



تَوِير

BIOLOGY

Lec no :

File Title : Summarizing Ch_13

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وَقُلْ رَبِّ رَبِّيَ عَلِيمًا

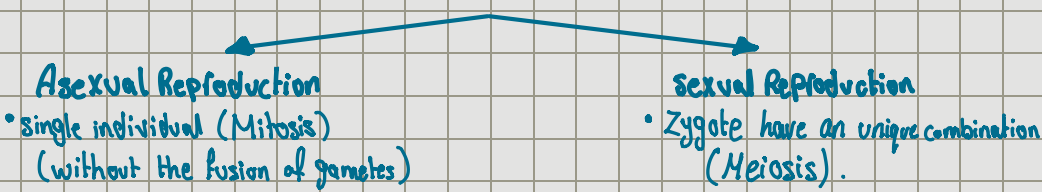


Meiosis & sexual life cycles

• Living organisms are distinguished by their ability to reproduce their own kind.

- Genetics: the scientific study of heredity and variation. (علم الوراثة)
- Heredity: is the transmission of traits from one generation to the next. (الوراثة)
- variation: is demonstrated by the differences in appearance that offspring show from parents and siblings. (التباين/التنوع)
- Genes: the units of heredity.
- locus: is a location of gene on a certain chromosome.
 - * DNA is carried on a chromosome.
 - * Genes is carried on a DNA.
 - * Genes are passed to the next generation via reproductive cells called **Gametes (sperm & egg)**

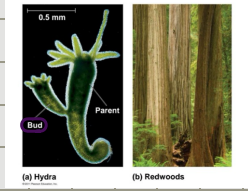
• Comparison of Asexual & Sexual reproduction:



→ Clone: a group of genetically identical individuals from the same parent (a result of asexual reproduction).

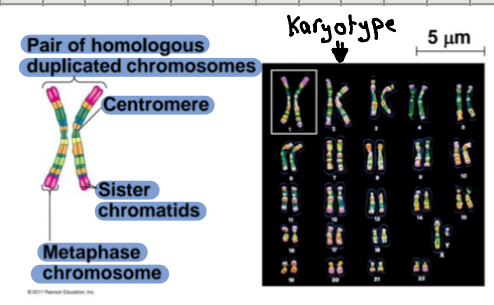
↓ Example of Asexual reproduction

- Hydra: reproduces by budding
- All trees in this circle of redwoods



→ Bud: a localized mass of mitotically dividing cells.

- Somatic cells: any cell other than a gamete have 23 pair of chromosome (2n). (is arranged according to their length.)
- Karyotype: an ordered display of the pairs of chromosomes from a cell. (الهيئة الوراثية) → Karyotype (الهيئة الوراثية) هو الترتيب المنظم للزوجات من الكروموسومات التي تحتوي على الجينات الخاصة من الكروموسوم.
- Homologous chromosomes: two chromosomes in each pair. (الزوجات الوراثية) → homologous chromosomes in a homologous pair are the same length & shape & carry genes controlling the same inherited characters.
- Maternal chromosome: comes from mother.
- Paternal chromosome: comes from father.

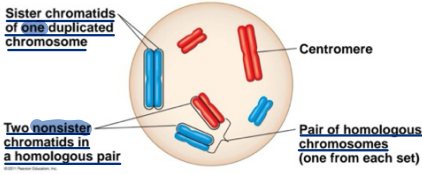
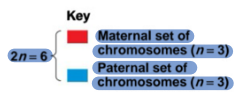


• The process of lining up the homologous chromosomes called (pairing of homologous chromosomes) called **Synapsis**.

• Each set of 23 consists of 22 **autosomes** & single sex chromosome. (كروموسومات جسمانية (لون العيون، لون الشعر، لون الدم، لون البشرة، لون الشعر))

- sex chromosomes: which determine the sex of the individual, are called X and Y.
 - Females (in an unfertilized egg (ovum)) → XX.
 - males (in a sperm cell) → XY.
- Fertilization: Union of gametes (sperm with egg).

- * The 46 chromosomes in a human somatic cell are two sets of 23: one from the mother and one from the father.
- diploid cell (2n) = 2 sets of chromosomes (2n = 46)
- haploid cell (1n) = single sets of chromosomes (n = 23)



gonads → males (testes) } → diploid (2n).
 females (ovary)

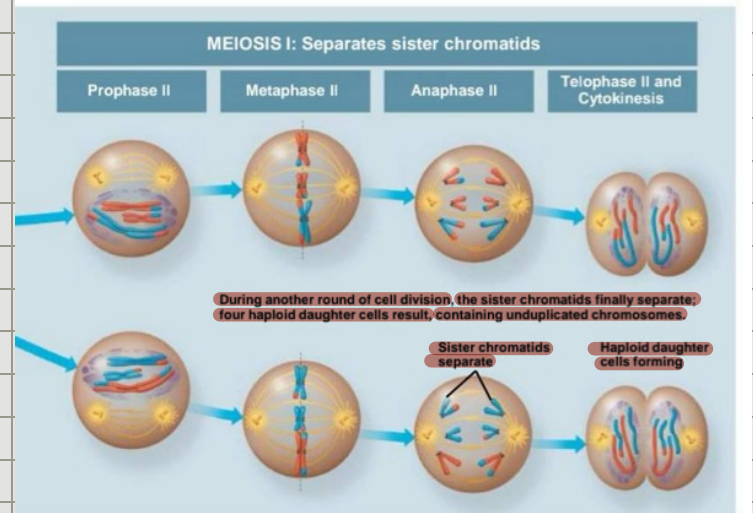
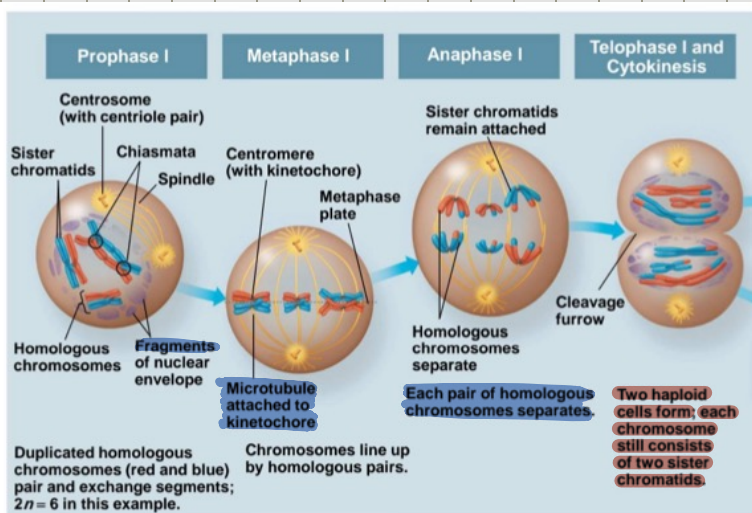
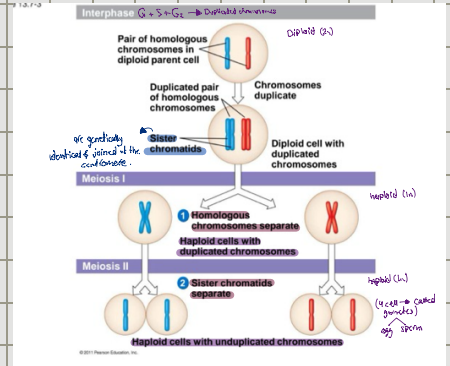
- 1- تكاثر تناسلي cell cycle → replication the DNA
- 2- يلتصق الـ homologous chromosomes ببعضها Synapsis
- 3- يلتصق بروتين cohesion protein
- 4- يتكون شكل رباعي (tetrad).

* Meiosis :-

- It reduces the number of chromosome sets from diploid to haploid.
- each daughter cell has only 1/2 as many chromosomes as the parent cell.

- The stages of Meiosis :-

1. Meiosis I (reductional division): separated homologous, resulting in two haploid daughter cell with replicated chromosomes.
 - Prophase I
 - metaphase I
 - Anaphase I
 - Telophase I & cytokinesis
2. Meiosis II (equational division): separated sister chromatids.
 - Prophase II
 - metaphase II
 - Anaphase II
 - Telophase II & cytokinesis



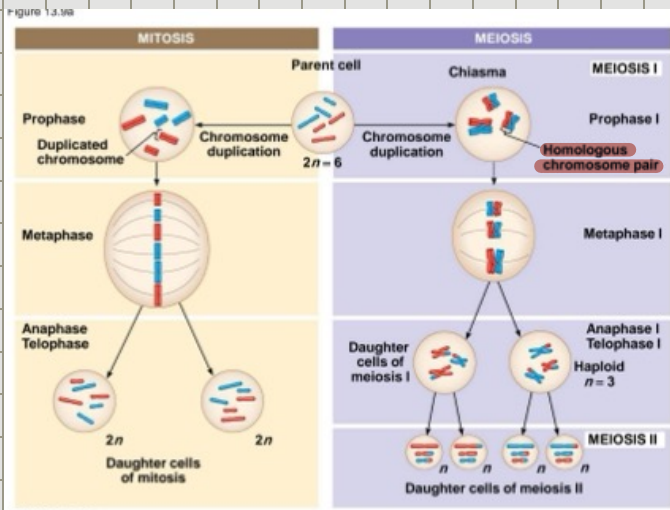
- nucleolus & nuclear envelop will disappear.
- centrosomes start moving to opposite pole of the cell + start realizing spindle microtubules.
- each chromosome will appear as 2 sister chromatids.
- chromosome will appear shorter & thicker (being to condense).
- The centrosomes settles on the cell poles.
- tetrads line up at the Metaphase plate
- Microtubules attached to the kinetochore.
- inactivation to cohesin protein.
- shorting & contraction to kinetochore microtubules
- cell became elongated more.
- sister chromatids remain attached at the centromere & move as one until toward the pole.
- cytokinesis usually occurs simultaneously forming two haploid daughter cells.
- realizing spindle microtubules.
- in late prophase II, chromosomes are arranged at the metaphase plate
- make toward the metaphase plate
- Because of crossing over in meiosis I, the two sister chromatids of each chromosome are no longer genetically identical.
- microtubules attached to kinetochore.
- sister chromatids separate
- The chromosomes arrive at opposite pole.
- Nuclei form & the chromosomes begin decandensing.
- Cytokinesis separates the cytoplasm.

• At the end of meiosis, there are 4 daughter cells, each with a haploid set of unreplicated chromosomes, each daughter cell is genetically distinct from the others & from the parent cell.

Chiasmata: X-shaped region where crossing over occurred
 Crossing over: nonsister chromatids exchange DNA segments, which leads to genetic variations

- Prophase I is the longest one (more than 90% of the time required for meiosis).
- each tetrad usually has one or more chiasmata.
- No chromosome replicated occurs between the end of meiosis I & the beginning of meiosis II because the chromosomes are already replicated.

• Comparison between Mitosis & Meiosis :-



المطفرات

• **Mutations** (changes in an organism's DNA) are the original source of genetic diversity.

→ **Mutations**: changes in an organism's DNA.

↳ it is create different versions of genes called **alleles**.

↳ **Reshuffling of alleles during sexual reproduction produces genetic variation**

* **Three mechanisms contribute to genetic variation** :-

1. Independent assortment of chromosomes
2. Crossing over
3. Random fertilization.

SUMMARY		
Property	Mitosis	Meiosis
DNA replication	Occurs during interphase before mitosis begins	Occurs during interphase before meiosis I begins
Number of divisions	One, including prophase, metaphase, anaphase, and telophase	Two, each including prophase, metaphase, anaphase, and telophase
Synapsis of homologous chromosomes	Does not occur	Occurs during prophase I along with crossing over between nonsister chromatids; resulting chiasmata hold pairs together due to sister chromatid cohesion
Number of daughter cells and genetic composition	Two, each diploid (2n) and genetically identical to the parent cell	Four, each haploid (n), containing half as many chromosomes as the parent cell; genetically different from the parent cell and from each other
Role in the animal body	Enables multicellular adult to arise from zygote; produces cells for growth, repair, and, in some species, asexual reproduction	Produces gametes; reduces number of chromosomes by half and introduces genetic variability among the gametes

① (development)

② (growth)

③ (repair)

④ (asexual reproduction)

①

②

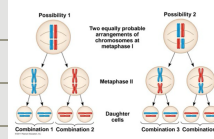
③ sexual reproduction

• Cohesins are cleaved along the chromosome arms in anaphase I (separation of homologs) and at the centromere in anaphase II (separation of sister chromatids)

1. Independent Assortment of chromosomes:

• at metaphase I of meiosis.

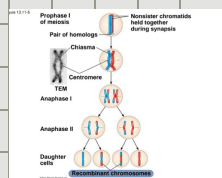
• In it each pair of chromosomes sorts maternal & paternal homologs into daughter cells independently of the other pairs.



• The number of combinations possible when chromosomes assort independently into gametes is 2^n , where n is the haploid number.

2. Crossing Over :-

- In prophase I
- It happens between nonsister chromatids.
- it produces **recombinant chromosomes**.



→ **recombinant chromosomes** :- which combine DNA inherited from each parent.

• it contributes to genetic variation by combining DNA from 2 parents into a single chromosome.

3. Random Fertilization :-

• الانجاب العشوائي (any sperm can fuse with any ovum)

• The fusion of 2 gametes (each with 8.4 million chromosome combination from independent assortment) produce a zygote with any of about 70 trillion diploid combinations.

→ each zygote has a unique genetic identity.

→ The importance of genetic variation is → producing new qualities.