

Introduction to Biology. Lecture 29

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Outline

- 1 Where we are?
- 2 Genetics and inheritance
 - Life cycle
 - Gregor Mendel
 - Genes and chromosomes



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- 1 Where we are?
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 - Gregor Mendel
 - Genes and chromosomes



References to films



Life on Earth. Episode 3. First forests.

http://en.wikipedia.org/wiki/Life_on_Earth_%28TV_series%29

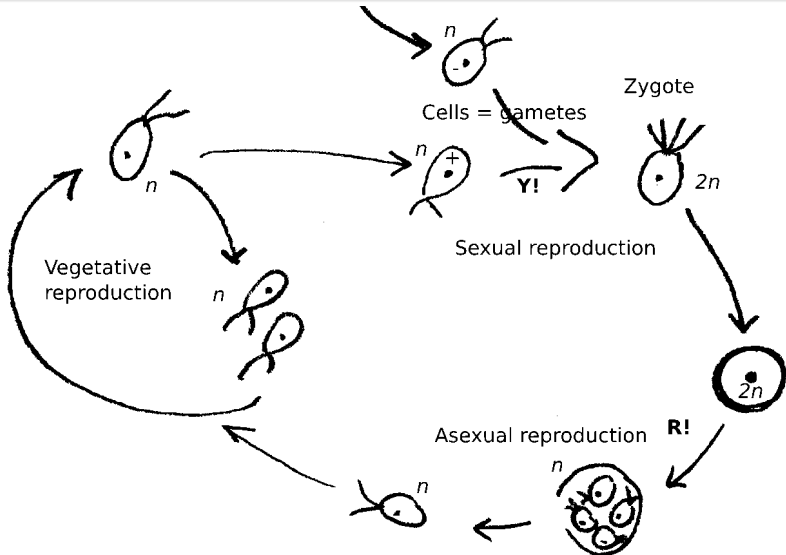


Walking with monsters. Episodes 1 and 2.

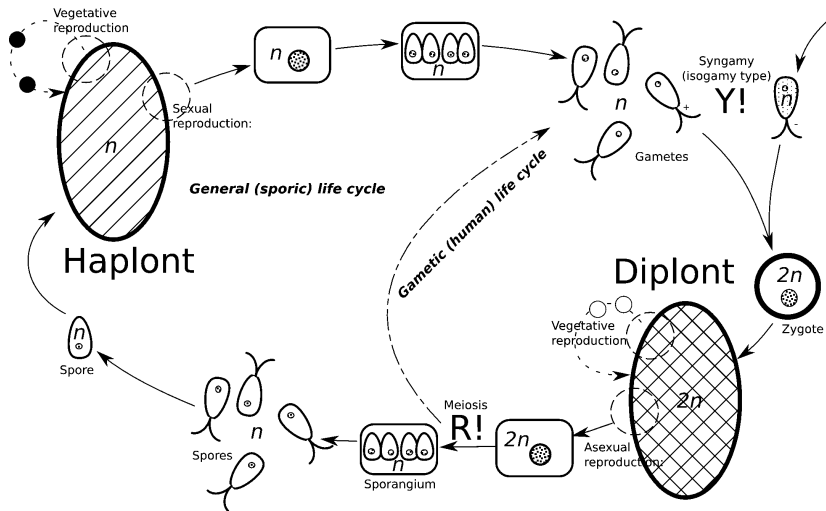
http://en.wikipedia.org/wiki/Walking_with_Monsters



Life cycle of unicellular organism



Life cycle of multicellular organism



Genetics and inheritance

Life cycle



Terms associated with life cycles

- mitosis, meiosis (R!), syngamy (Y!)
- vegetative reproduction (cloning)
- result of syngamy: zygote
- participant of syngamy: gamete
- smaller gamete: male, bigger gamete: female
- movable male gamete: spermatozoon (sperm), motionless female gamete: oocyte (egg cell)
- haplont and diplont
- spores
- sporic life cycle and gametic life cycle



Genetics and inheritance

Gregor Mendel



Pea

- Self-pollinated: to cross, one needs to pollinate it artificially
- Contrasting characters (flower color, seed coat color, seed coat surface, plant height, pod wall color etc.)
- Pure lines: always produce the same characters



First and second generations

- First: all the same
- Second: $\frac{3}{4}$ like one parent and $\frac{1}{4}$ like another parent



Theory

- Two different factors (variants of one character)
- Factors are paired in plant but separated in gametes
- One factor is dominant



Theory and explanation

- Two different factors (variants of one character): *two variants (**alleles**) of one **gene***
- Factors are paired in plant but separated in gametes: *meiosis*
- One factor is dominant: *one variant is working DNA, the other is not*



Genes and characters

- Genotype and phenotype
- Homozygous and heterozygous plants
- $3/4$ and $1/4$ is the result of **combining probabilities**



Experiment with two characters (dihybrid crossing)

- First generation: all same
- Second generation: 9/16 like one parent, 1/16 like another and two new groups (3/16 and 3/16) with intermediate combinations of characters—**recombinants**



Theory

- Different characters are separating between gametes independently
- This is because different characters are located in different places



Theory and explanation

- Different characters are separating between gametes independently: *anaphase I of meiosis*
- This is because different characters are located in different places: *in different pairs of chromosomes*



Genetics and inheritance

Genes and chromosomes



Thomas Hunt Morgan and fruit fly

- Grey with normal wings \times black with reduced wings: in first generation, all same (gray normal) but in second generation only two groups: 3/4 gray normal and 1/4 black reduced!
- BUT if you count thousands of fruit flies, few recombinants may be found
- WHY?



Linkage and crossing-over

- If genes are located in the same chromosome, they are **linked** and will not be inherited independently
- However, linkage could be broken in **crossing-over** (it runs in prophase I of meiosis)



Sex and chromosomes

- One gender has the pair where chromosomes are non-equal
- Deviating chromosome is sex chromosome, it contains small number of genes
- Two variants are possible: XY (mammals, fruit fly, ginkgo tree) and ZW (birds, butterflies)
- In both cases, sexes are 1:1
- The gender where chromosomes are equal often has the second chromosome inactivated (i.e., Barr body in human female cells)
- The gender where chromosomes are non-equal is more susceptible to mutations because all mutations in main chromosome will be manifested (it has no counterpart)



Summary

- While in the life cycle of plants (“sporic”), diplont and haplont interleave, in animal life cycle (“gametic”) haplont is reduced.
- Mendelian (classic) genetics is based on segregation, dominance and independent assortment
- Chromosome (Morgan) approach added here linkage, crossing-over and sexual chromosomes



For Further Reading



Mendelian genetics.

http://en.wikipedia.org/wiki/Mendelian_inheritance



Linkage.

http://en.wikipedia.org/wiki/Genetic_linkage



Sex chromosomes.

http://en.wikipedia.org/wiki/Sex_chromosome

