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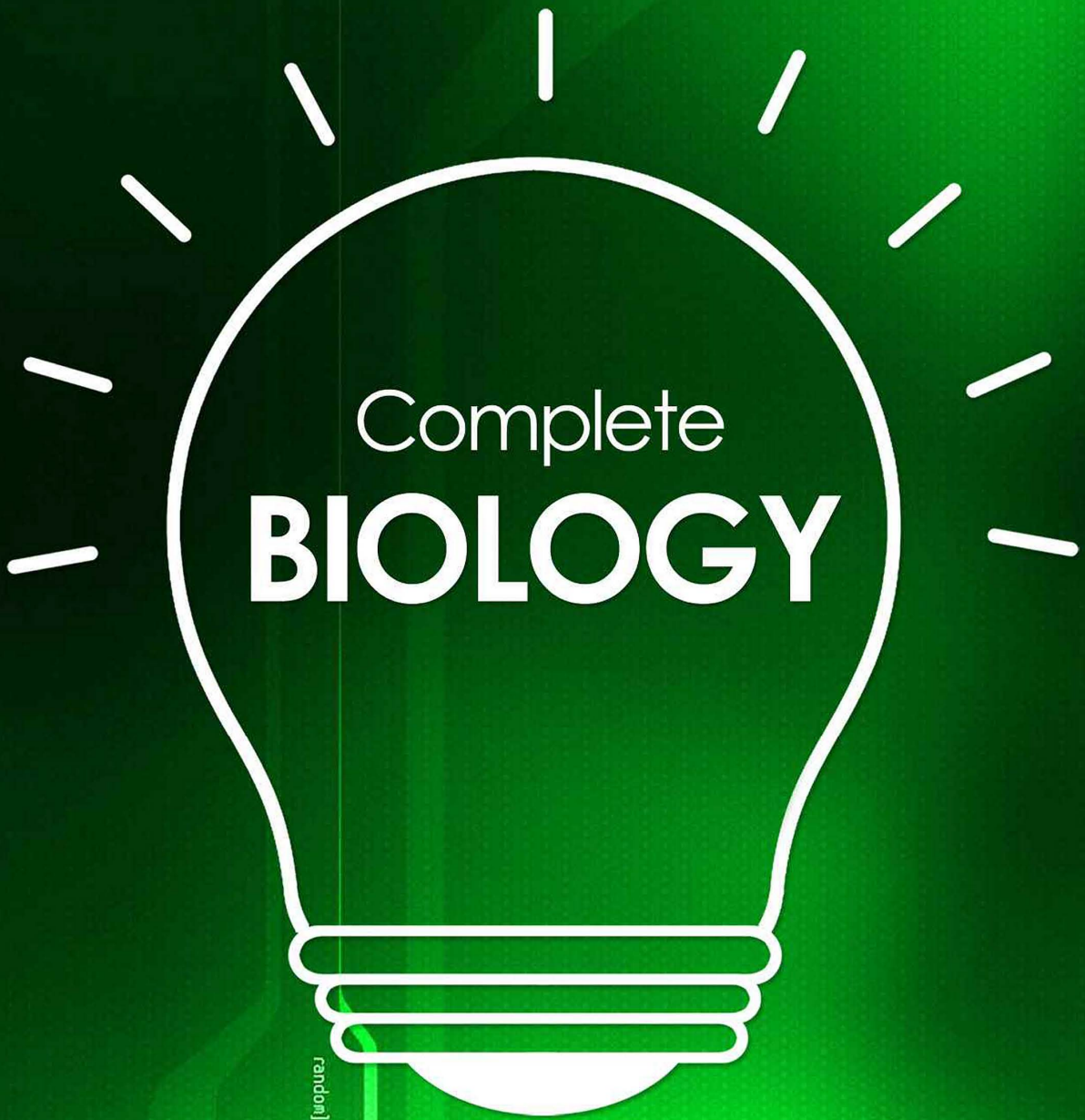

Complete BIOLOGY

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CLASS 11&12th

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CLASS 11th

Breathing and Exchange of Gases

01. Introduction

All activities of living organisms require energy. They obtain this energy by the breakdown of nutrients present in their food, such as glucose, amino acids, fatty acids, etc. This usually takes place in the presence of oxygen and energy is released in the process as ATP. During the process of breakdown of food molecules, carbon dioxide gas (which is toxic to the body cells) is also released.

02. Types of Respiration

Based on the mode of oxidation of nutrients respiration is of following two type

(i) **Aerobic respiration** It occurs when the cells utilise molecular oxygen for oxidising nutrient. It occurs in the mitochondria of cells. it produces a lot of ATP per glucose molecule. It is done under normal circumstances by an animal, when heart rate and breathing rates are normal.

(ii) **Anaerobic respiration** It occurs, when nutrients are oxidised without using molecular oxygen. It is also called **fermentation.** It occurs in the cytoplasm of the cells. It produces less ATP per glucose molecule. It is done during oxygen deficient situations, i.e. like the first 1−2 minutes of exercise.

Respiratory organs and modes of respiration in various animals		
Respiratory organ	**Mode of respiration**	**examples**
Body surface	Body surface respiration	Almost all lower animals upto phylum-Annelida including sponges (*Leucosolenia*) and coelenterate (*Hydra*) and free-living helminthes
Gills	Bronchial respiration	Grustaceans (prawn), cartilage and bony fish
Book gills	Book gill respiration	Limulus (king crab)
Skin	Cutaneous respiration	Annelids (earthworm) and amphibians (frog)
Trachea (Ectodermal tubes)	Tracheal respiration	Insects (cockroach), centipedes and millipedes
Lungs	Pulmonary respiration	Most of tetrapod
Book lungs	Book lung respiration	Arachnids (spiders and scorpion)

03. Respiratory System in Human

The special features of mammalian respiratory system are

(i) Presence of a nose.

(ii) Elongation of nasal passage and its complete separation from the buccal passage through palate so that internal nostrils open deep into nasopharyngeal part of pharynx.

(iii) Long windpipe due to the presence of well-defined neck.

(iv) Spongy and solid lungs.

04. External Nostrils

A pair of external nostrils represents the initiation of the respiratory passage. These are the holes of our nose present above the upper lip. These lead into nasal passage through vestibule.

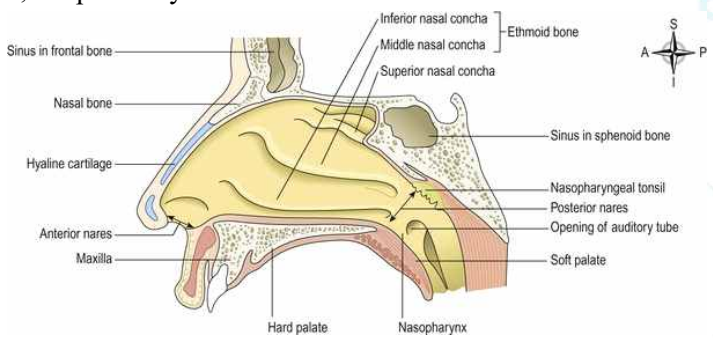
05. Nasal Passage

The portion inside the nose is called **vestibule,** which contains mucous lining and hair epithelium. The portion behind it is called **nasal chamber.** *The nasal chamber has*

(i) **Respiratory region** It is a highly vascularised region involved in the air conditioning (temperature and moisture maintenance) of the air entering through the nasal passage.

(ii) **Olfactory region** It is the upper part, lined by olfactory epithelium for smell, called as **Schneiderian membrane.**

In the nasal chamber, the processes of three bones are seen to increase the surface area of this chamber. These processes are known as **turbinates** or **concha.** These are named as superior, middle and inferior concha. The three bones involved in their formation are nasals, ethmoids and maxilla, respectively.



06. Internal Nares

These are the posterior openings of the nasal cavities that lead into the nasopharynx.

07. Nasopharynx

Internal nares open into a part of pharynx known as nasopharynx. It is the portion of pharynx through which only air can pass. It opens into the trachea through the glottis of laryngeal region. Glottis is the opening at the upper part of larynx.

08. Larynx

It is commonly called as the **voice box.** It is an organ in the neck of mammals involved in sound production. The larynx houses the pale folds of vocal cords, which are an essential component of phonation. In adult humans, the larynx is found in the anterior neck at the level of 3^{rd} to 6^{th} cervical vertebrae. It connects the inferior part of the pharynx (hypopharynx) with the trachea. Larynx is made up of cartilage present at the upper part of trachea. Its upper part has an opening, i.e. glottic. During swallowing of food, this glottis can be covered by **epiglottis.** Epiglottis is a leaf-shaped cartilaginous structure made up of elastic cartilage. It prevents the entry of food into the larynx. The laryngeal skeleton consists of nine cartilages, i.e. three single (thyroid, cricoid and epiglottis) and three paired (arytenoid, corniculate and cuneiform). Thyroid cartilage is involved in formation of **Adam's apple.** It is a C-shaped cartilage and is prominent in males. Cuneiform cartilage connects epiglottis with arytenoid cartilage. The hyoid bone is not the part of larynx, though it is connected to is as shown in the figure above. In humans, true glottis is called **rima glottidis.**

It can be further differentiated into

(i) **Intermembranous space,** i.e. its part towards thyroid cartilage.

(ii) **Intercartilaginous space,** i.e. its part in between arytenoid cartilages.

09. Trachea

It is an air conducting tube with non-collapsible walls due to cartilaginous C-shaped/incomplete rings of hyaline cartilage. The number of rings are 16 or 17 in human beings. The trachea is further divisible into following two regions on the basis of their functions.

(i) Purely conducting zone.

(ii) Respiratory cum conducting zone.

In purely conducting zone, no gaseous exchange takes place. Thus, it works only for conduction or transport of gases. In respiratory cum conducting zone, transport associated with gaseous exchange takes place.

10. Bronchi and Bronchioles

Trachea enters into lungs after first branching in the form of bronchus (pl. bronchi). The finer branches of these bronchi are called bronchioles, which further divide to form alveolar ducts. These alveolar ducts then open to atrium containing alveolar sacs. These alveolar sacs contain the primary units of gaseous exchange, i.e. alveoli or alveolus. Trachea has the diameter of 2.5 cm^2 only, while the total area of alveoli in a human lung is 70 m^2 (approx.) These give more surface area for diffusion or exchange of gases.