

Mitosis and meiosis
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Different types of cultivars

- Clonal cultivars – potato, ornamentals.
- Seed cultivars
 - Soybean – naturally self-pollinated. Cultivars breed true and are referred to as pure line cultivars.
 - Alfalfa – naturally open-pollinated. Cultivars do not breed true and are referred to as synthetic cultivars.

Clonal - no implication because they are not seed propagated (mitosis)

Introduction

Plant growth requires dramatic increase of cell numbers and volume which are achieved through cell division and expansion.

Fact: chromosome number is constant from cell to cell in spite of repeated cell divisions, how does this happen?
A mechanism must exist to maintain this consistency.

Mitosis

- **Mitosis** is the nuclear division associated with the division of *somatic cells* – cells that are not destined to become “sex” cells.
 - Cells in vegetative organs such as leaf, stem, root are all somatic cells
- Mitosis produce two identical daughter cells in one division.
 - Clonal cultivars such as sugarcane are vegetative propagated by stem cuttings; new canes from these cuttings are the results of somatic cell division (mitosis);
 - individuals produced in this way are genetically identical.

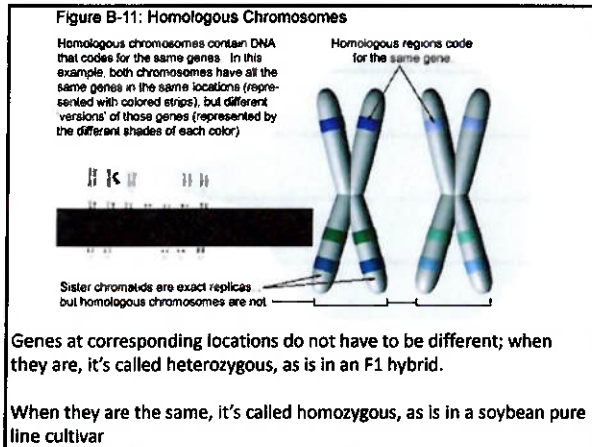
Before we discuss mitosis and meiosis in details, we need to know two concepts

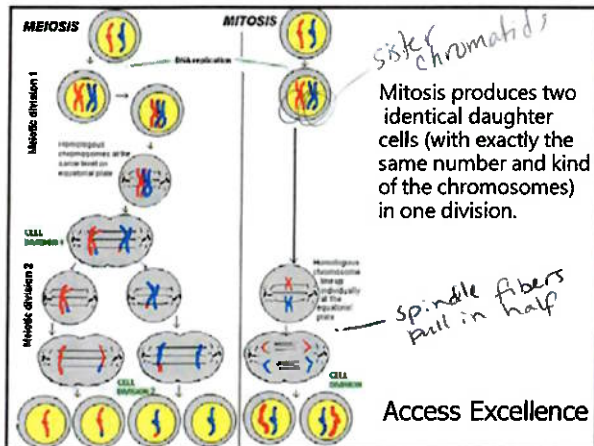
Concept 1: Chromosome sets

- Chromosome sets: Corn plants have 20 chromosomes, consisting of two sets with one set (10 chromosomes) from the male gamete and the other set from the female gamete.
- Corn is a diploid and its gametes (sperms or eggs) are haploids which contain only one set of the chromosomes.

Concept 2: Homologous chromosomes

- The 20 chromosomes in corn somatic cells are made up of 10 homologous pairs.
- One chromosome of each pair came from the male parent while the other from the female parent.
 - This concept is particular useful in understanding meiosis.





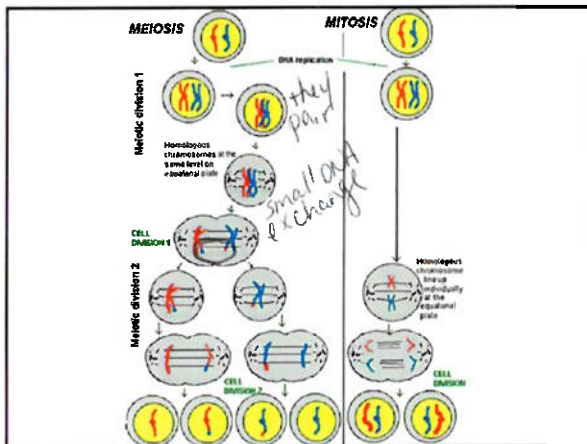
Meiosis

- Fact: chromosome number is constant from one generation to next within a species.
- Seed production requires that a male gamete is united with a female gamete.
- So can a species maintain chromosome number constant between generations?

A mechanism must exist to reduce the chromosomes in gametes to half of that in a non-sex cell

Meiosis

- **Meiosis** is the nuclear division in reproductive cells that produce gametes (sperms or eggs) such as corn tassel (produce pollen, thus sperms) and ear (producing eggs).
- Through meiosis, one cell produces 4 daughter cells in two consecutive divisions
- Chromosome numbers in each of the four daughter cells is reduced to half.



synapsis: chromosomes are very close together. Happens just before the small DNA exchange.

Important features of meiosis

- 1) Meiosis results in male and female gametes with halved chromosome number.
- 2) Random assortment of chromosomes during meiosis results in gametes that may contain varied combinations of parental genes.
- 3) Pairing causes chromatid exchange and results in recombination of linked genes.

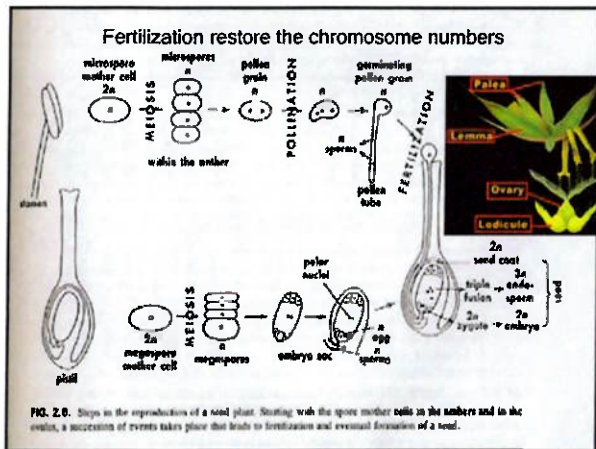
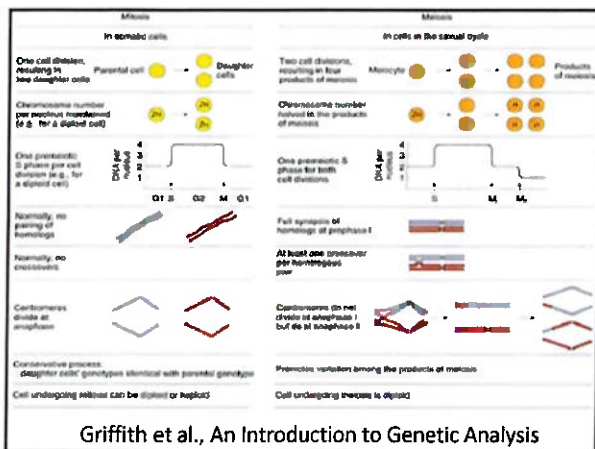


FIG. 2.8. Steps in the reproduction of a seed plant. Starting with the spore mother cells in the anthers and in the ovules, a succession of events takes place that leads to fertilization and eventual formation of a seed.



- For alfalfa, genes at corresponding locations in the homologous chromosome pairs often vary, thus gametes will likely carry different combinations of genes. In addition, cross-pollination introduces more "impurity".
 - Not breed true

- For soybean, genes at corresponding locations in the homologous chromosome pair are the same, thus gametes carry same combinations of genes. In addition, soybean do not cross-pollinate – breed true.
