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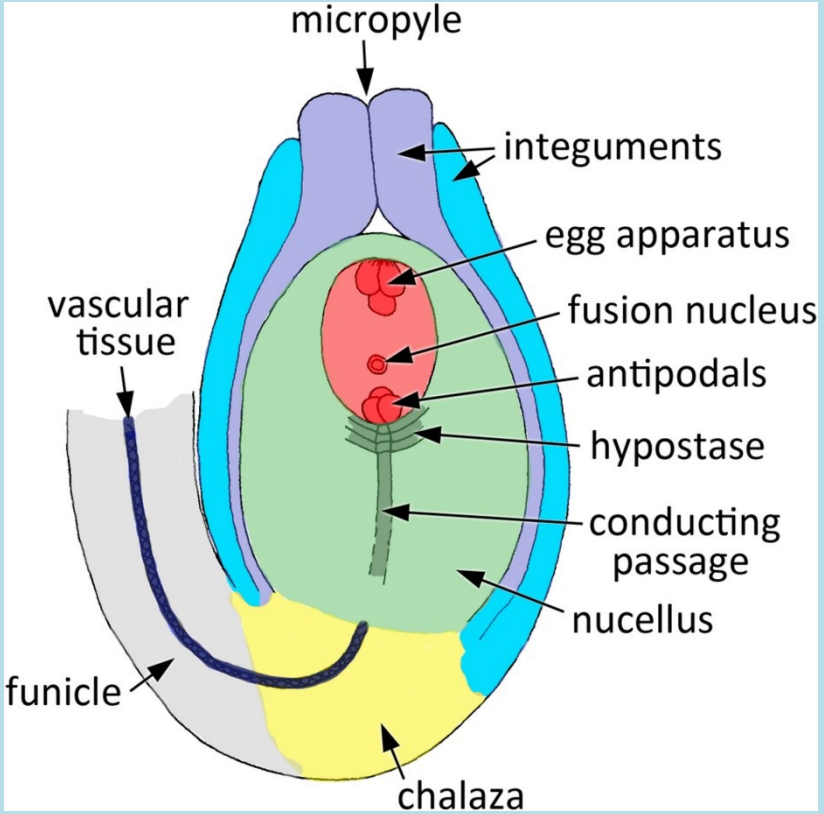

Megasporogenesis Types & Development of Female Gametophyte

DEPARTMENT OF BOTANY

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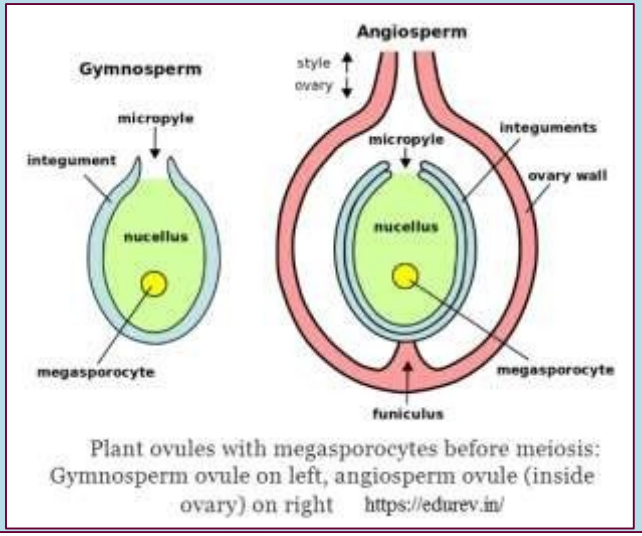
Megasporogenesis

Megasporogenesis is the process of formation of megaspores from the megaspore mother cell.

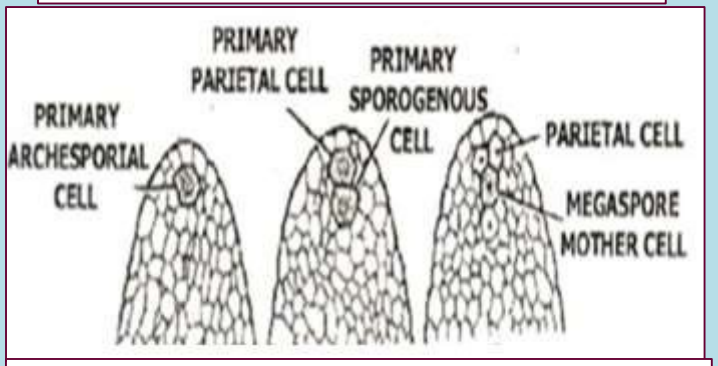
→ In the hypodermal region of nucellus towards the micropylar end develops a primary archesporial cell.

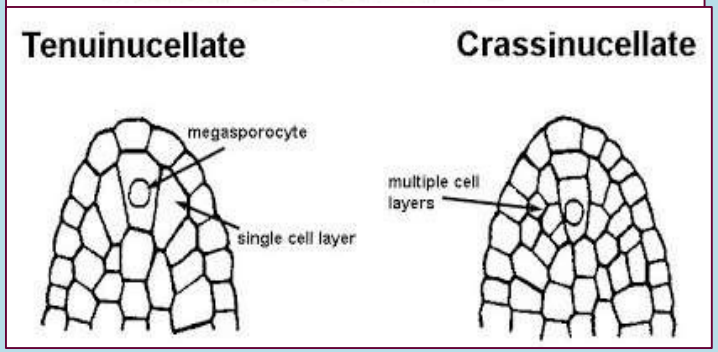
→ The archesporial initial either acts directly as a megaspore mother cell or divides periclinally into an outer primary parietal cell and the inner primary sporogenous cell which later functions as megaspore mother cell (MMC).

Gamopetalae – Tenuinucellate type & Polypetalae – Crussinucellate type



Plant ovules with megasporocytes before meiosis: Gymnosperm ovule on left, angiosperm ovule (inside ovary) on right https://edurev.in/





The MMC is large and contains a dense cytoplasm and a prominent nucleus. It undergoes meiosis to produce four megaspores.

Step wise events in Megasporogenesis

Mega Spore Mother Cell (MMC)

Megasporo genesis

↓ meiosis

Megaspore tetrad

3 degenerate & 1 remain functional

↓ 1st Mitosis

2 nucleate embryo sac

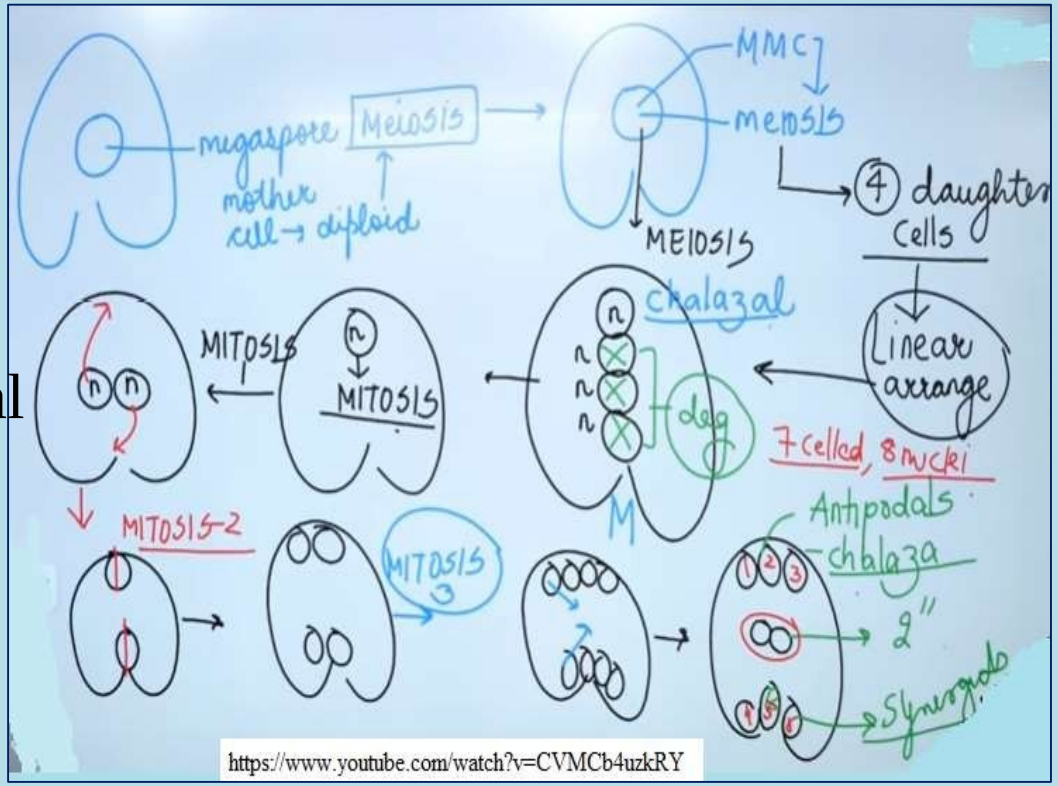
↓ 2nd Mitosis

Megaga metogen esis

4 nucleate embryo sac

↓ 3rd Mitosis

8 nucleate embryo sac



7 Celled , 8 nucleate Embryo sac

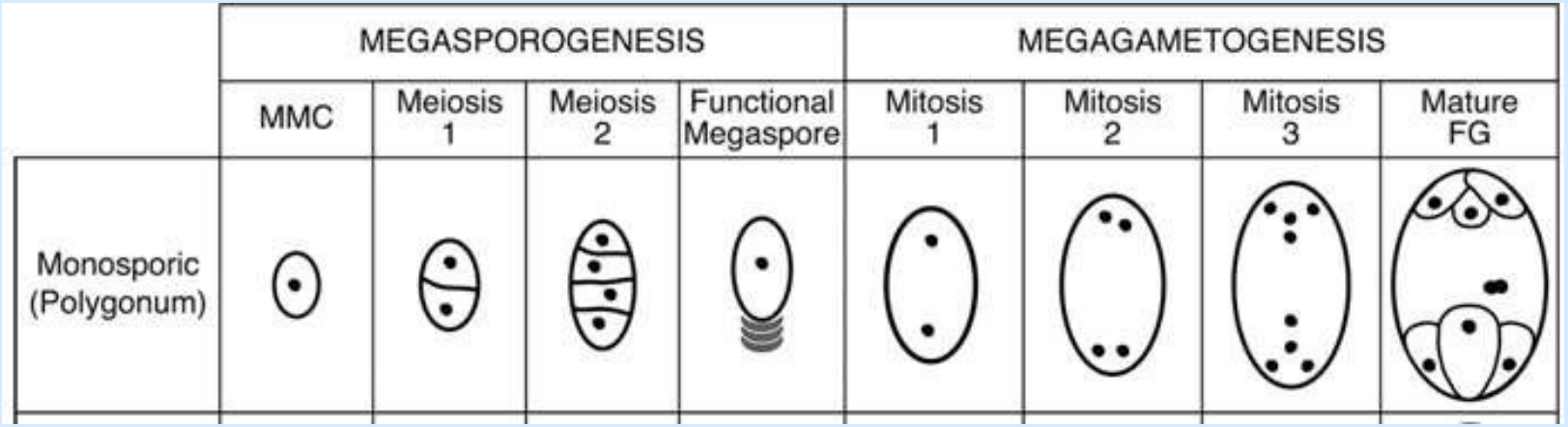
Megagametogenesis : It is the process of the female gametophyte, or megagametophyte, in plants. During the process of megagametogenesis, the megasporogenesis, develops into the embryo sac, which is where the female gamete is housed. which is formed during

→ Patterns of megasporogenesis in Angiosperms

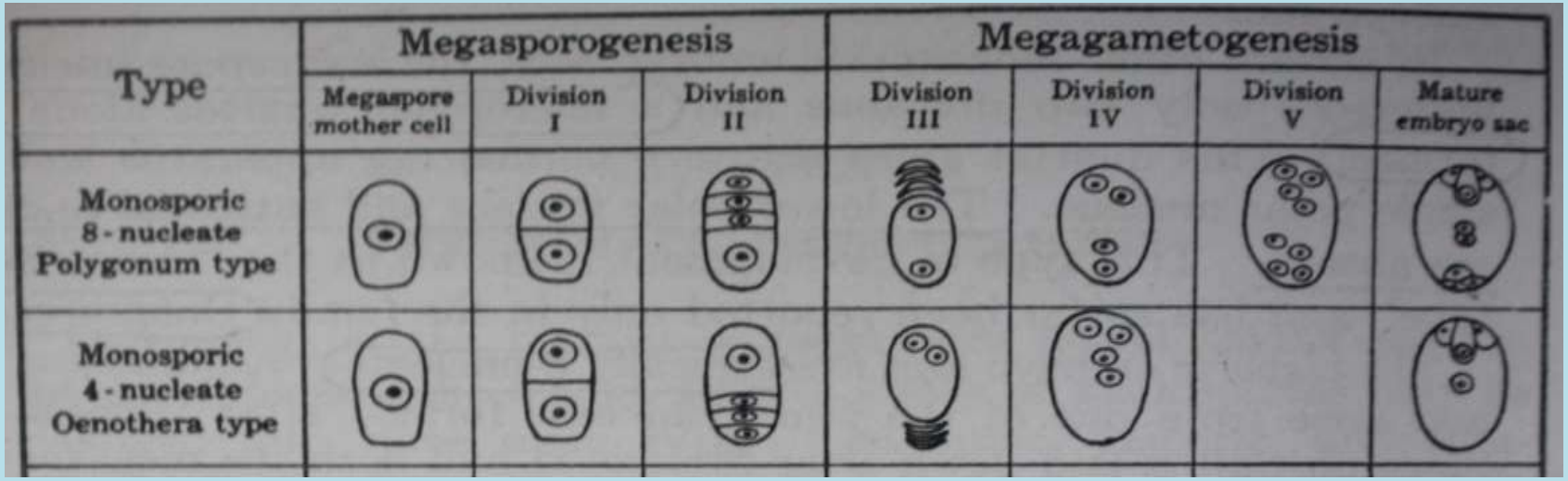
→ Monosporic –

→ Bisporic and

→ Tetrasporic



Monosporic pattern - most common - both meiotic divisions are accompanied by cell plate formation - resulting in four one-nucleate megaspores - three megaspores, generally the micropylar-most megaspores, undergo cell death



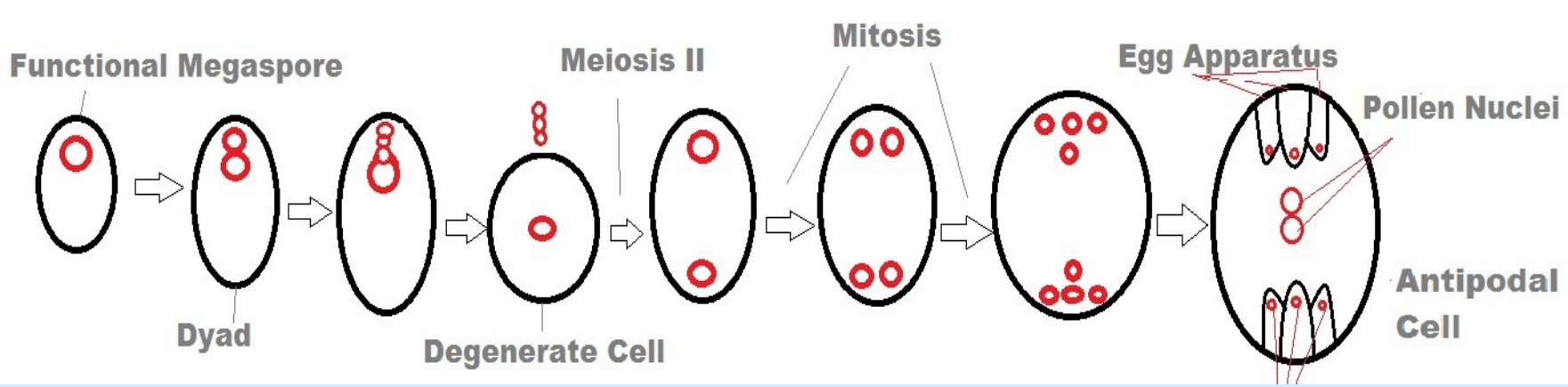
Type	Megasporogenesis			Megagametogenesis			
	Megaspore mother cell	Division I	Division II	Division III	Division IV	Division V	Mature embryo sac
Monosporic 8-nucleate Polygonum type							
Monosporic 4-nucleate Oenothera type							

1. Polygonum Type: 8 Nucleate & 7 celled embryo sac
2. Oenothera Type: 4 nucleate – one in central cell & 3 in egg apparatus; Antipodal cells absent; Endosprem Diploid

Bisporic embryo sac pattern :

Development of embryo sac by megaspores

- ✓Allium Type – Chalazal megaspores
- ✓Endymion – Micropylar megaspores

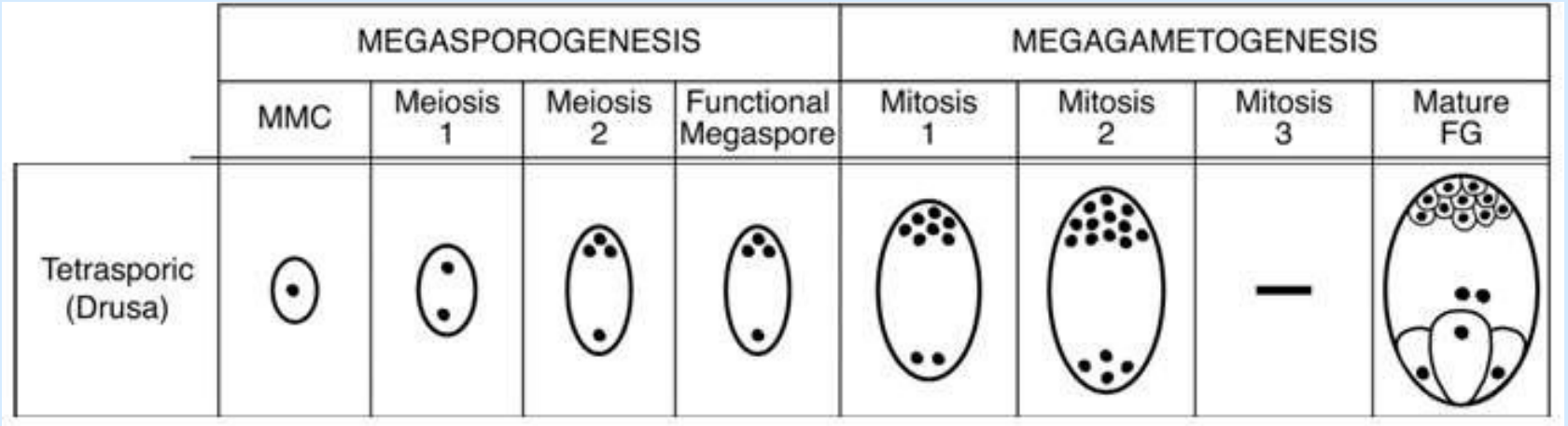


Tetrasporic embryo sac :

embryo sac both the meiotic divisions karyokinesis not followed by cytokinesis.

→ All the four haploid nuclei at the end of meiosis are enclosed in a common cytoplasm forming a **coeno-megaspore.**

→All the 4 nuclei take part in formation of 7 celled & 8 nucleate embryo sac.

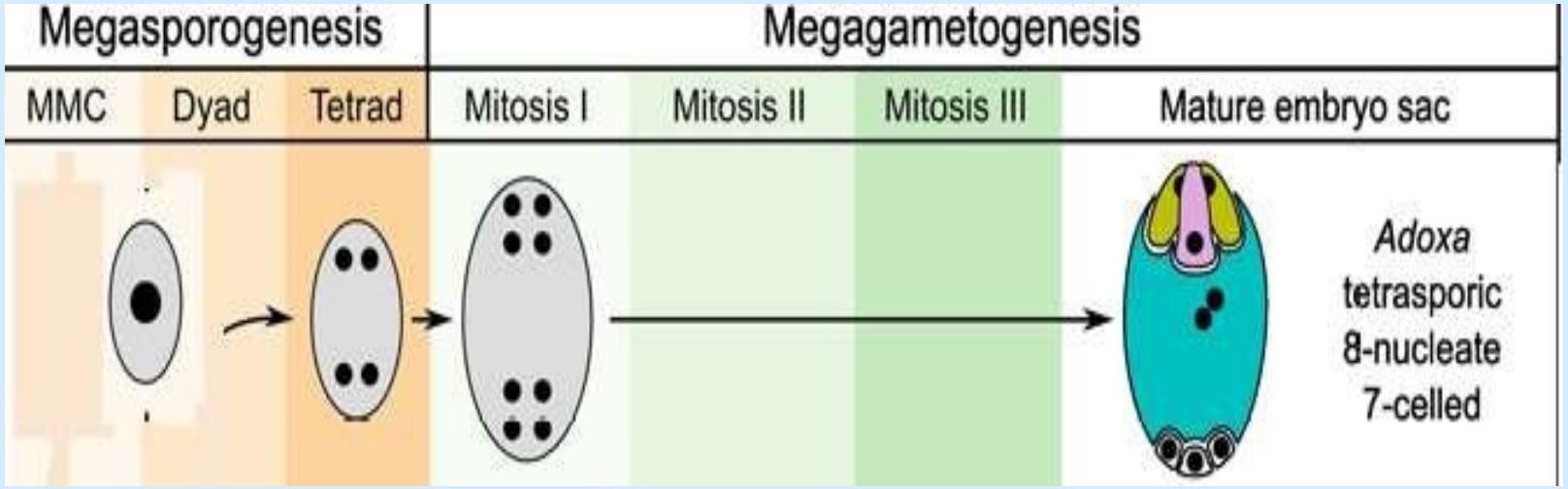


Tetrasporic embryo sac types: (based on the arrangement of nuclei)

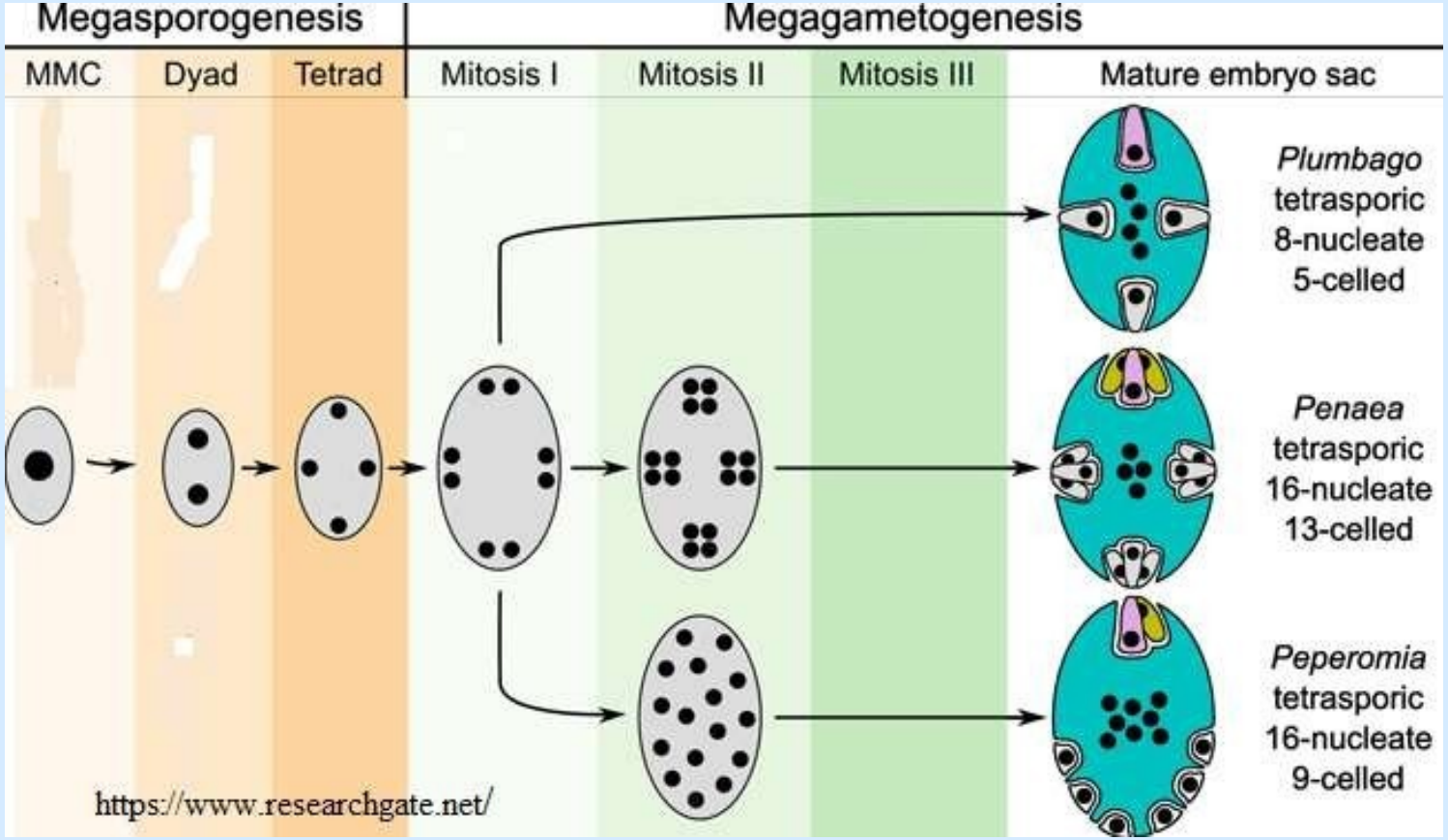
1. Adoxa type - Ex: Adoxa
2. Drusa type – Ex: *Drusa oppositifolia* of Apiaceae
3. Plumbago type – Ex: Plumbago of Plumbaginaceae
4. Plumbagella type – Ex: Plumbagella of Plumbagellaceae
5. Fritillaria type – Ex: Fritillaria, Tulipa etc. of Liliaceae
6. Penaea type– Ex: Penaea of Penaeaceae
7. Peperomia Type – Ex: Peperomia of Piperaceae

Types of Tetrasporic Embryo sac	Number of nuclei in Sec. nucleus	Ploidy of endosperm
1. Adoxa type	2	3n
2. Chrysanthemum type	3	4n
3. Plumbago type	4	5n
4. Plumbagella type	4	5n
5. Fritillaria type	4	5n
6. Penaea type	4	5n
7. Peperomia type	8	9n

1. **Adoxa type** –
   - MMC -> meiosis -> four nuclei -> arranged two at each end.
   - Both the nuclei -> mitotic division -> eight nuclei
   - One egg & 2 synergids at the micropylar region; three antipodal cells at the chalazal end & two nuclei in the centre.

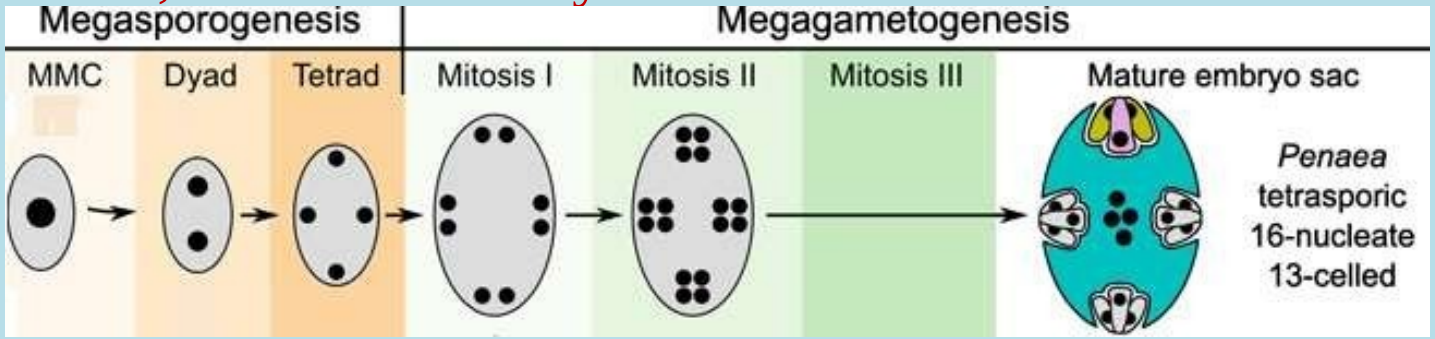


2. Plumbago type: Four nuclei -> Mitosis -> eight nucleated -> arrangement of two nuclei at each side (four sides) -> four nuclei, one from each side, become aggregated in the centre. The nucleus at the micropylar end behaves as egg

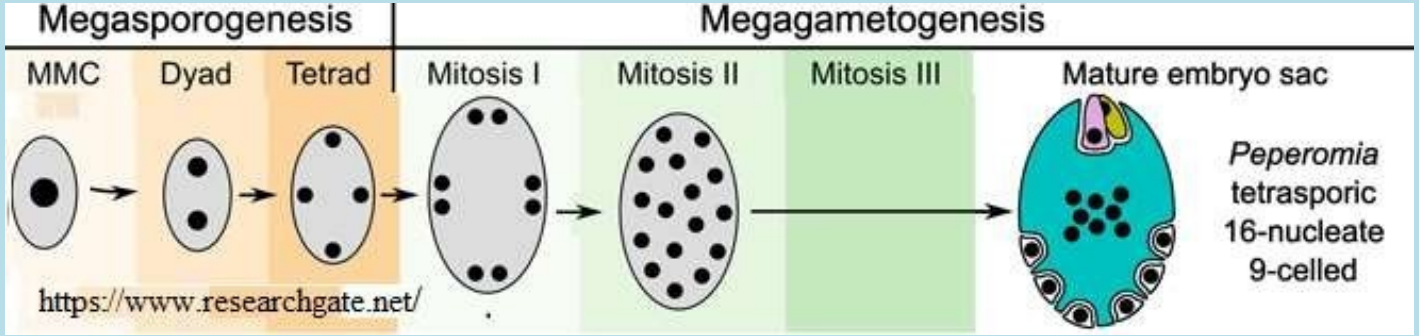


3. Penaea type: Four nuclei -> 1st Mitosis -> eight nucleated -> 2nd Mitosis 16 nucleated -> 4 nuclei at each side (four sides) remain crosswise. Later on, four nuclei, one from each side, become aggregated in the centre.

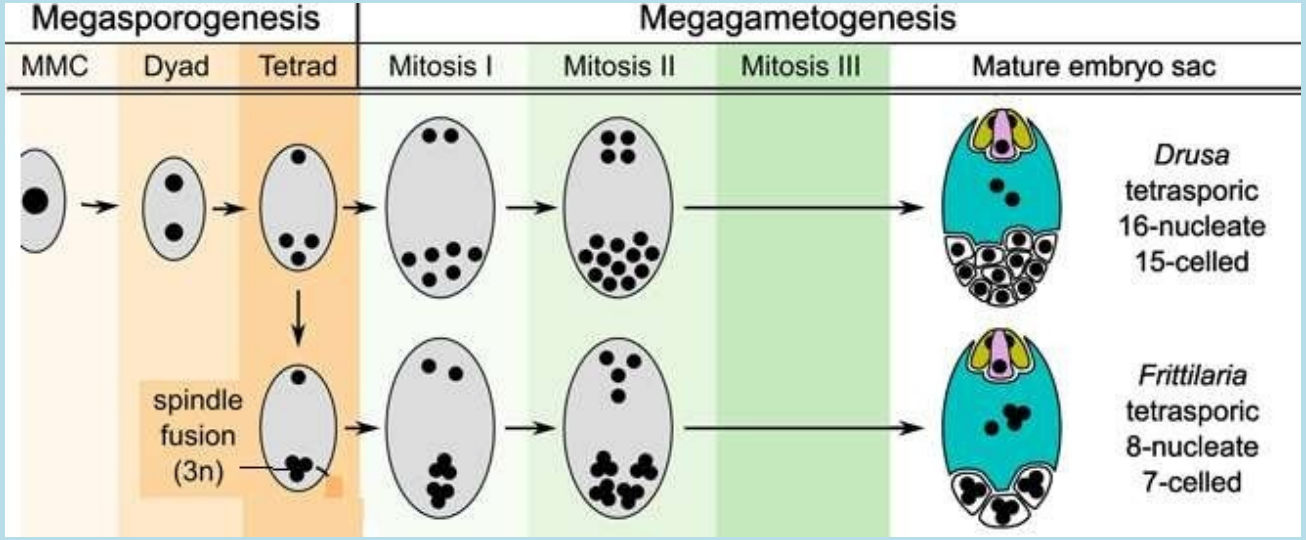
→ 16 nucleate, 13- celled embryosac



4. Peparomia type: Four nuclei -> 1st Mitosis -> eight nucleated -> 2nd Mitosis 16 nucleated -> dispersed -> 8 become polar nuclei, 6 antipodals at chalazal end & one egg and one synergid remain at the micropylar end.



5. Drusa type: Four nuclei -> one at micropyle end & 3 at chalazal end ->1st Mitosis -> eight nucleated -> 2nd Mitosis 16 nucleated -> one nucleus from each side aggregate at center . 16 nucleate, 15- celled embryosac



6. Frittilaria type: Four nuclei -> one at micropyle end & 3 at chalazal end -> fusion of chalazal nuclei (3n) -> 1st Mitosis -> 4 nucleate (2 haploid & 2 triploid) -> 2nd Mitosis -> 8 nucleate (4 haploid & 4 triploid) -> one nucleus from each side aggregate at center, 3 haploid nuclei at micropyle one egg and 2 synergids & 3 triploid(3n) nuclei at chalazal end forms antipodals. 8 nucleate, 7- celled embryosac

7. Plumbagella type: Four nuclei -> one at micropyle end & 3 at chalazal end -> fusion of chalazal nuclei (3n) -> 1st Mitosis -> 4 nucleate (2 haploid & 2 triploid) -> one nucleus from each side aggregate at center, onehaploid nuclei at micropyle & one triploid(3n) nuclei at chalazal end 8 nucleate, 3- celled embryosac