MEANS OF TRANSPORT

SYNOPSIS

J.C Bose is considered as father of physiology in India.

J.C Bose designed an instrument called "**Coherer**" for detecting radiowaves.

J.C Bose explained the various bioelectrical responses of plants through "**Pulsating theory**" to explain ascent of sap in plants.

J.C Bose designed an instrument called **crescograph** to record growth of a plant which can record the growth upto a millionth part of a millimeter.

J.C Bose is an author of books "**Researches on Irritability of plants**" and **"Nervous mechanisms in plants".**

INTRODUCTION

- Plants need to move molecules (water, photosynthates, minerals, hormones etc) over very long distances when compared to animals. A complex and orderly movement of different compounds occurs in the plant body in different directions as every organ receives some substances and gives some other.
- Transport processes that occur in plants are understood by the knowledge of cell structure and anatomy of plants.
- Movement across short distances (within the cell and from cell to cell across the membrane) takes place in plants.
- In plants short distance transport occurs by diffusion and cytoplasmic streaming.
- Long distance transport through vascular system is called **translocation**. Xylem transport is unidirectional and phloem transport in bidirectional but transport of substances in plants is multidirectional.

Simple Diffusion :

Diffusion is the passive movement of substances, without expenditure of energy over a short distance either within the cell or between the cells.

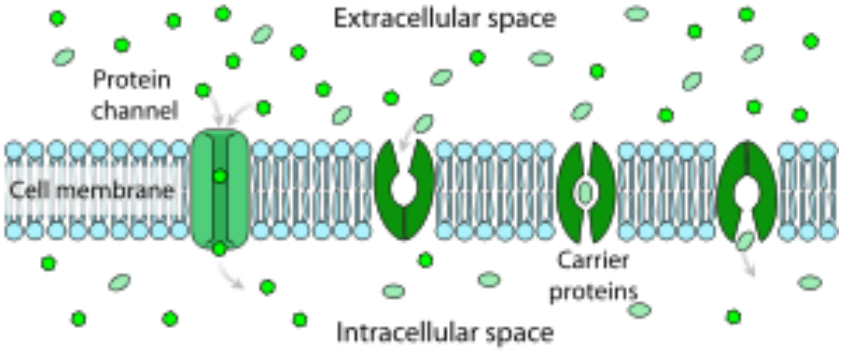
- Simple Diffusion is driven by concentration gradient and does not require a living system. It is a slow process.
- Simple diffusion of gases is faster than liquids and diffusion of liquids is faster than solids.
- The diffusion of gases and liquids in solids is easier than solids among themselves.
- Gaseous movements within the plant body occur only by diffusion.
- Diffusion rates are affected by concentration gradient, membrane permeability, temperature and pressure.
- It does not require any transporter and is not selective.
- It is not an uphill transport, hence energy is not required.

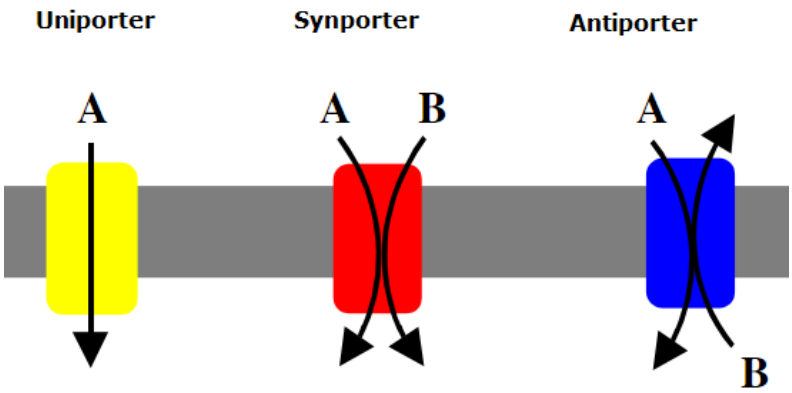
Facilitated Diffusion:

- The diffusion rate of a substance depends on its size, lipid solubility (membrane lipids).
- Substances that do not have lipid solubility or substance that have a hydrophilic group attached to them cannot move directly through lipid bilayer, hence get transported through special proteins, without involving ATP (energy). This is called **facilitated diffusion**.
- Facilitated diffusion is substrate specific, reaches saturation and is sensitive to inhibitors.
- Protein channels in the membranes may be always open or controlled (gated).
- **Porins** are proteins that form large pores in the outer membranes of plastids, mitochondria, and some bacteria.

Aquaporins are water channels that help in transport of water and hydrophilic substances.

- Transport proteins may act as channel protein or as carrier proteins.
- Carrier proteins may facilitate "**symport**", "**antiport** " or "**uniport**" type of movements across the membrane.





Active transport:

- Pumping of molecules by membrane proteins against a concentration gradient using energy is called **active transport**.
- Carrier proteins that facilitate active transport are called **pumps**.
- Simple diffusion and facilitated diffusion both occur along the concentration gradient and do not require energy.

- v Facilitated diffusion and active transport both occur through specific membrane proteins and are highly selective. They reach saturation, respond to inhibitors and are regulated by hormones.