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 № 21

Division Angiospermae, Magnoliophyta. Class Dicotyledones

(1 hour)

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

Plan of lecture:

1 General characteristic of Angiosperm plants.
2 Bases of systematic.
3 Characteristic of families Magnoliophyta, Schizandraceae, Lauraceae, Nimphaceae, typical species and practical uses.

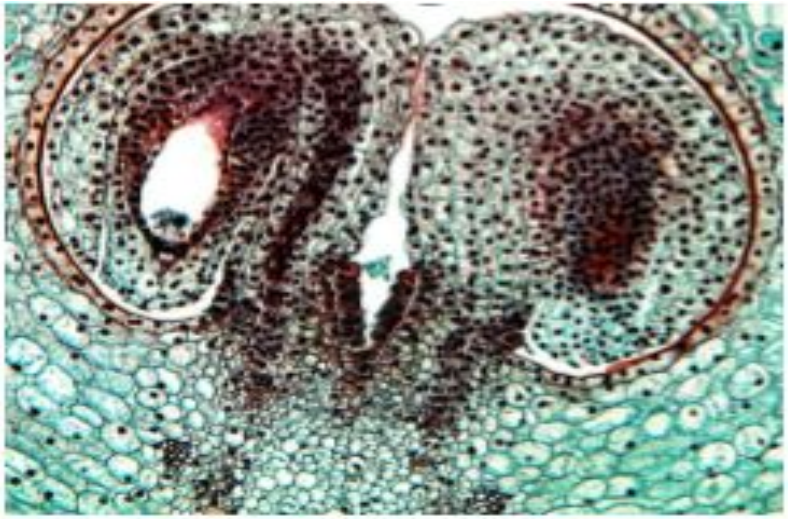
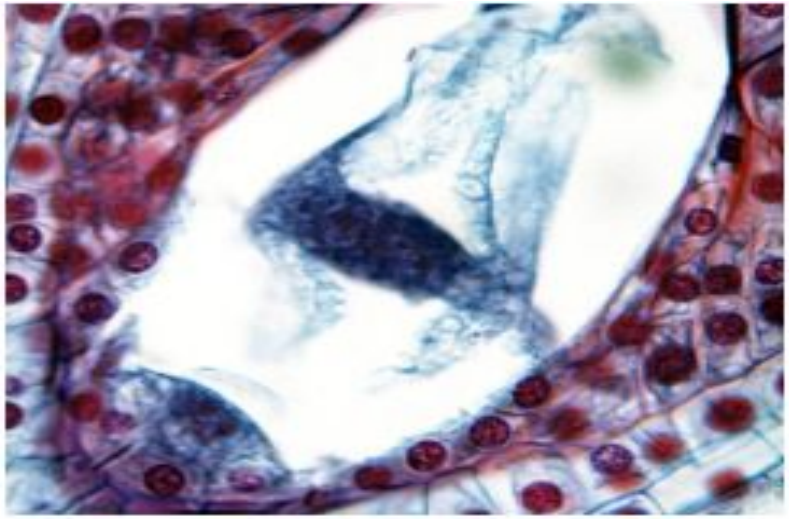
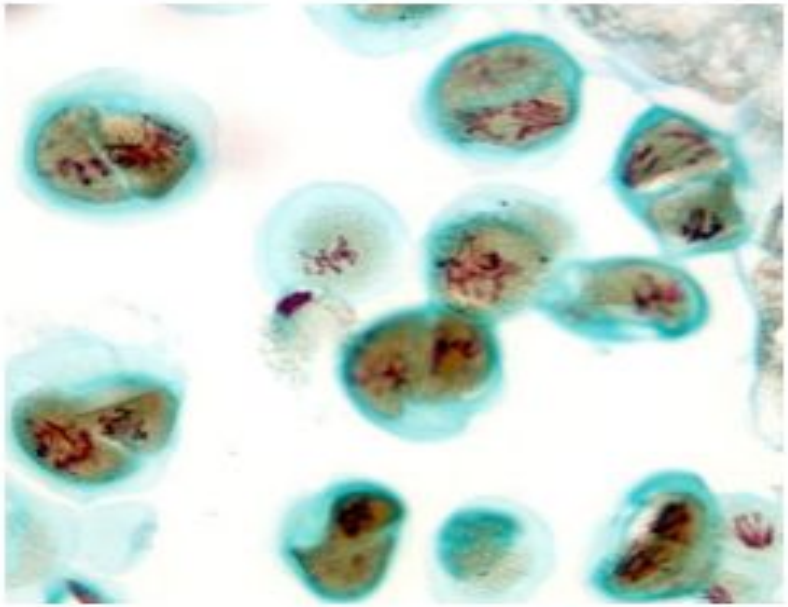
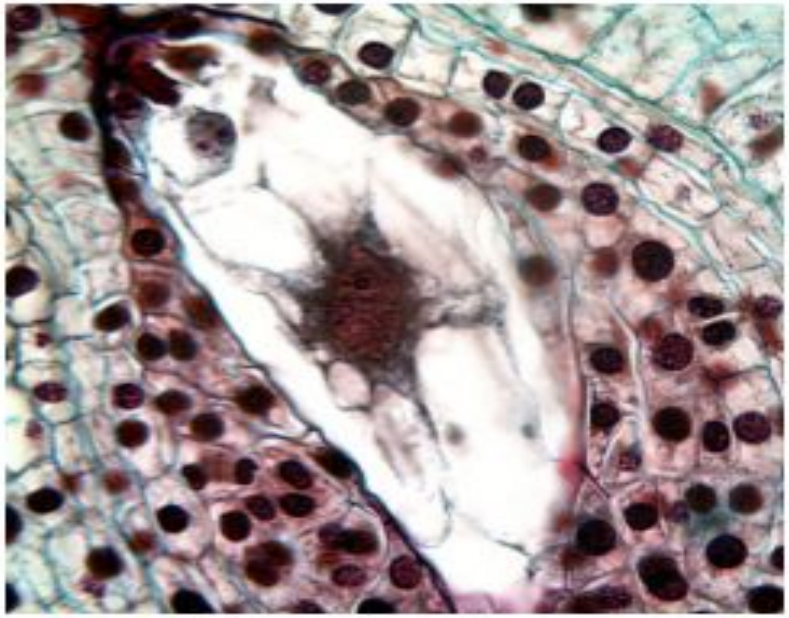
Basic literatures:

1 Еленевский А.Г., Соловьев М.П., Тихомиров В.Н. Ботаника: систематика высших, или наземных, растений. 2 изд. - М.: Academia, 2001. - 429 с.
2 Нестерова С.Г. Лабораторный практикум по систематике растений. - Алматы: Қазақ ун-ті, 2011. - 220 с.
3 Родман А.С. Ботаника. – М.: Колос, 2001. - 328 с.

Additional literatures:

1 Билич Г.Л., Крыжановский В.А. Биология. Т. 2: Ботаника. - М.: Оникс 21 век, 2002. - 543 с.
2 Ишмуратова М.Ю. Систематика и интродукция растений (курс лекций). - Караганда: РИО Болашак-Баспа, 2015. - 100 с.
3 Тусупбекова Г.Т. Основы естествознания. Ч. 1. Ботаника. – Астана: Фолиант, 2013. – 321 с.

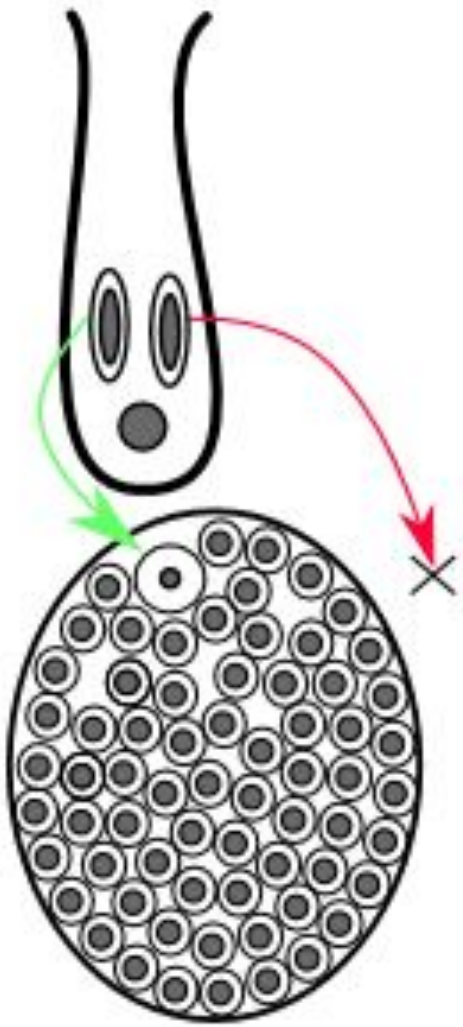
Flowering plants (angiosperms, Angiospermae) are sometimes referred to as “Spermatophyta 2.0.”, or “upgraded gymnosperms”. In fact, there is no single character which unequivocally differs flowering plants from other seed plants. Only several characteristics combined together will distinguish angiosperms. Flowering plants have their ovules inside an additional cover: pistil which corresponds with megasporophyll (sporangium-bearing leaf); later, the pistil develops into the fruit. These plants have an almost complete reduction of gametophytes: three or even two cell of the pollen (male gametophyte) and seven (sometimes even four) cells in embryo sac (female gametophyte), there are no archegonia or anteridia. Like gnetophytes, theyhavedoublefertilization. Thesperms(spermatia)comethroughthepollentube (like in conifers and gnetophytes). One sperm fertilizes the egg cell, and the other sperm fertilizes the biggest cell of embryo sac.

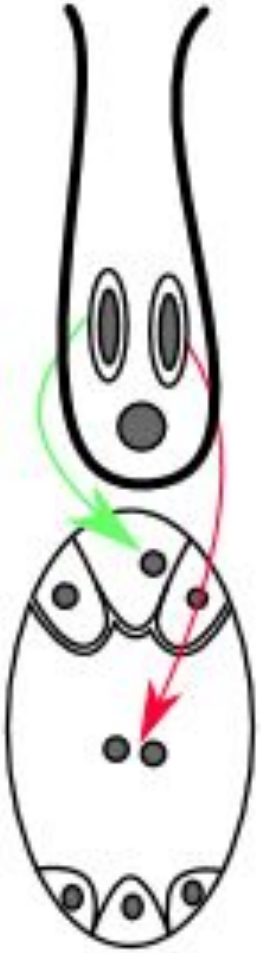
Left to right, top to bottom: *Lilium* (Liliidae) ovules, female gametophyte (embryo sac), meiosis II in pollen sacs and double fertilization (egg cell on top is fusing with first sperm, second sperm nucleus in the center is fusing with the nucleus of the central cell). Magnifications ×100 (first) and ×400 (others).

While the first fertilization results in a “normal” diploid zygote which grows into embryo, the second fertilization ignites the process of feeding tissue development. This feeding tissue is endosperm2, frequently triploid (3n) since it originates from the sperm and cell with two nuclei and sperm, or diploid (2n), if the biggest cell of embryo sac (central cell) had one nucleus only.

Double fertilization may be explained in several ways: (1) the second fertilization results in second,“altruistic”embryo which sacrifices itself to feed the“brother”; (2) second fertilization is only a signal which initiates the development of endosperm and it does not really matter which genotype it has; and/or (3) to make a functional nutrition tissue, angiosperms need a polyploid genome whereas its origin is not so important. Onewayoranother,floweringplantsabandonedthe pre-fertilization development of the nutrition tissue, and changed endosperm 1 to endosperm 2.

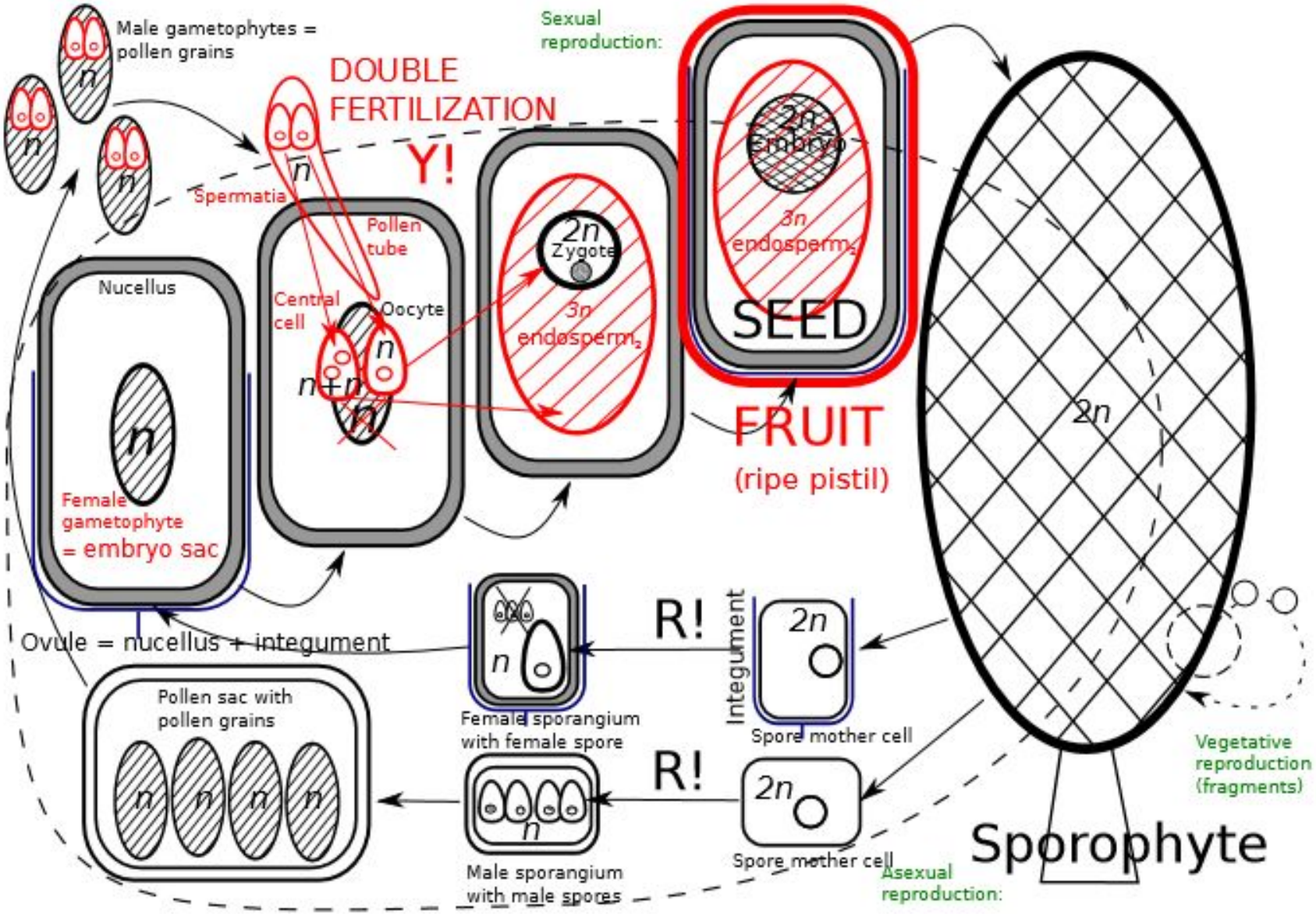


Single fertilization



Double fertilization

In the Mesozoic era, gymnosperms were the dominating plants of the tree story. However, in the uderstorey, herbaceous spore plants did not surrender to seed plants and were still dominating. Amazingly, the rewereal most no herbaceous gymnosperms! The explanation is that gymnosperms, being quite advanced in general, had a slow and ineffective life cycle. Ineffectiveness was in part due to the absence of sophisticated cross-pollination like insect pollination (which requires edible parts like nectar or excess pollen).

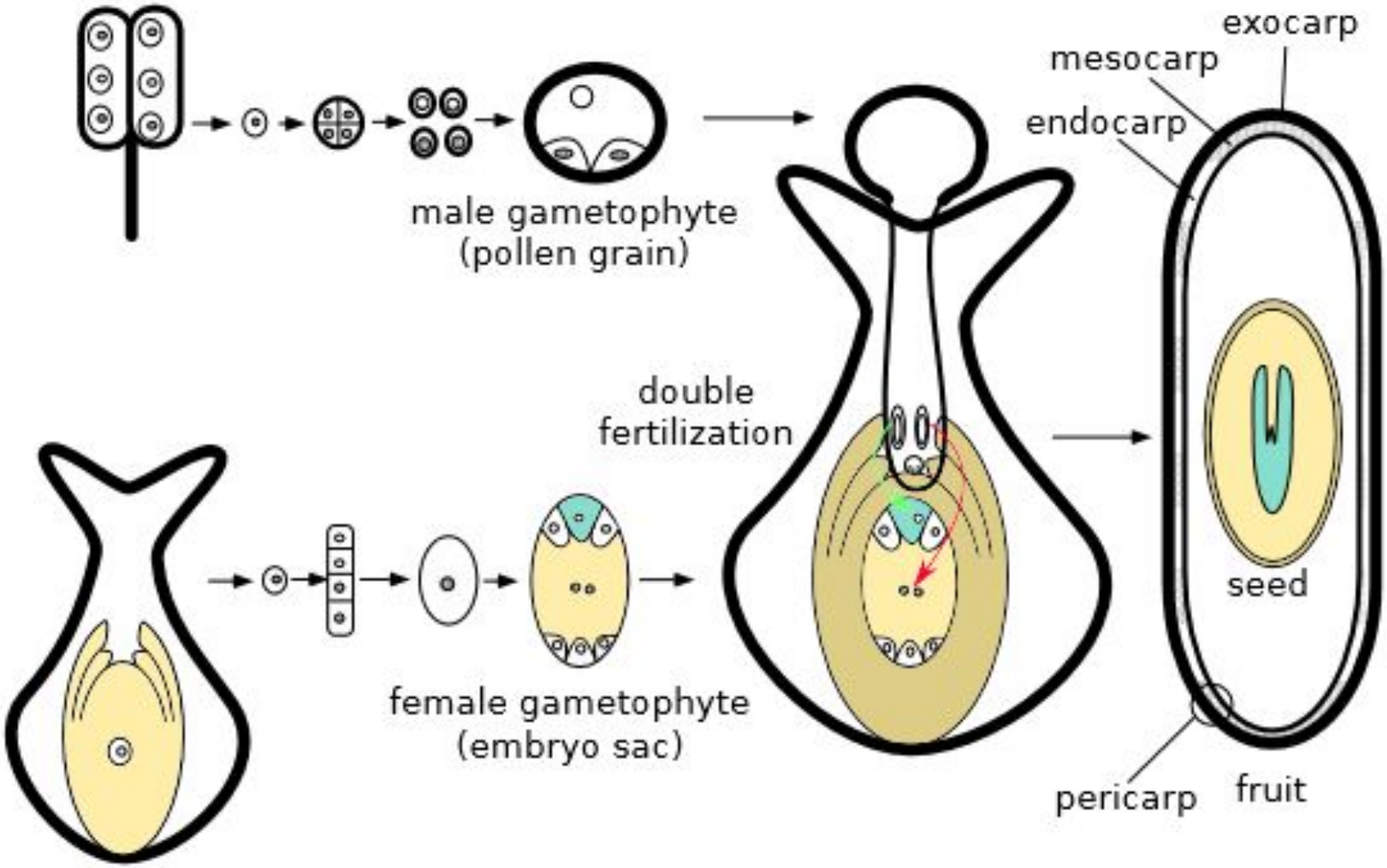


Life cycle of angiosperms. Innovations (comparing with the the ancestral seed plant life cycle) are in red.

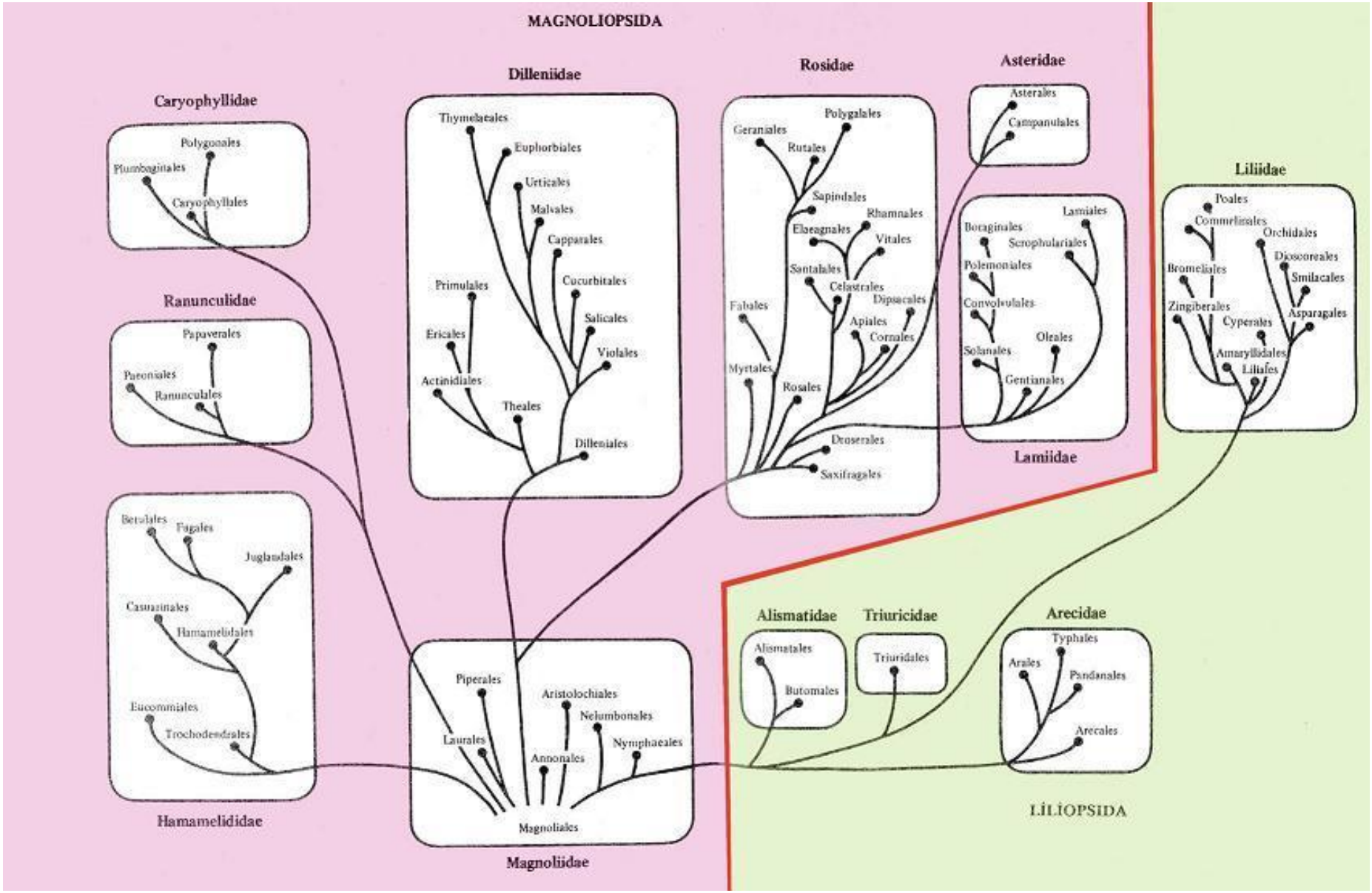
Double fertilization:

1. 1st sperm cell (1st spermatium, n) + egg cell (n) $\rightarrow$ zygote ($2n$)
2. 2nd sperm cell (2nd spermatium, n) + central cell ($2n$ or sometimes n) $\rightarrow$ mother cell of endosperm$_2$ ($3n$ or sometimes $2n$)

Origin of fruits



System of Angiosperm by A.L. Takhtadjyan



The most important signs of organization of flower plants:

- **flower;**
- **much reduction of gametophytes;**
- **system of pollination;**
- **creation of nucellus and fruits;**
- **developed transport system and system for water economy;**
- **developed root system;**
- **developed leafy apparatus;**
- **diversity of life forms.**

Systematic group of Angiosperm

Class 1. *Magnoliopsida or Dicotyledones*	**Class 2. *Liliopsida,*** or ***Monocotyledones***
Sub class 1. *Magnoliidae*	Sub class 1. *Alismatidae*
Sub class 2. *Ranunculidae*	Sub class 2. *Triuriddidae*
Sub class 3. *Caryophyllidae*	Sub class 3. *Liliidae*
Sub class 4. *Hamamelididae*	Sub class 4. *Arecidae*
Sub class 5. *Dilleniidae*	-
Sub class 6. *Rosidae*	
Sub class 7. *Lamiidae*	
Sub class 8. *Asteridae*	

Comparative characteristic of monocots and dicots plants

Sign	Dicots	Monocots
Amount of cotyledons in embryo	2	1
Flower	Often 5- or 4-parted, rare 3-parted	Often 3-parted, rare 4-parted
Anatomical structure of stalk	Cambium is presence, structure id secondary (bundle-shaped or not bundle-shaped), bundles lie in one ring	Cambium is absent; structure is primary (bundle-shaped), bundles lei more than one ring
Venation of leaves	Pinnate or palmate	Parallel
Корневая система	System of main root	System of additional root
Life form	From trees till annual grassy plants	Annual, biennial or perennial plants, very rare woody
Amount of families	418	122
Amount of gena	10 000	3 000
Amount of species	190 000	63 000

Family – *Magnoliaceae*

Family includes 12 gena and about 240 species.
Spreading – sub-tropics and tropics, center of species diversity – Southern-Eastern Asia.
Life forms – trees and bushes, usually evergreen.
Formula of flower - *P6A∞G∞
The important gena are *Magnolia*, and *Liriodendron*.
Practical uses:
Herb - *Magnolia grandiflora,* for treatment of hypertonia.
Decorative - *M. grandiflora,* is cultivated in gardens and parks.

Magnolia ovata

Family *Shisandraceae*

Family include 2 gena and 47 species.
Spreading – countries of Eastern Asia.
Life forms – evergreen bushes.
Formula of flower *P5-24 A4-80 G (12-300)
The important genus is *Schisandra*.
Practical uses:
Medical – *Schisandra chinensis,* seeds and fruits are used for production of preparations with stimulate and tonic activity.

Schisandra chinensis

Family *Lauraceae*

Family include 45 gena and about 2500-3000 species.
Spreading – sub-tropic and tropics.
Life forms – trees, bushes and lianas.
Flower formula *P4-6 A 6 G 1
The important gena – *Laurus*, *Cinnamomum* and *Persea* .
Practical uses:
Medical – Laurus nobilis is used for extraction of essential oils for treatment of flue and organ of digestion system.
Cinnamomum camphora) – is a source of natural camphora;
Food - Laurus nobilis is used as a spicy; cork of *Cinnamomum zeylanicum* is also used as a spicy; *Persea americana* is used for preparation of butter and salad, important dietary product.

Persea americana

Laurus nobilis

Cinnamomum camphora

Family Nymphaeaceae

Family includes 5 gena and about 70 species.
Spreading – lakes, ponds and rivers with fresh water of all continents.
Life forms – annual or perennial grassy water plants.
Flower formula - *Ca4-5 Co ∞ A ∞ G (5-35)
Pollination – cross-pollination by bags and self-pollination.
The important gena – *Nuphar*, *Nymphaea*, *Victoria.*
Practical uses:
Decorative – cultivation in botanical gardens and parks.

Nuphar lutea

Nymphaea alba

Control questions:

1 What are the defects of artificial system of classification of plants?
2 Define biosystematics.
3 What is Binomial nomenclature?
4 Write the objectives of classification of plants.
5 What are the aims of biosystematics.

Testing questions:

Name of species is created from 2 names of taxons:
A) Family
B) Genus
C) Class
D) Order
E) Species epithet
F) Type
G) Division
H) Kingdom

Formula of lower *Ca4-5 Co ∞ A ∞ G (5-35) **belongs to**:
A) Trifolium
B) Nuphar
C) Nymphaea
D) Chamomilla
E) Rubus
F) Polygonum
G) Persea
H) Laurus