CASE

Curriculum for Agricultural Science Education

Principles of Agricultural Science – Plant

Root Absorption

Unit 4 – Anatomy and Physiology
Lesson 4.2 The Radicle Root

Check for Understanding…

How do plant roots "absorb" water?

Root Physiology Misconception:

- Many speculate that roots act like sponges, absorbing water by pulling it into the root.
- In reality the root doesn't "absorb" water.
- Water uptake is a physiological process involving osmosis.

Cell Access

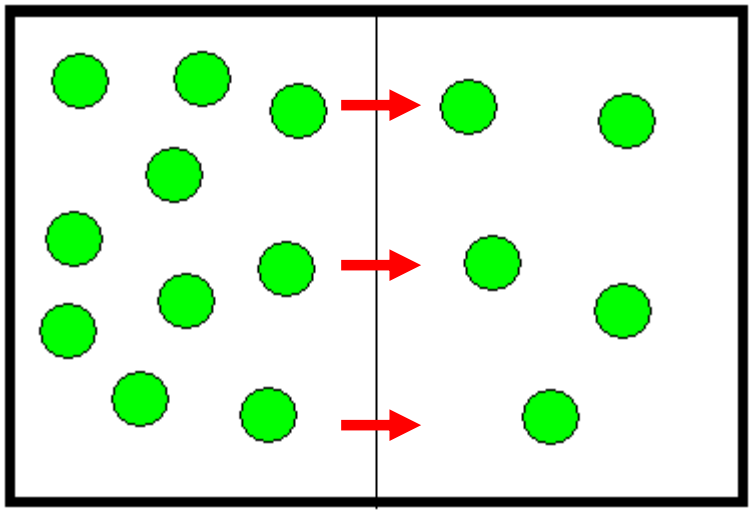
- **Passive transport:** requires no energy output from the cell to transfer substances in and out of the cell.

- **Active transport:** requires an output of energy from the cell to move substances.

Diffusion

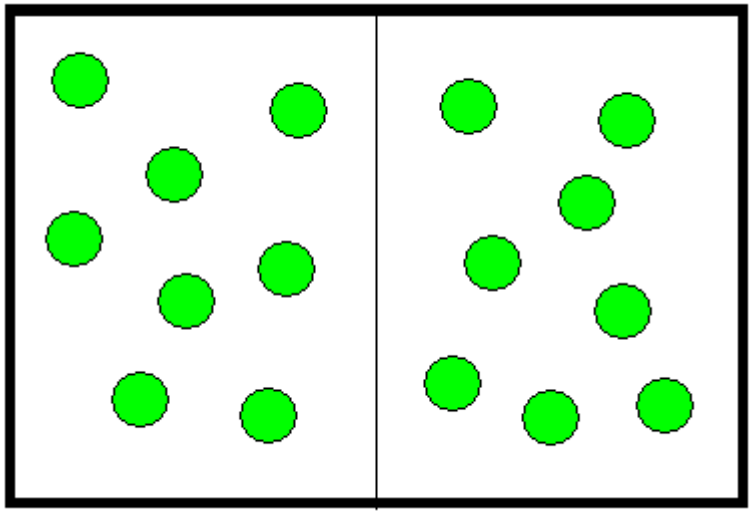
The movement of particles from areas of higher concentration to areas of lower concentration.

Which way will the substance move?



Diffusion

Diffusion occurs until there is equilibrium.

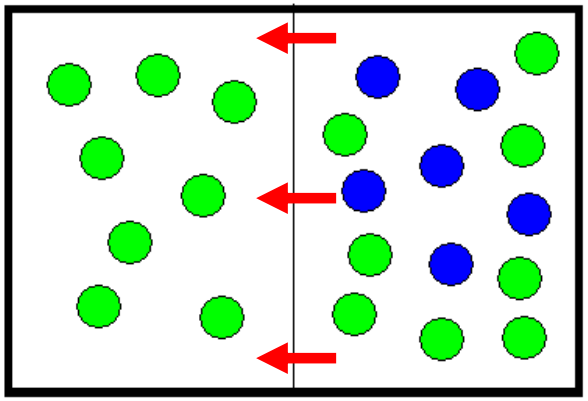


Osmosis

Diffusion of water through a semi-permeable membrane separating two solutions.

Maintains the level of water necessary in the cell.

Which way will the water move?

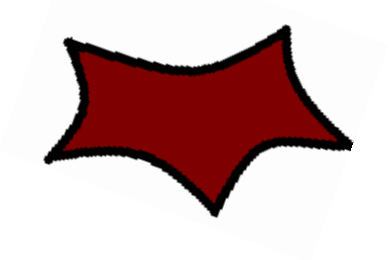


What happens in osmosis?

As water reaches equilibrium, a cell may be dehydrated or over-hydrated:

Hypertonic:

Lower H_2O conc. out of cell, H_2O moves out = cell shrinks

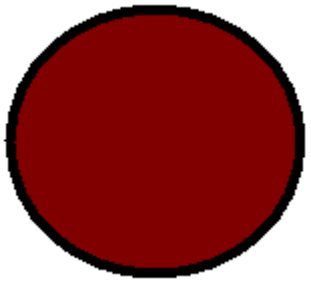


Isotonic:

H_2O conc. in cell = H_2O conc. out of cell.

Hypotonic:

Higher H_2O conc. out of cell, H_2O moves in = cell expands.



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So Where Does Osmosis Happen?

Water and dissolved nutrient uptake happen through the root hairs.

Root hairs are specialized epidermal cells on the surface of roots.

(University of Wisconsin-Madison, 2008)

Fluid Transfer

- As the plant consumes water, water and dissolved nutrients are drawn up the plant stem.
- This causes an unbalance between the cell content and soil.
- Water and dissolved nutrients pass through the cell membranes of root hairs to balance the deficiency.

The Concept of Turgor

- Internal water pressure of a plant
- Balloon analogy:
  - If fully inflated a balloon can stand up vertically and be very rigid.
  - If the balloon does not have enough pressure, it will flop over and not stand up.

Bounty of Water

- Soil can’t distribute “too much water” to plants unless it is saturated.
- The plant won’t absorb any more water if turgid.
- If the soil is saturated with water, the root hairs die from the lack of oxygen, and thus end the uptake of water and nutrients.

Not Enough Water

The plant reaches its wilting point:

- Plants without enough water will deflate
- If no water is present in the soil, some water loss will happen from the roots.
- This causes the plant to wilt very fast and shut down physiological processes.

References

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