Nutrition in Plants

Do plants go on a diet? Do they have to bother about the kind of nutrition that they are taking? If you have ever wondered about how nutrition in plants occurs, then you are at the right place. Dive in to extract more information!

Nutrition in Plants

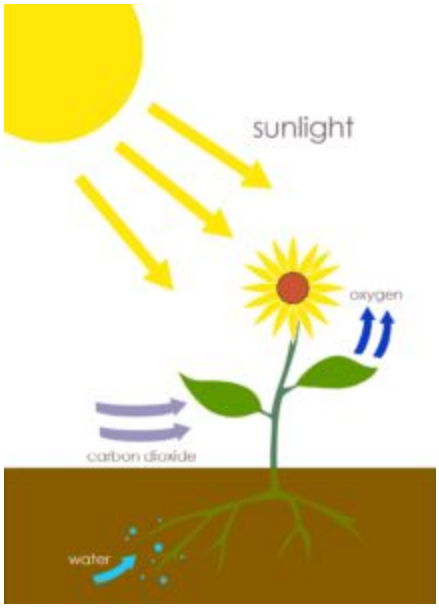
Every living organism needs some kind of energy and nutrient materials to ensure that the life processes go on smoothly. Moreover, this energy requirement is got from the food. You can understand this better in animals and human beings as you see it on a daily basis. You very well know what happens if you skip breakfast or lunch! But what about plants? Do they require any nutrition at all?

Plants and their Nutrition Requirements

Plants are also living things that need some form of energy. They have cells and tissues. They also grow in size and girth. And they are the producers of the ecosystem. So, in order to synthesize food, they do have nutrient requirements. Of course, the kind of nutrient requirements varies.

This kind of nutrition in plants is called the *autotrophic mode of nutrition.* What does this actually mean? It means that plants have the special capability to make their own food, by using simple inorganic substances to produce organic molecules/substances. They get the energy sources from non-living things such as sun and carbon dioxide.

Plants also have chlorophyll in them, the green colour pigment. With the help of all these above factors, plants can produce simple carbohydrates. The carbohydrates thus produced are utilized by the plant and gives it energy. When there is an excess of carbohydrates in the plants, then it is stored as a reserve for later use.



Types of Autotrophic Nutrition

According to the type of energy source used, autotrophic nutrition in plants can be of two types. They are Photo-autotrophic nutrition (where sunlight is the energy source) and Chemo-autotrophic nutrition (where chemicals are the energy source).

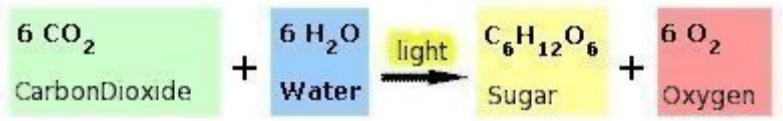
Learn more about the Nutrition in Animals.

The Process of Photosynthesis in Autotrophs/Plants

To put it simply, plants require certain raw materials, in order to make their own food. These raw materials include carbon dioxide, water, and sunlight. Plants get water from the soil that enters through the roots. And sunlight is the source of energy. But how does carbon dioxide enter the plants? You should first understand that carbon dioxide is a gas.

You have learned in your earlier classes that plants have openings called stomata. Guard cells surround these stomata. These stomata are the openings through which carbon dioxide enters the plants. Gaseous exchange i.e. the exchange of carbon dioxide and oxygen in plants occurs through these stomatal openings.

Water is also lost through the transpiration process through these openings. And hence, when the carbon dioxide requirement is met with for photosynthesis, plants close the stoma.



The above equation shows the chemical reactions that occur during photosynthesis.

Chlorophyll is present in structures called chloroplasts. They are disc-shaped organelles that are present in the mesophyll cells of the leaves. These help in trapping the sunlight within the plant. As the carbon dioxide enters the plant through the stoma, the light energy converts into chemical energy, by the splitting of the water molecules of the plants. Simple carbohydrates are produced in this process. Oxygen is a byproduct of photosynthesis.

In this way, plants are able to take up simple inorganic substances and convert them into simple carbohydrates, to meet their nutrient requirements.

Solved Question For You

Q: What is the site of Photosynthesis in plants? Explain briefly.

Ans: Chloroplasts are the disc-shaped cell organelles that have chlorophyll pigment in them. Photosynthesis occurs at this site in the plants. These cell organelles are present in the mesophyll tissue of the leaves. Their position is strategic in the leaves, as they can absorb the maximum amount of sunlight

Nutrition In Animals

Did you ever wonder what happens to all the food that you eat? How does your body digest it and use it? How about the food requirements of other animals? Are they same for all? Obviously not! Animals cannot make food on their own. They depend on plants for their food either directly or indirectly. And therefore, nutrition in animals is said to be heterotrophic.

Heterotrophic Nutrition in Animals

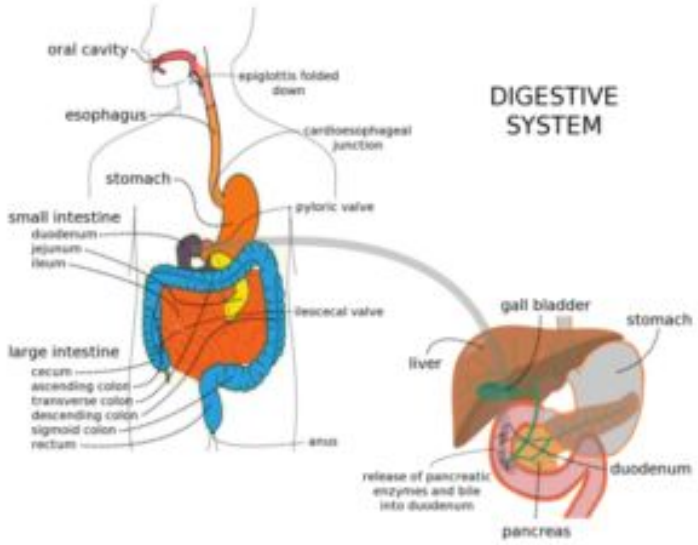
The mode of nutrition where organisms depend on other organisms for their food requirements is called heterotrophic nutrition. Animals are called consumers as they depend on autotrophs for their nutrition requirements. So nutrition in animals is heterotrophic in nature.

Now, this dependence on other animals may be of different types. Some organisms such as fungi break down the food outside the body and then absorb it. There are some more organisms who are parasites living on other animals and plants.

In humans, the type of nutrition that is found is called holozoic nutrition. It simply means eating or ingesting food and then digesting

the food, to get the required nutrition. The digested food gets absorbed and assimilated, and finally, any waste is excreted outside.

When animals including humans ingest food particles, they have some form of digestive systems to break down the complex food particles into simpler particles. The digestive system varies from the lower organisms such as amoeba and paramecium when compared to other higher-order animals such as fishes, amphibians, humans etc.



Human Digestive System

One important aspect of nutrition in animals is the digestion of food. Digestion is the process where complex food substances are broken down into simpler food molecules. It occurs through a proper set of

organs and secretions from other associated organs. Digestion is an important process, as we humans cannot take in the complex food particles directly.

The food that you eat gives you the energy to do work and also helps in cell growth and cell repair. (You know that your body is made up of many cells and tissues.) If you are wondering as to how the digested food goes to other parts of the body, then it is the all-important blood that completes this function.

Parts of the Digestive System

The human digestive system consists of different parts such as the mouth or oral cavity, alimentary canal, stomach, large intestine, small intestine, rectum, and anus. There are other organs such as the liver, pancreas, salivary glands that play an important role in digestion.

They secrete enzymes which are nothing but biocatalysts. They help in digesting the food, which is generally in the form of carbohydrates, proteins, and fats.

Process of Digestion

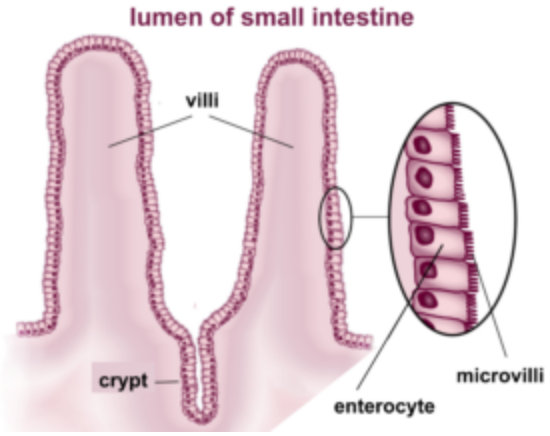
The process of digestion starts right in the mouth. Food is ingested or taken in through the mouth. Here, teeth and salivary glands present. The teeth help in chewing and masticating the food. The salivary glands produce saliva that gets mixed with the food particles. Saliva has an enzyme called amylase that starts acting on the carbohydrates or starch.

From the mouth, this ball of food reaches the stomach after passing through the alimentary canal, which is a hollow tube-like structure. The alimentary canal shows movements called peristaltic movements, which are wave-like muscle contractions. In the stomach, there are some digestive enzymes and gastric juices secreted such as mucus, pepsin, HCl etc. These enzymes act on the protein part of the food, converting them into simpler proteins.

Know more about Transportation in Plants?

From the stomach, this semi-digested food is sent into the small intestine. A sphincter muscle present here controls the amount of food sent. The small intestine is a long coiled muscular tube-like structure. The pancreas and the liver secrete their pancreatic juices and bile respectively into the small intestine. These help in the further

digestion of proteins and fats. Bile helps in the breakdown of fat and its role is very significant.



The various enzymes act on the food and the digested food is absorbed and assimilated in the small intestine. There are many small projections called the villi that help in the absorption of the digested food. There is an extensive network of blood vessels present here. This facilitates the easy absorption of the simpler food molecules from where it is sent to other organs for assimilation.

Any leftover undigested food goes into the large intestine. Here water is absorbed back into the system. The undigested waste is then stored in the rectum, from where it is ejected out of the body through the anus.

Solved Questions For You

Q: Which part of the digestive system receives secretions from other organs? Write a few lines about it.

Ans. The small intestine receives secretions from the pancreas and the liver. These help in the further simplification of the proteins and the fats present in the food. The small intestines also have structures called villi which help in the absorption of the digested food.

Respiration

As you are reading this, you are simultaneously breathing in oxygen and giving out carbon dioxide. Did you realize this? This is an action that you do continuously. To put it in scientific terms, it is a process called respiration that is happening. Let us explore this life process.

Respiration

Did you know that there are complex chemical reactions that occur inside the human body during this respiration process? This process involves the production of energy due to the various reactions.

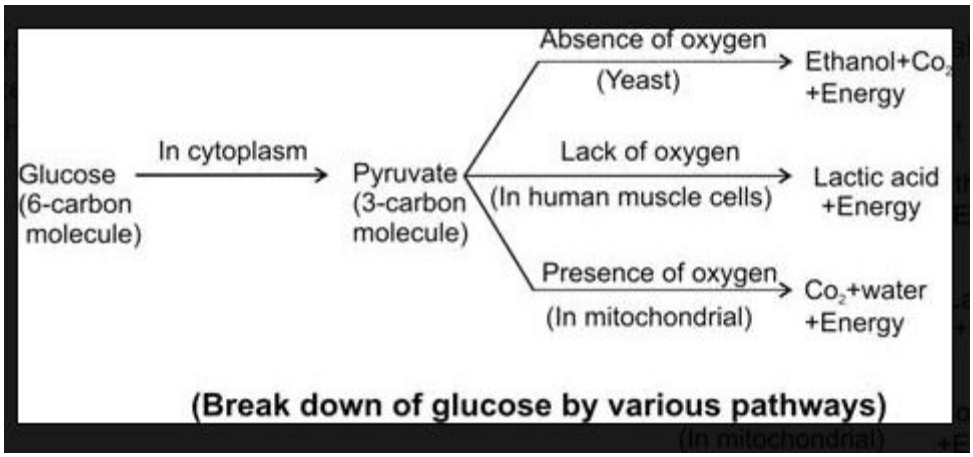
The food that you eat gives energy. There are various biochemical reactions that take place to produce this energy. The digested food molecules that are absorbed by the cells in the body undergo oxidation (react with oxygen molecules) to produce energy. Let us learn more about this process and the chemical reactions that occur.

Types of Respiration

Aerobic and anaerobic respiration are the two types of respiration that occur, based on the presence or absence of oxygen. Respiration

process that occurs in the presence of oxygen is called aerobic respiration, generally seen among humans. But in certain organisms like bacteria and algae, respiration occurs in the absence of oxygen, called anaerobic respiration.

In both the types of respiration, it is the glucose (carbohydrate molecule) that undergoes reactions. The following picture shows how glucose gets converted to energy and releases CO2, lactic acid, ethanol, and water, depending on the presence or absence of oxygen.



Respiration in Humans

From the above figure, it is now understood that in humans, aerobic respiration occurs. But, remember that in an emergency situation,

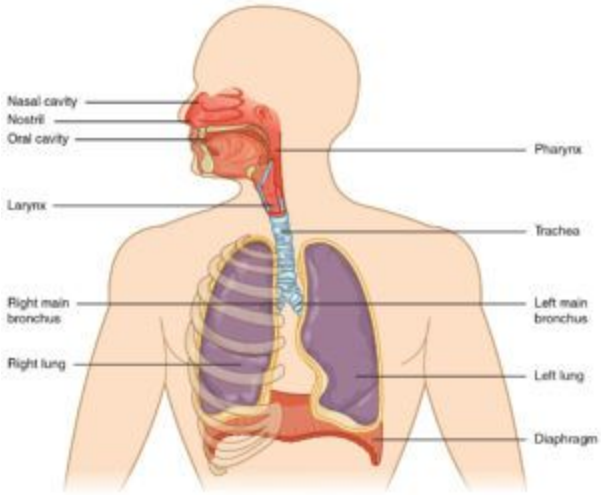
anaerobic respiration can also occur in some muscle cells, to maintain the life processes.

So, where does this respiration occur? In the cells of course! And in the cells, the entire chemical process occurs in the mitochondria. Here, the energy that is released is stored in the form of ATP. As and when the need arises, the mitochondria release the stored energy.

What is ATP?

The full form of ATP is Adenosine Triphosphate. It is the energy currency in the cellular respiration. So, when cells of the body require energy for performing the metabolic activities, they use this ATP and break it down to get the required energy.

Respiratory System in Humans



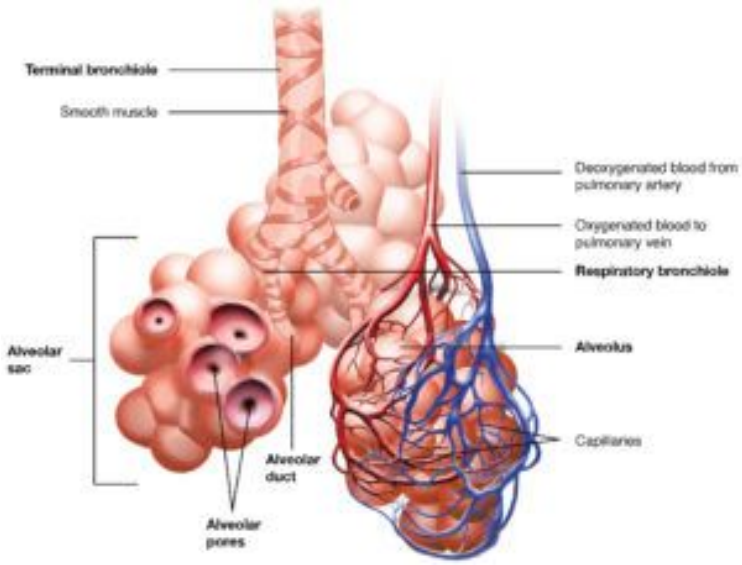
The human respiratory system consists mainly of a pair of lungs, trachea, bronchi, and alveoli. Air enters the body through the nostrils. They pass through an air passage called the nasal passage. From here, it enters the pharynx and larynx. The larynx is called the voice box. From the larynx, the air then goes to the trachea, from where they enter the lungs. The trachea has rings of cartilage that prevent the collapse of the trachea when the air is not present.

As the trachea enters the lungs, it divides and forms branches called as bronchi, which enter the two lungs. In the lung, every single bronchus further divides into bronchioles. At the end of the bronchioles, there are air sacs present called as the alveoli. Each alveolus comprises of a thin membrane. This is the place where exchanges of gases take place. There is an extensive network of blood capillaries and blood vessels here.

As the air enters our lungs through the nasal passage, the alveoli get filled with air. The oxygen is taken in by the blood vessels in the alveoli. Blood contains a pigment called haemoglobin that has a great affinity to oxygen. The carbon dioxide from the different parts of the

body brought here to the alveoli by the blood vessels is then released out.

The whole process of the breathing cycle occurs in a systematic fashion. The lungs also have some residual volume of air. This ensures that there is sufficient time for oxygen to be absorbed and for the carbon dioxide to be released.



Solved Questions For You

Q: Pyruvate, the three carbon molecule breaks down into carbon dioxide, energy, and water at which site?

a. Chloroplast

b. Mitochondria

c. Cytoplasm

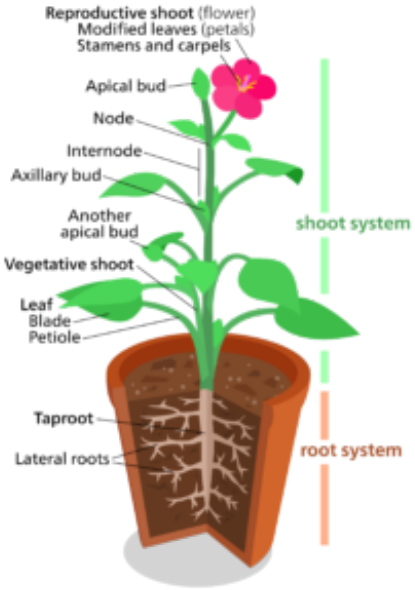
d. Nucleus

Ans: Mitochondria are the site of cellular respiration, where the breakdown occurs.

Transportation in Plants

You have learned that they can make their own food and are called as autotrophs. But did you ever wonder how this food that is prepared in the leaves goes to other parts of the plant body? How does transportation in plants occur? Though not as complex as the transportation system seen in animals, the transportation of raw materials and food in plants occurs through a systematic network of tissues. Let us understand the plant structure along with internal vascular structure to know more.

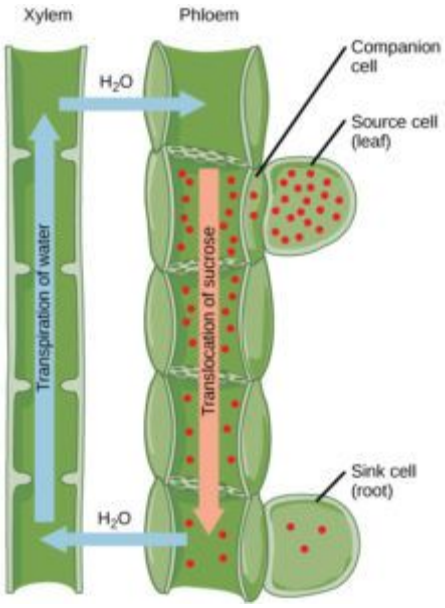
Transportation in Plants



The plant body is generally divided into roots, stem, and leaves. The roots are in the soil, which is the major source of nutrients in plants. Water and other nutrients enter the plant through the roots. The leaves are the food production centres. Using the sunlight and Carbon dioxide they synthesize food through photosynthesis in the chloroplasts.

Now, food from the leaves has to reach the other parts and the water, along with other nutrients has to reach leaves and other parts. All of this takes place through the vascular tissues of the plants. This is basically the transportation in plants.

You have already learned in earlier classes about the specialized cells and tissues in plants, which are the xylem and phloem. Together, they constitute the vascular structure in plants.



Vascular Structure

When talking about transportation in plants we must discuss Xylem and Phloem. Xylem and Phloem tissues are present throughout the plant. They begin at the root and then move up to the stem, branches, and leaves.

The xylem tissue transports water and minerals from the roots to the leaves whereas the phloem tissue transports food from the leaves to the other parts of the plant. Xylem tissue has tracheids and vessel elements. Phloem tissue has companion cells and sieve tubes.

When transpiration in plants occurs, water gets evaporated from the leaves. This results in more water being pulled from the root. This phenomenon explains how water moves up in the plants, against

gravity, without the use of any pump! The flow of water in the xylem tissues is unidirectional. It moves up the stem from the roots. It occupies the centre of the vascular bundle.

The phloem, on the other hand, is responsible for the translocation of the nutrients like carbohydrates and amino acids from the leaves to other areas of the plants. Here, the flow is bidirectional. It moves up and down the stem. Phloem occupies the edge of the vascular bundle, as seen in the following figure. Food movement in the phloem occurs due to the pressure flow mechanism. The differences in the osmotic pressure help in the movement of food from the area of high concentration to areas of low concentration.

Solved Questions For You

Q: Choose the wrong statement about xylem tissue.

a. Xylem cells are dead cells
b. Xylem transports food.
c. The flow is unidirectional.
d. Xylem tissue has tracheids and vessel elements.

Ans: Statement “b” is wrong. Xylem transports water.

Q: Transpiration organ in a plant is which of the following?

a. Epidermus
b. Xylem
c. Cortex
d. All of the above

Ans: The correct answer is “A”. Stomata are a part of the epidermal system in plants. Transpiration occurs through stomata in the leaves of the plants.

Transportation In Human Beings

If you were amazed by the beautiful roads that transport cars and bikes, then take a moment to see within yourself. There is this amazing network of blood vessels inside your body that covers a distance of an astonishing 100,000 km. These are responsible for the transportation of human beings. Let us take a closer look.

Circulatory System and its Components

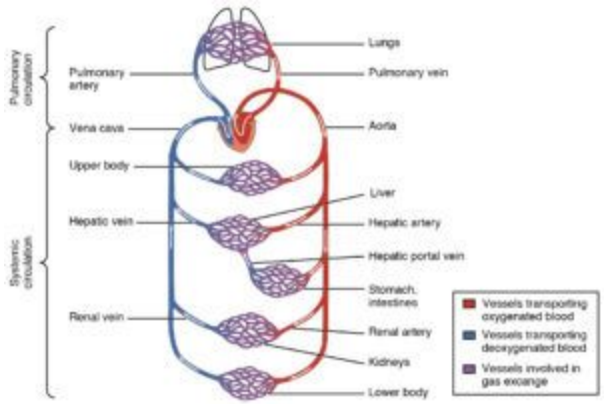
In human beings, the various organs associated with this system include the heart, lungs, blood vessels, capillaries, and blood. The heart is the pumping organ that squirts out blood. The heart does this with so much pressure that it is capable of squirting blood up to 9 meters high. It never stops and beats continuously so that blood can travel to all parts of the body.

Your blood travels through these blood vessels transporting oxygen, carbon dioxide, digested food, hormones and even waste products. It is amazing to see how transportation in human beings is carried out by

the circulatory system, with the heart and the vast network of blood vessels.

Blood

Blood is an important fluid connective tissue. It is mainly composed of plasma and blood cells. There are three types of blood cells, namely, red blood cells, white blood cells, and blood platelets. The RBCs have haemoglobin, an iron-containing complex protein. The WBCs are the cells that help in fighting diseases and attack any foreign bodies in the blood. The blood platelets are the ones that help in clotting of blood.



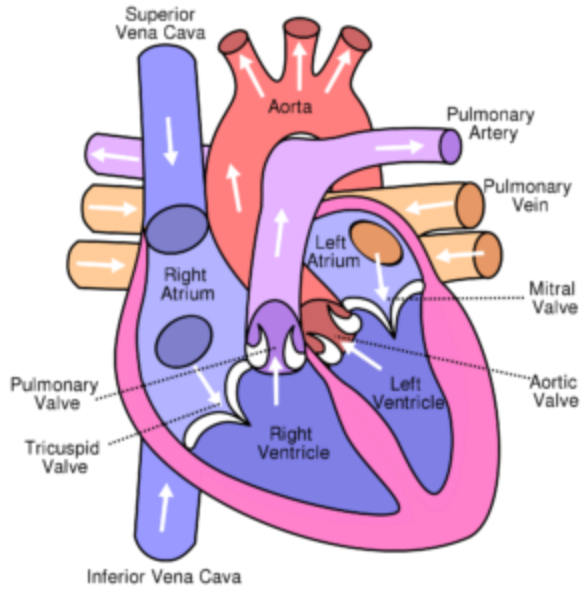
In human beings, there is a phenomenon called *double circulation* that occurs, which is an efficient way. The heart pumps the blood, and through the various blood vessels, it travels to different organs and then comes back again to the heart. Now, this flow of blood in humans

occurs in two pathways called the pulmonary pathway and the systemic pathway.

This system ensures that the deoxygenated blood (blood carrying carbon dioxide) from the right side of the heart goes to the lungs, where gaseous exchange occurs. Blood gets filled with oxygen from the lungs and carbon dioxide is given out to the lungs(from where it leaves the body). The oxygenated blood then travels from the left side of the heart to all other parts of the body.

The double circulation seen here ensures that there is no mixing of oxygenated blood and deoxygenated blood. There is also an efficient supply of oxygen to the body cells and a greater rate of blood flow in the body.

Heart



How do the oxygenated blood and the deoxygenated blood not get mixed? Firstly, they travel in different blood vessels. Secondly, in the heart, there are four chambers. The blood without oxygen and the blood with oxygen flow into different chambers.

The human heart is a muscular organ, which has four chambers. The two upper chambers called the right atrium and the left atrium, and the two lower chambers called the right ventricle and left ventricle. The right atrium and the right ventricle together may be called the right heart. The left atrium with the left ventricle together can be called as the left heart. All the chambers of the heart are separated by muscular walls called septum.

Read about the Excretion System in Humans, Plants and Animals.

Blood Vessels

Arteries and veins are the main blood vessels. These are interconnected by a network of smaller vessels called capillaries. Veins carry deoxygenated blood to the right side of the heart whereas arteries carry oxygenated blood away from the heart to different parts of the body.

Lymphatic system

In human beings and vertebrates, the lymphatic system acts as a subsystem of the circulatory system. It also has a role to play in the transportation in human beings. Lymph is a special fluid called the tissue fluid. It plays a role in the exchange process of nutrients and gases that occurs through blood. Any excess fluid remaining in the cells and tissues is collected by the lymph and is drained into the veins, which carry blood.

Read about the Transportation in Plants and Nutrition in Plants.

Solved Questions For You

Q: Write a short note on blood pressure in humans.

Ans: Blood pressure is an important vital sign of health. It is the force that blood applies on the walls of the blood vessels. It is expressed in terms of systolic pressure and diastolic pressure. The unit of measurement is mmHg. The normal blood pressure range is 120/80 mmHg.

Excretion

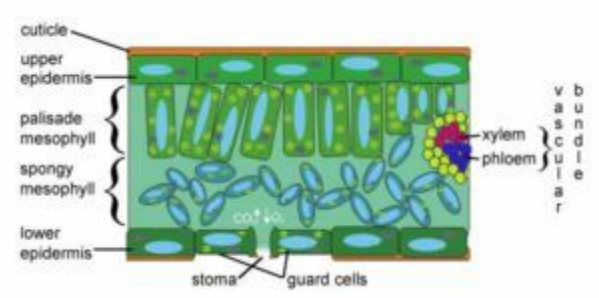
Living organisms are one giant chemical lab. Hundreds of chemical reactions happen in our bodies between various biomolecules. In plants, photosynthesis is basically a chemical reaction. All these metabolic reactions have byproducts that are eliminated through the process of excretion. Let us learn about how this elimination of waste products occurs in plants and animals.

Excretion in Plants

There is an immense difference in the structure and composition of plants and animals. Did you know that when chemical reactions occur in plants, oxygen is released? This oxygen is supposedly a waste product that the photosynthesis process generates.

Photosynthesis occurs in plants, in the presence of sunlight. This chemical reaction gives rise to oxygen, which is a gas. It diffuses through the stomata or the openings in the leaves. Any excess water that is present in plants gets evaporated through the transpiration process.

Another interesting feature here in plants is that some of the plant wastes are stored in cellular vacuoles, in leaves that fall off. Some other waste products are stored in the xylem, like resins and gums.

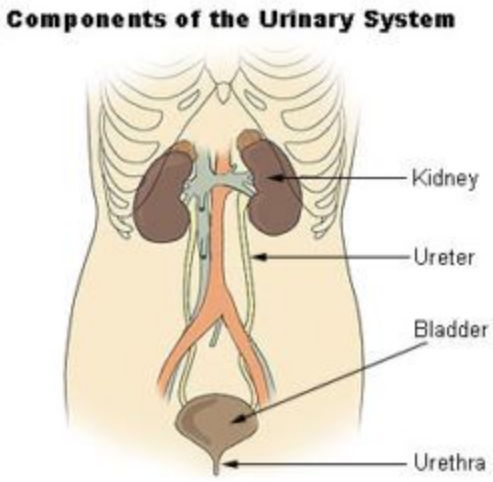


Excretion in Animals

Animals are generally more complex in nature when compared to plants, especially the animals belonging to the higher order phyla. Even among some lower organisms, excretion occurs through specialized organs, such as the nephridia seen in earthworms. In others, excretion happens through diffusion.

In the higher phyla and classes of the animal kingdom, animals such as fish, birds, reptiles, etc. have a specific excretory system in place to get rid of the metabolic wastes.

Excretory system in Human Beings



This is a well-developed and complex system that takes care of eliminating the wastes from the human body. This is a vital function that helps in the smooth functioning of the human body. Kidneys are the main organs of the excretory system in human beings. Ureters, urinary bladder, and urethra along with blood vessels are the other components present. The urine that is formed in the kidneys is transported through the ureters to the urinary bladder. It is expelled out through the urethra.

But, a point to be noted is that skin and lungs, also have a role to play in excreting or eliminating waste substances from the body. The sweat glands in the skin help in the excretion of small amounts of water, salts, and urea. Lungs help in getting rid of carbon dioxide through the

respiration process. Let us learn more in detail about the human excretory system.

Kidneys

They are a pair of bean-shaped organs that lie in the abdominal cavity. Not only excretion, kidneys also control the balance of water and other mineral ions in the body. The kidney in humans has two distinct regions, which are the cortex and medulla. Both the cortex and medulla are enclosed externally by three layers. These layers consist of a tough connective tissue, fat tissue, and renal capsule.

Internally, the cortex forms the outer layer and the medulla is the inner layer. There is also a region called the hilum of the kidney. This is the part where blood vessels enter the kidney. The ureters, some blood vessels, and nerves also exit from this point. The complex network of blood vessels i.e. arteries, veins, and capillaries, in this area play a significant role in the filtration and elimination process.

The cortex has tiny tubules called the nephrons. These nephrons are the basic units of filtration in the kidneys. Hence they are called the functional units of the kidney. Each nephron has three parts, namely renal corpuscle, a renal tubule, and the capillary network. The renal

corpuscle has clusters of tiny blood capillary network. This is called the glomerulus and Bowman's capsule.

The blood vessels bring in blood that has to be filtered. The blood supply to the kidneys starts with the aorta, which branches out into renal arteries and ends with renal veins that exit out of the kidneys, to join the vein called inferior vena cava.

Process of Filtration and Urine Formation

Through the process of filtration, urine is formed in the nephrons. Ultrafiltration occurs in the glomerulus part of the nephrons. Inside the glomerulus, there is high pressure, due to which waste products get filtered and urine is formed. The nephrons filter out wastes, minerals, and water while retaining red cells proteins and large molecules.

The urine travels down the collecting duct system. In the tubular part of the nephron, water is reabsorbed. From here, the concentrated urine eventually enters into the ureter. The ureter is a long tube that connects the kidneys to the urinary bladder. Here, the urine is stored until it is passed out through the urethra. Human urine is mainly composed of water, urea, uric acid and salts.

Now you know how important kidneys are in the human body. But what happens when kidneys fail to function? Read along to find out.

What Happens when Kidneys Fail?

Our kidneys do many tasks that are essential for the proper running of the human body. They are responsible for maintaining the balance in the body. They eliminate wastes and also help control blood pressure.

But, kidneys also can get damaged. When they are damaged, they cannot perform their functions well. This then turns out to be a question of life and death. If kidneys fail completely, it can lead to death. The waste products and excess water get accumulated in the body, with no proper channel for elimination. When both the kidneys fail, kidney transplantation and dialysis can be of help.

Dialysis

It is a treatment, where a device performs some of the tasks that kidneys perform. This device separates the wastes from the blood. Dialysis helps in the following.

- It removes wastes, salt and excess water from the body, preventing their build-up.

- It keeps the levels of certain chemicals in safe limits.
- Dialysis also helps to control blood pressure.

Solved Question For You

Q: Why are kidneys important? Justify your answer.

Ans: Kidneys play a crucial role in eliminating wastes from the body. They also help in maintaining the body balance. Blood pressure in the body is also regulated by the kidneys. When kidney failure occurs, it could lead to death. Kidney transplantation and Dialysis are the two options that are present in case of kidney failure.