Lecture 2: Reproduction in Flowering plants

Plant reproduction is the production of new offspring in plants, which can be accomplished by sexual or asexual reproduction.

Sexual reproduction produces offspring by the fusion of male and female gametes, which are genetically different from either parent. This type of reproduction occurs in flowering plants commonly known as angiosperms have the sex organs in which result in producing seeds enclosed in fruit.

Plants have two different multicellular stages in their reproduction life cycles, a phenomenon called **alternation of generations.** These two stages are the multicellular, **gametophyte** (haploid) and **sporophyte** (diploid).

Alternation of generation:

alternation of generations, also called **metagenesis**, is the alternation of a sexual phase and an asexual phase in the life cycle of an organism. The two phases are often morphologically, and chromosomally, distinct.

The haploid **gametophyte** produces the male and female gametes by mitosis in distinct multicellular structures. Fusion of the male and female gametes form the diploid zygote, which develops into the **sporophyte**. After reaching maturity, the diploid sporophyte produces spores by meiosis, which in turn divide by mitosis to produce the haploid gametophyte. The new gametophyte produces gametes, and the cycle continues. This is the alternation of generations, and is typical of plant reproduction.

Sexual reproduction stages:

a. Sporophyte stage (2n)
b. Gametophyte stage (n)

Sporophyte (2n)

This phase in the plant life cycle is asexual, the spore bearing generation of the plant, featuring diploid cells. This means the cells in this phase have two sets of chromosomes. The zygote, fertilized cell, is what conduced to form the sporophyte.

It is defined as the diploid multicellular individual or generation of a plant with alternation of generations that begins from a diploid zygote and produces haploid spores by meiotic division.

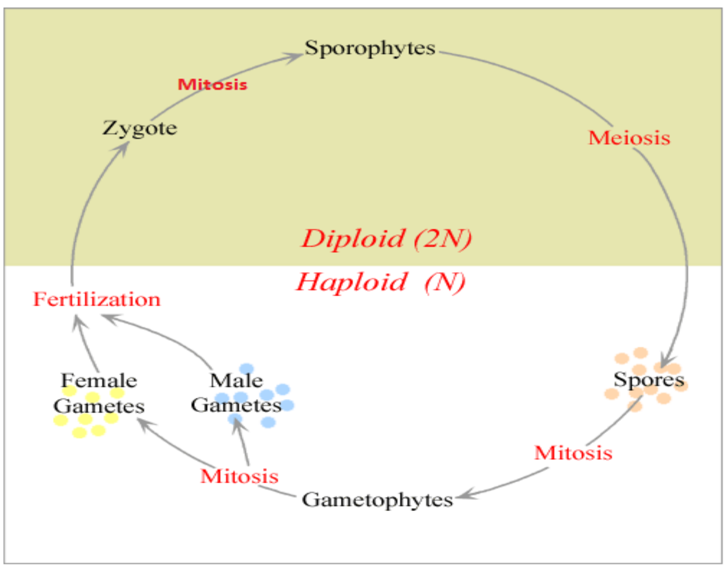
By the process of meiosis (reduction division), the sporophyte produces haploid spores. Since spores are formed in this generation, hence this phase called sporophyte. The haploid spores produced will then form the next gametophyte generation by growing into multicellular, haploid individuals called gametophyte. As we learned the zygote or fertilized cell is diploid, however, the spores formed by them are haploid as a result of meiosis cell division.

Gametophyte (n)

The other alternating phase in the plant life cycle is the gametophyte generation, in which gametes are formed. In this stage the haploid gametes are formed (egg and sperm) (n), having only one set of chromosomes in them. Hence, gametophyte phase is the sexual phase, gamete producing stage.

Spores are the first cells of the gametophyte generation. These spores undergo the process of mitosis results in producing male and female gametes with equal number of chromosomes. When these gametes meet, they fuse together, get fertilized and form the zygote, which is diploid (2n). This diploid zygote then forms the basis of the next alternating sporophyte generation. It forms the first cell of the diploid sporophyte generation. Then later forms the haploid spores in the sporophyte generation and the cycle continues in the life cycle of the plant.

Simply it is defined as the sexual phase in the life cycle of plants. It develops sex organs that produce gametes, haploid sex cells that participate in fertilization to form a diploid zygote which has a double set of chromosomes.

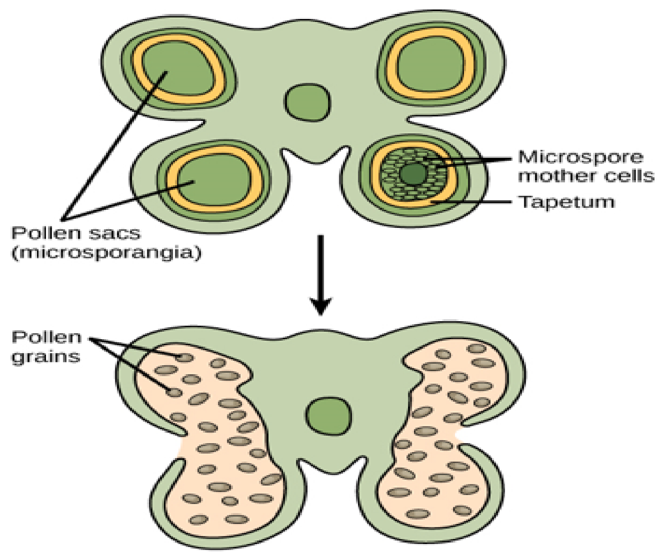


Gametogenesis in Plants

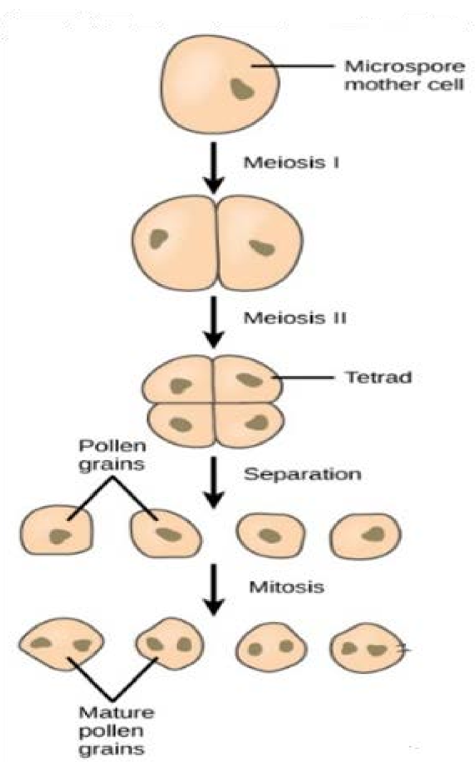
Gametogenesis is a biological process by which haploid male and female gametes are formed which occurs in both plants and animals. In higher plants, there are two stages that are involved- sporogenesis and gametogenesis. Sporogenesis is the formation of spores whereas gametogenesis is the formation of gametes.

Formation of Male Gametes (Micro-gametogenesis)

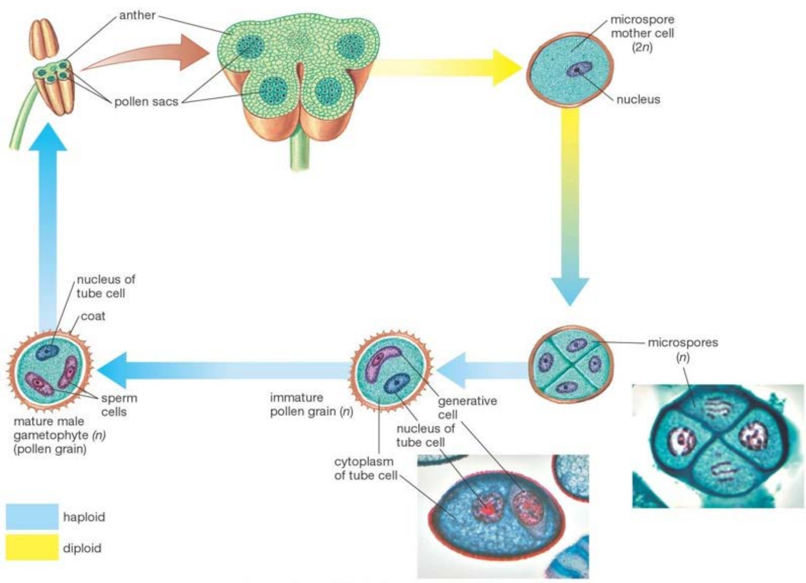
The male gametophyte develops and reaches maturity in an immature anther. In a plant male reproductive organ, development of pollen takes place in a structure known as the **microsporangium**. Each somatic cell in the anther increases in volume then two following division of meiosis occur.



As a result of the two divisions within the microsporangium, the reduction in chromosome number to half give rise to four microspores (male sexual cell), each of them will ultimately form a pollen grain. The nucleus of each cell has a haploid number of chromosome (n). At maturity, the transformation of pollen grains begins after 2-3 weeks from division process. During the formation of mature pollen grain, the nucleus divided one mitosis division produces two nucleuses, the first is generative nucleus and the second is vegetative nucleus or pollen tube cell. Upon germination, the tube cell forms the pollen tube through which the generative cell migrates to enter the ovary. During its transit inside the pollen tube, the generative cell divides to form



two male gametes (sperm cells) (n). Upon maturity, the microsporangia burst, releasing the pollen grains from the anther.



Formation of Female Gametes: (mega-gametogenesis)

While the details may vary between species, the overall development of the female gametophyte has two distinct phases.

First, in the process of megasporogenesis, a single cell in the diploid (2n) **megasporangium** an area of tissue in the ovules undergoes meiosis to produce four haploid (n)megaspores, only one of which survives and increased in volume.

During the second phase the surviving haploid (n) megaspore undergoes mitosis to produce eight (8) nucleuses, distributed differently. Two of the nuclei, the polar nuclei, move to the equator and fuse, forming a single, diploid central cell. This central cell later fuses with a sperm to form the triploid endosperm. Three nuclei position themselves on the end of the embryo sac opposite the micropyle and develop into the **antipodal** cells, which later degenerate. The nucleus closest to the micropyle becomes the female gamete, or egg cell, and the two adjacent nuclei develop into **synergid** cells. The synergids help guide the pollen tube for successful fertilization, after which they disintegrate. Once fertilization is complete, the resulting diploid zygote develops into the embryo, and the fertilized ovule forms the other tissues of the seed.