ST. LAWRENCE HIGH SCHOOL

A JESUIT CHRISTIAN MINORITY INSTITUTION

STUDY MATERIAL -2

Class: XII **Sub: BIOLOGICAL SCIENCE** **Date: 09.06.2020**

Chapter - Sexual Reproduction in flowering plants

Topic _: Structure of Flower and development of male gametophyte

SEXUAL REPRODUCTION IN FLOWERING PLANTS

INTRODUCTION

There are two phases in the life-cycle angiosperms – a diploid sporophytic phase and a haploid gametophytic phase. The plant body, which usually develops from the seed, is well developed from the seed, is well developed and differentiated into root, stem and leaves. It represents the sporophytic phase, a dominant phase in the life-cycle of angiosperms. The sporophyte produces flowers, the reproductive structures of angiosperms. Haploid microspores and megaspores, which are formed in stamens and carpels respectively by reduction division, are the first cells of the gametophytic phase. Microspores give rise to male gametes (sperms) and megaspores to female gametes (eggs). The gametophytic phase is thus very inconspicuous and extremely reduced. The gametophyte is completely dependent upon sporophyte and under no circumstances it can be separated from the sporophyte. The diploid zygote formed by the fusion of male and female gametes restores the sporophytic phase, and it develops into embryo, thus, the flower plays an essential role in the life-cycle of angiosperms.

STRUCTURE OF THE FLOWER

Flowers are some of the most beautiful manifestations of biological diversity. Morphologically, the flower is considered a compressed shoot in which sepals, petals, stamens and carpels are successive lateral organs.

A typical flower has four sets of appendages, the outer two sets are known as **accessory organs** and the inner two sets as **essential organs**. Accessory organs are calyx (sepals) and corolla (petals). Essential whorls are – androecium (stamen) and gynocecium (pistil).

The androecium consists of one or more stamens, the male reproductive structures of the flower. The stamen is typically a slender organ and consists of two more or less distinct parts, a proximal sterile part, the **filament**, and a distal fertile part, the anther. The anther usually consists of four **microsporangia** which contain numerous **pollen grains** (microspores). The strip of tissue that lies between a pair of sporangia is known as **connective**.

The gynoecium, made up of one or more carpels, is the female reproductive organ of the flower. The carpel is divided into a proximal ovule bearing part, the **ovary**; a distal pollen receptive part, the

stigma and a median sterile part, the **style**. The ovary has one or more chambers, known as **locules**. The region where ovules are attached is usually more or less enlarged and is said to be placenta. The pattern of ovule arrangement in the ovary is called **placentation**.

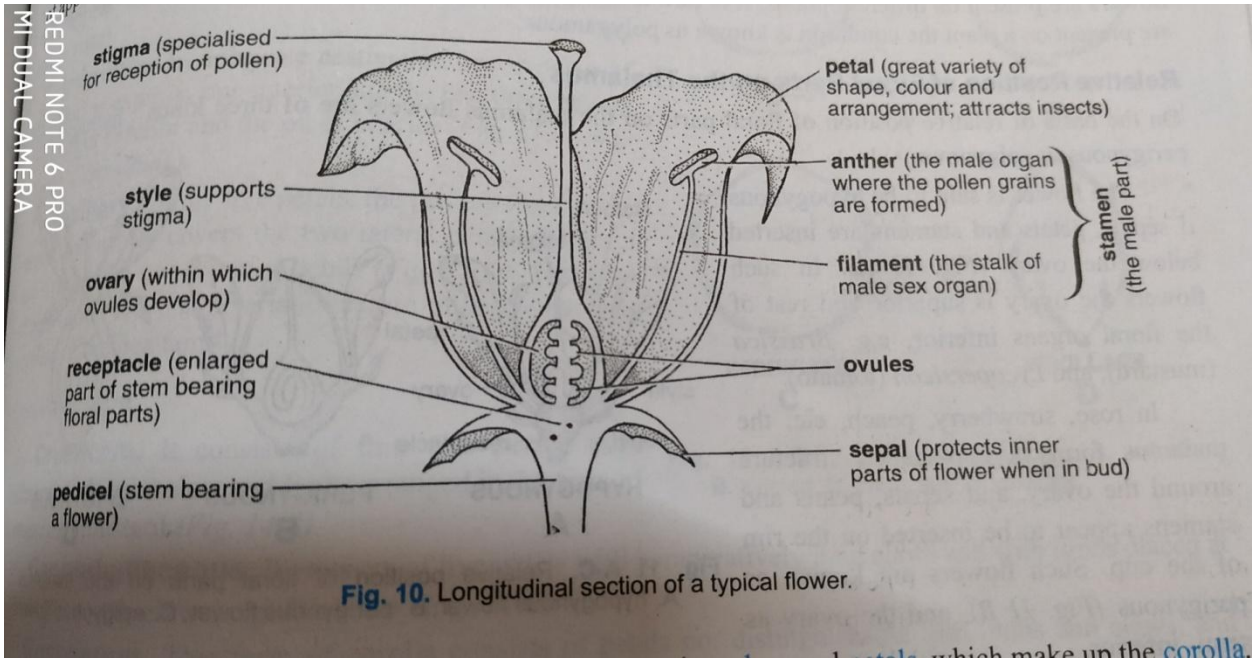


Fig. 10. Longitudinal section of a typical flower.

DEVELOPMENT OF GAMETE PRODUCING AND MALE GAMETOPHYTE

The anther shows great variety in form but a typical anther has two anther lobes. Each anther lobe has characteristically two pollen chambers (microsporangia). A large number of pollen grains (microspores) are present in each microsporangium.

STRUCTURE OF ANTHER AND FORMATION OF MICROSPORES

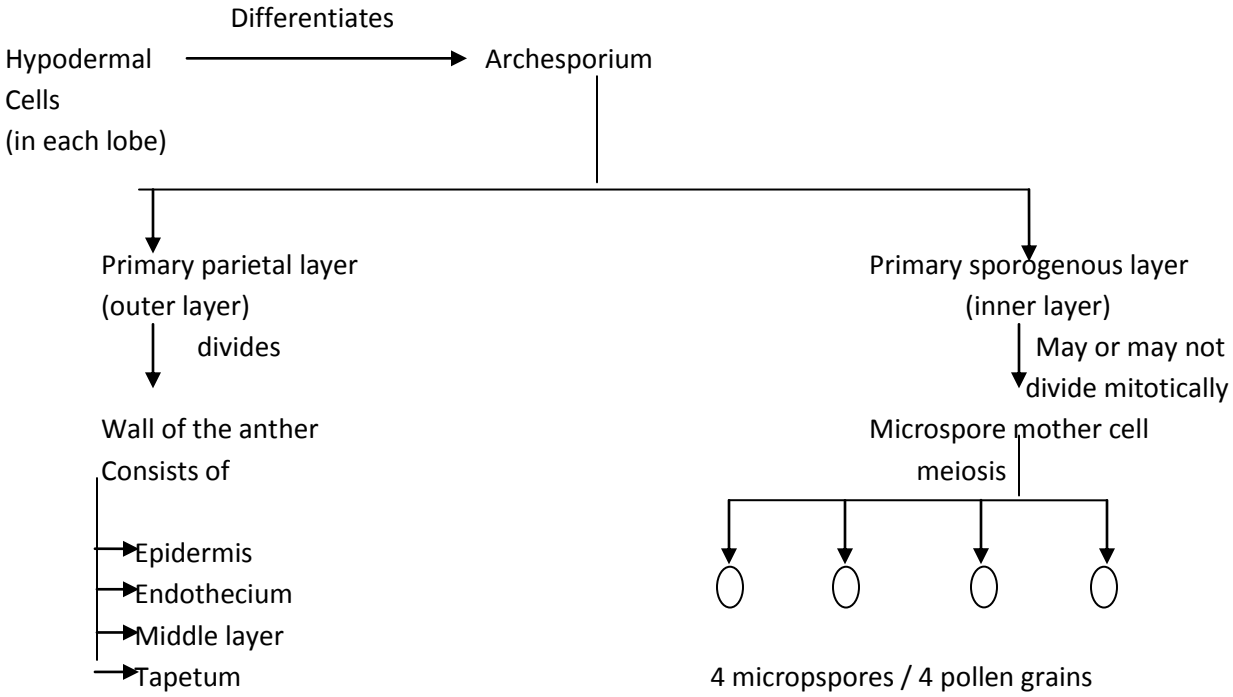
A young anther usually becomes four lobed at an early stage of development. Some hypodermal cells become distinct in each lobe. These cells, known as **archesporium**, divide periclinially, forming a **primary parietal layer** towards the outside and a **primary sporogenous layer** towards the inside. The primary parietal layer divides again forming a variable number of cell layers, which form the wall of the anther.

The wall of the anther is thus made up of **an epidermis, an endothecium, one or more middle layers and usually a single layer of tapetum**. The epidermis comprises of tangentially stretched cells. The endothecium has columnar cells and the radial and inner tangential walls of these cells have characteristic fibrous thickening bands. The cells of the middle layers are ephemeral and degenerate before the pollen mother cells undergo meiosis. The tapetum, which encases the sporogenous tissue, has densely cytoplasmic cells which may be multinucleate. It serves as a nutritive tissue for pollen mother cells and microspores.

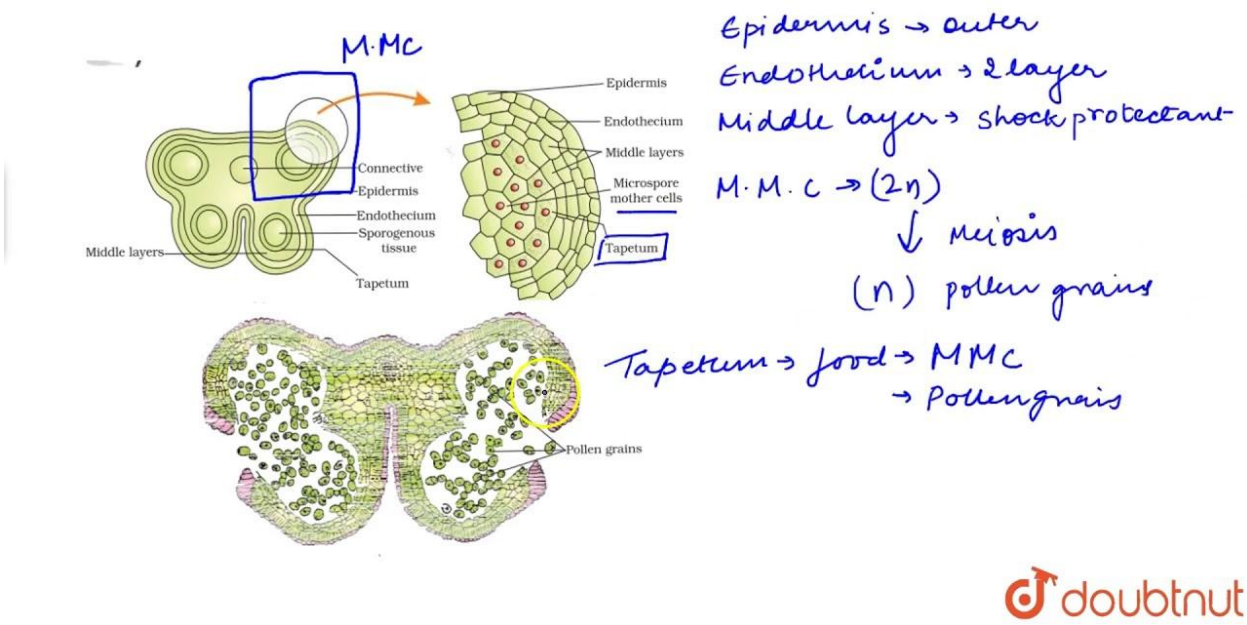
The primary sporogenous tissue may either directly or after dividing mitotically functions as **microspore mother cells**. Each microspore mother cell undergoes **meiosis** and forms **four haploid microspores**.

The process of formation of microspores from the sporogenous tissue is said to be **microsporogenesis.**

Pollen tetrads and structure of microspore : The four microspores formed from a microspore mother cell are usually arranged in tetrahedral or isobilateral tetrads. In tetrahedral tetrads, the four microspores lie at the four corners of a tetrahedron. Thus when seen from an angle, only three are visible and the fourth lies at the back. In isobilateral tetrads, all the four microspores are arranged in one plane. Sometimes, microspores may be arranged in decussate (e.g., *Magnolia*) T-shaped (e.g., *Aristolochia*) or linear (e.g., *Halophila*) tetrads. The microspores of a tetrad usually separate from each other as the anther matures, but sometimes they do not separate and remain stuck together in groups as in *Drimys* and *Drosera*. Such groups are called **compound pollen grains**. In the members of the family Asclepiadaceae, all microspores in a pollen sac form a single mass, called '**pollinium'**. The pollen grains are **uninucleate** when they separate from the tetrad.



SCHEMATIC REPRESENTATION
OF MICROSPOROGENESIS



STRUCTURE OF A POLLEN GRAINS

A pollen grain (microspore) has two wall layers, an outer thick ornamented **exine** and an inner thin **intine**. The exine is chiefly composed of **sporopollenin**, a substance considered to be the oxidative polymer of carotenoids and or carotenoid esters. It is a tough substance providing resistance to physical and biological decomposition and thus checks natural decay of pollen grains. The exine is very thin. It may lack at one or more places. These regions are known as germ pores and the pollen tube emerges through these regions. The intine is composed of pectin and **cellulose** and at the time of pollen germination it protrudes through the **germ pore** and gives rise to pollen tube. Pollen grains are densely cytoplasmic as long as they are in tetrads, but soon after their release from the tetrad they undergo considerable enlargement and their cytoplasm becomes highly vacuolated.

DEVELOPMENT OF MALE GAMETOPHYTE

A pollen grain divides to form two unequal cells, a smaller **generative** cell and a larger **vegetative** cell. The generative cell is initially attached to the intine but later it is detached from the pollen wall and lies free in the cytoplasm of the vegetative cell. The generative cell divides mitotically to form **two non-motile male gametes**.

Each male gamete consists of a large nucleus surrounded by a thin sheath of cytoplasm externally limited by a cell membrane. In most angiosperms the cell membrane is not covered by a cell wall the male gametes are naked.

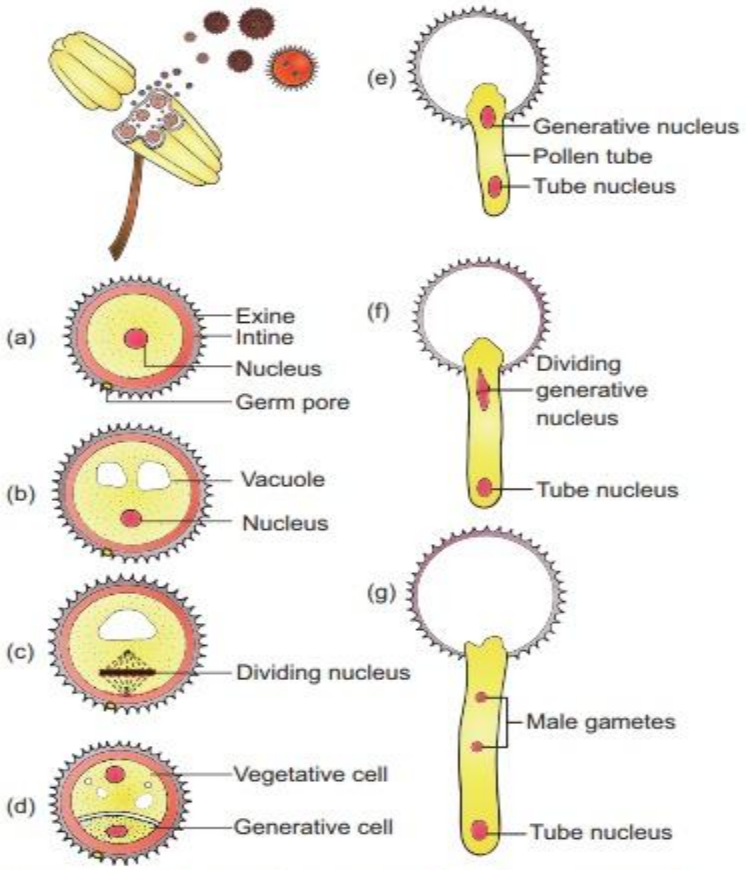


Figure 1.6 Development of male gametophyte

IMPORTANT QUESTIONS FOR H.S. EXAM

Short answer type:

Explain the following terms:

1) Sporopollenin
2) Microsporogenesis
3) Pollenium
4) Tapetum
5) Placentation

Long answer type

1) What is microsporogenesis? Explain with the help of a diagram the process of microsporogenesis.
2) Briefly explain the development of a male gametophyte .At what stage of male gametophyte the pollination takes place?

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