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Question :- White Notes on Transport of gaseous?

Answer :- Gas exchange :-

Gas exchange is the physical process by which gases move passively by diffusion across a surface. For example, this surface might be the air / water interface of water body. The surface of a gas bubble in a liquid, a gas permeable membrane or a biological membrane that form the boundary between an organism and its extracellular environment.

Gases are constantly consumed and produced by

cellular and metabolic reaction in most living things so an efficient system for gas exchange between, ultimately the interior of the external environment is required. Small, particularly unicellular organisms, such as bacteria and protozoa, have a high surface-area to volume ratio. In these creatures the gas exchange membrane organisms, such as flatworms are also able to perform sufficient gas exchange across the skin or cuticle that surrounds their bodies.

## Physical principles of gas-exchange :-

### Diffusion and surface area

The exchange of gases occurs as a result of diffusion down a concentration

gradient. Gas molecules move from a region in which they are at high concentration to one in which they are at low concentration. Diffusion is a passive process, meaning that no energy is required to power the transport and it follows Fick's law.

$$J = -D \frac{dp}{dx}$$

In relation to a typical biological system, where two compartments ('inside' and 'outside'), one separated by a membrane barrier, and where a gas is allowed to spontaneously diffuse down its concentration gradient

- J is the flux, the amount of gas diffusing per unit area of membrane per unit time. Note that this is already scaled for the

- ② is the diffusion coeffici which will differ from gas to gas, and from membrane to membrane, according to the size of the gas molecule in quest and the nature of the membrane itself (particularly its viscosity, temperature and hydrophobicity).

- $\varphi$ is the concentration of the gas.
- x is the positive across the thickness of the membrane.

- $d\varphi/dx$ is therefore the concentration gradient across the membrane. if the two compart-ments are individually well-mixed, then this is simplifies to the difference in concentration of the gas between the inside and outside compartments divided by the thickness of the membrane.

## Interaction with circulatory systems

In multicellular organisms therefore, specialised respiratory organs such as gills or lungs are often used to provide the additional surface area for the required rate of gas exchange with the external environment. However the distances between the gas exchanger and the deeper tissues are often too great for diffusion to meet gaseous requirements of these tissues. The gas exchangers are therefore frequently coupled to gas-distributing circulatory systems, which transport the gases evenly to all the body tissues regardless of their distance from the gas exchangers.

Some multicellular organisms such as flatworms (Platyhelminthes) are relatively large but very thin, allowing their

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outer body surface to act as a gas exchange organ. Flatworms therefore lack gills or lungs, and also lack a circulatory system.

Invertebrates :-

The mechanism of gas exchange in invertebrates depends their size, feeding strategy, and habitat (aquatic or terrestrial).

The sponges (Porifera) are sessile creatures, meaning they are unable to move on their own and normally remain attached to their substrate. They obtain nutrients through the flow of water across their cells, and they exchange gasses by simple diffusion across their cells, and they exchange gases by simple diffusion across their cell membranes.