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GPT – Biology Handbook (Part 1)

Why is diffusion insufficient to meet the oxygen requirements of multicellular organisms like humans?

Multicellular organisms such as humans possess complex body designs. They have specialised cells and tissues for performing various necessary functions of the body such as intake of food and oxygen. Unlike unicellular organisms, multicellular cells are not in direct contact with the outside environment. Therefore, diffusion cannot meet their oxygen requirements.

What criteria do we use to decide whether something is alive?

Any visible movement such as walking, breathing, or growing is generally used to decide whether something is alive or not. However, a living organism can also have movements, which are not visible to the naked eye. Therefore, the presence of life processes is a fundamental criterion that can be used to decide whether something is alive or not.

What are outside raw materials used for by an organism?

An organism uses outside raw materials mostly in the form of food and oxygen. The raw materials required by an organism can be quite varied depending on the complexity of the organism and its environment.

What is the role of the acid in our stomach?

The hydrochloric acid present in our stomach dissolves bits of food and creates an acidic medium. In this acidic medium, enzyme pepsinogen is converted to pepsin, which is a protein digesting enzyme.

What is the function of digestive enzymes?

Digestive enzymes such as amylase, lipase, pepsin, trypsin, etc. help in the breaking down of complex food particles into simple ones. These simple particles can be easily absorbed by the blood and thus transported to all the cells of the body.

How is the small intestine designed to absorb digested food?

The small intestine has millions of tiny finger-like projections called villi. These villi increase the surface area for more efficient food absorption. Within these villi, many blood vessels are present that absorb the digested food and carry it to the blood stream. From the blood stream, the absorbed food is delivered to each and every cell of the body

What advantage over an aquatic organism does a terrestrial organism have with regard to obtaining oxygen for respiration?

Terrestrial organisms take up oxygen from the atmosphere whereas aquatic animals need to utilize oxygen present in the water. Air contains more O₂ as compared to water. Since the content of O₂ in air is high, the terrestrial animals do not have to breathe faster to get more oxygen. Therefore, unlike aquatic animals, terrestrial animals do not have to show various adaptations for better gaseous exchange

How is oxygen and carbon dioxide transported in human beings?

Haemoglobin transports oxygen molecule to all the body cells for cellular respiration. The haemoglobin pigment present in the blood gets attached to four O₂ molecules that are obtained from breathing. It thus forms oxyhaemoglobin and the blood becomes oxygenated.

This oxygenated blood is then distributed to all the body cells by the heart. After giving away O₂ to the body cells, blood takes away CO₂ which is the end product of cellular respiration. Now the blood becomes de-oxygenated, Since haemoglobin pigment has less affinity for CO₂, CO₂ is mainly transported in the dissolved form. This de-oxygenated blood gives CO₂ to lung alveoli and takes O₂ in return

How are the lungs designed in human beings to maximize the area for exchange of gases?

The exchange of gases takes place between the blood of the capillaries that surround the alveoli and the gases present in the alveoli. Thus, alveoli are the site for exchange of gases. The lungs get filled up with air during the process of inhalation as ribs are lifted up and diaphragm is flattened. The air that is rushed inside the lungs fills the numerous alveoli present in the lungs. Each lung contains 300-350 million alveoli. These numerous alveoli increase the surface area for gaseous exchange making the process of respiration more efficient.

Why is it necessary to separate oxygenated and deoxygenated blood in mammals and birds?

Warm-blooded animals such as birds and mammals maintain a constant body temperature by cooling themselves when they are in a hotter environment and by warming their bodies when they are in a cooler environment. Hence, these animals require more oxygen (O₂) for more cellular respiration so that they can produce more energy to maintain their body temperature. Thus, it is necessary for them to separate oxygenated and deoxygenated blood, so that their circulatory system is more efficient and can maintain their constant body temperature.

What are the components of the transport system in highly organised plants?

In highly organised plants, there are two different types of conducting tissues – xylem and phloem. Xylem conducts water and minerals obtained from the soil (via roots) to the rest of the plant. Phloem transports food materials from the leaves to different parts of the plant body

How are water and minerals transported in plants?

The components of xylem tissue (tracheids and vessels) of roots, stems, and leaves are interconnected to form a continuous system of water-conducting channels that reaches all parts of the plant. Transpiration creates a suction pressure, as a result of which water is forced into the xylem cells of the roots. Then there is a steady movement of water from the root xylem to all the plant parts through the interconnected water-conducting channels

How is food transported in plants?

Phloem transports food materials from the leaves to different parts of the plant body. The transportation of food in phloem is achieved by utilizing energy from ATP. As a result of this, the osmotic pressure in the tissue increases causing water to move into it. This pressure moves the material in the phloem to the tissues which have less pressure. This is helpful in moving materials according to the needs of the plant. For example, the food material, such as sucrose, is transported into the phloem tissue using ATP energy.

What are the methods used by plants to get rid of excretory products?

Plants can get rid of excess of water by transpiration. Waste materials may be stored in the cell vacuoles or as gum and resin, especially in old xylem. It is also stored in the leaves that later fall off.

How is the amount of urine produced regulated?

The amount of urine produced depends on the amount of excess water and dissolved wastes present in the body. Some other factors such as habitat of an organism and hormone such as Anti-diuretic hormone (ADH) also regulates the amount of urine produced.

How are fats digested in our bodies? Where does this process take place?

Fats are present in the form of large globules in the small intestine. The small intestine gets the secretions in the form of bile juice and pancreatic juice respectively from the liver and the pancreas. The bile salts (from the liver) break down the large fat globules into smaller globules so that the pancreatic enzymes can easily act on them. This is referred to as emulsification of fats. It takes place in the small intestine

What are the necessary conditions for autotrophic nutrition and what are its by products?

Autotrophic nutrition takes place through the process of photosynthesis. Carbon dioxide, water, chlorophyll pigment, and sunlight are the necessary conditions required for autotrophic nutrition. Carbohydrates (food) and O₂ are the by-products of photosynthesis

How are the alveoli designed to maximise the exchange of gases?

The alveoli are the small balloon-like structures present in the lungs. The walls of the alveoli consist of extensive network of blood vessels. Each lung contains 300–350 million alveoli, making it a total of approximately 700 million in both the lungs. The alveolar surface when spread out covers about 80 m² area. This large surface area makes the gaseous exchange more efficient

What would be the consequences of a deficiency of haemoglobin in our bodies?

Haemoglobin is the respiratory pigment that transports oxygen to the body cells for cellular respiration. Therefore, deficiency of haemoglobin in blood can affect the oxygen supplying capacity of blood. This can lead to deficiency of oxygen in the body cells. It can also lead to a disease called anaemia.

What is the difference between a reflex action and walking?

A reflex action is voluntary action which is a rapid and automatic response to stimuli while walking is a voluntary action which requires our thinking and in our control.

What happens at the synapse between two neurons?

A synapse is the gap between the two neurons. At synapse the electrical signals converted into chemicals that can easily cross over the gap and pass on to the next neurons where it again converted into electrical signals

What are plant hormones?

Plant hormones are the fluids which are secreted within the plant also known as phytohormones. Plant hormones regulate the growth and development of the plant. Examples of plant hormones are auxin, gibberellins etc

How is the movement of leaves of the sensitive plant different from the movement of a shoot towards light?

The movements of the leaves of the sensitive plant are touch sensitive and independent of growth while the movement of the shoot towards light is growth related and known as phototropism

How do auxins promote the growth of a tendril around a support?

When tendrils come in contact with any support, the part of the tendril in contact with the object does not grow as rapidly as the part of the tendril away from the object. This is caused by the action of auxin hormone. Less auxin occurs on the side of contact as compared to the free side as a result, auxin promotes growth on the free side and the tendrils coil around the support

How does chemical coordination take place in animals?

Chemical coordination takes place in animals with the help of hormones. Hormones are the chemical fluids that are secreted by the glands of the endocrine system. Hormones regulate the overall growth and development of the animals.

How does our body respond when adrenaline is secreted into the blood?

When someone is in danger or in emergency then adrenal gland secrete adrenaline hormone. It is secreted directly into the blood and is transported to different parts of the body. It speeds up the heartbeat and hence supplies more oxygen to the muscles. This results in increasing breathing rate and blood pressure which enable them to fight with such urgent situation

Why are some patients of diabetes treated by giving injections of insulin?

Diabetes is caused due to less or no secretion of hormone insulin by pancreas. In such a person, blood sugar level is high. Insulin converts extra sugar present in blood into glycogen. Thus, patients suffering from diabetes are given insulin injection to control their blood sugar level

How does phototropism occur in plants?

The growth movement in plants in response to light stimulus is known as phototropism. The shoots show positive phototropism and the roots show negative phototropism. This means that the shoots bend towards the source of light whereas the roots bend away from the light source. For Example: The flower head of sunflower is positively phototropic and hence it moves from east to west along with the sun.

How does chemical coordination occur in plants?

Chemical coordination occurs in plants with the help of plant hormones. Different plant hormones help to coordinate growth, development, and responses to the environment. They are synthesized at places away from where they act and diffuse to the area for action, For example, auxin promotes cell growth, gibberellins promote stem growth, cytokinins promote cell division and abscisic acid inhibits growth and its effects include wilting of leaves

What is the need for a system of control and coordination in an organism?

There are various organs in an organism. These organs must be carefully controlled and coordinated for the survival of an organisms. In the body of an organism various fluids are secreted from the glands of the endocrine system. These hormones are responsible for the overall growth and development of an organism. All others daily decision that includes voluntary and involuntary action are controlled by central nervous system(CNS).

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