

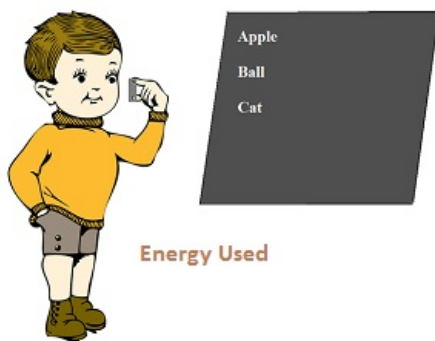
Class 7 Biology Respiration in Organisms

Introduction

Introduction

All organisms in this vast universe are made up of tiny structural and functional units called cells which perform certain essential functions necessary for sustaining life like nutrition, transport, excretion and reproduction.

But to perform any of these functions the cell requires energy. This energy is derived by the breakdown of the food consumed by us into carbon-dioxide, water and energy. This process is known as respiration. The food has energy stored in it and is released during respiration.



In the above picture it can be easily observed that the energy obtained by consuming the food is used in studying.

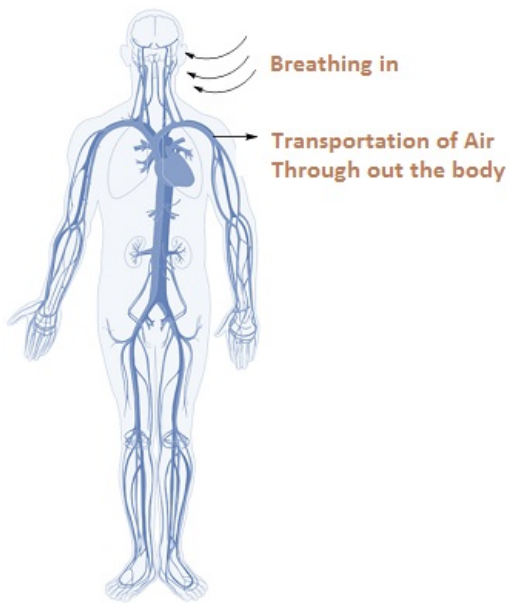
Respiration is a biochemical process involving breakdown of glucose in the presence of oxygen resulting in the release of carbon dioxide, water, and ATP also known as the energy currency in cells.

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Cellular respiration

Cellular respiration

- Cellular respiration refers to the process of breakdown of food in the cell with the release of energy. This cellular respiration can take place in either aerobic respiration or anaerobic respiration.
- While breathing we breathe in Oxygen breathe out carbon-dioxide.
- The breathed in oxygen is transported to the entire body parts and to each cell. This oxygen is required by the cells for breakdown of food in order to derive energy to perform necessary functions for survival.

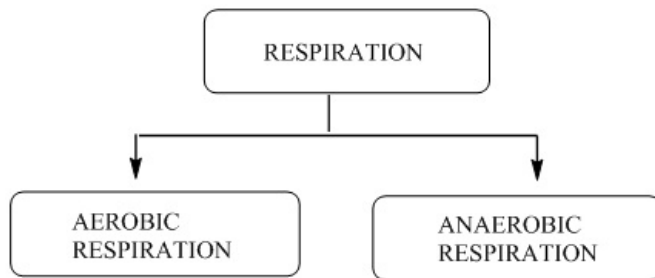


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Types of respiration

Types of respiration

- Respiration can be broadly categorized into two types:



- Aerobic respiration refers to the process of breakdown of food into carbon-dioxide and water in the presence of oxygen.
- Anaerobic respiration refers to the process of breakdown of food into carbon-dioxide and water in the absence of oxygen.

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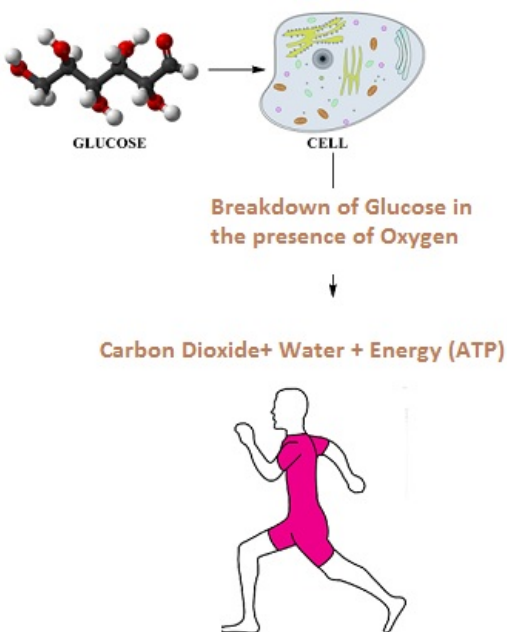
Aerobic respiration

Aerobic respiration

- In this type of respiration the breathed in oxygen is sent to the entire body and to the cells where the food is broken down into carbon dioxide, water and energy in the presence of oxygen. For instance, in human beings aerobic respiration takes place.



Glucose $\xrightarrow[\text{of oxygen}]{\text{In the presence}}$ Carbon-dioxide + Water + Energy

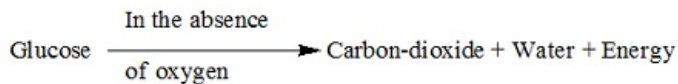


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Anaerobic respiration

Anaerobic respiration

- In this type of respiration the food is broken down into carbon-dioxide and energy in the absence of oxygen. For instance, facultative anaerobes and obligate anaerobes.



- Facultative anaerobes are the organisms that are capable of respiring both in presence as well as absence of oxygen. For example, Escherichia coli.

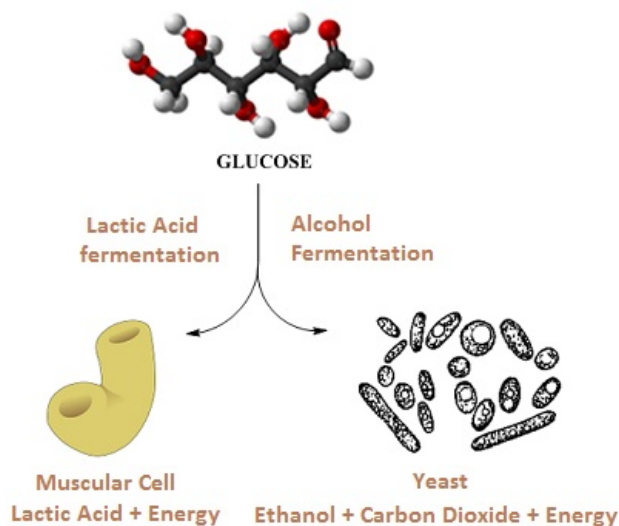


- Obligate anaerobes are the organisms that are capable of respiring only in absence of oxygen. For example, clostridium tetani.



Anaerobic respiration can further be classified into two types:

Lactic acid fermentation and alcohol fermentation.



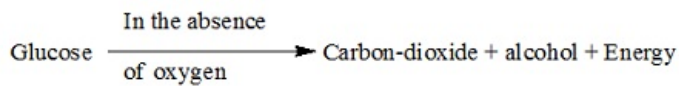
- Lactic acid fermentation refers to the metabolic process in which glucose are converted into cellular energy and the metabolite lactate.
- Alcoholic fermentation refers to the biological process in which glucose and other sugars such as fructose, and sucrose are converted into cellular energy, producing ethanol and carbon dioxide.

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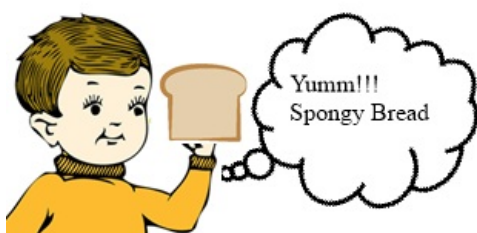
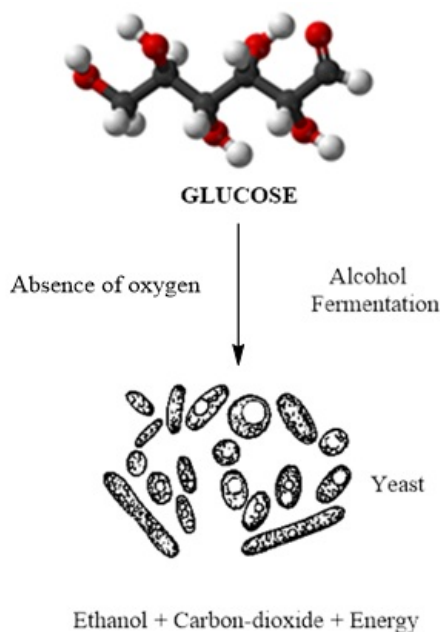
Respiration in yeast

Respiration in yeast

- Yeasts are eukaryotic, single-celled microorganisms belonging to fungus kingdom.
- They are used for several purposes in the food and beverage industry.
- They are used in bakery industry. Brewer's yeast is used in beer fermentation and in wine fermentation.
- They are capable of surviving even in the absence of air and hence are termed as
- Since they can survive in the absence of air they can even break down the glucose into alcohol, carbon dioxide and energy in the absence of oxygen and hence undergo anaerobic respiration.



- The carbon-dioxide released in the process makes the bread and other baked food items spongy.

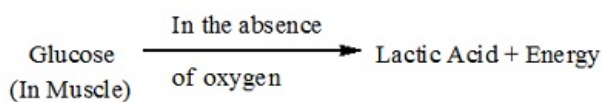


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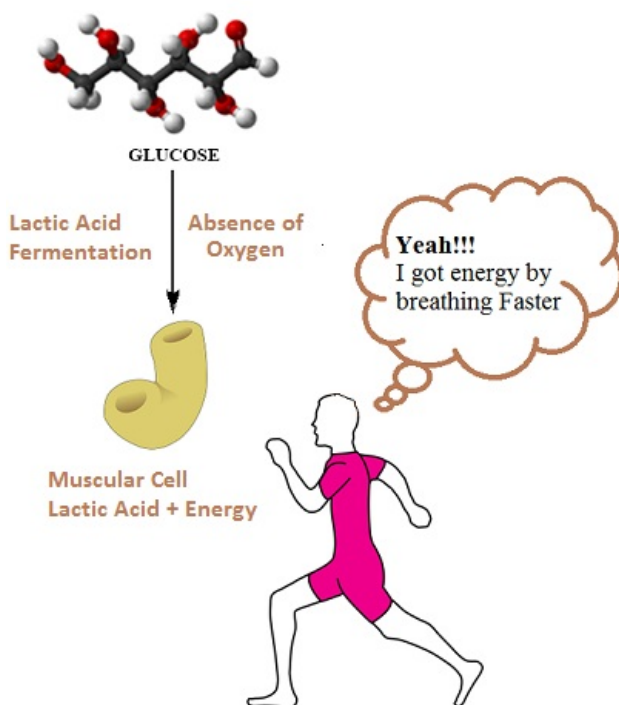
Respiration in muscle cells

Respiration in muscle cells

- Like yeast the muscular cells are also capable of surviving in the absence of air and hence can respire anaerobically.
- But they can respire anaerobically only during temporary deficiency of
- For instance, heavy exercises like cycling, walking, heavy weight lifting, fast running, and many more require heavy supply of oxygen. But the supply of oxygen for producing energy is limited.
- At this time of temporary deficiency of oxygen the muscular cells respire anaerobically to fulfill the demand of energy.



- This lactic acid produced is carried to the cells of the body by the protein carrier and is used as fuel by the energy fabrics in muscle cells.
- It is stored in the form of glycogen in the muscular cells.

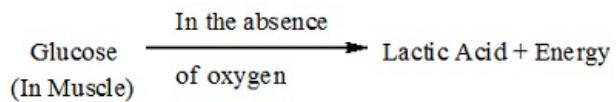


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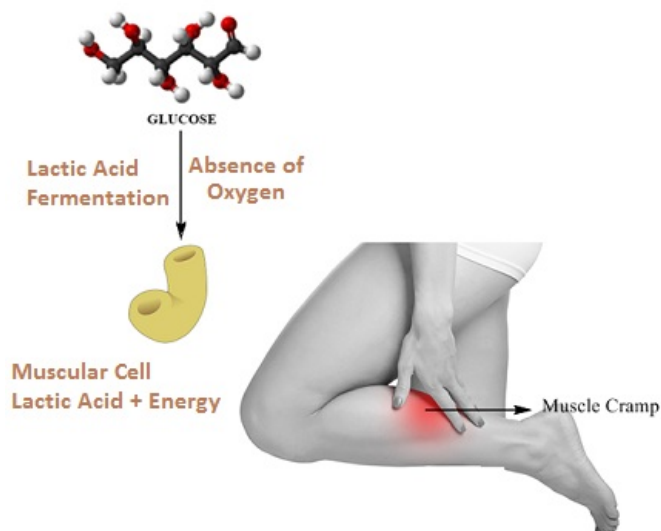
Reason for muscle cramps

Reason for muscle cramps

- As we discussed that in temporary deficiency of oxygen the muscular cells respire anaerobically.



- This leads to the partial breakdown of glucose into lactic acid.
- This lactic acid gets accumulated in the body consequently leading to muscle
- Hot water bath or a massage improves circulation of blood thereby increasing the supply of oxygen to the muscle cells.
- This sufficient supply of oxygen to the cells results in complete breakdown of lactic acid into carbon dioxide and water thereby giving you relief.

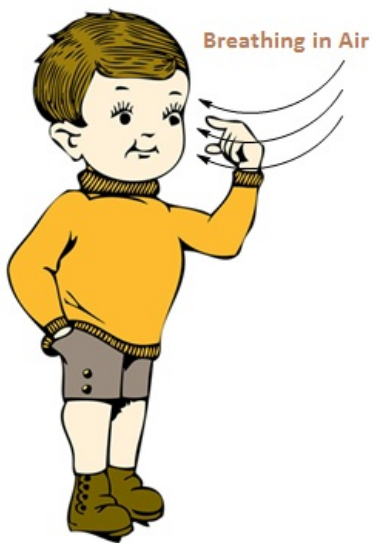


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Breathing

Breathing

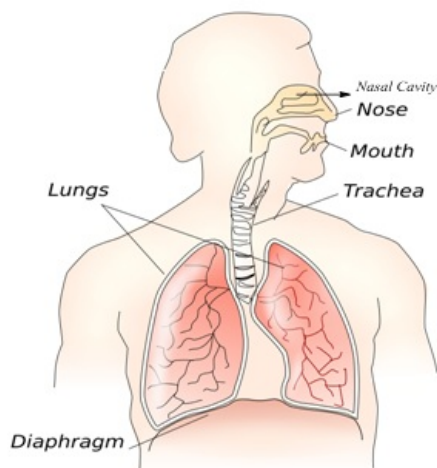
- The process of respiration requires oxygen to break down food and convert it into energy along with the release of carbon-dioxide gas. For this purpose we need a medium for taking in oxygen and expelling out the carbon-dioxide. This purpose is solved by a process called breathing.
- The process of taking in oxygen rich air and giving out air rich in carbon-dioxide is referred to as breathing. It is an endless process that continues throughout the life of a living organism.
- The process of breathing is carried out fluently using the respiratory organs.
- The process of breathing in oxygen rich air through the respiratory organ is called inhalation.
- The process of breathing out carbon-dioxide rich air through the respiratory organ is called exhalation.
- One breath equals to the composition of one inhalation and one exhalation. Number of times a person breathes in a minute is referred to as breathing rate.



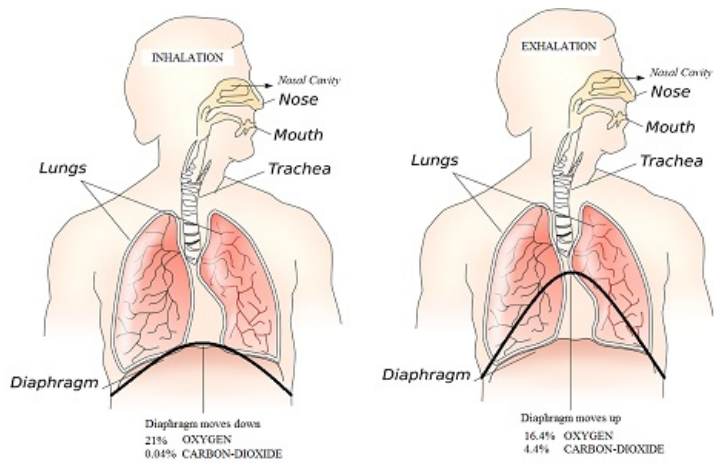
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The process of breathing

The process of breathing



- The process of breathing is very important for carrying out life. This process is carried out through the respiratory system of the body.
- The air rich in oxygen is inhaled through the nostrils and is passed onto the nasal cavity where air is warmed and humidified by the mucus present in the nostril. The tiny hairs called ciliated epithelium filter out dust and other particles present in the air.
- The nasal cavity is divided into two halves left and right by a wall of thin bone known as the central septum.
- The air then passes through the windpipe also known as the trachea. The trachea filters the air we inhale and branches into the bronchi.
- The trachea further divides into bronchi.
- Bronchi refers to two air tubes that carry the atmospheric air directly into the lungs.
- Lungs are the pair of main organs of the respiratory system where oxygen is taken into and carbon dioxide is expelled out. The red blood cells present in the blood absorb the oxygen present in the oxygen-rich blood in the lungs.
- They carry it and distribute it to all body cells and pick up the carbon dioxide produced by the cells.
- This gaseous exchange takes place in a tiny sac-like structure present in the lungs and is known as the Alveolus.
- Muscular sheets called the diaphragm are also present in the chest cavity.
- The process of breathing is accompanied by the movement of the diaphragm and the rib cage.



- During breathing in oxygen rich air the rib cage moves up and outwards whereas the diaphragm moves down.
- This phenomenon expands the space available in the chest cavity which in turn makes the air get into lungs.
- During breathing out air rich in carbon-dioxide the rib cage moves down and inwards whereas the diaphragm moves up.
- This phenomenon reduces the space available in the chest cavity which in turn pushes out the air from the lungs.

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How faster breathing energizes a person

How faster breathing energizes a person?

- The average breathing rate of an adult is 15-18 breaths per minute.
- But during heavy exercise the body requires more energy. As result more quantity of food needs to be broken down to produce more energy.



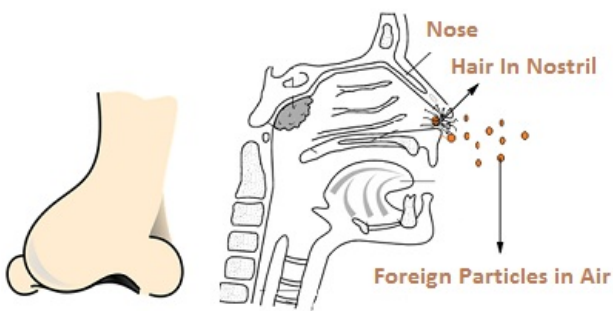
- This process requires more oxygen which cannot be fulfilled by normal breathing.
- Due to this reason the person performing heavy exercise breathes faster than a person at rest to get more oxygen. A person performing heavy exercise breathes approximately 25 times in a minute.
- Fast breathing supplies more oxygen to the cells which in turn speeds up the breakdown of food resulting in release of more energy.

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Sneezing

Sneezing

- Sneezing refers to the reflex action occurring due to common cold, flu, or due to inhalation of foreign particles causing irritation inside the nose.
- The air which we breathe in consists of many foreign particles including smoke and dust, pollens, etc.
- While breathing in, many foreign particles enter the nostrils and get trapped in the hair present in the nasal cavity.



- While some particles get trapped in the hair, some may even pass through them and cause irritation in the inner lining of the nasal cavity.
- This irritation results in a sneeze which expels out the dirty foreign particles that entered the cavity.



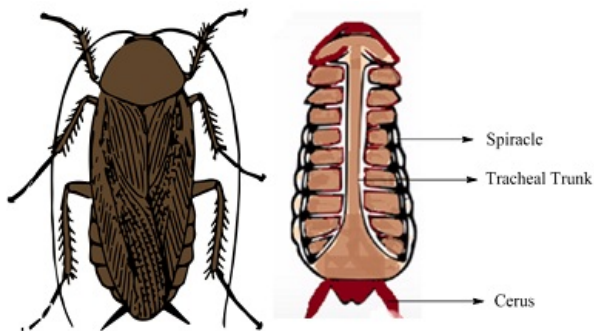
- Thus only clean and pure air enters the body

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Respiration in cockroach

Respiration in cockroach

- Cockroach is a terrestrial organism found in damp areas.
- It is an omnivorous insect feeding on food grains, cereals and other animals. They can consume any organic matter.



- The respiratory system of cockroach is a network of trachea known as tracheal system.
- They respire through the small openings called spiracles. These openings are regulated by the muscular pinchers.
- They breathe in oxygen rich air through the spiracles which opens into the tracheal tubes.

Air getting inside the body of the cockroach through the spiracles

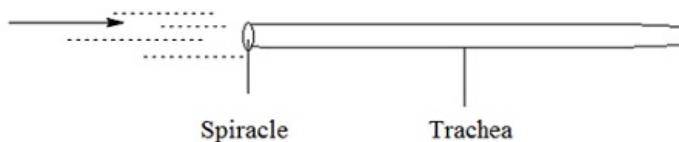


Figure of a trachea

- The tracheal tubes are the network of air tubes meant for smooth exchange of gas. These are found only in insects.
- The air then rushes towards the tracheal tubes and then diffuses into the different body tissues and cells.
- The trachea is then subdivided into thinner tube called tracheoles.
- Tracheoles contain a network of fluids which flows throughout the body of the insects.
- The air rich in carbon-dioxide rushes towards the tracheal tubes and is finally exhaled out through the spiracles.

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Respiration in earthworm

Respiration in earthworm

Earthworm is a reddish brown terrestrial invertebrate (it does not have a backbone).

They are found in the upper layer of the soil and improves the soil fertility.

It feeds on the dead and decaying matter present in the soil.



They do not have any specialized respiratory system. But they respire through their moist and slimy skin due to the moisture present in soil and the mucus present in their body.

It picks up oxygen from the water present in the soil using the hemoglobin present in the blood of earthworm.

During the rainy season the soil is too wet. That creates a problem in the respiration of the earthworm. Hence they come out to the surface and respire comfortably.

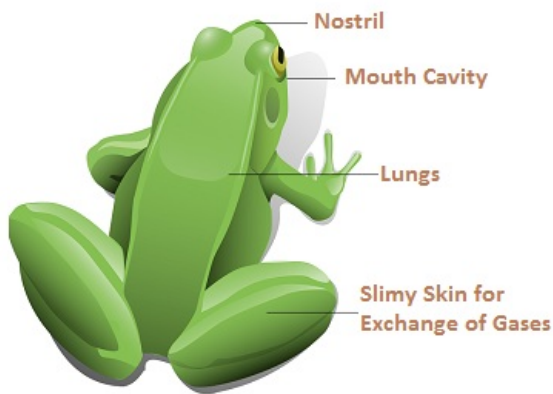
The moist and slimy makes it easy for the gas to pass through it and get into the body of the earthworm.

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Respiration in frog

Respiration in frog

- Frogs are short-bodied, tailless amphibians.
- They are carnivores.



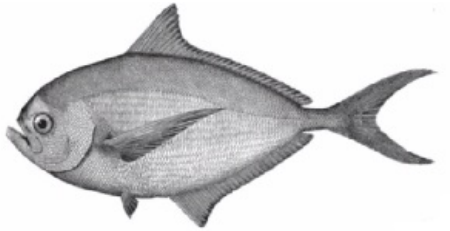
- They have dual system that helps them to breathe.
- They have a pair of lungs just like human beings.
- On the other hand they can breathe through their moist and slimy skin as well.
- When their skin is moist or when they are in water they breathe through their thin and membranous skin which is permeable to both water and gases.
- When they are on land, they take air into their lungs by pushing it from their mouths with their nostrils closed.

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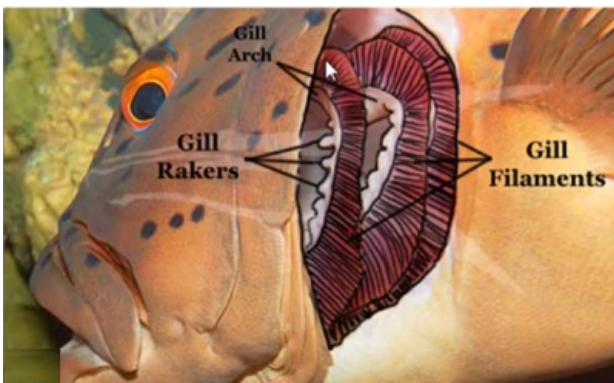
Respiration in fish

Respiration in fish

- Fish are vertebrates living in water.



- The rate of breathing of aquatic animals is higher than the terrestrial animals (animals that live on land) because the percent of oxygen present in water is less than the percent of oxygen present in the atmosphere. So a higher rate of breathing enables them to take up more oxygen.
- Fishes have certain projections on their body known as gills. These are feathery organs.
- These gills are connected with blood vessels for easy exchange of gases. These gills help the aquatic species like fish to utilize the oxygen dissolved in the water.



- The gills continuously keep moving that enables it to take the water. It takes the water through its mouth and forces it through the gills.

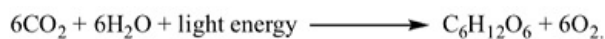
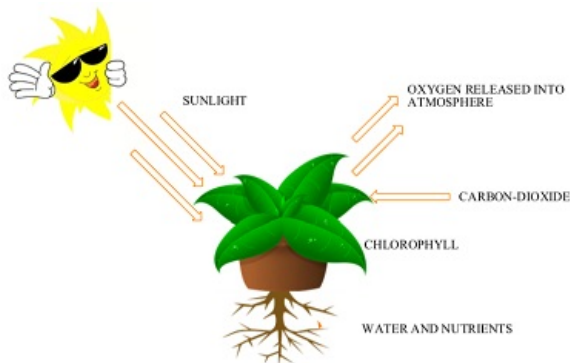
As water passes through the thin walls of the gills the dissolved oxygen moves into the blood vessel and travels to the different cells and tissues of the body of the fish.

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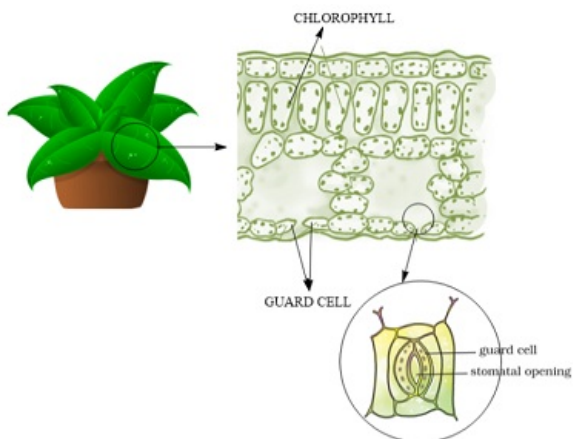
Respiration in plants

Respiration in plants

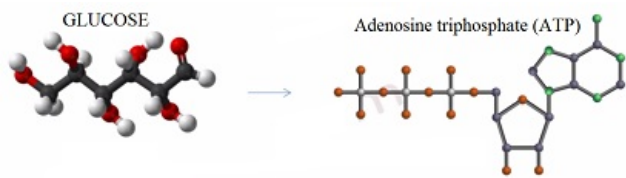
- Plants too require the phenomenon of respiration for survival.



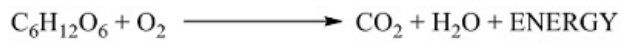
- They take in oxygen rich air from the atmosphere and breathe out air rich in carbon-dioxide through the tiny pores present in the lower surface of the leaves known as stomata.



- Root hairs, lenticels, stomata are some of the parts present in plants for gaseous exchange.
- The roots of plants too respire to generate energy but they follow a different method. They take up air rich in oxygen from air spaces between the soil particles.
- The breathed in oxygen is supplied to the cells where it is used to break down glucose into carbon-dioxide and water.
- By photosynthesis the plants produce glucose but the plants require energy to produce food.
- This glucose is converted into ATP which is the energy currency. Energy is stored in the form of ATP.
- This conversion of glucose to ATP requires respiration in the presence of oxygen.



- Equation for breakdown of food to release energy in plants is as follows:



- This energy is required by the plants for performing photosynthesis, excreting waste materials, for growth and development.
- The rate of respiration in plants is lesser than animals. Because animals require to take up oxygen from the surrounding but in plants oxygen is released during photosynthesis. So less oxygen has to be taken from surrounding.