

Introduction to Botany. Lecture 27

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Outline

- 1 Questions and answers
- 2 Life cycles
 - From general life cycle to the life cycle of angiosperms
- 3 Flower
 - General characters
 - Flower transformations
 - Inflorescences

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Previous final question: the answer

What is a flower?

Previous final question: the answer

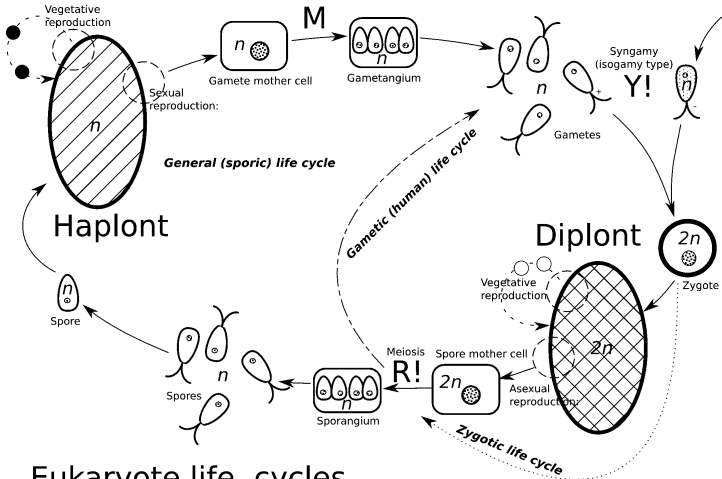
What is a flower?

- FU with sterile, male and female zones

Life cycles

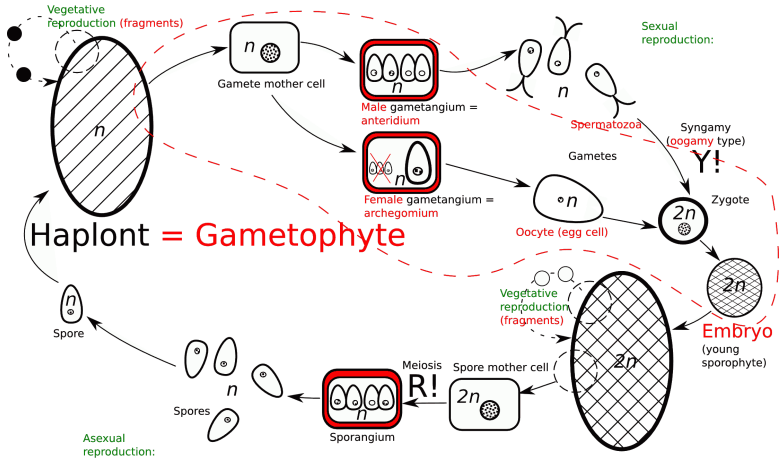
From general life cycle to the life cycle of angiosperms

General life cycle

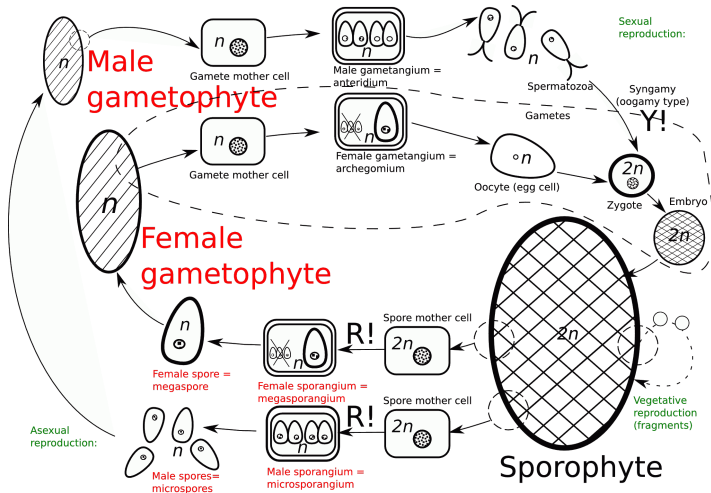


Eukaryote life cycles

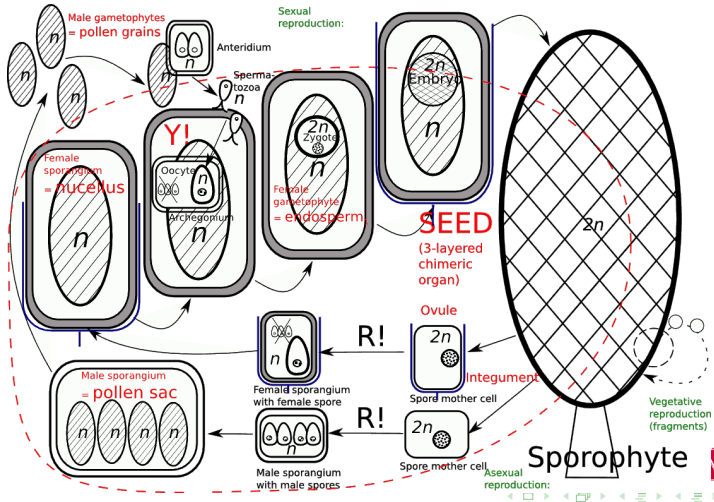
Life cycle of land plants: differences



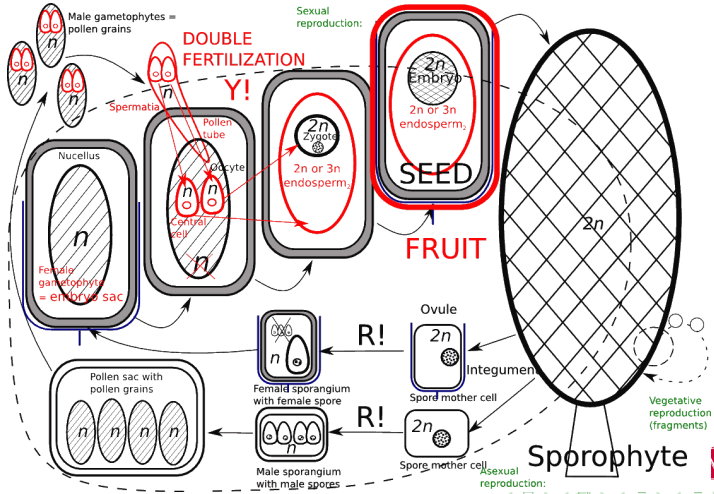
Heterosporic cycle: differences



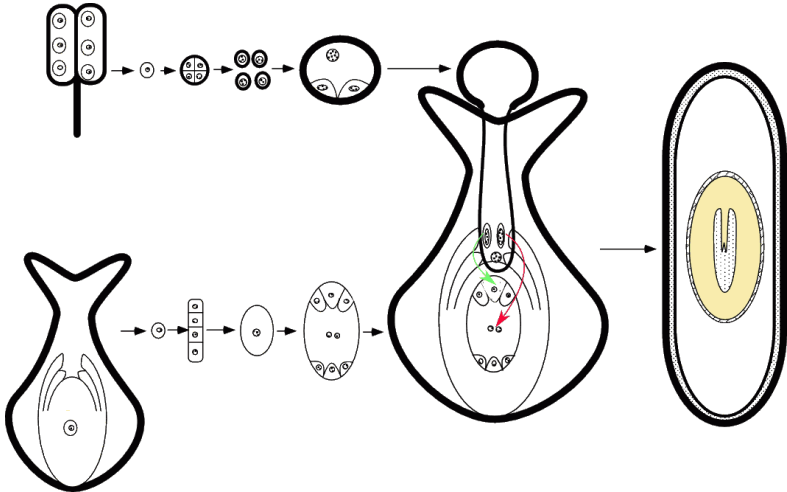
Life cycle of seed plants: differences from heterosporic ferns



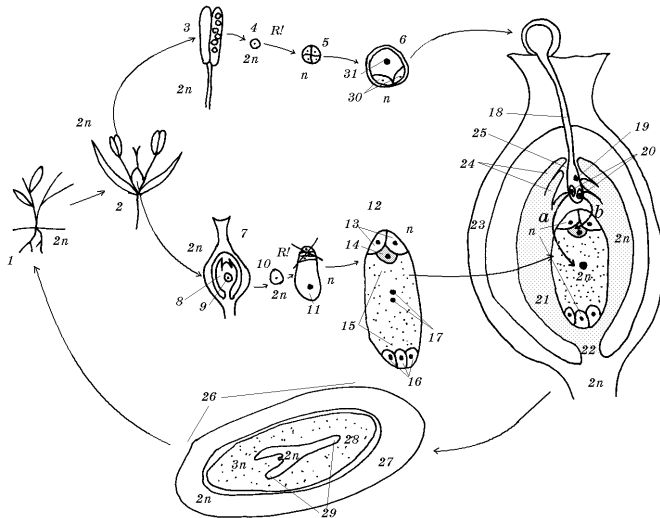
Life cycle of angiosperms: differences from primitive seed plants



Life cycle of angiosperms: relations between structures



Life cycle of angiosperms: another view



Flower

General characters

General characters of flower

- Complete and incomplete flowers
- Sex: staminate, pistillate (imperfect) and bisexual (perfect); monoecious and dioecious plants
- Merosity
- Whorls, connation and adnation
- Symmetry: radial (regular), bilateral (irregular), asymmetry
- Position of gynoecium and ovary: epyginous and hypogynous flowers, or inferior and superior ovary; hypanthium

Structure of ovary

- Locules and placentas
- Placentation: axile, central, parietal

Apomixis

- Reproduction without fertilization
- Apogamy (i.e., parthenogenesis): embryo develops from unfertilized gamete; sexual reproduction becomes vegetative
- Apospory: embryo develops from maternal diploid tissue, without meiosis; here asexual reproduction becomes vegetative

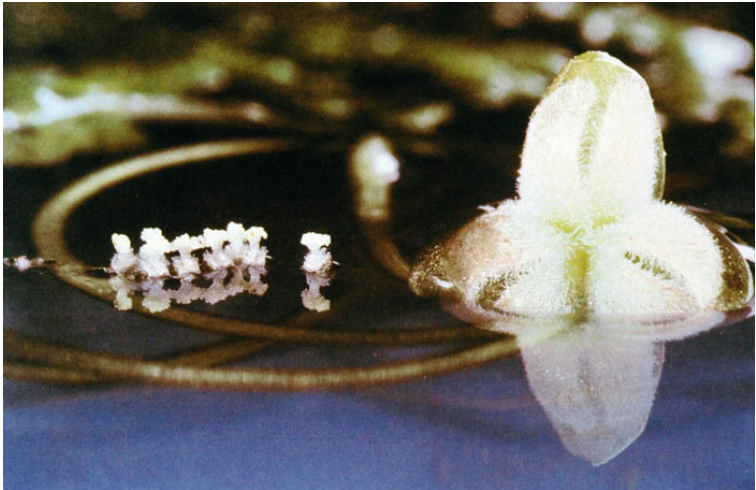
Pollination

- Self-pollination
- Cross-pollination: abiotic (gravity, wind, water) and biotic (insects, birds, bats, sometimes even possums)
- Every pollination type has associated **pollination syndrome**

Wind pollination: hazelnut



Water pollination: vallisneria



Bat pollination: cacti



Possum pollination: Australian Myrtaceae



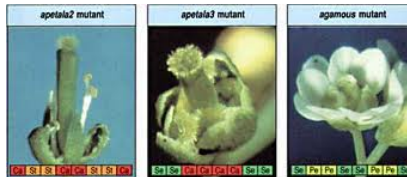
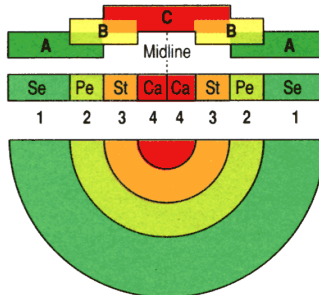
Flower

Flower transformations

ABC-genes

- There are 3 classes of genes expressed in overlapping, concentric rings.
- The A class (like *apetala2* gene) is expressed in the outermost ring and C (like *agamous*) is expressed in the center; B (e.g., *apetala3*) is expressed at the boundary of A and C.
- If A is expressed in a cell, it goes on to form a sepal.
- If C is turned on, it forms a carpel.
- Petals are formed where both B + A are active.
- Stamens are formed with the combination B + C.

ABC system



Flower evolution: elementary transformations

- Fixation: from indefinite to definite (reverse is diffusion)
- Connation (reverse is splitting)
- Reduction (reverse is multiplication)
- Differentiation (reverse is homeosis)

Flower Inflorescences

Inflorescence in general

- Isolated generative shoot bearing flowers
- Open and closed
- Bracteolate and non-bracteolate
- Transformations are similar to flower, plus *aggregation* and *formation of bracts*
- Sometimes flowers and inflorescences are hard to distinguish, these structures are **non-flowers**

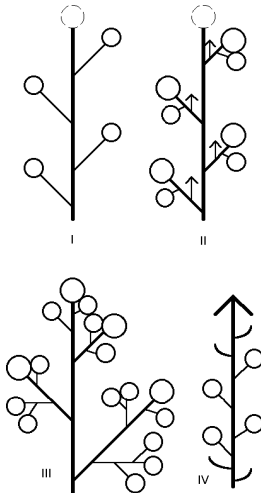


Trithuria non-flowers: one stamen (reduced staminate flower?)
surrounded by multiple pistils (reduced pistillate flowers?)

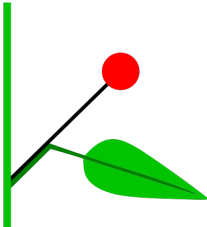
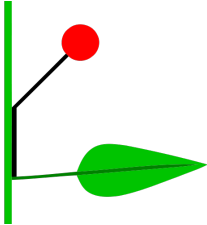
Types of inflorescences

- Model I. Raceme and its derivatives
 - Simple: raceme (11), spike/catkin (10), umbel (01), head (00)
 - Compound: compound raceme (11/11), compound umbel (01/01) etc.
- Model II. Thyrsus and its derivatives
 - Reduced (cymes): dichasium, cincinnus (scorpioid inflorescence) etc.
 - Thyrses in a strict sense
- Model III. Closed panicle (also umbel-like panicles)
- Model IV. Intercalary inflorescences

Models of inflorescences



Metatopy: concaulescence and recaulescence



Summary

- **Apomixis** is a reproduction without fertilization
- Every pollination type has associated **pollination syndrome**
- **ABC-genes** determine the fate of cells forming flower
- **Inflorescence** is an isolated generative shoot bearing flowers

Final question (2 points)

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How to distinguish inflorescence and flower?

For reading before Exam 3



A. Shipunov.

Introduction to Botany [Electronic resource]. 2010–onwards.

Mode of access: http://ashipunov.info/shipunov/school/biol_154/index.htm.

Lectures 17–27.



J. E. Bidlack, Sh. H. Jansky.

Stern's introductory plant biology. 12th edition.

McGraw-Hill, 2011.

Chapters 8–12.



Th. L. Rost, M. G. Barbour, C. R. Stocking, T. M. Murphy.

Plant Biology. 2nd edition.

Thomson Brooks/Cole, 2006.

Chapters 8–13.