Chap. → 2

Sexual Reproduc^{n} In Flowering plants.

↳ It is the forma^{n} of new individuals through the formation of gametes & fusion of gametes leading to Embryo forma^{n}.

Flowering plants :- Angiosperm → Higher plants

Advantage of Sexual Reproduc^{n} :- Also called → Amphimixis

↳ It involves fusion of male & female gamete.

↳ Genetic Variation & recombination occur.

↳ The possibility of develop. of new characters.

↳ The capacity of Adaptation is more.

Flowering plants :-

- Xylem - Tracheids, Vessels.
- Phloem - Sieve tube, Companion Cells } Muscular tissue
- Double fertilization • Proposed by (Nawaschin)

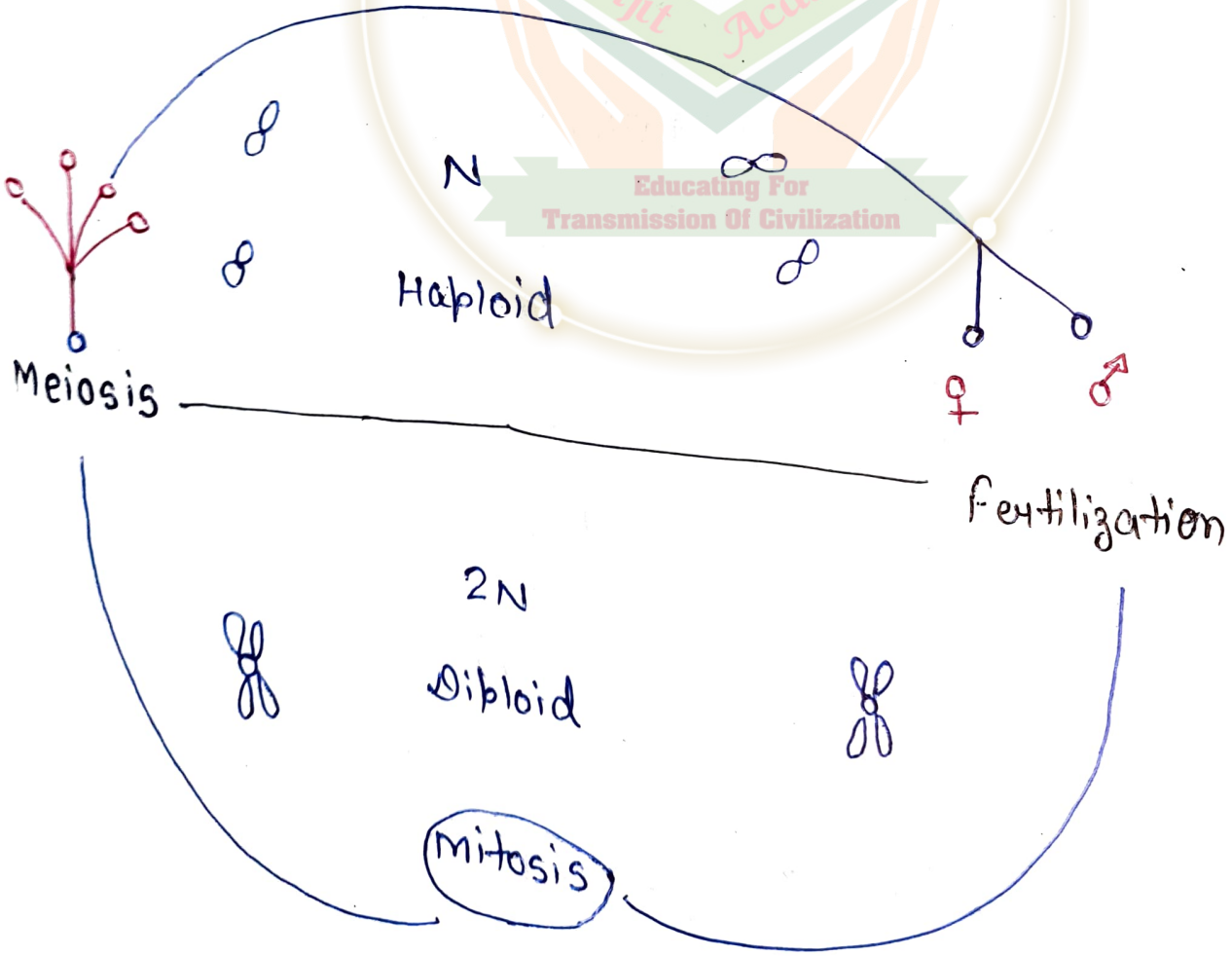
Types of Angiosperms :- They are following "two" types.

Monocot :- One seed coat present.

Eg:- Rice, wheat

Dicot :- Two seed coat present.

Eg:- Gram, Mango, Pea.



Sexual Reproduc^{n} → Amphimixis.

Asexual Reproduc^{n} → Apomixis → Process Sexual reproduc^{n} type, other Asexual reproduc^{n}.

Flowers :- 1) They are modification of a Condensed shoots.

* 2.) This is the type of leaves.

3) It's reproductive part of the plant body.

Structure of Flower.

A flower with Pedicel → Pedicellate.

without pedicel → Sessile.

→ four whorls of floral leaves may be found on a flower.

a) Calyx - Sepals

b) Corolla - Petals

c) Androecium → ♂ reproductive part.

d) Gynoecium → ♀ Reproductive part.

→ **Androecium** :- a) Also Called → Male reproductive part.

b) Androecium Contains → Stamens.

c) Stamen is made up of by → Anther & Filament.

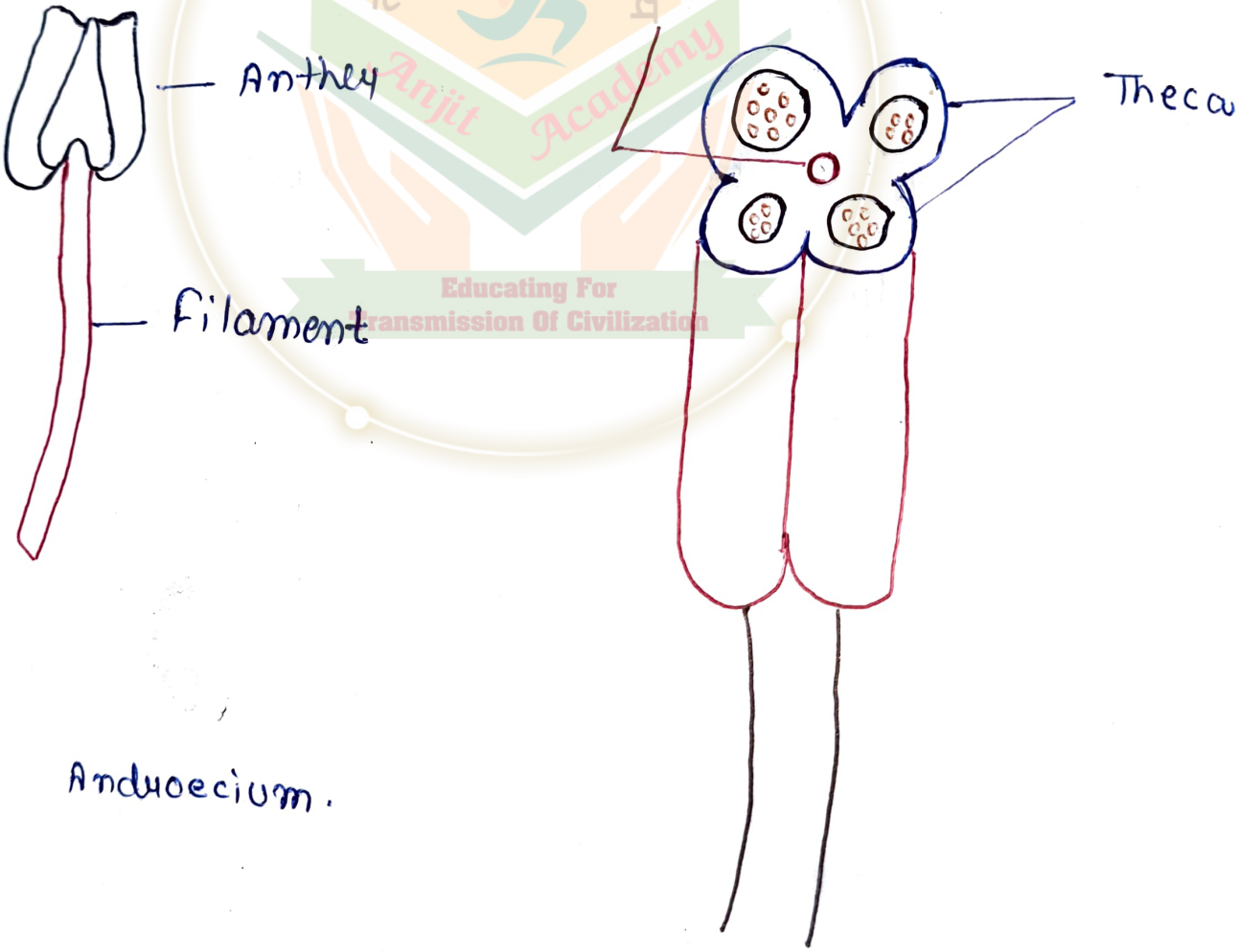


Fig:- Androecium.

Gynoecium :- a) Also called → female reproductive part. (Pistil). / Carpel

b) Gynoecium Contains → OSS — ovary, style, stigma.

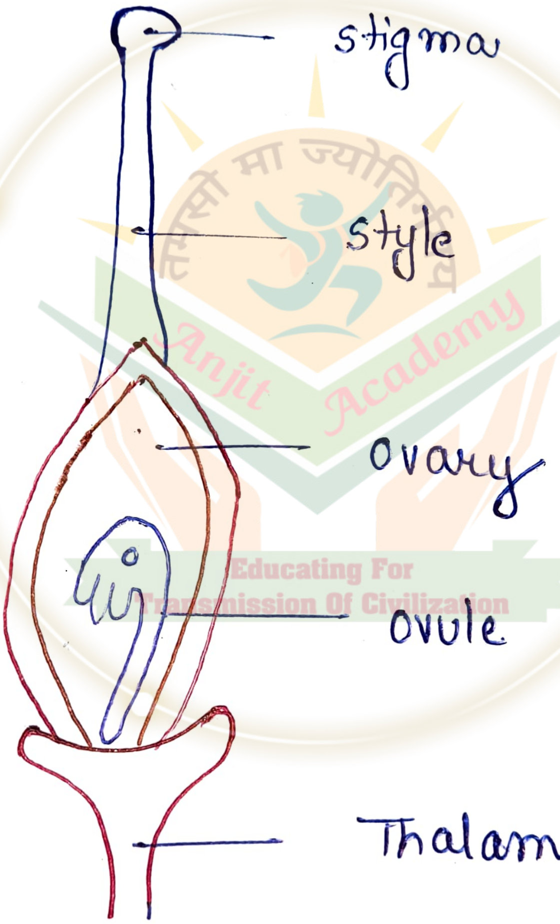


fig :- Gynoecium.

→ Steps of Sexual reproduc^{n} in Higher plants :-

1) Microsporogenesis and megasporogenesis.

2) Pollination.

3) Development of male & female gametophyte.

4) Gametogenesis.

5) Fertilization.

6) Embryogenesis.

Date

Microsporogenesis.

Formation of Anther.

Structure of Anther :-

a) Epidermis → Outer most part.

b) Endodermis → Just below the epidermis.

c) middle layer → Below the epidermis. It is 2 to 3 cell thick layer.

d) Tapetum →
1) Below the middle layer.
2) Just outside the pollen chamber.
* 3) They are diploid cell.
4) They are nutritive tissue, nourishing the developing microspores.

Microsporangia → 1) Present on the Inner side of tapetum.
* 2) It Contains a large no. of pollengrains.

Structure of Anther

↓

Bilobed

↓

Each anther lobe has

↓

Two Theca - (Sac like struc.)

↓

Each Theca has → [After maturation they are - fuse with each other.]

↓

One Microsporangia

↓

Anther is

Tetrasporangiate

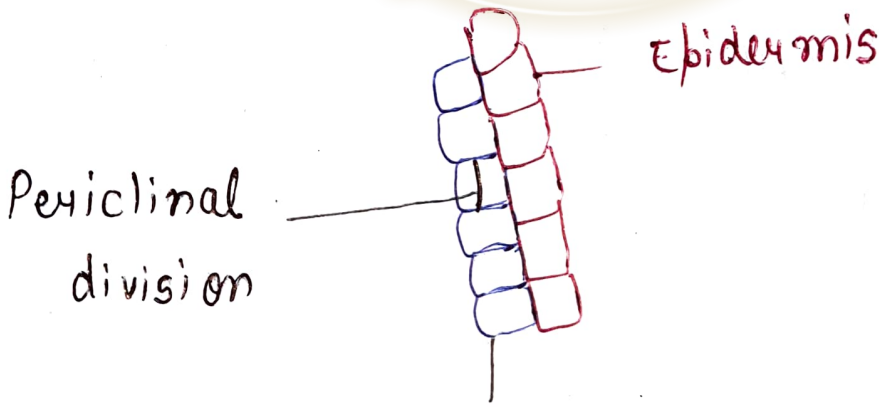
Structure of Microsporangia :-

① The development of microsporangia in Angiosperms is Eusporangiate- (Multi cell - microspore)

② The archesporial cells, → (Anther primordium) ↓ Cross cut show periclinal division & gives rise to.

a) outer parietal cells.

b) Inner sporogenous cells.



Archesporial Cell

Parietal Cells (Sub-epidermal) forms outer wall layers.

Sporogenous Cells (Inner) differentiate into microspore mother cells.

Parietal Cell

Sporogenous → Formation of pollen grains

* The parietal cells given by periclinal division to produce a 3-5 layers wall of microsporang

* The wall Consist of Endothecium, middle layers & Tapetum

Microsporogenesis :-

Archesporial Cell

↓ Mitosis

Sporogenous Tissue

↓ Mitosis

Pollen mother cell - PMC

Or

Microspore mother cell - MMC

↓ Meiosis

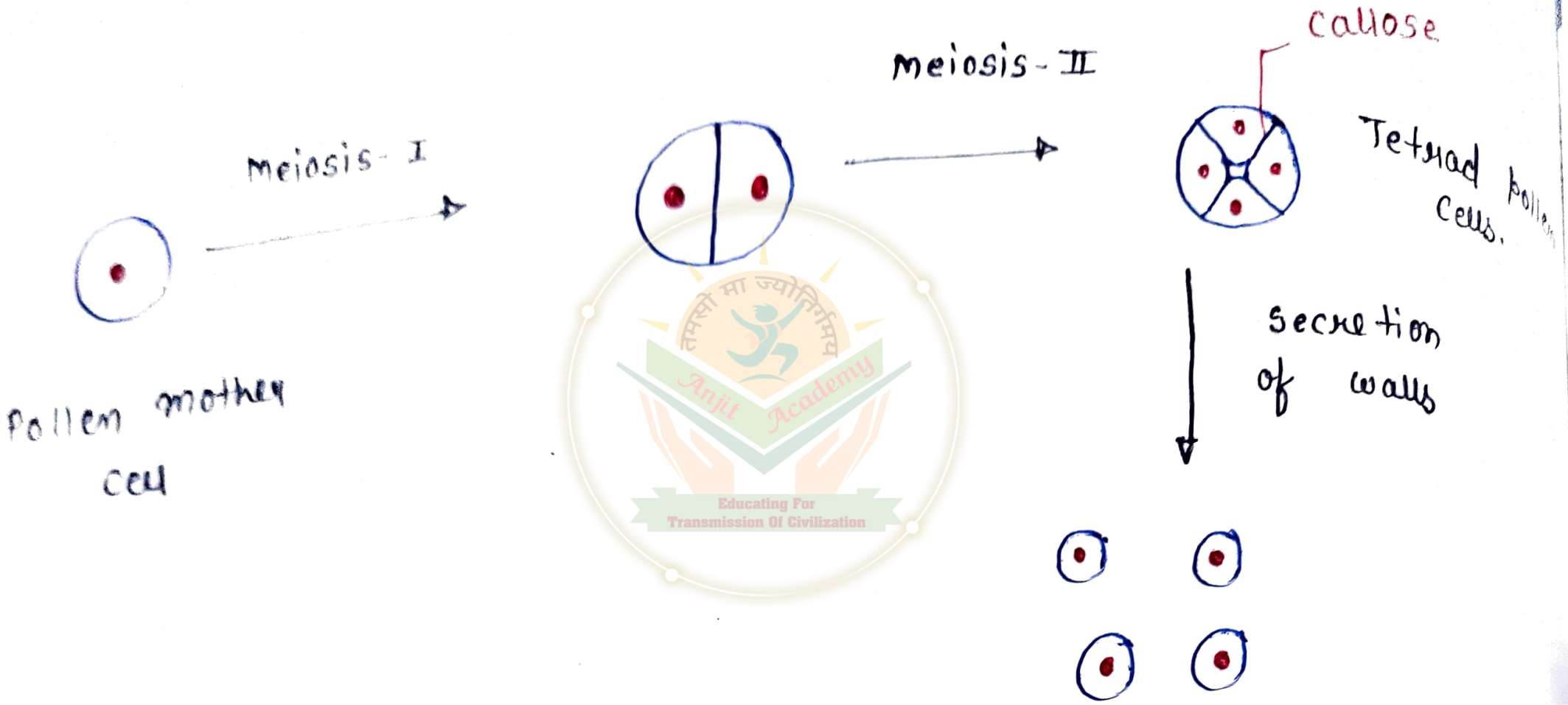
Tetrad of microspore

↓

Rounding off of individual pollen grain.

↳ MMC or microsporocytes develop an internal layer of Callose : (β - 1,3 glucan).

↳ This layer breaks the plasmodesmatal connections b/w the cells.



Arrangement of microspores :- The 4 microspores developing from a microspore mother cell may be arranged in following ways :-

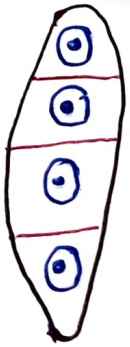
1) Isobilateral (monocot) :- The 4 microspore lie side by side.

2) Tetrahedral (dicot) :- Microspore are arranged tetrahedrally.

3) Decussate :- In this type, the upper & lower pairs of microspores are arranged in opposite direction.

4) T - Shaped :- In this type, the upper two microspores are horizontally in position, while lower two are Vertically arranged.

5) Linear :- The four microspores are arranged on a vertical axis.



Structure of Pollen grain :- Microspore

Microspore are generally spherical, measuring about 25-50 micrometers in diameter.

It has two layered wall.

Outer wall layer

↓

Thick, rigid & ornamented

↓

Called, Exine

↓

This layer is formed mainly by → Sporopollenin.

↓

It is covered by a yellowish viscous & sticky subs. Called → Pollenkit

Inner layer

↓

Thin, Continuous, soft & Elastic in nature.

↓

Called, Intine

↓

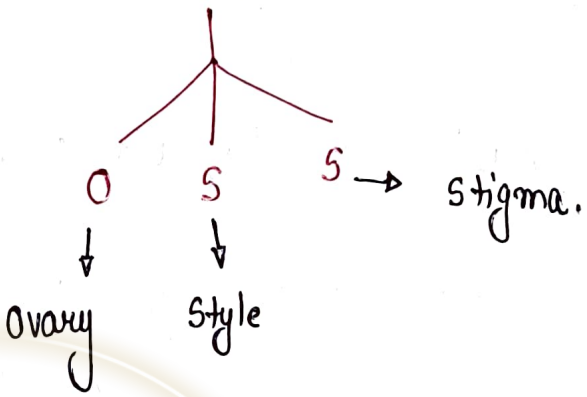
It's made up of pectin, Cellulose,

* Study of pollen grains is Called → Palynology.

Female Gametophyte

1) Gynoecium is the female reproductive organ.

2) F.R.O. also called as → Carpel, Pistil.



Structure of megasporangium :-

↳ Ovule is also K/a → megasporangium.

↳ Each ovule is attached to the placenta by stalk called → Funicle, Funiculus & Funiculum.

*

↳ Junction b/w ovule & funicle., is called → Hilum.

↳ The main region of the ovule is composed of mass of parenchymatous cells, called → Nucellus.

↓

It's the main part of ovule.

↳ The nucellus is covered by one or two coats or protective envelops. Called → Integuments.

↳ The integuments are incomplete at the apex of ovule forming a pore, called → Micropyle.

↳ opposite the micropylar end, is the Chalaza, representing the basal part of the ovule.

↳ Embedded inside the nucleus & towards the micropylar end, there is a large oval sac consisting of few cells, called → Embryo sac.

↓

It contain 8 cells

↓

Out of 3 cells formed Egg apparatus.

* Two polar nuclei situated at the center of Embryo sac & 3 cells at the chalazal end K/a → Antipodal cells.

→ Development of ovule :-

↳ In the beginning of this process, nucellus develops from the placenta in the form of a small rounded out growth like structure.

↳ Any one Hypodermal cell of nucellus differentiates & increases in size. It is called → Archesporial cell

↳ Archesporial cell forms → a primary parietal cell.
→ primary sporogenous cell.

* → The primary sporogenous cell directly acts as a megaspore mother cell. (at micropylar End).

↳ MMC is large cell with dense cytoplasm and a prominent Nucleus.

MMC divides meiotically to form, four haploid → megaspores.

→ Megasporogenesis :- a) The process of formaⁿ of megaspores from MMC. i called → megasporogenesis.

b) The four haploid megaspore are generally a in linear tetrad.

* c) In a majority of flowering plants the low a chalazal megaspore remains functional, 4 - megaspores. & the other three which towards the micropyle degenerate

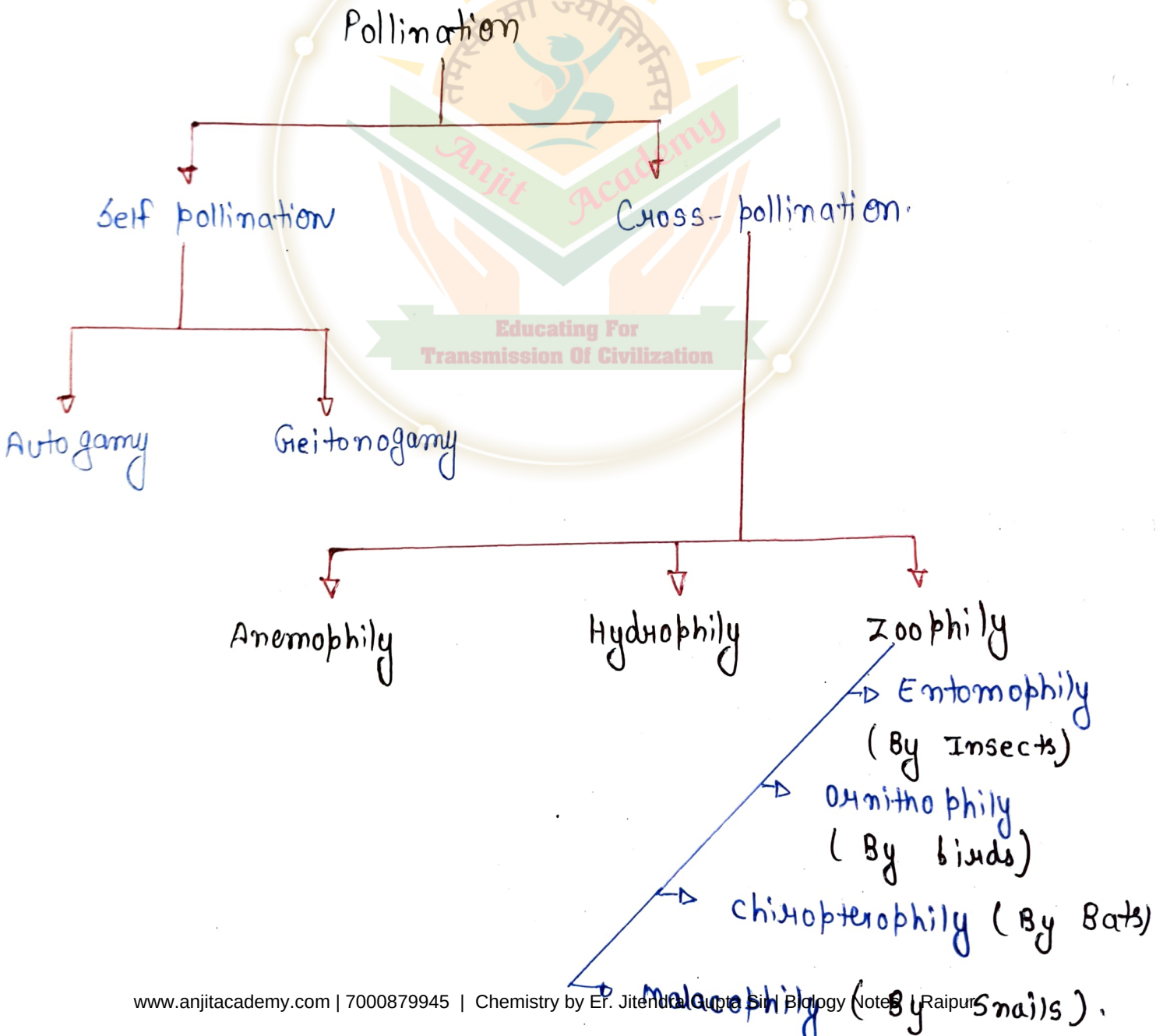
d) The functional megaspore produces → femal

e) This method of Embryo Sac formaⁿ from megaspore called → Monosporic develop.

Pollination

↳ Transfer of pollen grains from anther to the stigma

Kinds of pollination :— Pollination is of different types :- on the basis of source of pollen.



Self pollination

The transfer of pollen grains from anthers to the stigma of the same flower is k/a → self pollination.

Types of pollination :-

1) Autogamy → when a flower is pollinated by its own pollen.

Ex:- Wheat, Pea, Rice. etc.

2) Geitonogamy → when pollen grains from one flowers are transferred on the stigma of another flower on the same plant.

Ex:- Onion, broccali, spinach.

Cross pollination

1) Also called as → Allogamy.

2) Transfer of pollen grains from the anthers to the stigma of flower of the same species.

Types :- Cross pollination

Abiotic

Anemophily → By air
Ex:- Maize, Sugarcane, Bamboo, grasses.

Hydrophily → By water
Ex:- Vallisneria, Hydrilla.

Biotic.

→ Entomophilly → By Insects.
Ex:- Babul, Touch me not, Bougainvilea.

→ Ornithophily → By birds.

→ Chiropterophily → By Bats.

→ Malacophily → By Snails.

Self Incompatibility

or

Pollen - Pistil Interaction.

a)

↳ Incompatibility → Inability of pollen grains to germinate on a stigma.

b) It's Very Common phenomenon in Nature.

c) Self incompatibility is the phenomenon in which pollen grains fail to germinate on the stigma of the flower that produced them.

Significance :- 1) The process of inbreeding & outbreeding is controlled by this.

2) It favours the produc^{n} of healthy & more viable seeds.

3) Due to this process, new combination of genes are produced in every generation.

Fertilization

It is the process of fusion of two dissimilar sexual reproductive units, called → gametes.

After pollination, fertilization takes place in the following steps.

1) Germination of pollen grains :- a) After pollination when the pollen grains reach the stigma they absorb moisture & swell up.

b) The intine grows out through a germ pore in the form of a germ tube / pollen tube.

c) The growth of pollen tube is stimulated by sugary substances secreted by stigma.

2) Course of pollen tube :- They are following "four" types.

1) Siphonogamy :- Pollen tube moves towards the micropyle of the ovule and enter through style.

2) Porogamy :- Pollen tube enters the ovule through the micropyle.

3) Mesogamy :- Pollen tube enters the ovule through integuments.

4) Chalazogamy :- Pollen tube enters inside Embryo sac through Chalazal end of ovule.

3) Entry of pollen tube into Embryo sac & fusion of gametes :- a) The fully developed Embryo sac at this stage Consist of 3- Antipodal cells and Secondry Nucleus, 2 - Synergids, one Egg Cell.

b) Pollen tube penetrates through the Nucellus & enters into the Embryo sac.

4.) Discharge of male gametes :- a) After Entry of pollen tube into Embryo sac.

b) The tip of pollen tube : dissolves & the two male gametes are discharge.

5) Fusion of male & female gametes :- a) After discharge,

One fuses with the Egg Cell to form Diploid zygote/oospore. While the other moves to the Secondry nucleus.

b) The fusion b/w male & female gametes is Called → Syngamy/ Fertilisation.

*

c) The Second male gamete fuse with Secondry nucleus (2n) to give rise to Endosperm nucleus (3n).

d) The fusion b/w Second male gametes & Secondry nucleus is Called → Triple fusion.

Double - Fertilization.

↳ It is the characteristics feature of Angiosperms.

↳ The two male gametes formed inside the pollen tube are different in their size.

↳ The larger male gamete fuse with Secondry Nucleus.

↳ While smaller male gamete fuses the Egg forming Zygote.

*

→ The Double fertilization/fusion b/w the diploid (2n) Secondry nu. & haploid (n) male gamete results into the formaⁿ of Triploid Endosperm Nucleus (3n).

Significance :-

1) The Triploid nu. (Endosperm Nu.) developed to form an Endosperm, which provides nourishment to Embryo.

2) Being triploid in nature, the Endosperm is capable of absorbing food materials.

3) The development of Embryo & Endosperm is interdependent on each other.

Development In flower after Fertilisation

→ Also called as Post - Fertilisation events.

↳ Develop. of Endosperm.

↳ Develop. of Embryo.

↳ Develop. of Seed.

→ Endosperm :- a) Endosperm develop. procedes Embryo develop.

* b) Endosperm is a triploid struc.

* c.) It's formed by Double fertilisation or triple fusion.

d.) Endosperm is a nutritive struc. which is meant for nourishing the Embryo in seed plants.

e) The seed without Endosperm → Exalbuminous.
Ex:- bean, Pea, Radish sunflower

f) The seed with Endosperm → Albuminous.
Ex: most monocots → grass, palms.

Types of Endosperm :- 3 - types.

1) Free Nuclear Endosperm → a) very common.

Ex:- Poaceae , Asteraceae.
↓ ↓
Pea Aster
Sun-flower.

2) Cellular Endosperm →

Ex:- → Datura , petunia.

3) Helobial Endosperm → Ex:- → Vallisneria , Asphodelus.

Development of Embryo

↳ Embryo develops at the micropylar end of the embryo sac where zygote is situated.

↳ The process of development of embryo from the zygote is called → Embryogenesis or Embryogeny.

↳ Most zygote divide only after certain amount of endosperm is formed. This is an adaptation to provide assured nutrition to the developing embryo.

↳ The embryonal cell divides by mitotic divisions to gives rise to the proembryo & subsequently to the globular, heart shaped & mature embryo.

Dicot - Embryo.

1) A typical dicot Embryo consists of an Embryonal axis and Two Cotyledons.

2) Embryonal axis → a) Axis present b/w plumule and radicle is called → Embryonal axis.

b) Also C/a → Tigellum. [main Embryonal axis]

3) The portion of Embryonal axis Above the level of Cotyledons. is K/a → Epicotyl. → It terminates → Plumule.

4) The portion of Embryonal axis below the level of Cotyledons, is K/a → Hypocotyl. → It terminates → Radicle.

) Embryo develop. in Dicots :-

Crucifer type

Monocot - Embryo

→ It possess only one cotyledon, called → Scutellum that is situated towards one side of the Embryonal axis.

→ At its lower end, the Embryonal axis has the radical & root cap enclosed in an undifferentiated sheath called → Coleorrhiza.

→ The portion of the Embryonal axis above the level of attachment of scutellum → Epicotyl

→ Epicotyl has a shoot apex, and a few leaf primordia, called → Coleoptile.

Seed.

→ In Angiosperms, the seed is the final product of sexual reproduc^{n}.

→ It is fertilised ovule.

* → Seeds are formed inside fruits.

→ A seed Contain.

Seed coat — cotyledon — an Embryo axis.

* → when, the general metabolic activity of the Embryo slow down. The Embryo may Enter a state of Inactivity, Called → Dormancy.

* → The wall of Ovary develops into the wall of fruit, Called → Pericarp.

→ False fruit :- A fruit formed from other floral parts.

Ex :- Apple, Strawberry, Cashew.

→ True fruit :- A fruit formed from fertilised ovary.

Ex:- watermelon, lemon, cherry, blueberries.

→ Parthenocarpic fruits :- a) There are a few species in which fruits develop without fertilisation.

b) This process is k/a → Parthenocarpy.

c) Ex:- Banana, pineapple, grape, orange, cucumber etc.

Apomixis :— It is a form of asexual reproduc^{n} that occurs via seeds, in which Embryo develop without fertilisation.

Ex:- Blackberries, grass, hawkweeds.

Polyembryony :— The forma^{n} of more than one Embryo from a single fertilised ovum or in a single seed.

Ex:- Mango, Jamun.