

# Introduction to Botany. Lecture 18

Alexey Shipunov

Minot State University

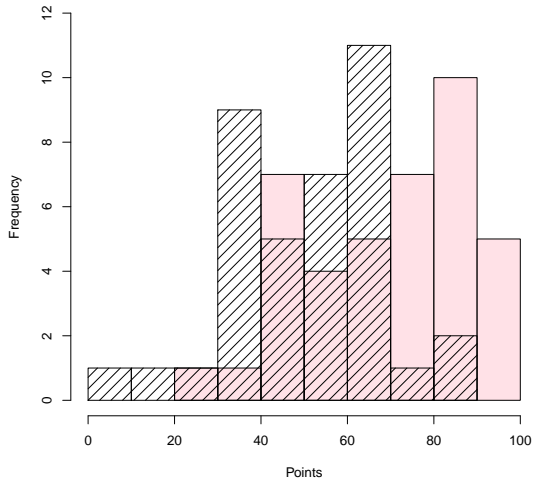
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# Outline

- 1 Mitosis and meiosis
  - Mitosis
  - Meiosis

# Exam 2

Exam 2 vs. Exam 1



# Definition of mitosis

- *Equal cell division, where each of daughter cells receives the same number of chromosomes as a mother cell*
- Chromosome formula:  $X \longrightarrow I + I$
- **The goal of mitosis** is the equal distribution of pre-synthesized DNA
- Mitosis does not change genotype of cells

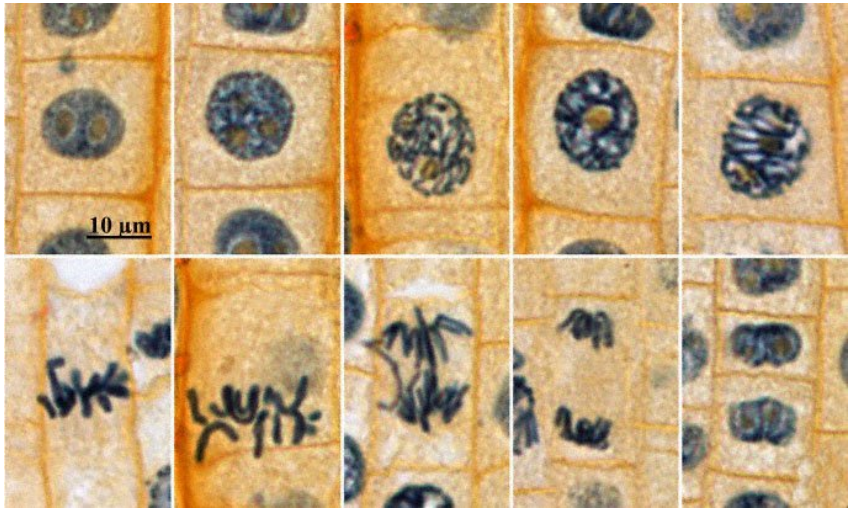
# Mitosis, karyokinesis and cytokinesis

- Mitosis is the kind of karyokinesis
- Cytokinesis is a different process, the part of **cell cycle**

# Stages of mitosis\*

- Prophase
- Metaphase
- Anaphase
- Telophase

# Which stage?

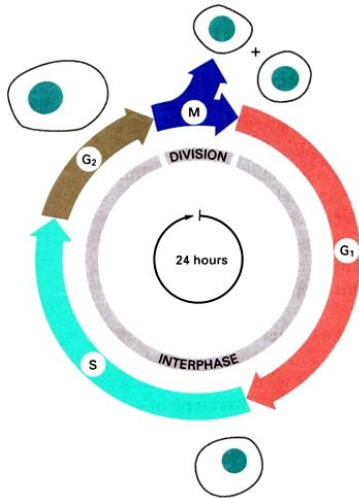


# Cell cycle

- Interphase
  - Pre-synthetic stage ( $G_1$ )
  - Synthetic stage (S): DNA duplicated
  - Post-synthetic stage ( $G_2$ )
- Mitosis
- Cytokinesis



# Cell clock



# Exchange and renovation of DNA

- To sustain with the ever-changed environment, organisms must evolve
- To evolve, they need a genetic diversity: different genotypes in different organisms
- To be genetically diverse, they need a process of genetic exchange
- One of ways of exchange is a sexual process in a form of **syngamy**
- However, constant syngamy will result in constant increase of DNA amount
- Meiosis is a counterbalance to syngamy

# Definition of meiosis

- *Reductive cell division, where each of daughter cells receives the half of mother cell chromosomes*
- Chromosome formula:  $XX \longrightarrow X + X \longrightarrow I + I + I + I$
- **The goal of meiosis** is to counterbalance the syngamy
- Meiosis changes genotype of cells because: (1) chromosomes are **recombined** and (2) chromosomes exchange their genetic material

# Ploidy, or chromosome set

- In diploid ( $2n$ ) organisms, chromosomes form pairs
- Paired chromosomes (XX) are **homologous**
- In haploid ( $n$ ) organisms, all chromosomes are single
- In mitosis, ploidy will be the same:  $2n \longrightarrow 2n + 2n$
- In syngamy, ploidy will increase:  $n + n \longrightarrow 2n$
- In meiosis, ploidy will reduce:  $2n \longrightarrow n + n$

# Stages of meiosis\*

- First division: reductive part
  - Prophase I: homologous chromosomes form pairs (**synapses**) and start to exchange DNA (**crossing-over**)
  - Metaphase I
  - Anaphase I: homologous chromosomes will go *independently* to different poles
  - Telophase I becomes Prophase II, without interphase (and typically without cytokinesis)
- Second division: equal part (similar to mitosis)
  - Prophase II
  - Metaphase II
  - Anaphase II
  - Telophase II

# Summary

- **Mitosis** is a process of cell multiplication, **ploidy stays constant**, **genotype does not change**
- **Syngamy** is a process of DNA renovation, **ploidy doubles**, **genotype changes**
- **Meiosis** is a process of reduction of DNA amount, **ploidy halves**, **genotype changes**

# For Further Reading



Th. L. Rost, M. G. Barbour, C. R. Stocking, T. M. Murphy.  
*Plant Biology*. 2nd edition.  
Thomson Brooks/Cole, 2006.  
**Chapter 12.1.**