LECTURE 4

THEME:

Morphology of vegetative organs of higher plants. Basic concepts.

Morphology, physiology and anatomy of the root.

The specificity of the structure of the roots of plants belonging to different taxonomic groups, and its importance for the identification of plants.

The organism of higher plants consists of separate parts - organs. Organon, being a Greek word, means a tool, a weapon. Organ means a part of a living organism, including plants, possessing a definite structure and fulfilling a definite function.

There are 2 types of plant organs:

Vegetative (participating in vegetative reproduction)

- Root – Radix
- Stem – Caulis
- Leaf – Folium

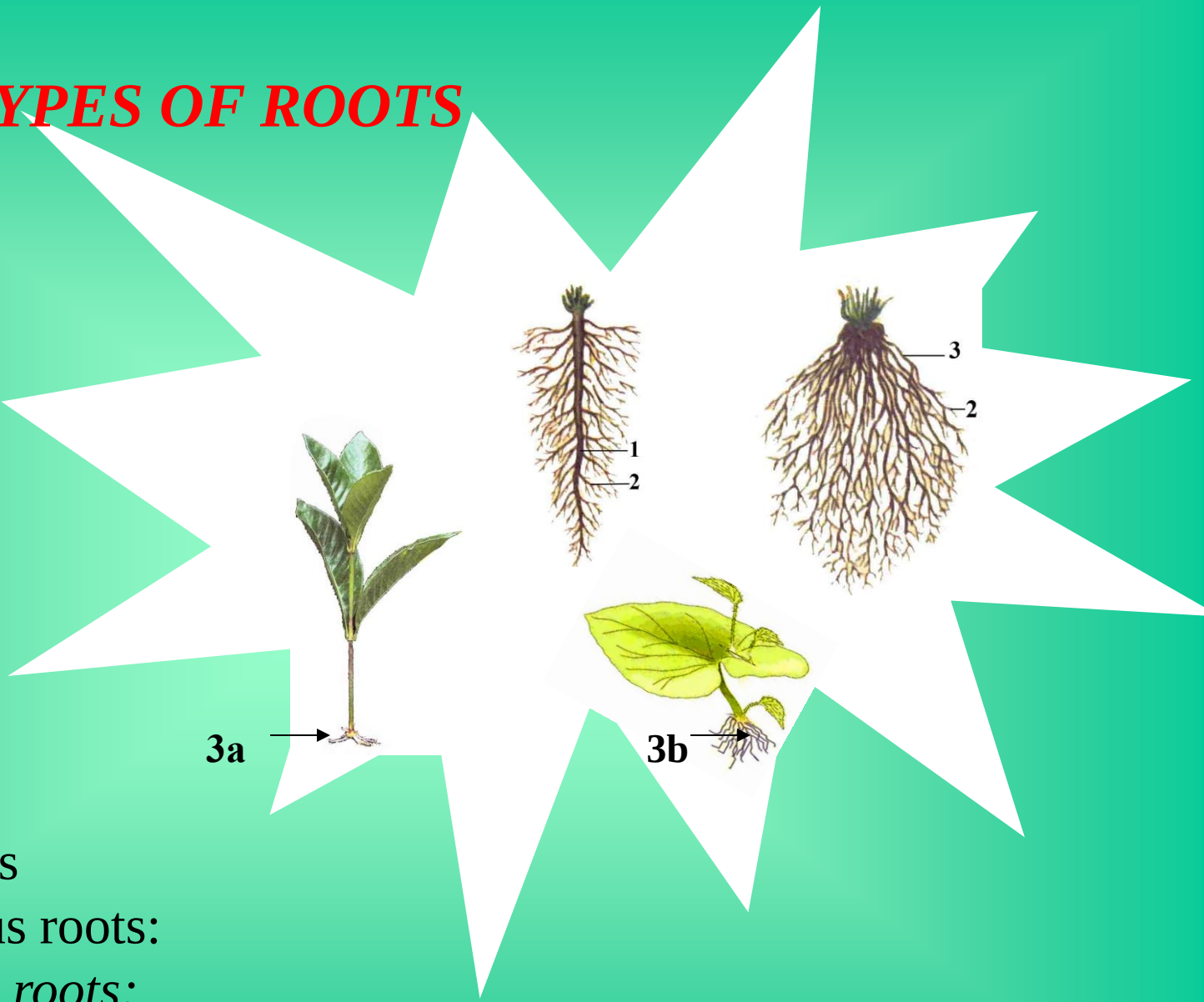
Generative (involved in fertilization)

- Flower – Flos
- Fruit – Fructus
- Seed – Semen

ROOT – RADİX

- **Root** is an organ of a plant that in any conditions does not have leaves and shoots, located in a certain order. At the tip of the root are usually located the root cap and mycorrhizas. The root always grows by morphological tip and has a feature of endogenous branching (internal derivatives).
- The main function of the root - is the attachment of the plant to the substrate and obtaining water and minerals from it. Very often the root is transformed into an organ that stores nutrients, participates in the process of vegetative reproduction. In addition, it can store in itself biologically active substances that have great importance for pharmacy.

TYPES OF ROOTS



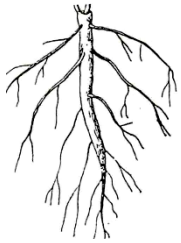
1 – main root
2 – lateral roots
3 – adventitious roots:
a – pedicellate roots;
b – leaf roots.

The aggregate of all plant roots is its root system.

- Three types of root system are defined, according to the structure and features of development:
- Tap root system;
- Fibrous root system;
- Mixed root system.

The size of the root system can be different, and this depends on the place of growth of the plant. Widespread in the lowland regions of Azerbaijan, the herbaceous plant camel thorn has a taproot system up to 15-20 m, root of cotton 1,5-2 м, medick 3,5 m, and the root of the cucumber penetrates into the soil to 0.4-0.6 m. The roots of trees are especially well developed. For example, the root of the old apple tree moves away from the trunk to a distance of up to 15 m and goes to a depth of 3-4 m.

ROOT SYSTEMS



A

B

C

A – Tap root system
B – Fibrous root system
C – Mixed root system

Metamorphoses of the root

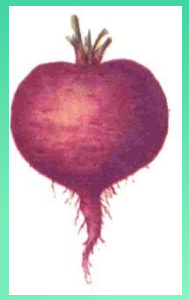
- Root metamorphoses are more common in perennial grasses. In most cases, in addition to the usual functions, the root is transformed into an organ that collects reserve nutrients. In this case, it is converted into the following forms.

- *1. Root crop.*
- *2. Tuber.*
- *3. Air (respiratory) roots.*
- *4. Pillar-like,plank-buttress, stilted and other roots.*
- **Mycorrhiza.** The term originating from the fusion of two Greek words. "Mikes" means a mushroom, and "ridza" (riza) is the root. In living plants, the joint, symbiotic coexistence of the root with the fungus is called mycorrhiza. Mycorrhiza is a symbiosis of the mycelium of the fungus with the roots of living plants.

Root crops

1

2



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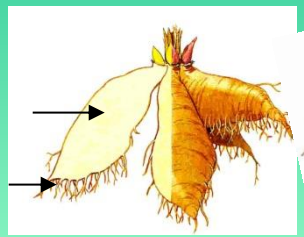
Tuber



1

2

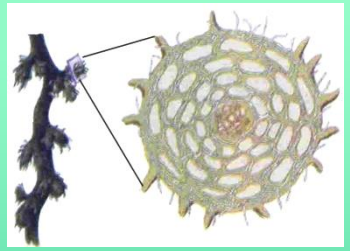
3

Nitrogen-fixing roots (*Fabaceae*)

1

H

Mycorrhiza



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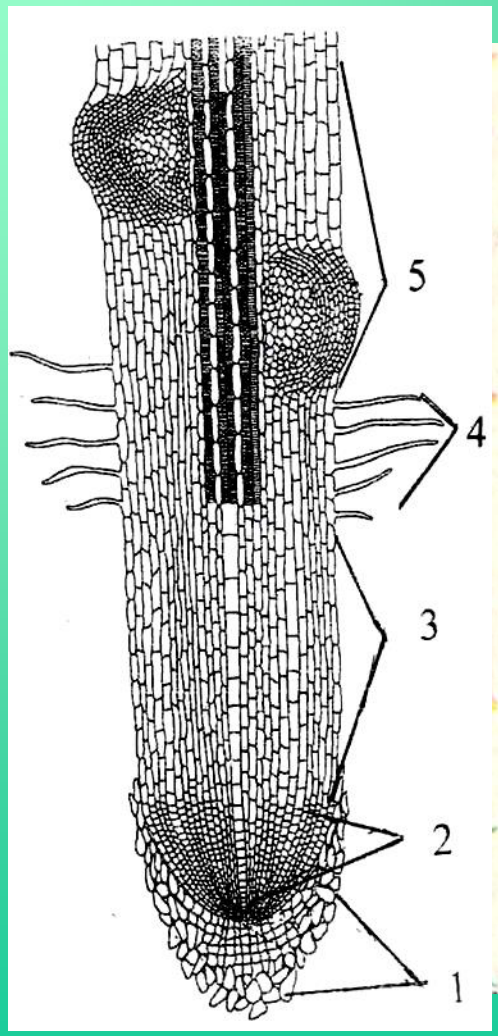
Airial (respiratory) roots

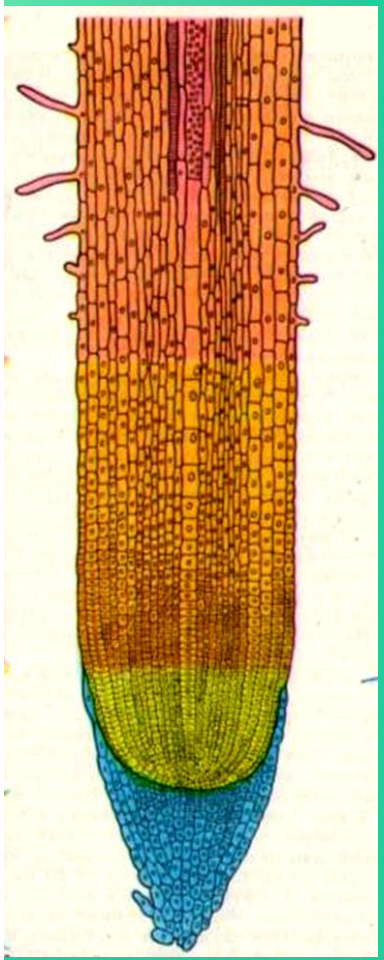
Pillar-like,plank-buttress and stilted roots.

THE ANATOMICAL STRUCTURE OF THE ROOT

- ROOT ZONES:

1. root cap
2. apical meristems
3. region of the growth or elongation
4. region of absorption or root hairs
5. region of anchoring and conducting





The anatomical structure of the root

To study the primary structure of the root, it is necessary to prepare a cross section of the absorbtion region.

Here you can observe three distinct layers.

- Covering tissue (epiblema) (1)
- Primary cortex (2-4)
- Central cylinder (5,6)

1 - epiblema

2 - exoderm

•3 - mesoderm

•4 - endodermis:

•*a -Casparian bands;*

•*b - passage cell*

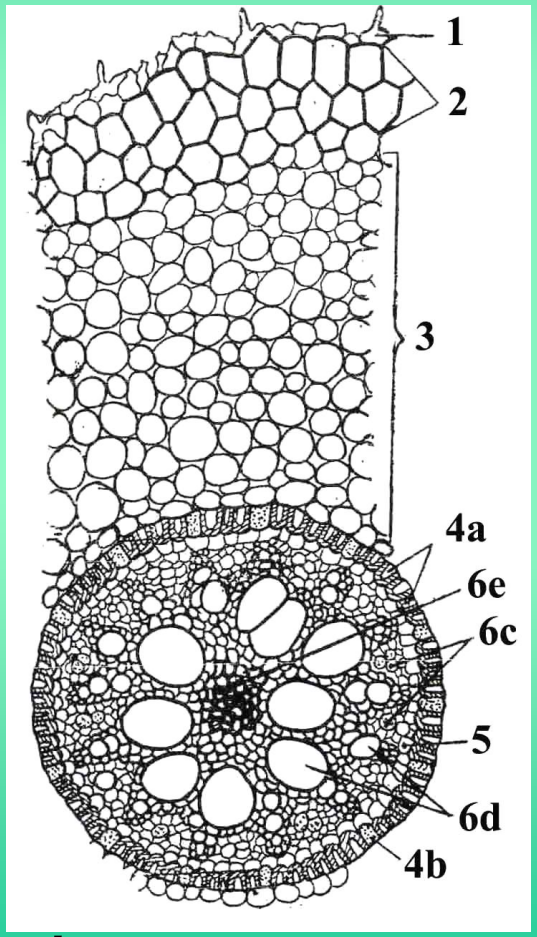
•5 - pericycle

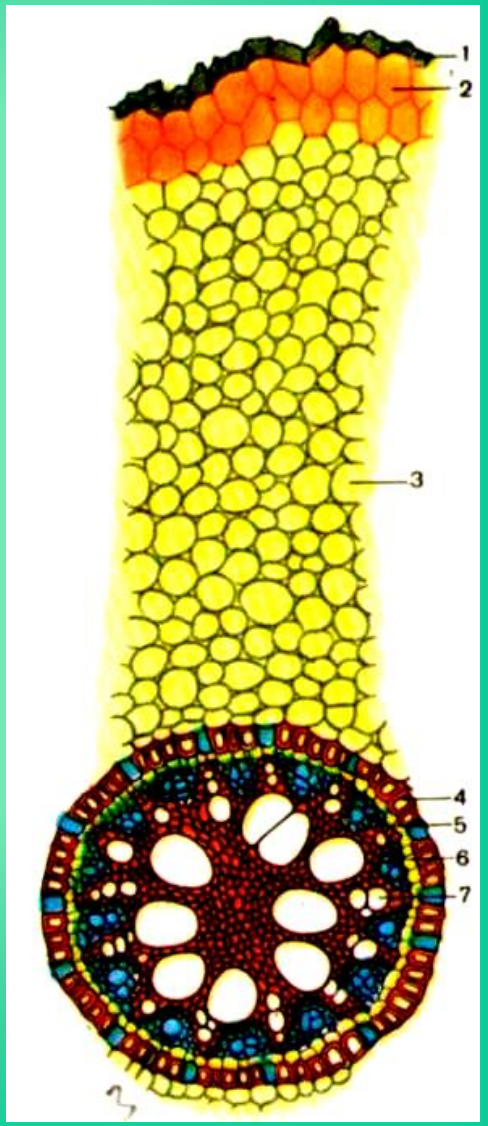
•6 - radial bundle

•*c - primary phloem;*

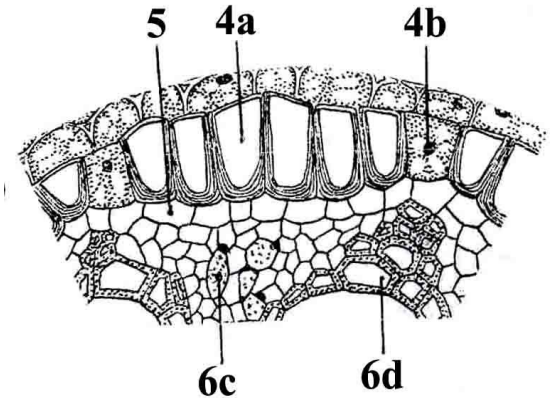
•*d - primary xylem;*

•*e - pith representative by sclerenchyma*

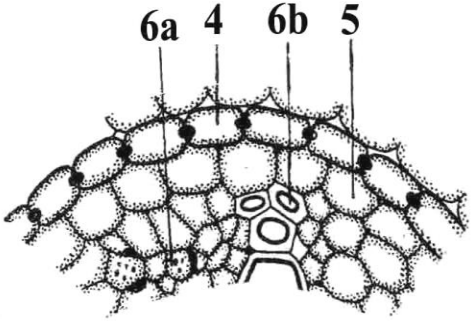




- ***The "Casparian bands" of the endodemis***



Monocots



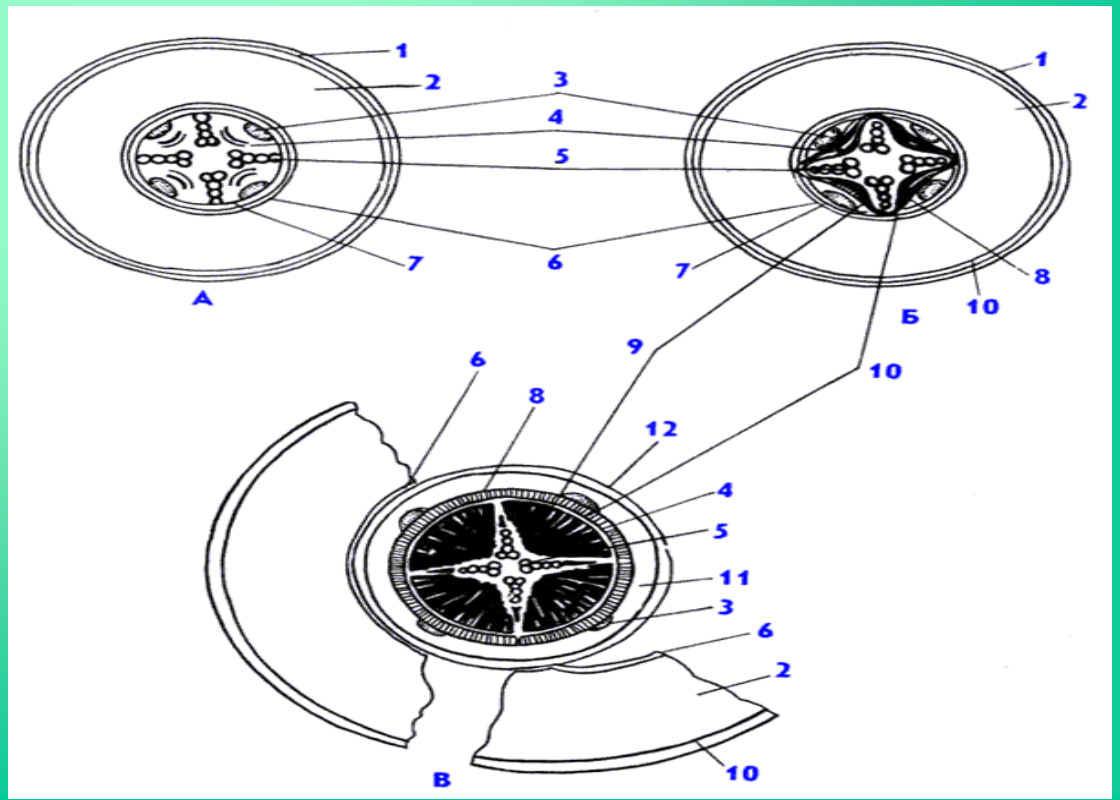
Dicots

The endodermal layer regulates the passage of water and mineral substances absorbed from the soil into the central cylinder.

Secondary structure of the root

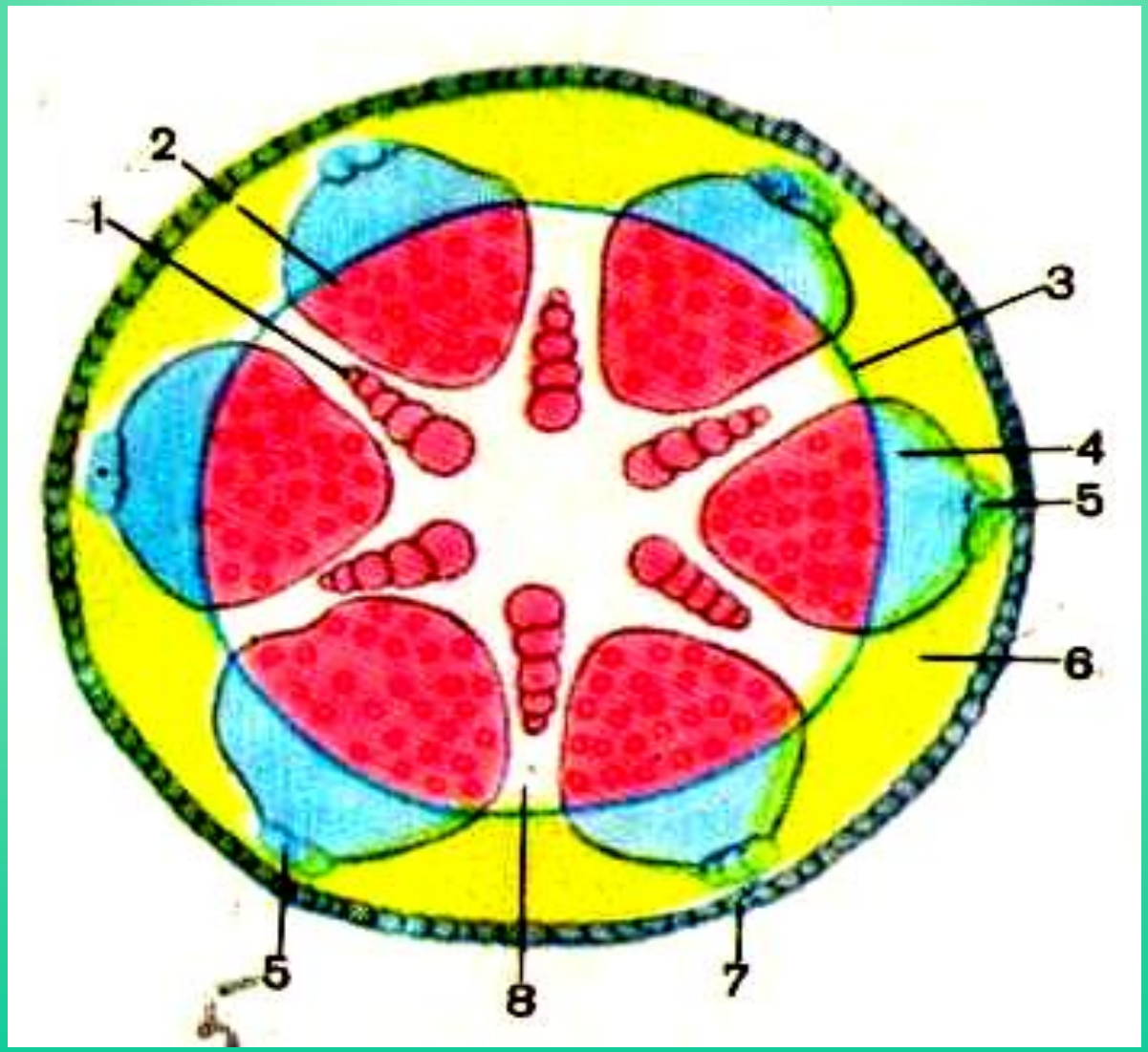
As the root grows, it goes deeper, and as a rule, it focuses and changes structurally: the primary structure is replaced by a secondary structure. Usually, in dicot angiosperms and gymnosperms , the reason for the transition to the secondary structure is the formation of a new meristem - the cambium - over the zone of lateral roots. Because of the formation of the cambium, the structure of the root changes completely, and a secondary structure appears that differs significantly from the primary structure. In most plants, the secondary structure can be seen 2-3 cm above the tip of the root.

1 – epiblema
2 – primary cortex
3 - primary phloem
4 - cambium
5 - primary xylem
6 - endoderm
7 - pericycle
8 - secondary phloem
9 - secondary xylem
periderm
10 – exoderm
11 – secondary cortex
12- periderm



Secondary structure of the root

(The transition of the root from the primary to the secondary structure begins with the formation of a cambium layer)



THANK YOU FOR ATTENTION!

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