Ministry education and Science of Republic of Kazakhstan
Karaganda State University named after academician Ye.A. Buketov

Biological and geographical faculty

Botany Department

Course – Botany
Specialty - 5B011300 – «Biology»

Lecture № 5

Stem and system of stalk

(1 hour)

Lecturer: candidate of biological science, associated professor
Ishmuratova Margarita Yulaevna

Plan of lecture:

1 Definition of stem. Vegetative and generative stems.
2 Structure of buds.
3 Morphology of stem.
4 Metamorphosis of stem.
5 Anatomical structure of stem.

Basic literatures:

1 Бавтуто Г.А. Практикум по анатомии и морфологии растений. – Минск: Новое знание, 2002. – 185 с.

2 Родман А.С. Ботаника. – М.: Колос, 2001. - 328 с.

Additional literatures:

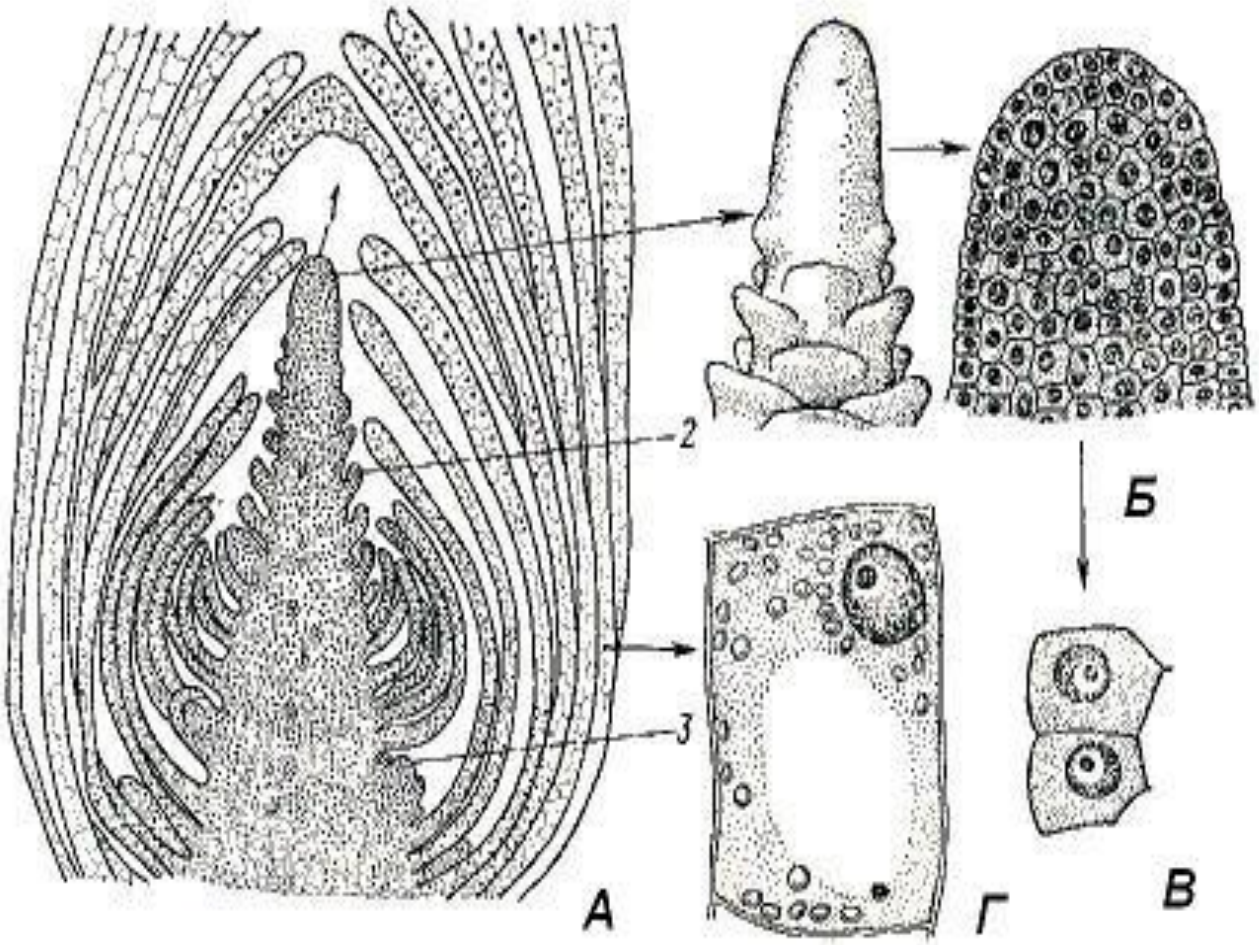
1 Ишмуратова М.Ю. Ботаника. Учебно-методическое пособие. - Караганда: РИО Болашак-Баспа, 2015. - 331 с.

2 Тусупбекова Г.Т. Основы естествознания. Ч. 1. Ботаника. – Астана: Фолиант, 2013. – 321 с.

3 Байтулин И.О. Основы ризологии. - Алматы: Гылым, 2001. – 210 с.

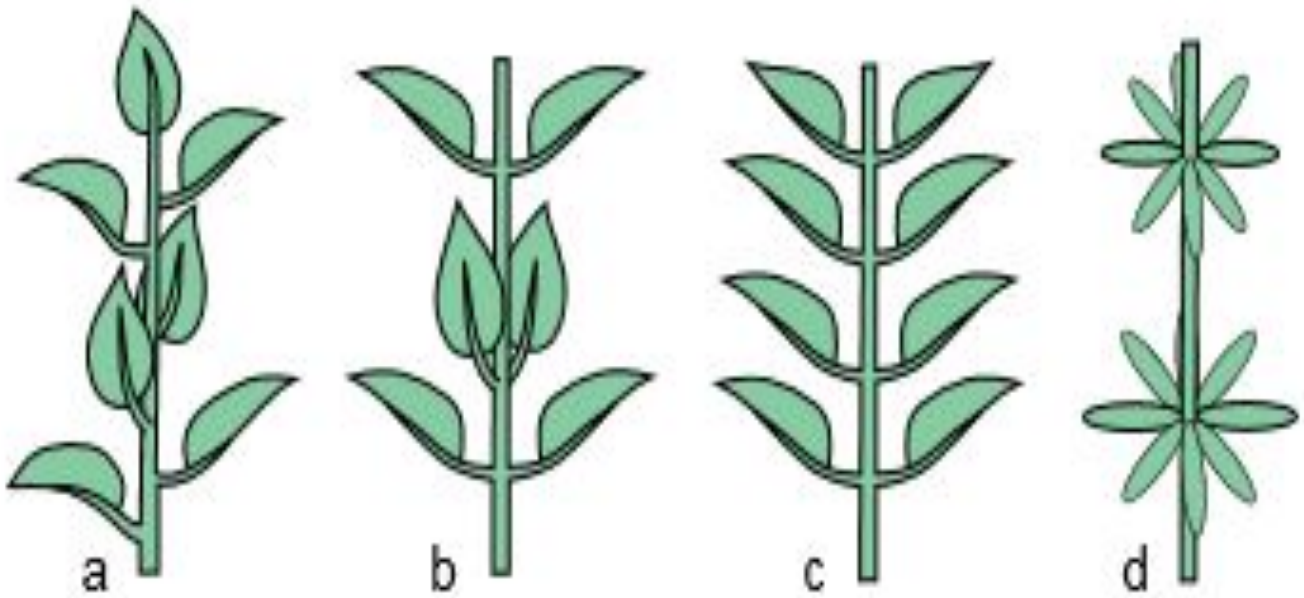
The **stem** is an *axial organ of shoot*. It has functions of support, transportation, photosynthesis, and storage. Stem has radial structure, no root hairs and grows continuously.

Structure of bud



А – lateral cut; Б – apex (internal view and cross cut); В – cells of apical meristem; Г – parenchyma cells of adult leaf; 1 – apex of growing; 2 – young leaf; 3 – young bud

Phyllotaxis

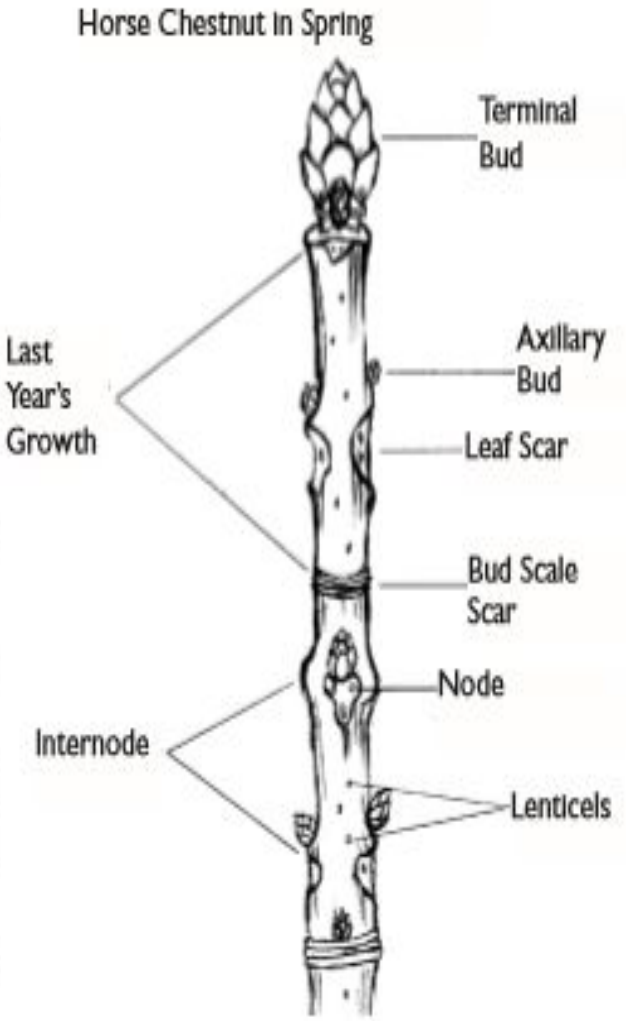


Types of phyllotaxis (leaf arrangement):
a - spiral (alternate), b and c - opposite,
d - whorled

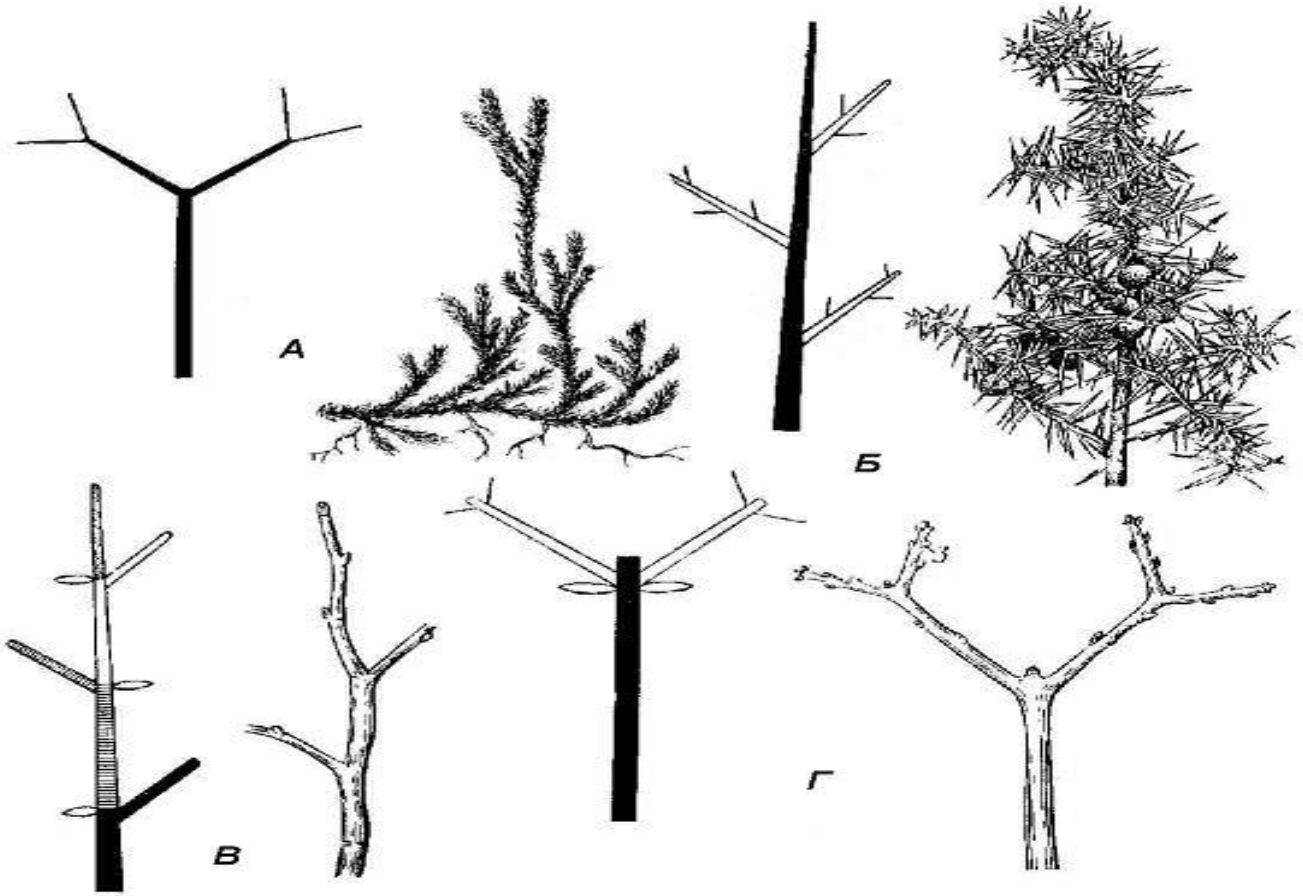
Stem Characteristics

Stems can be very important when identifying plants, particularly when identifying woody plants in winter. Several stem features are worth learning. (See Figure 5).

Node—the position on a stem where a leaf or bud is or was attached.
Internode—the portion of a stem between two nodes.
Lenticel—a pore which allows gas exchange; often raised; variable size.
Axil—the upper angle between a leaf (or any other lateral structure) and the stem to which it is attached.
Bud—the structure giving rise to a leafy stem, a flower, or both; it may be naked or protected by bud scales or stipules; it may be lateral or terminal.
Terminal bud—bud borne at the apex of many stems; often larger than other buds; the first bud to open in spring.
Axillary bud—a bud borne in the axil of a leaf (also called a lateral bud).

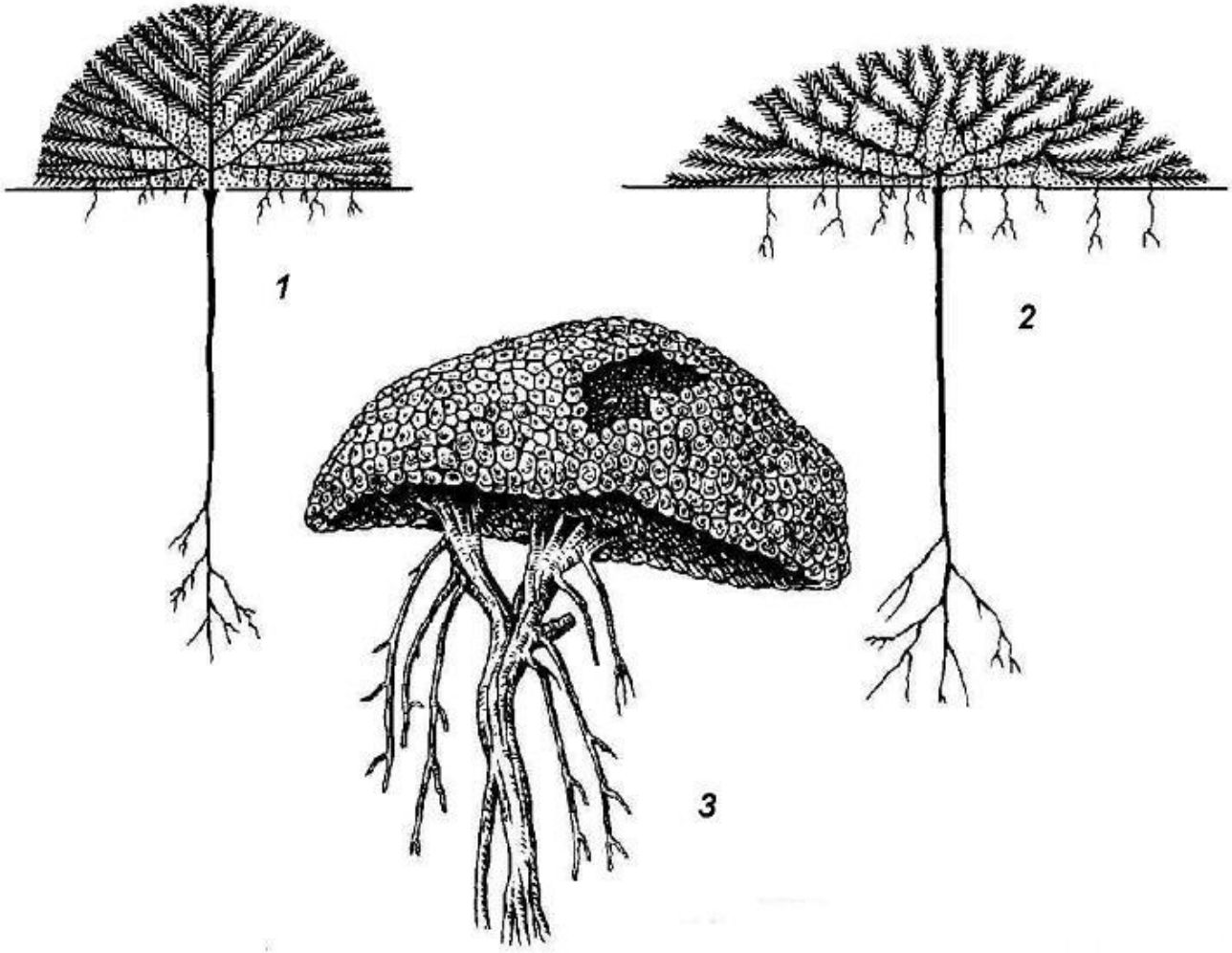


Type of branching



А – dichotomous (licopodium); Б – monopodial (juniper); В – sympodial – monochasium (bird chery); Г – sympodial by type of dichasium (acer).

Plants – creeping bushes

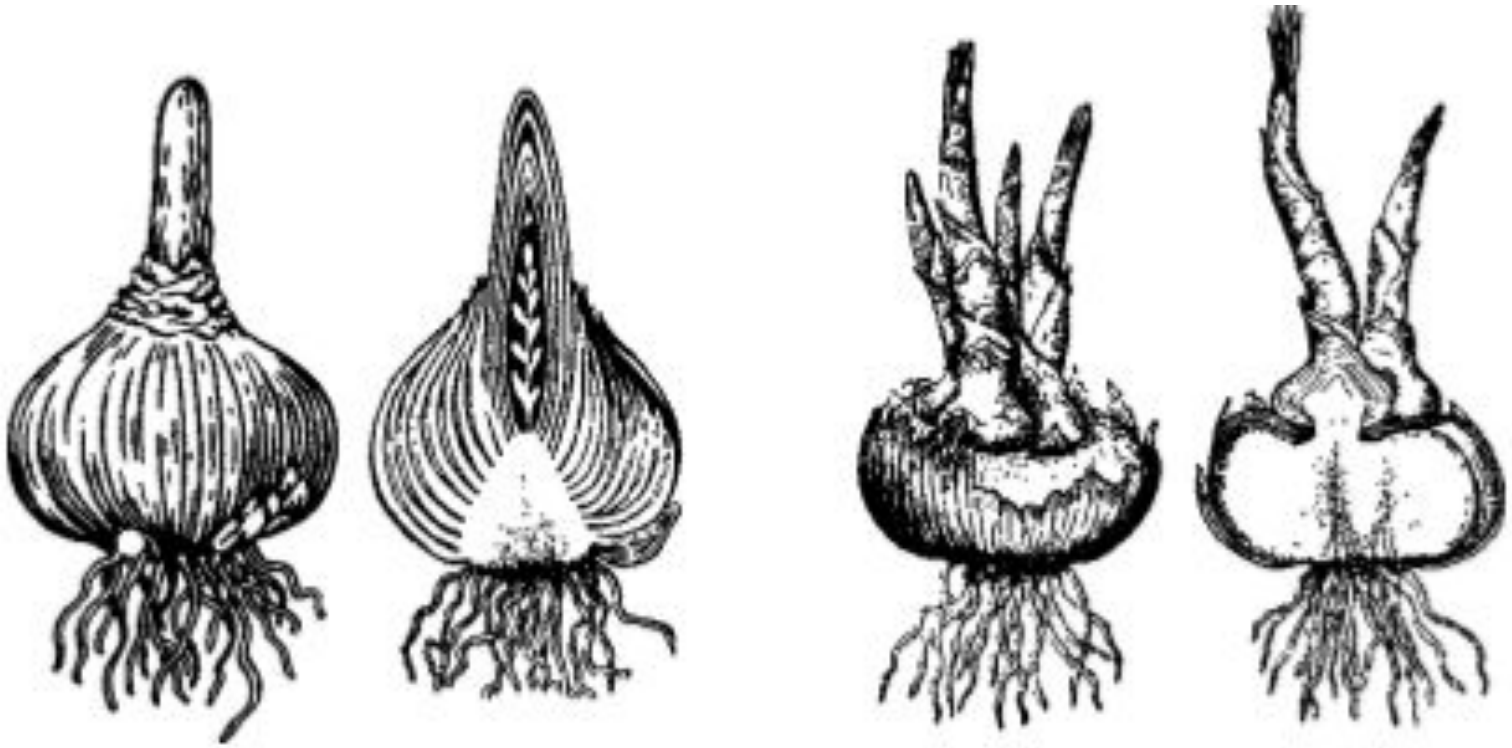


1, 2 – schemes of structure; 3 – azorella from island Kergelen

Metamorphosis of different prgans

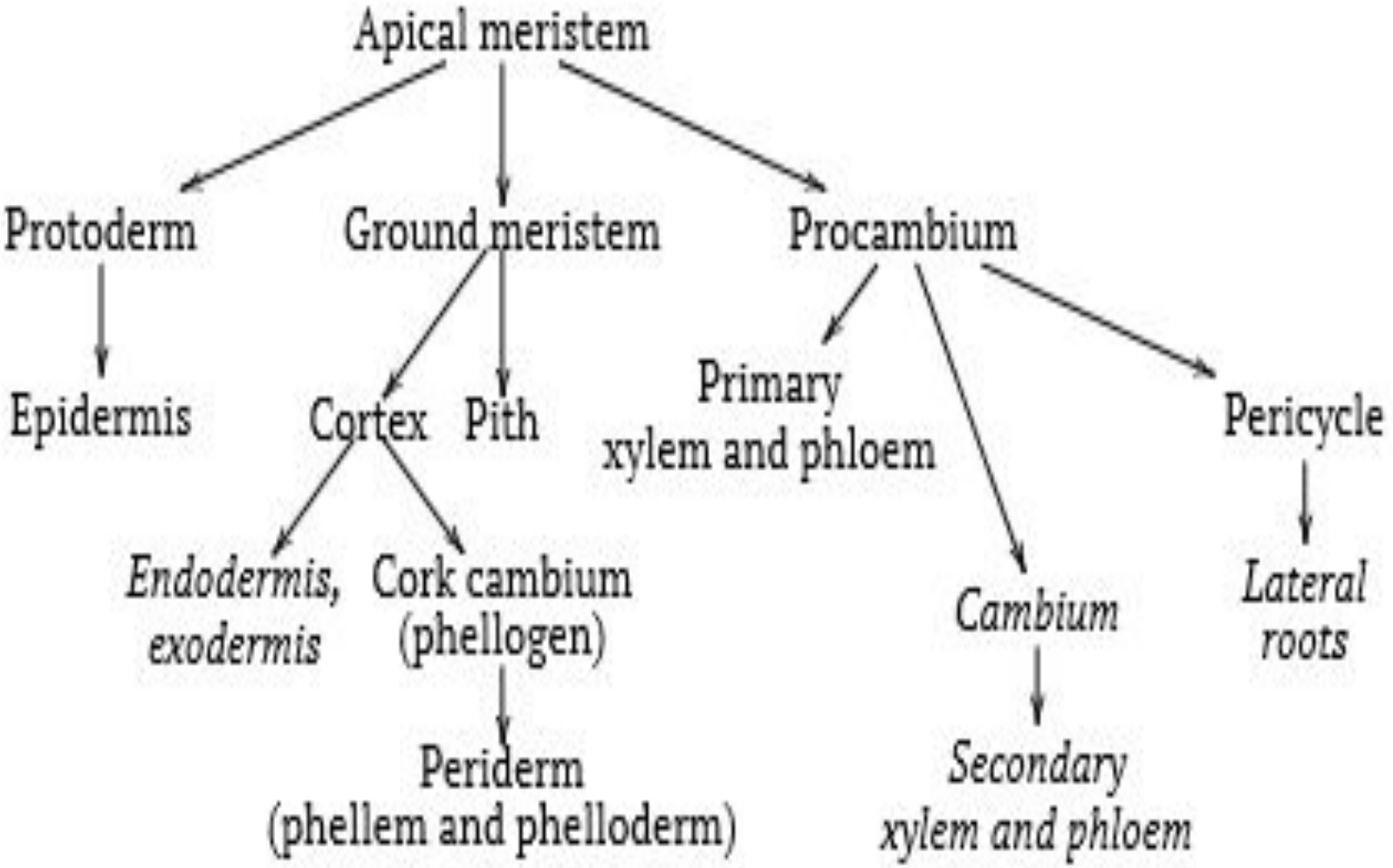
Function \ Organ	Leaf	Stem/shoot	Root
Absorption	Absorption leaves (bromeliads)	Rhizoids	*Default*
Defense	Spines, scales	Thorns, prickles	Spines
Expansion	Plantlets	Rhizomes, stolons, runners	Adventive buds
Interactions	Traps, sticky epidermis, urns, colored leaves	Traps, insect nests	Haustoria, mycorrhizae, root nodules, nematode traps, insect nests
Photosynthesis	*Default*, phyllodes	Cladophylls	Green roots (orchids)
Storage	Succulent leaves, pitchers	Bulbs, corms, tubers	Storage roots
Support	Tendrils, false stems, floats, suckers	*Default*, tendrils	Buttress, aerial and contractile roots, suckers

Metamorphosis of undergraund stems

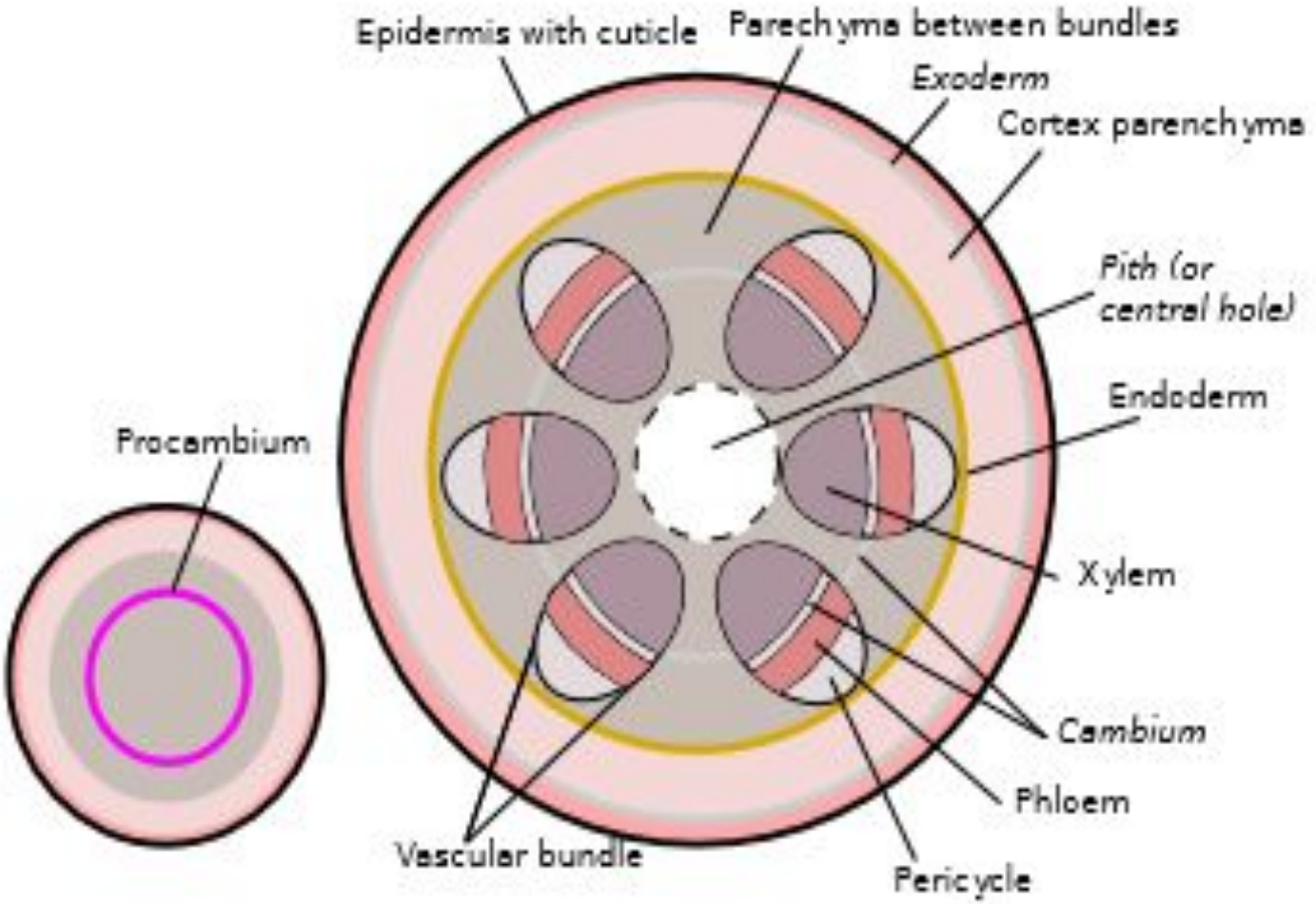


Bulbs (left) and corms. (*Modified from various sources*).

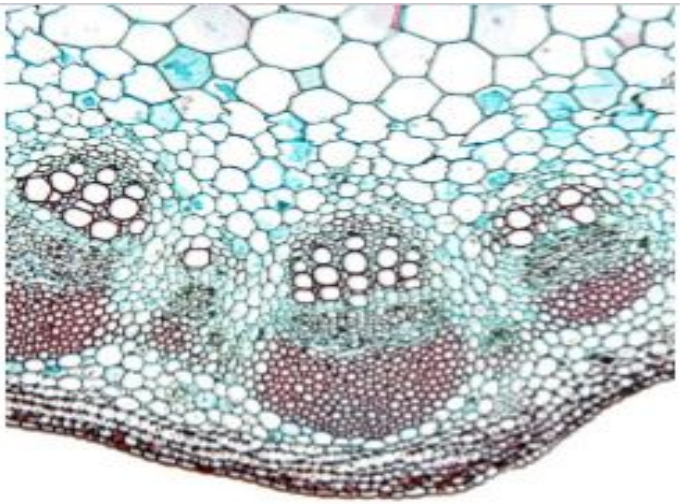
The basic tissues of stem

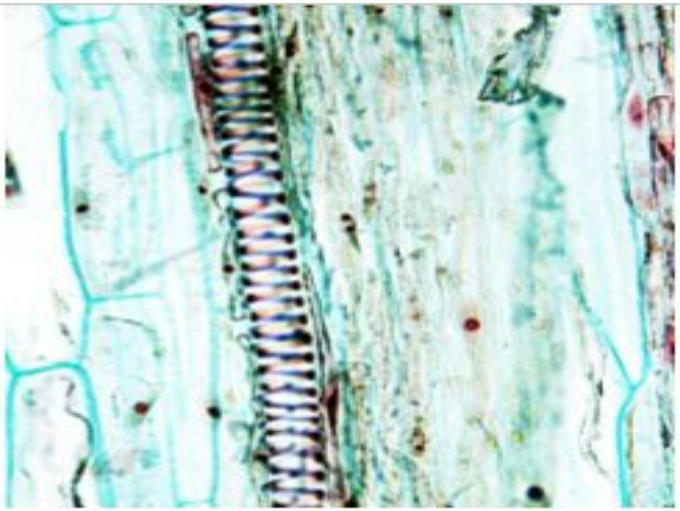


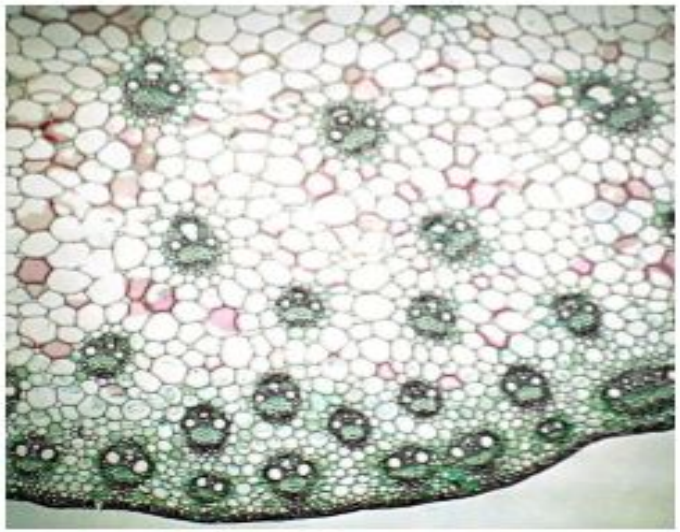
Anatomy of the primary stem (right). *Slanted font* is used for "optional" tissues

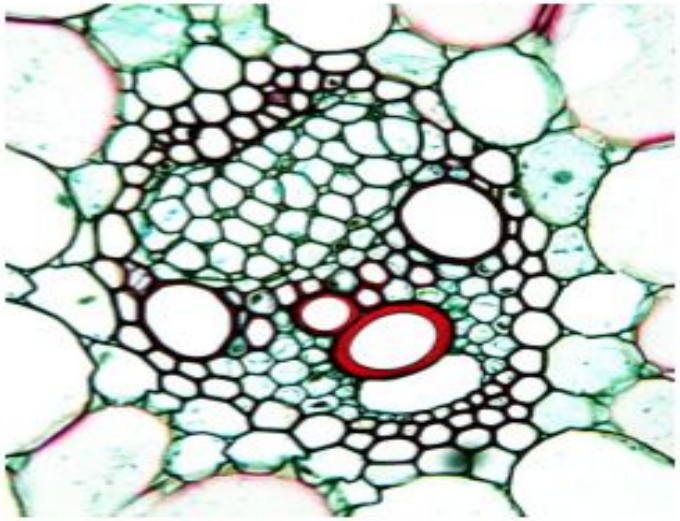


Anatomy of the primary stem



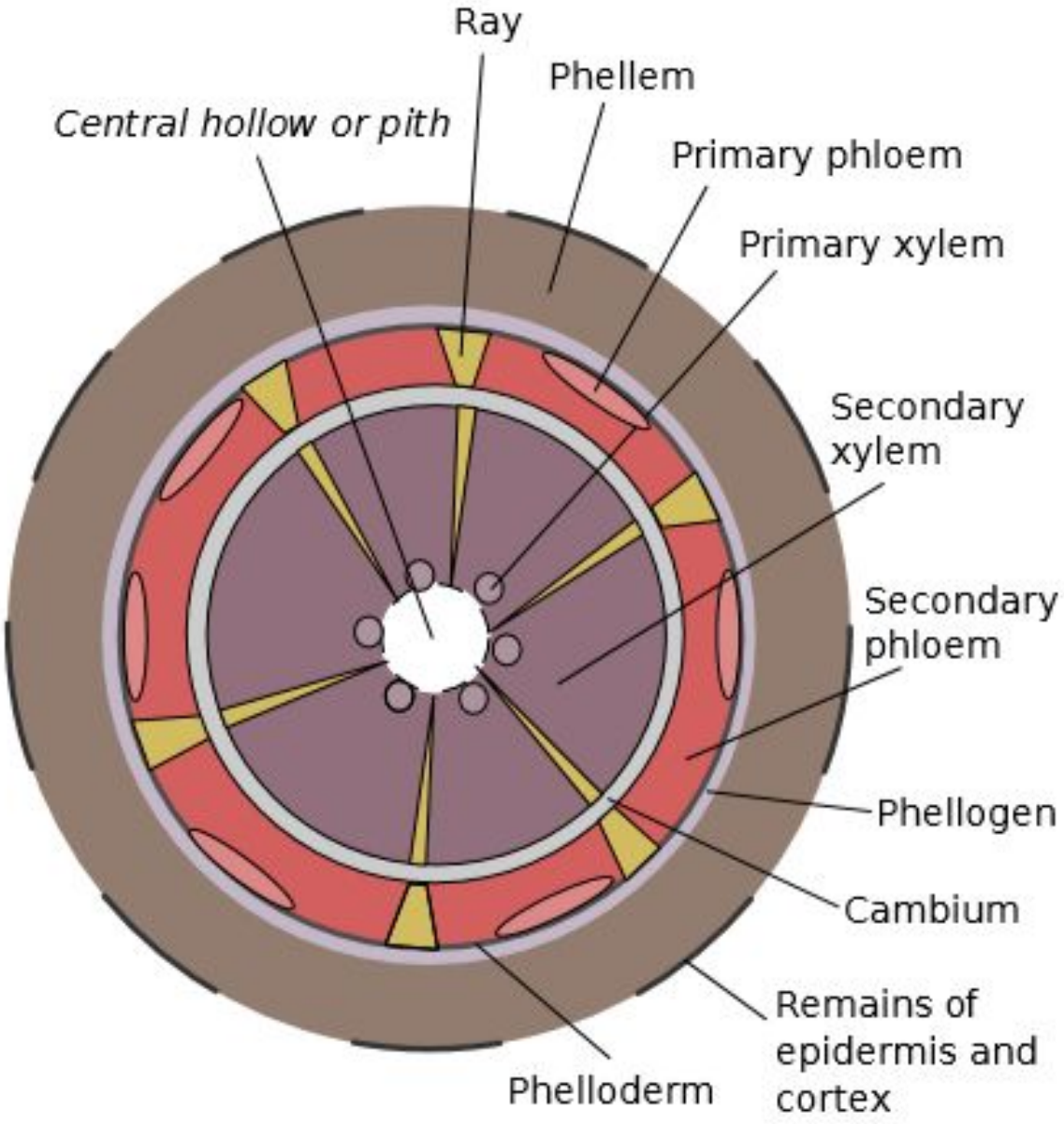




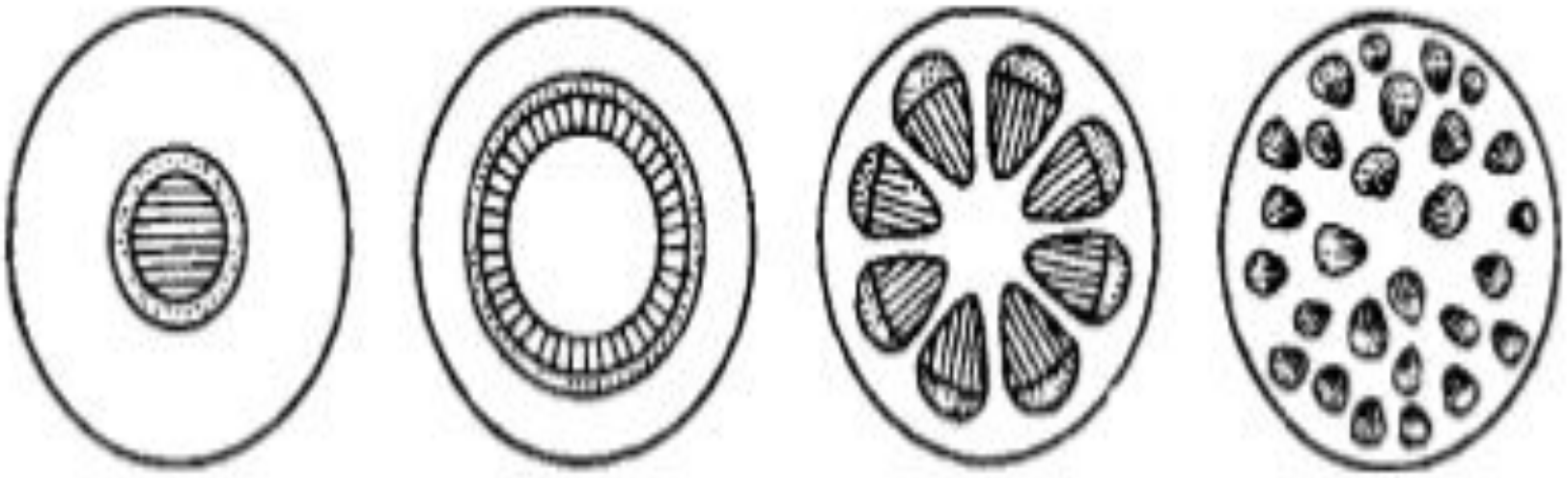


Left to right, top to bottom: eustele (stem segment), xylem vessel (longitudinal section) and ataktostele (stem segment and vascular bundle). First photo is from the stem of *Helianthus*, second from *Trifolium*, last two from the stem of *Zea*. Magnifications ×100 (first and third) and ×400 (second and fourth).

Anatomy of the secondary stem



Left to right, top to bottom: eustele (stem segment), xylem vessel (longitudinal section) and ataktostele (stem segment and vascular bundle)



Control questions:

1 What are the main differences between primary and secondary structure of stems?
2 Note the main changing between grassy and woody stems of plants.
3 What is the main function of stem?
4 Define the main metamorphosis of stems and their functions.
5 Why stem is vegetative organ of plants?

Test questions:

Type of transport bundles of dicotyledonous plants:
A) collateral
B) bi-collateral
C) radial
Д) parallel
E) concentric
F) Lacular
H) bi-lateral

Aboveground metamorphosis of stems:
A) tendrils
B) acanthon of gledicia
C) trichomes of leaves
Д) simple trichome
E) wax cover