* Ion/Nutrient uptake Mechanism

Ion uptake is the process in which mineral nutrients enter the cellular material following the same pathway as that for water. Nutrients may be taken by plants by two mechanism.

(1) Passive Uptake
(2) Active "

Passive Uptake:

It is the absorption of mineral nutrients by plants (along the conc. gradient) without direct expenditure of metabolic energy.

Passive absorption is not affected by temperature & metabolic inhibitors. There are 4 theories lying under passive absorption/uptake.

1. Mass flow Theory.
2. Contact exchage theory
3. Carbonic acid exchage theory.
4. Donnan equilibrium Theory.

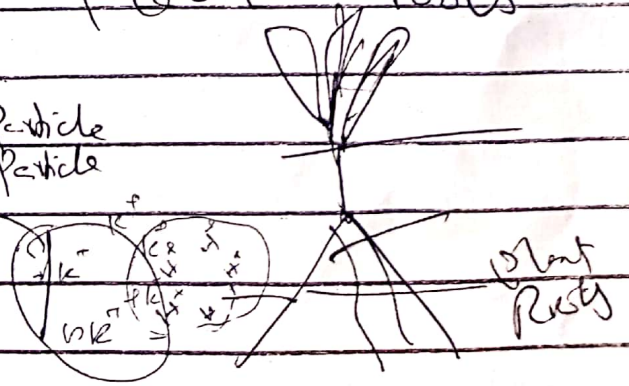
Mass Flow Theory:

According to this theory ions are absorbed by the roots along with mass flow of water under the effect of transpirati. An increase in transpirational pull increases the uptake of ions by roots. Thus, mass flow of ions through root tissue occurs due to transpirational pull in the absence of metabolic Energy.

Contact Exchange Theory: According to this theory, ions adsorbed on ~~the~~ colloidal particles (micelles) get adsorbed to the root in exchange for hydrogen ions previously adsorbed on the roots.

Ions adsorbed on the colloidal particles oscillate within a small space, when two particles (root & soil particle) are close enough the oscillation space of an ion adsorbed to one particle overlaps the oscillation space of an ion adsorbed to another particle. Thus, exchge of ions may take place b/w soil particles & plant roots. e.g K^+ ion is adsorbed on the colloidal particle while H^+ ion is adsorbed on the plant roots. When oscillation space of both ions overlaps exchge of ions occurs and H^+ ion will go to colloidal particle while K^+ ion to plant roots.

Reserve Acidity



Carbonic acid Exc

The soil sol. provides a medium for the exchange of ions b/w the roots and colloidal particles. CO_2 released during root respiration forms carbonic acid by reacting with water of soil solution. This carbonic acid is then dissociate in soil sol. to form H^+ and HCO_3^- ions. H^+ ions adsorbed to colloidal particles it exchages for cations such as K^+ which are released into soil solution. From there may diffuse to plant roots & taken up by plants.

↓ Lecture in old Register

Donnan Eq

org. Molecules.

Cell membrane is composed of macro molecules of proteins & lipids that have different functional groups like Carboxylic group (-COOH) and phosphate group ($-PO_4$) a from which positively

(phenolic gp.)

charged particles like proton dissociates, leaving the macromolecules with net -ive charge. Thus the membrane is usually -ively charged. The -ive charges are not ~~diffusable~~ So produced are not diffusible b/c they are within the membrane structure. These -ively charged ions on the membrane are called fixed ions. The -ively charged membrane is called donnan phase. As a result of net -ive charge in the membrane structure the cations like K^+ will tend to diffuse through the membrane b/c of electric potential difference.

The cations will finely come to equilibrium with the fixed -ive charges of the membrane. This equilibrium is called Donnan equilibrium.

Active Don uptake

The active transport of ions from the outer space of cell to the inner space generally occurs

against the conc. gradient & hence requires metabolic energy. This energy is obtained from the metabolism of cell.

During active ion trasport the carrier proteins, picks up an ion from one side of the membrane & discharges it on the other site. The picking up & discharge of ion by carrier protein requires energy. Energy is obtained from the hydrolysis of ATP. (synthesis of ATP charge into ADP. Energy released is used to change conformation of carrier protein so that the ion is picked up on one side of the membrane & released on the other.

After discharge of ion carrier protein is set back to pickup an other ion. The carrier protein may carry one ions inward & exchge it with an other ion at the inner surface of membrane, so that other ion

is carried by the same protein carrier outward.

Redistribution of Ions in Plant Bo

The continued movement of salt ions into leaves along transpir pull results in an increase Salt content during growing season. Not all of salts which enter a given leaf will retai in that leaf, some of the salt ions are exported / transported bas into stem from where they are transported into other parts of the plant.

Redistributin of salts within plar body seems to be controlled largely by metabolic activities o various parts of the plant. Salt ions tend to be move from older leaves to younger leaves, reproductive structure and metabolically active regions befo the fall of older leaves. Similar trasplantatin of salt ion