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Canadian Organic Growers
Cultivons Biologique Canada

ALL ABOUT PLANT ROOTS

A General Discussion About the Foundation of a Plant

IMPORTANCE OF ROOTS

Roots play a vital role in plant survival by transporting water and nutrients to the above-ground organs and depositing root exudates into the rhizosphere. Their biomass and surface area often surpass those of the visible (above ground) parts of the plant. Since plants cannot move, they have evolved root structures that are specifically adapted to their environments. These roots are highly influenced by external conditions and grow by adding cells to their tips.

ROOTS DETECT STRESS

Roots are the primary organ of the plant that detects and responds to environmental stresses, such as water availability, nutrient levels, temperature, soil compaction, and even the presence of harmful substances or pathogens, showcasing their critical function in a plant's overall resilience and adaptability.

THE ROLE OF PLANT ROOTS

Plant roots fulfill three essential roles:

1. Anchoring and stabilizing the plant.
2. Absorbing water and nutrients (including processes like nutrient solubilization, mycorrhiza colonization, and rhizophagy).
3. Storing nutrients, particularly in perennial plants.

Tap roots and fibrous roots are the primary types of roots found in nature.

Tap Roots:

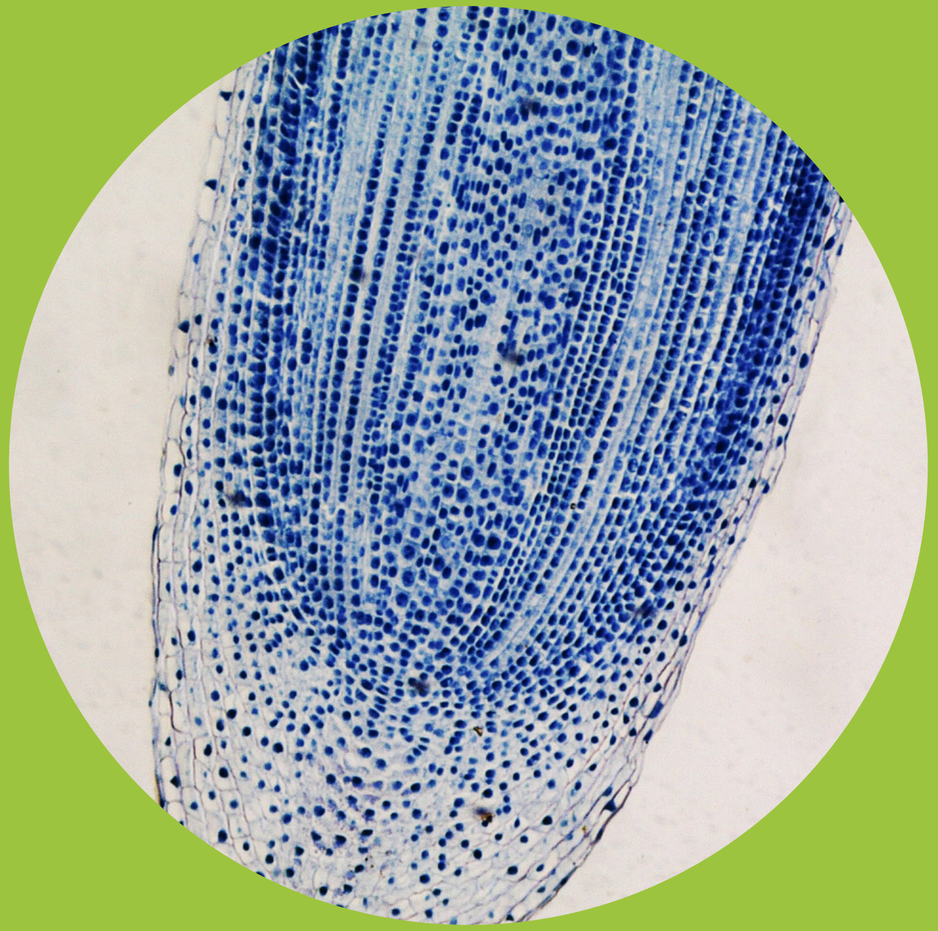
Have a large, central root with smaller lateral roots branching off. They grow deep into the soil and include plants such as chicory and tillage radish.

Fibrous Roots:

Composed of numerous thin, branching roots that spread widely near the soil’s surface to better help the plant absorb water and nutrients. Cereal crops are excellent examples of plants with fibrous roots.

ROOT CELL TYPES

Roots are composed of various cell types, each serving distinct roles to support the plant. Their primary functions include absorbing nutrients and protecting the plant, storing resources and plant regulation, as well as enabling growth and facilitating transport. Let’s take a closer look at the cells involved with these plant functions.



ROOT CELLS: NUTRIENT ABSORPTION AND PROTECTION

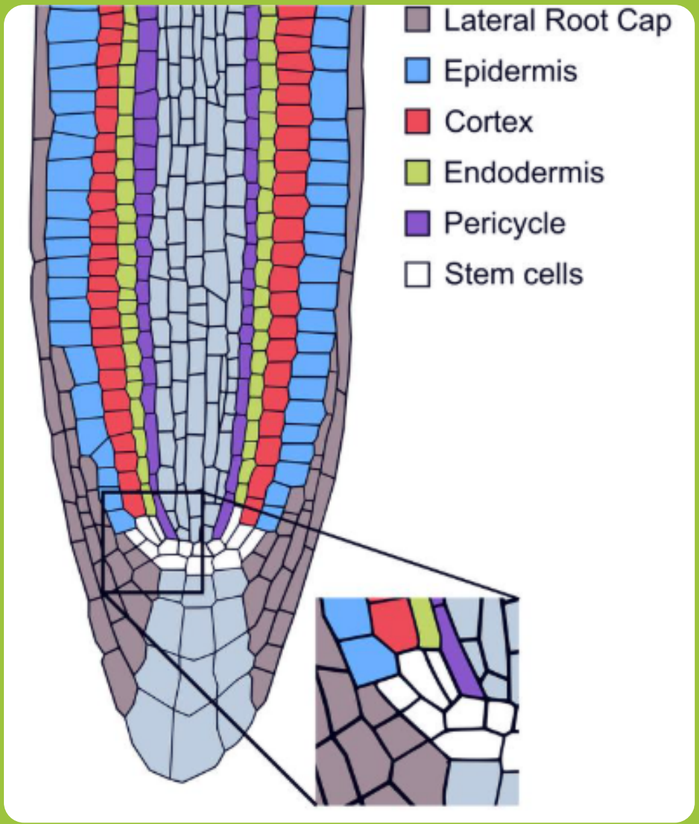


Photo source: https://www.innovations-report.com/health-life/life-sciences/specialized-plant-cells-regain-stem-cell-features-to-heal-wounds/

EPIDERMAL CELLS:

- Include root hairs (each root hair is a single cell)
- First line of defense.
- Absorb water, minerals and in the case of rhizophagy, absorb bacteria.
- As root hairs develop, surface area increases, which makes these processes more efficient.

ROOT CAP CELLS:

- Protect the delicate root tip as it pushes through the soil.
- Helps the root grow downward by detecting gravity (gravitropism).

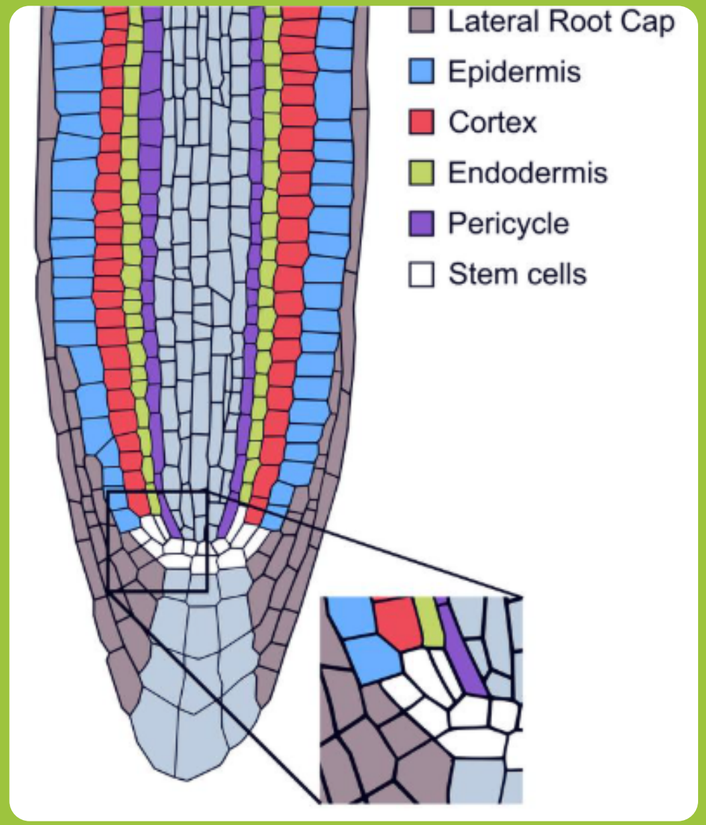
ROOT CELLS: RESOURCE STORAGE AND REGULATION

CORTEX CELLS:

- Found between the epidermis (outermost layer of “skin” cells) and endodermis (innermost layer of “skin” cells).
- Store nutrients in the plant (e.g., starch) and help move water and minerals inward.

ENDODERMIS CELLS:

- Function as gatekeepers.
- Regulate what enters the vascular system, letting in what the plant needs and keeping out unwanted substances.



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ROOT CELLS: GROWTH AND TRANSPORT

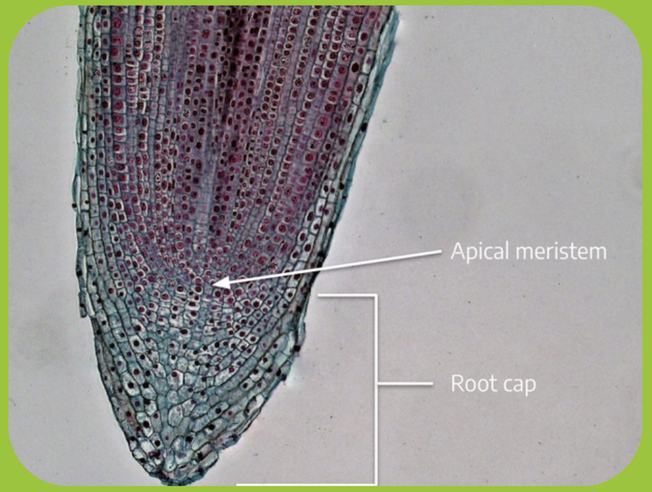


Photo source: https://open.lib.umn.edu/horticulture/chapter/7-1-meristem-morphology/

MERISTEMATIC CELLS:

- Located at the root tip.
- Responsible for root growth.
- These cells divide to make the root longer (primary meristem) and thicker (secondary meristem) over time.

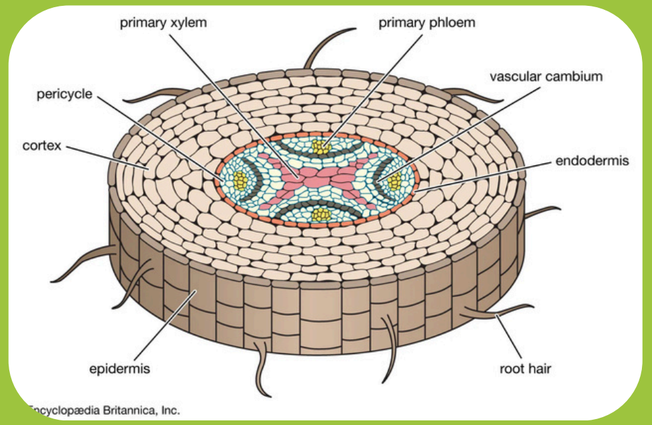
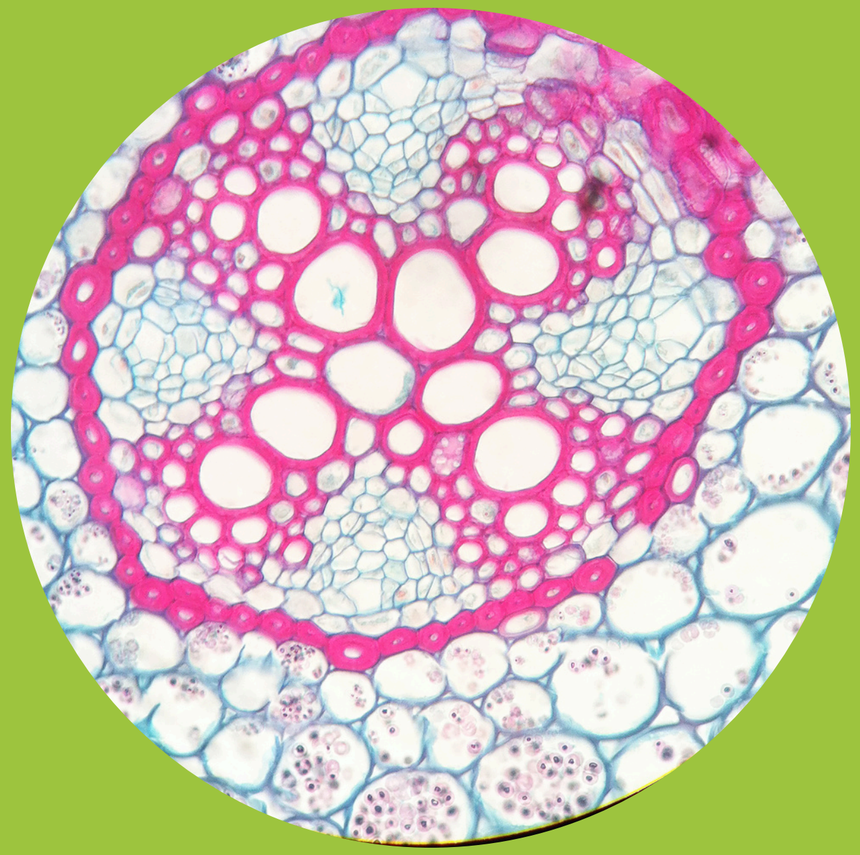


Photo source: https://www.britannica.com/science/root-plant#ref41880

PERICYCLE CELLS:

- Involved in forming new lateral branching roots, helping the root system expand.

ROOT CELLS: GROWTH AND TRANSPORT



VASCULAR TISSUE CELLS:

- Include xylem and phloem.
- Responsible for transportation within the plant.
- Xylem carries water and dissolved minerals upward.
- Phloem moves sugars around (mainly from the leaves where they are made) to the rest of the plant, thereby nourishing the plant.

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THANK YOU FOR READING