Plant Propagation PLS 3221/5222

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Chapter 2

Introduction to the Biology of Plant Propagation
-A review-

The Plant Breeder and the Plant Propagator

Plant Breeder, The role of the plant breeder is to recreate patterns of genetic variation in its many forms from which to select new kinds of plants useful to humans.

Plant Propagator. The role of the plant propagator is to multiply these selected cultivars and to do it in such a manner as to maintain the genetic characteristics of the original population.

Species

The natural grouping of plants that have common characteristics in appearance, adaptation, and breeding behavior (can freely interbreed with each other).

Cultivar

A group of plants that have originated in cultivation, are unique and similar in appearance, and whose essential characteristics are maintained during propagation.

Chapter 2

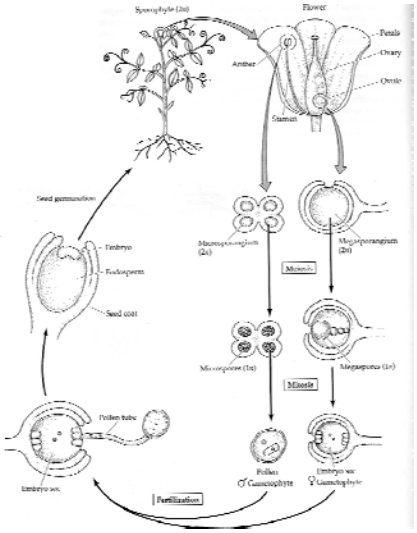
Objectives are to Understand

- Alternation of generations as it relates to life cycles in plants
- Sexual (seed) and asexual (vegetative) propagation
- Seedling populations and clones
- How genes impact propagation
- Plant hormones and their role in plant development
- Basic life cycles of plants as related to propagation
- Ownership and control of cultivars

1. Alternation of Generations in Reproduction

The life cycle begins with the zygote.

a zygote is the single cell that results from the union of a male and female sex cell.



http://www.nicksnowden.net

Cell Division

- Mitosis - is cell division in vegetative tissue (somatic), cell division for growth.
- Meiosis - is a reductive division used during the sexual reproductive cycle to produce the gametes (male and female sex cells).

Cell cycle -

period from the beginning of one cell division to the next.

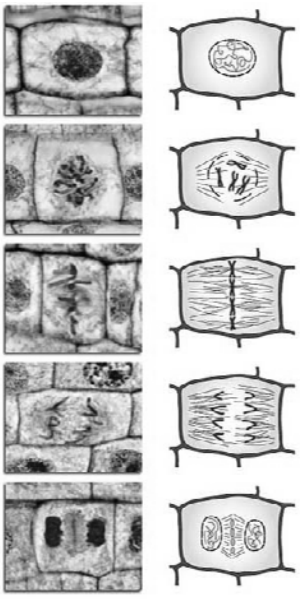
Interphase

Prophase

Metaphase

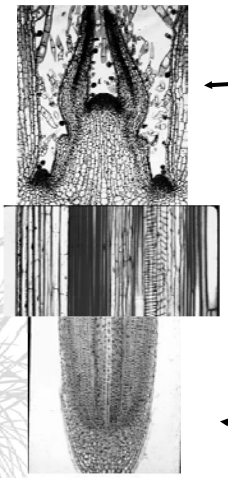
Anaphase

Telophase



http://www.life.illinois.edu

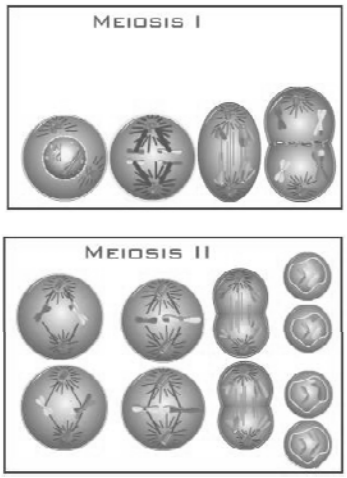
Meristematic Cells



http://www.skidmore.edu/academics/biology/plant_bio/photos/photos/planttissue.html

ag.arizona.edu/hydroponictomatoes/ tomatoz1.gif

Meiosis

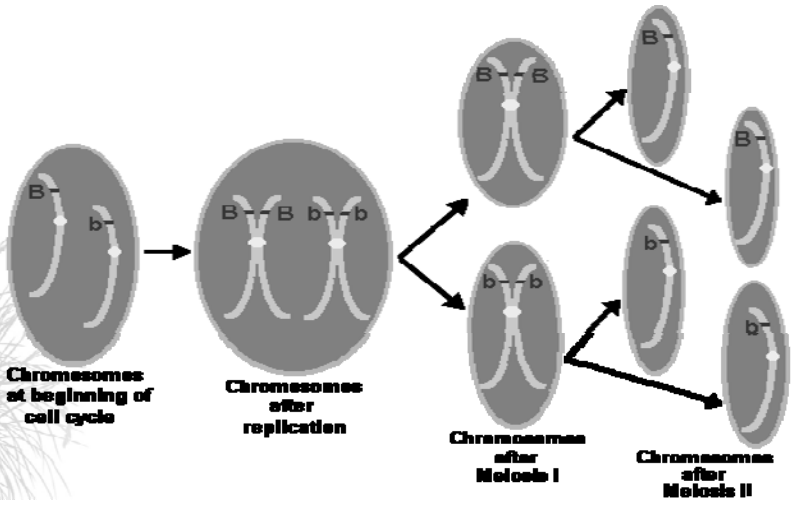


Prophase 1
Metaphase 1
Anaphase 1
Telophase 1

Prophase 2
Metaphase 2
Anaphase 2
Telophase 2

http://www.tutorvista.com

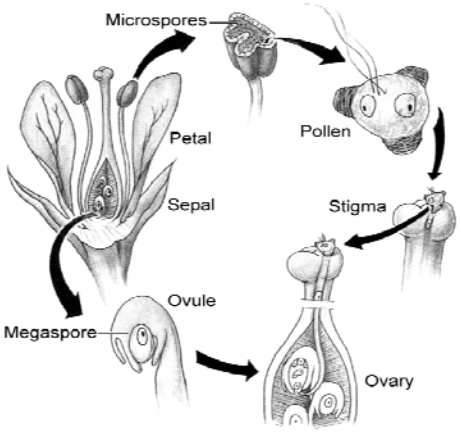
Meiosis



www.ksu.edu/biology/pob/ genetics/meiosis.gif

Sexual reproduction

Meiosis is the process that results in new patterns of genetic variation.



www.geo.arizona.edu

Three opportunities for variation exist:

1. Crossing over - The exchange of chromosome segments
2. The independent assortment of the chromosomes during the later stages of meiosis II (Anaphase 2)
3. The creation of new zygotes during fertilization.

2. Seedling versus Clonal Populations

- Seedling propagation
  - genotype versus phenotype
  - Genetic variation
- Clonal propagation

Seedling Population

a group of plants propagated from seed and originating from the same parental source.

Plants produced from seed are separate individuals, each with a new and unique genotype.

Genotype versus Phenotype

Genotype = the total combination of genes - nuclear, cytoplasmic and mitochondrial.

Phenotype = the overall appearance, performance, and adaptation of a particular plant.

Phenotype = Genotype + environment

Genetic Variation

Dominant - D Recessive - d

Homozygous = gene pairs predominantly the same on homologous chromosomes.

(DD or dd)

Heterozygous = gene pairs predominantly different on homologous chromosomes.

Dd

Genetic Variation

Parental generation: DD (tall) dd (dwarf)

Gametes: D d

F_1 generation: Dd (tall)

Inheritance involving a single pair of alleles in the gene controlling height in the garden pea.

Genetic Variation

Gametes from F_1 male parent

Gametes from the F_1 female parent

	D	d
D	DD	Dd
d	Dd	dd

F_2 generation after self-fertilization
Three tall plants (DD Dd Dd)
One dwarf plant (dd)

Genetic Variation

F_2 generation after self-fertilization
Three tall plants (DD Dd Dd)
One dwarf plant (dd)

Phenotype (Genotype)

Segregation within the F2 generation
- two phenotypes (tall & dwarf)
- three genotypes (DD Dd dd)

Clonal Population

All members of the population have originated by vegetative propagation from a single plant and are expected to possess it's same genotype.

This is possible because of adventitious shoots and roots.

Clonal Propagation

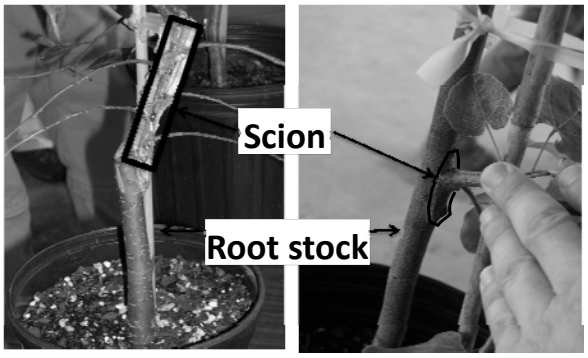
natural adventitious shoot and root production

Adventitious stem on roots of *Ilex*

Adventitious roots on stem of *Hoya*

Clonal Propagation

grafting and budding



Joining separate stems together where one component provides the root system (root stock) and the other the shoot system (scion).

3. How genes impact Plant Propagation

Provide the physical mechanisms by which individual traits and characteristics are reproduced from generation to generation both by seed (meiosis) or clones (mitosis).

How genes impact Plant Propagation

Genes contain the specific directions for regulating the chain of morphological and physiological events that determine the expression of specific traits and characteristics of the phenotype.

4. Gene Regulation

Dr. Dave Clark

- Gene Regulation
- Biotechnology