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ANATOMY OF A ROOT

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Анатомічна будова кореня відповідає функціям, які він виконує, та умовам його росту. Кореням у природних умовах потрібно долати значні перепони, пристосовуватись до різних умов життя, тому всі тканини та їхні гістологічні елементи розміщені так, щоб вони спільно виконували поглинаючу, провідну й механічну функції. За умов проростання насінини першим починає рости і заглиблюватись у ґрунт зародковий корінець. І саме на ньому ньому добре вивчати анатомічну будову кінчика кореня.

The anatomical structure of the root corresponds to the functions it performs and the conditions of its growth. Roots under natural conditions have to overcome significant obstacles, adapt to different living conditions, so all tissues and their histological elements are arranged so that they jointly perform absorbing, conductive and mechanical functions. Under the conditions of seed germination, the first germ begins to grow and deepen into the soil. And it is good to study the anatomical structure of the root tip.

Key words*: the xylem the phloemthe cambiumthe pericycle, the stele, the epidermis, the cortex.*

The structure of the root is not the same length. Considering the longitudinal section of the tip of a typical root, it is possible to distinguish several zones, different in structure and function.

The root tip is covered with a root cap. The root cap is a specific structure that covers the apical meristem - the cone of root growth and helps the root to move in the soil. It consists of living parenchymal cells covered with mucus, which as they progress in the soil coalesce. The root cap is capable of controlling the georeception of the root. Its center of assistance is the central column, the cells of which contain starchy amyloplasts, and act as statolites. The origin of the root cap in different plants is not the same. In the process of ontogeny, an initial layer, a kalyptrogen, appears, which restores the root cap inside. The root cap exists throughout the life of the plant root. It is most developed in intensively growing roots. Under the root cap is located apical (apical) meristem - cone of root growth.

The anatomy of the roots is linked closely with function. Within the root, vessels and tracheids of the xylem conduct the absorbed water and minerals through the small roots to the larger ones and are on into vessels and tracheids in the stems and leaves. The food is conducted from the leaves to the roots by the sieve tubes of the phloem. Xylem and phloem are the conducting, or vascular, tissues of a plant. The xylem, as we have seen, is the tissue that conducts water and minerals; the phloem is the food-conducting tissue. Let us locate the xylem and phloem and other tissues by studying a cross-section of a dicot root from the region just back of the root hair. The cells in this region were derived from the root type. The tissues differentiated from cells that originate at the root type are known as primary tissues.

The Epidermis. The single layer of cells on the exterior of the root comprise the epidermis whose cells generally lack a cuticle. In the younger part of the maturation region root hairs extend outward from the epidermal cells.

The Cortex. The innermost layer of the cortex region is known as the endodermis, and the ring is only one cell wide. Many of the endodermal cells have thickened walls. The other cells of the cortex, those of the endodermis to the epidermis, are parenchyma cells. You will recall that these are thin-walled, living cells whose dimensions are about equal. Food in the form of starch grains is frequently stored in parenchyma cells of the cortex.

The Stele. The central cylinder of the root is the stele. It is bounded externally by the pericycle. Xylem and phloem occur inside the pericycle. In dicotyledons a cambium layer is often present between the xylem and phloem, but it is absent in monocot roots. Let us next consider the parts of the stele and more detail.

THE PERICYCLE. The pericycle is a continuous ring of cells, usually one cell wide. The pericycle is important because here branch roots arise and cork originates. Branch roots arise back of the root hair zone. A branch root originates through the division of pericycle cells that are opposite a xylem point. Here the pericycle cells divide in a plane parallel to the root surface. Shortly a small conical mass of cells is developed, and these cells through a division form a young branch root.

THE XYLEM. The xylem occupies the center of the stele. The smaller cells of the xylem are tracheids, the larger ones vessels. Both types conduct water and minerals, and when mature they lack protoplasm. You will recall that tracheids are long, cylindrical cells with tapering end walls. Vessels are long tubes made up of cells joined end to end with the cross-walls digested out. Some vessels and tracheids have pits in their thickened walls, but others have thickenings in the form of rings or spirals. Such thickenings add strength to xylem tissue. The xylem tissue of the root forms a tough central core that provides high tensile strength with flexibility, properties leading to effective anchorage of the plant.

THE PHLOEM. The phloem is located between the arms or points of the xylem. The radial arrangement (a xylem arm on one radius, and a group of phloem cells on a different radius) is characteristic of roots, but not of stems. The radial arrangement in a root permits water and minerals absorbed from the soil to enter the xylem without first passing through the phloem. The water absorbed from the soil moves across the epidermis, cortex, and pericycle, and then enters the xylem. If the phloem and xylem were on the same radius, as they are in stems, water and minerals would pass through the phloem before entering the xylem.

THE CAMBIUM. A cambium layer is present between the xylem and phloem in the roots of many dicotyledons. The cells of this layer divide to form additional phloem cells toward the outside and additional xylem cells toward the inside of the root. Roots of mono-cotyledons do not have a cambium layer and therefore their roots do not increase in diameter. Roots of corn, wheat, and other monocots remain slender.

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