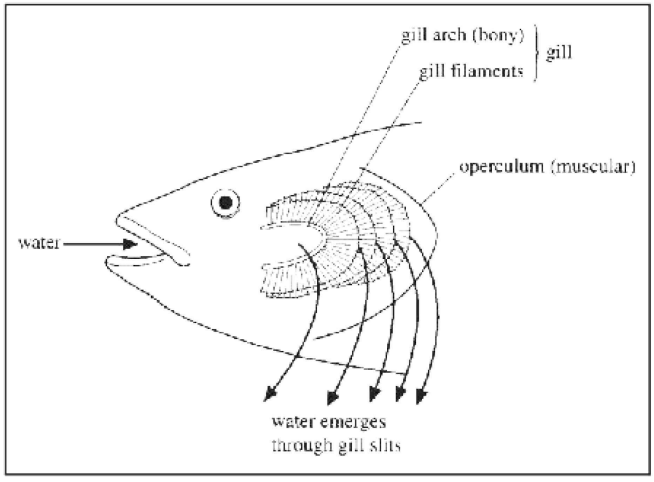
Fig. Water flows unidirectionally over the gills of a fish

Gills may be placed in ***bronchial cavities*** which are covered by operculum (Bony fishes).

Gills have great surface area for exchange of gases and gill surface is all the time ventilated by constant flow of water.

(ii) Heart:

Heart in the fishes is single circuit and the blood flows in only one direction. The deoxygenated blood from different parts of the body is received by heart, and it is pumped into gills from heart.



(iii) Exchange of Gases:

As water passes over the gills, the exchange of gases between blood and water takes place.

(5) FROG

In frog, the gaseous exchange occurs the:

(i) Lungs (ii) Skin (iii) Buccal Chamber

Pulmonary respiration is the exchange of gases through the lungs.

Nostrils: In frog, when the nostrils open, the mouth is closed and air enters through the ***nostrils.*** When the air enters, the nostrils close. The buccal cavity floor is raised, as the result, air is pushed into the lungs. This is known as *inhalation or inspiration* or intake of air.

Exhalation occurs exactly in reverse order in sequence of inspiration.

Structure of Lungs: In frog, lungs are ***balloon like simple sacs*** when they are fully expanded or filled with air. Thin walled *air chambers* are present in the lungs in order to increase the surface area of lungs. The walls of these air chambers are richly supplied with *capillaries*.

The ***main sites for exchange of gases*** in lungs are these blood containing areas. After gaseous consumed air, moves out of the lungs through the nostrils. ***The removal of consumed air out of the lungs is called exhalation or expiration.***

The gaseous exchange through the skin is known as cutaneous respiration. The buccal chamber is also richly supplied with blood vessels for gaseous exchange.

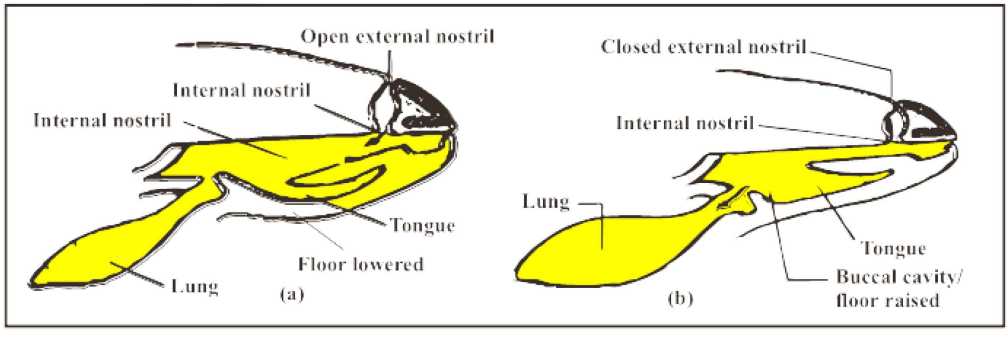


Fig. Two stages in inspiration (Buccal respiration)

(6) BIRDS

Active Animals: Birds are very ***active animals*** with ***high metabolic*** rate, thus they need large amount of oxygen. Therefore, in birds respiratory system is most efficient and elaborate.

One Way Flow of Air: In birds, there is one-way flow of air. Through the lungs, air is renewed after inspiration.

Parabronchi:

* Parabronchi are *tiny thin walled ducts* present in lungs.
* The parabronchi are opened at both ends and air is constantly ventilated.

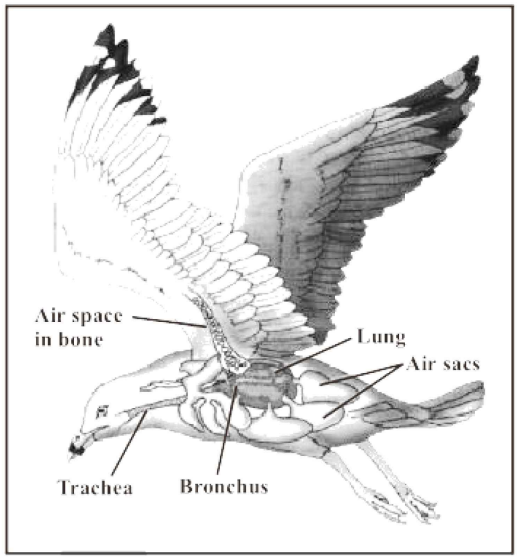
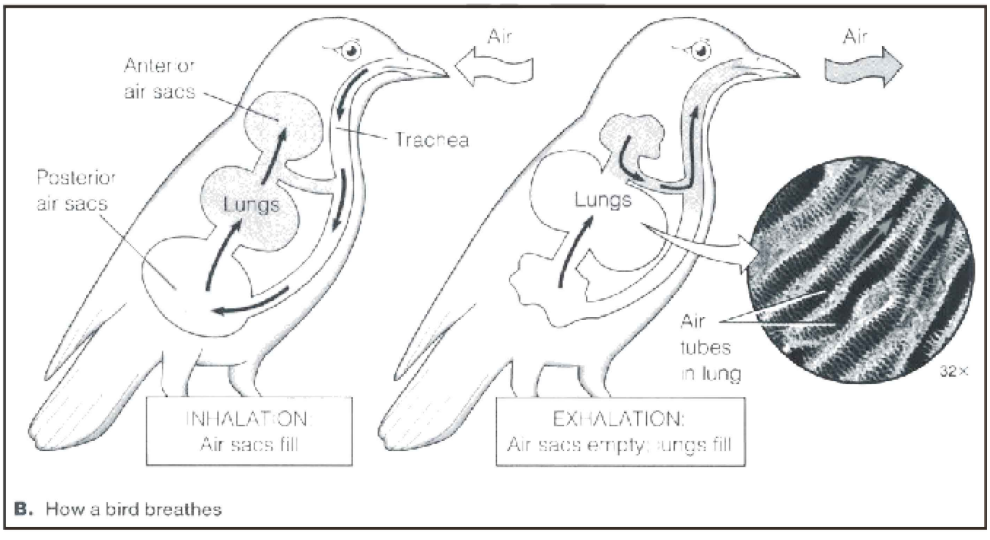


Fig. The Respiratory System of Bird



The chief sites of gaseous exchange are thin walls of these parabronchi.

* The blood flow direction in the lungs is opposite to the air flow through the parabronchi.
* This counter current exchange increases the amount of oxygen which enter the blood.
* No air remains in parabronchi, in this respect, lungs in the birds are very efficient.

Q.6 Describe the process of gaseous exchange in man.

Ans. **GASEOUS EXCHANGE IN MAN**

In man respiratory system consists of lungs and air passages, which are responsible to carry fresh air to the respiratory sites.

Air Passage Ways:

Air passage ways consist of ***nostrils, nasal cavities, pharynx, larynx, trachea, bronchi, bronchioles*** and ***alveolar ducts***. The ***alveolar ducts*** ultimately lead into the ***alveolar sacs***.

Nasal Cavities:

The nasal cavities have, ***mucous membrane,*** mucous ***secreting glands, hairs*** and ***ciliated epithelium.*** These cavities have three subdivisions due to the projection of bones in them. ***Nasal cavities have internal openings into the pharynx, throat or glottis.*** Through the external nostrils, air enters into the nasal cavity, where it is filtered with the help of hair, cilia and mucous. Dust and other particles come out in nasal cavities.

Pharynx (Throat):

* *Nostril opens into the pharynx.*
* It is a ***muscular passage*** and ***lined with mucous membrane***.
* Palate divides the pharynx into ***nasal pharynx*** and ***oral pharynx***.
* In pharynx, the passage of air and food is regulated to trachea and esophagus, respectively.

Larynx:

The upper end of the trachea is surrounded by a complex ***cartilaginous structure*** *called larynx or* ***voice box***.

Epiglottis:

Epiglottis is *cartilaginous*. It is controlled by muscles.

Epiglottis ***serves as a lid*** and ***hinge like in action.*** During swallowing it automatically *covers the opening of the larynx* and prevent the entry of food or liquids into the larynx.

Glottis is the cavity of the larynx and it also has mucous membrane covering.

Vocal Cord:

* Vocal cords are the ***fibrous structures*** present in larynx.
* They are ***two in number*** and have thin edges.

* As air passes through larynx, the vocal cords become stretched and ***produce sound.***

* *By tongue and lips, this sound changed into words.*

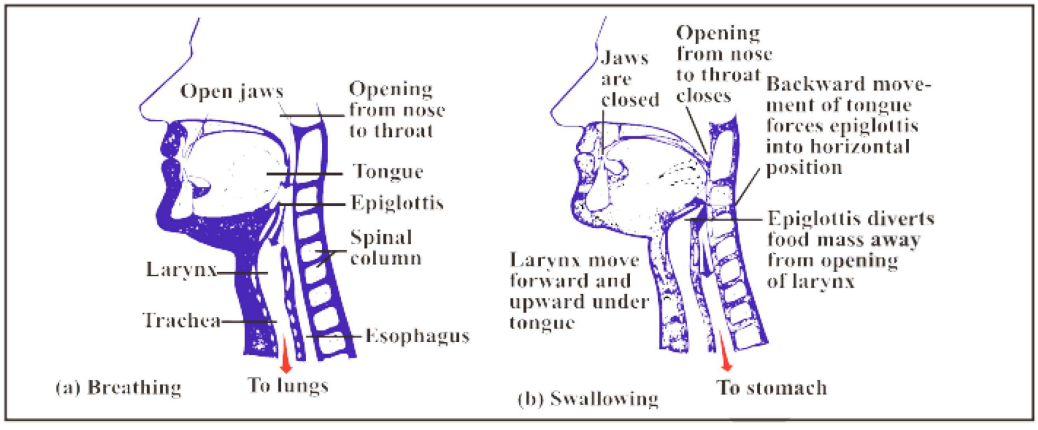


Fig. Events in the throat associated with breathing (a) and swallowing (b) The commonly held belief that the epiglottis closes downward upon the larynx when food is swallowed is not quite true. The closure is probably never complete; the degree of closure is determined partly by the backward movement of the tongue during swallowing (which forces the epiglottis into a more or less horizontal position) and partly by the upward movement of the larynx (which brings it up under the epiglottis). Food does not enter the partly open larynx and obstruct breathing primarily because the epiglottis diverts the food mass to one side of the opening and safely down the esophagous.

Trachea:

Larynx leads to the trachea which is **tubular structure and is supported by "C"** shaped cartilages. Due to these cartilages, trachea does not collapse and provides a passage for air to move.

Trachea after passing through neck, enters the chest cavity, where it divides into two bronchi. Each bronchus on entering into the lungs divides and sub divides into smaller tubes and channels. Bronchi have same cartilage rings as the trachea, but these rings are replaced by irregularly distributed cartilage plates.

Smaller bronchi when attain the diameter of 1.0 mm or less then that they are called bronchioles.

Bronchioles are made up of ***circular and smooth muscles*** and they totally ***lack cartilage.***

ALVEOLI

The bronchioles are divided and subdivided into the lungs and open into a large number of **air sacs.** The air sacs have cluster of ***grapes like structure***.

Each air sac consists of several single layered microscopic structure called alevoli. These are the functional units of lungs. ***Each alveolus is provided by a rich network of blood capillaries,*** which are excellent sites for the exchange of gases.

Lungs

Lungs are closed sacs, which are connected to outside by the way of the treachea and nostrils or mouth. Because of the presence of millions of alveoli, lungs become *spongy*.

Lungs are ***placed in chest*** cavity which are bounded by ***ribs*** and side muscles.

The floor of the chest is called ***diaphragm***.

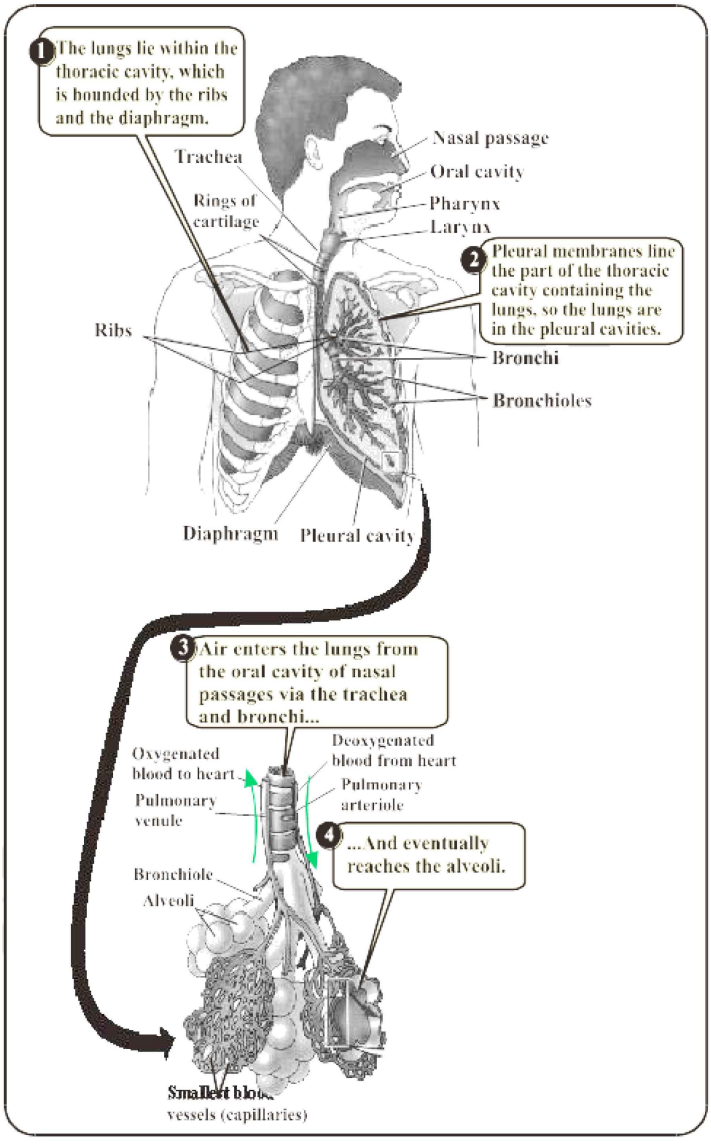


Fig. Human Respiration

Lungs are covered with double layered thin membranous sacs called ***pleura***.

Breathing

Breathing is a mechanical process which is concerned with pumping in and out air to and from lungs. It comprises of *inhaling* or taking in air or inspiration and *exhaling* or expelling of air from the lungs or expiration.

HELPLINE

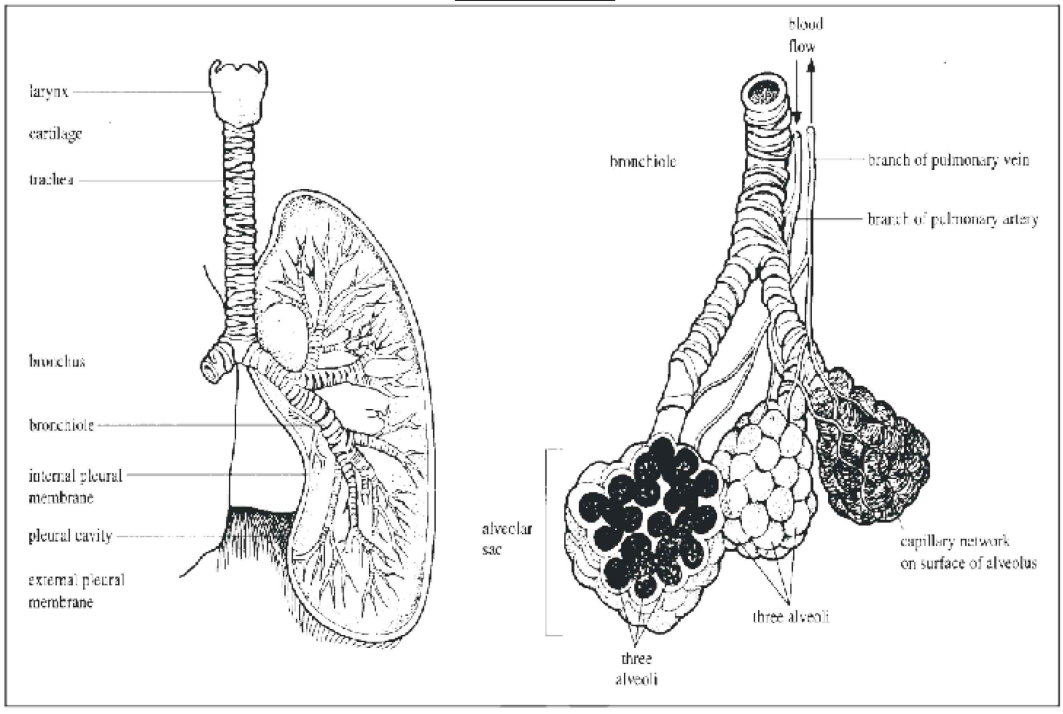


Fig. Human trachea and lungs

When a person is at rest the rate of ***breathing is 15 – 20 time per minute***. During exercise it may rise upto 30 – 40 times per minutes.

HELP LINE

Table Path of Air

Structure	Description	Function
Nasal cavities	Hollow spaces in nose	Filter, warm, and moisten air
Pharynx	Chamber behind oral cavity and between nasal cavity and larynx	Connection to surrounding regions
Glottis	Opening into larynx	Passage of air into larynx
Larynx	Cartilaginous organ that contains vocal cords (voice box)	Sound production
Trachea	FLexible tube that connects larynx with bronchi (windpipe)	Passage of air to bronchi
Bronchi	Major divisions of trachea that enter lungs	Passage of air to each lung
Bronchioles	Branched tubes that lead from the bronchi to the alveoli	Passage of air to each alveolus
Lungs	Soft, cone-shaped organs that occupy a large portion of the thoracic cavity	Gas exchange

Q.7 *Describe the mechanism of breathing in man?*

Ans. **BREATHING IN MAN**

Breathing is a ***mechanical process***, in which air containing more oxygen or fresh air is pumped into the lungs and air with more carbon dioxide is pumped out of the lungs.

The process of breathing consists of two phases:

(1) Inspiration (2) Expiration.

(1) Inspiration (Inhalation):

The space in ***chest cavity is increased*** during inspiration in two ways.

(i) Firstly, the muscles of ribs contract, as the result ***ribs elevate upwards*** and forwards.

(ii) And secondly, the muscles of diaphragm also contract, as the result, ***diaphragm becomes less dome like***.

(iii) The upward and outward movement of the ribs and the downward movement of diaphragm, increases in the volume of chest cavity and reduces pressure.

(iv) ***Due to reduction is pressure, lungs expand. A vaccum is created inside the lungs due to expansion in vacuum the air rushes from the outside. This phase is called inspiration.***

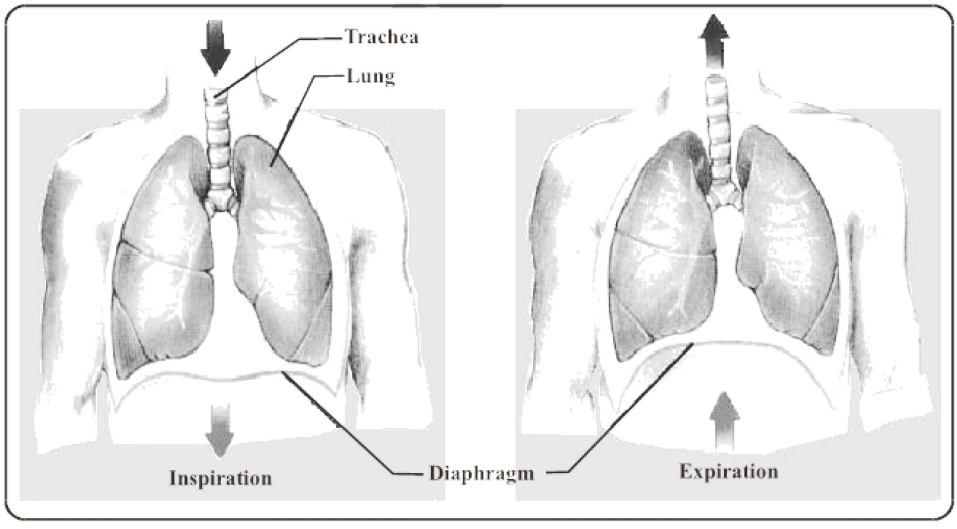


Fig. Movement of Diaphragm

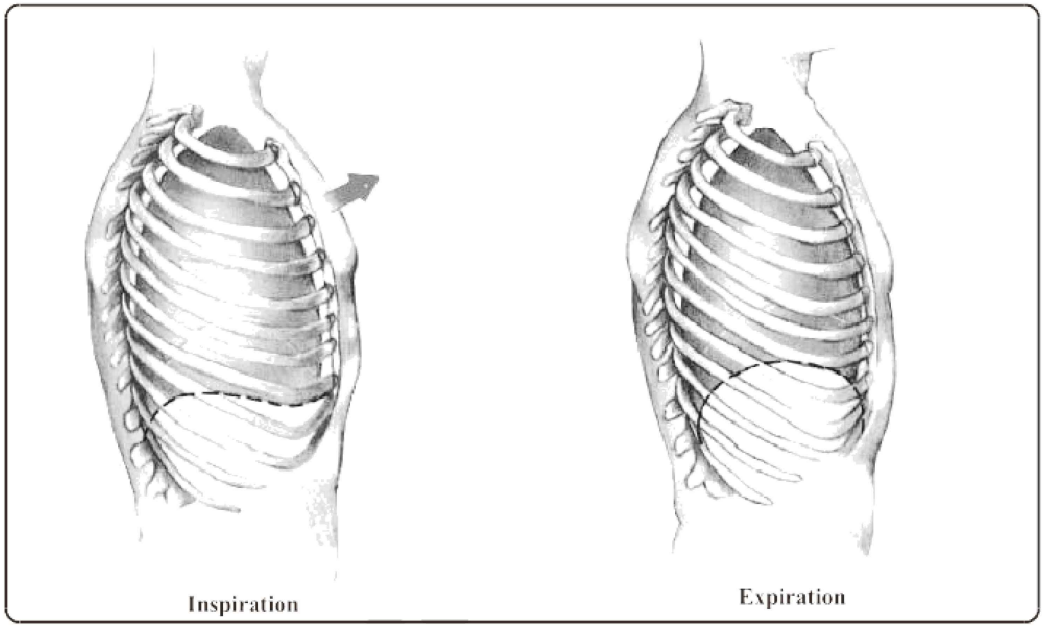
(2) Expiration (Exhalation):

(i) ***During expiration the muscles of ribs are relaxed. As a result the ribs move downward and inward.***

(ii) The space from the side of chest cavity becomes less. At the same time the muscles of diaphragm also relax.

(iii) It become dom like, as the result, from the floor, the volume of chest cavity also reduces.

(iv) The reduction in space of the chest cavity exerts pressure on lungs. The lungs press the air inside and air moves out of them. This is expiration.



Q.8 How does transportation of oxygen and carbon dioxide takes place?

Ans. (a) TRANSPORT OF OXYGEN

Haemoglobin is the respiratory pigment in human beings. It is present ***in red blood corpuscles,*** and is made up of ***574 amino acids.***

The haemoglobin ***combines with oxygen*** and form ***bright red Oxyhaemoglobin.*** In the condition of low oxygen concentration and less pressure, the Oxyhaemoglobin is splits into *normal purple-red coloured* haemoglobin and oxygen.

In red blood cells this respecting of oxyhaemoglobin facilitated by ***carbonic anhydrase enzyme***. In this way, haemoglobin acts as a efficient *oxygen carrier*.

A small quantity of oxygen also gets dissolved in the blood plasma.

$$Hb + O_2 \xrightarrow{\text{Carbonic anhydrase}} HbO_2$$

(Haemoglobin)	(Oxy-haemoglobin)
Dark red	Bright red

COMBINATION OF O_2 AND HAEMOGLOBIN AT SEA LEVELS

At sea level, the haemoglobin can absorb maximum oxygen. Normal human blood absorbs and carries maximum amount of oxygen about ***20 ml/100 ml of blood, at the sea level***.

This is the maximum capacity of haemoglobin for oxygen when it is fully oxygenated. ***The blood of alveoli of the lungs under normal conditions is not completely oxygenated.***

In the lungs, when oxygen tension is 100 mm mercury, then haemoglobin gets 98% saturation, it means it contains 19.6 ml of oxygen per 100 ml of blood.

In cells and tissues, the oxygen saturation of haemoglobin decreases very sharply, when oxygen pressure falls below 60 mm mercury. As the result large quantity of oxygen liberates from haemoglobin. In the tissue where oxygen tension is low, oxyhaemoglobin dissociates rapidly.

There are three important factors which affect the capacity of heamoglobin to combine with oxygen.

(1) Temperature:

Increase in temperature, decreases the oxygen carrying capacity of blood.

(2) Carbondioxide:

Increased carbon dioxide tension favours the greatest liberation of oxygen from blood to the tissue.

(3) pH:

pH also affects the oxygen carrying capacity of blood. As the ***pH of the blood declines, there is an increase in hydrogen ions in blood and these hydrogen ions combine with the protein part of the haemoglobin to combine oxygen is reduced conversely***. An increase in pH of blood results in an increased ability of haemoglobin to bind oxygen.

(b) TRANSPORT OF CARBON DIOXIDE

Carbon dioxide is more soluble than oxygen in the tissue fluid. There are different states for carbon dioxide transportation.

(i) Major part of carbon dioxide (about 70%) is transported in combination with water. As carbon dioxide from tissue fluid enters. The capillaries it combines to form carbonic acid.

$$CO_2 + H_2O \longrightarrow H_2CO_3$$

The carbonic acid quicily ionized and produced hydrogen ions and bicarbonate ions.

$$HO_2 + CH_2O \longrightarrow H^+ + HCO_3$$

When blood enters in lungs it contains CO_2 in the form of bicarbonate ions. Here bicarbonate ions combine with hydrogen ions to form carbonic acid. The carbonic acid splits into water and carbon dioxide. Carbon dioxide diffuses out into space of alveolar space from the capillaries of the lungs.

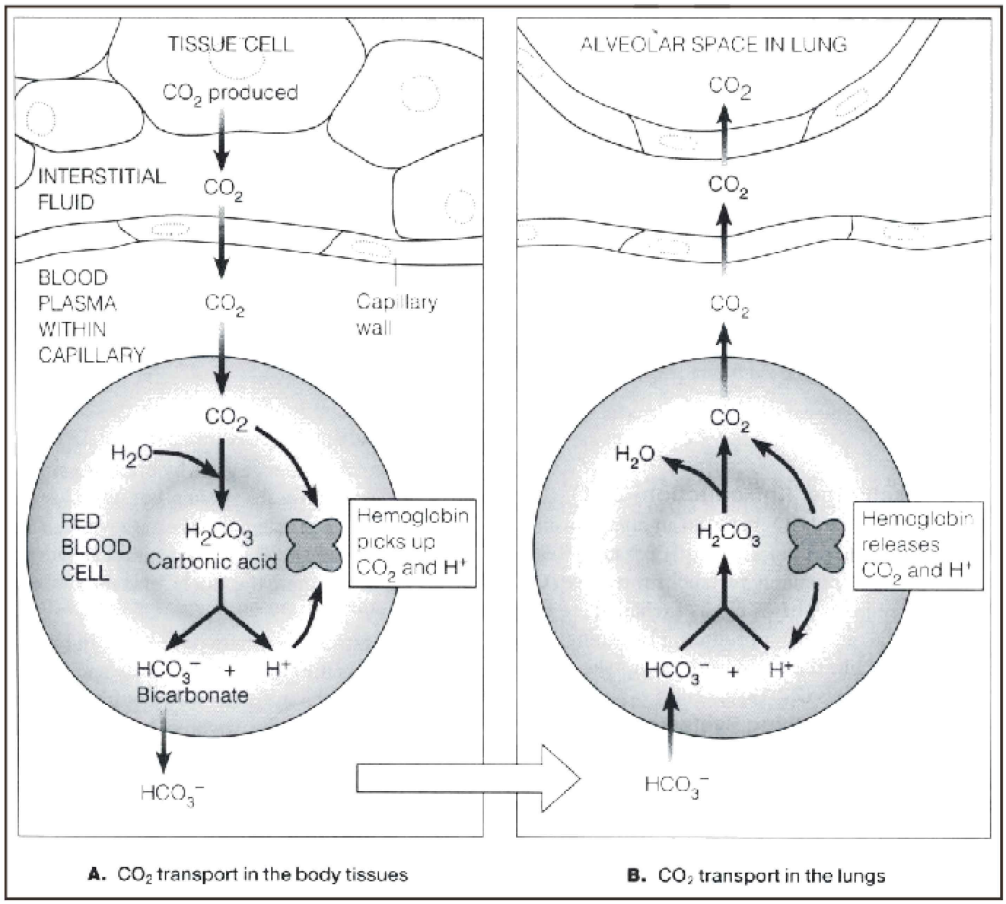
$$HCO_3 + H^+ \longrightarrow H_2CO_3 \longrightarrow CO_2 + H_2O$$

(ii) About ***20% of the carbon dioxide is carried*** in the form of ***carboxyhaemoglobin.***

(iii) About ***5% of the carbon dioxide is carried from the body fluids*** to the capillaries of lungs by the plasmic proteins.

(iv) ***Small amount of carbon dioxide is also carried by corpuscles,*** combined with potassium.

HELPLINE



Q.9 Write a note on some respiratory disorders in man. OR
Write notes on: (i) Emphysema (ii) Asthma (iii) Tuberculosis (iv) Cancer

Ans. (i) Emphysema (Break Down of Alveoli, Smoker's Cough):

Emphysema is more common in ***smokers***.

Emphysema is the break down of alveoli and increases the resistance in air passage.

The chemicals present in the smoke *weaken the walls of alveoli*. Smoke also cause the *irritation*, resulting in to **cough**, called *smoker's cough*. This coughing results into the break down of weak alveoli. The person suffering from emphysema cannot oxygenate his blood properly and least ***exertion*** makes him *breathless* and *exhausted*.

(ii) Asthma

Asthma is a serious respiratory disorder.

It is associated with ***severe paroxysm*** of ***difficult breathing***.

Asthma is followed by a period of complete relief and ***attack is repeated at regular intervals***. It is an allergic reaction.

Allergy may be due to pollen, spores, pollution, humidity, cold etc, which increases the ***spasmodic contraction*** of small bronchioles during asthma.

Some inflammatory chemicals like histamines release into the blood that cause severe contraction of bronchiole.

(iii) Tuberculosis (*Lung infection by Mycobacterium*)

Tuberculosis is the general name a group of diseases of respiratory system caused by ***Mycobacterium tuberculosis.***

In the pulmonary tuberculosis inside of the ***lung is damaged*** resulting in ***cough*** and ***fever***. It is more common in poor people because ***malnutrition*** and poor living conditions facilitate the growth of *Mycobacterium*.

This disease is ***cureable*** with proper medical alternation.

(iv) Cancer

The uncontrolled growth of parts of the body is called cancer.

Lung cancer is one of the most serious diseases of respiratory system.

Cancer or carcinoma is a ***malignant tumor*** of unlimited growth, that expands.

This tumor replaces the lung tissue and also block it.

Smoking and ***pollution*** are the major reasons of cancer.

It is estimated that 90% of lung cancer is *caused by smoking* and more than 10 compounds of tobacco smoke are involved in the reason of cancer.

HELP LINE

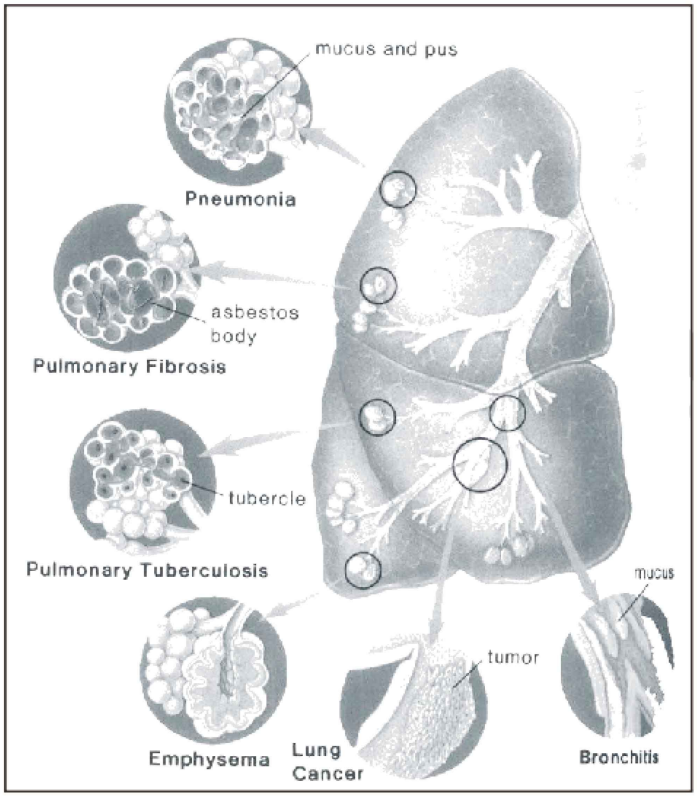


Fig. Common bronchial and pulmonary infectious diseases and disorders.

Q.10 Write notes on:

(a) Respiratory pigments

(b) Lung capacity

Ans. (a) Respiratory Pigments

The pigments carrying the oxygen in the blood are called respiratory pigments. There are various types of respiratory pigments.

Heamoglobin is the most important, which is present in vertebrates including man.

Haemoglobin:

Haemoglobin is *present in the red blood cells*.

In man, it *increases the oxygen carrying capacity* of blood up to 75 times.

Myoglobin:

Myoglobin is *present in the muscle fibres* and is also known as muscle haemoglobin.

It acts as our intermediate compound for the transport of oxygen from haemoglobin to aerobic metabolic processes of the muscle cells.

Haemocyanins, Haemoerythrin, Chlorocorius:

These pigments are ***found in invertebrates***, haemocyanin is blue in colour due to presence of copper and is present in Mollusca and Arthropods.

(b) Lung Capacities:

In an adult human being, the total inside capacity of lung is about 5 litres when the lungs are fully inflated.

The exchange of gases is only about half a litre when at rest or asleep while during exercise the volume of air is taken inside the lungs and expelled is about *3.5 litres*.

In other words, *during exercise there is a residual volume of 1.5 litre which we expel.*

Q.11 Are Tuberculosis, Asthma and Cancer cureable diseases?

Ans. (i) **Tuberculosis** is a cureable disease because *Mycobacterum tuberculosis* may be is killed by antibiotics.

(ii) **Asthma** may be cureable if allergic reactions are avoided and by avoiding the allergy causing agents and utilization of antibiotics.

(iii) In early stage **cancer** may be controlled by *chemotherapy* and *Radiotheropy*, otherwise, it becomes uncureable, ultimately.

Q.12 What are histamines and how they are controlled?

Ans. *Histamines are those chemical which are secreted by the body in response to allergic agents.*

Histamines secretions become the reason of different allergies.

Allergies may be cured by Anti-histamine drugs like Avil & Incidal etc..

Q.13 What is cancer?

Ans. ***Uncontrolled growth*** of cells or tissues of body organ results tumor formation or disturbed amount or function of cells or tissue is called cancer.

Q.14 What is the distribution of following pigments:
(i) Haemocyanins (ii) Haemoglobin (iii) Myoglobin.

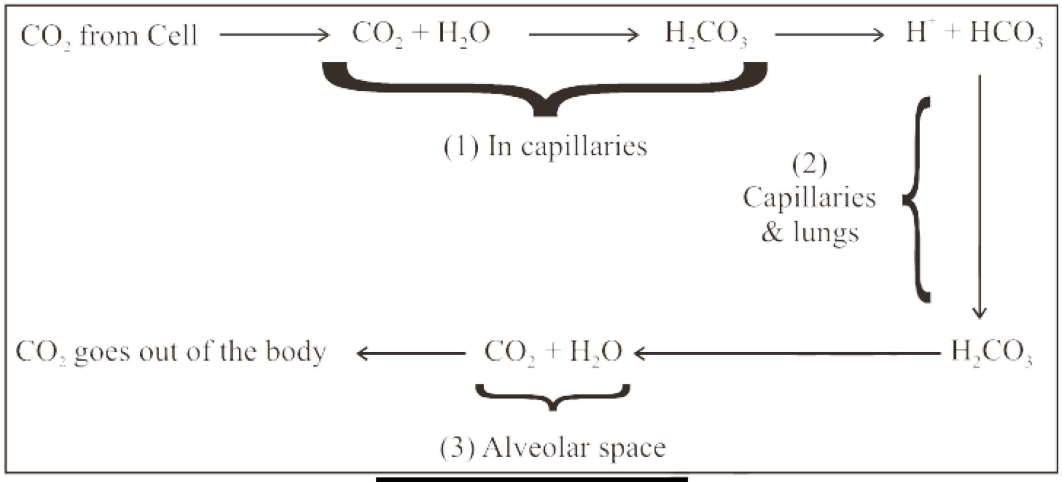
Ans. ***(i) Haemocyanin*** found is Mollusca and Arthropods.

(ii) Haemoglobin found in RBCs.

(iii) Myoglobin found in muscles fibres.

Q.15 Give representation of chemical reactions of transport of CO_2.

Ans.



CONCEPTUAL VIEW