MSC BOTANY EMBRYOLOGY

PREPARED BY RAMYA.M DEPT.OF BOTANY, LF COLLEGE GURUVAYOOR Fertilization- 4 POST POLLINATION CHANGES IN THE EMBRYOSAC The synergid which is visited by the pollen tube degenerates faster than the other. That is called as the degenerating synergid and the other is the persistant synergid Some of the characters shown by the degenerating synergid are:

- 1. The large chalazal vacoule disappears
- 2. The nucleus and the nucleolus are somewhat flattened and the nuclear membrane disappears
- 3. The organelles get disorganised
- 4. Crystals appear in the cytoplasm

Induction of synergid degeneration:

Ultrastructural observations indicate that the synergid receiving the pollen tube follows a cell death process resulting in a degenerated synergid, which provides a gateway for the entrance of sperm into the egg and central

The pollen tube only enters the degenerated synergid. Therefore, synergid breakdown is essential in receiving the pollen tube. In some plants, a synergid degenerates at anthesis, without pollination, but in others, the synergid degenerates only after the approaching pollen tube. Three types of synergid degeneration have been described in angiosperms:

 The synergid degenerates before pollination, due to developmental processes not related to the pollen tube;
 Synergid degeneration occurs before the arrival of the pollen tube following pollination, suggesting synergid degeneration is related to the pollen tube signal (most angiosperms are of this type)

(3) Degeneration is initiated when the pollen tube enters the synergid cell and is induced by direct contact between the pollen tube and the synergid. Only a few plants exhibit this type. Pollen tube growth regulation in synergid cells:

- After the pollen tube penetrates the filiform apparatus, growth of the tube is arrested inside the degenerated synergid.
- The tube tip subsequently breaks and releases two sperm cells into the cytoplasm of the degenerated synergid.
- The mechanisms involved in the ceasation of tube growth, including the breaking of the tube tip and tube content release are not fully understood



ig. 9.25 Diagrammatic summary of the changes in the synergids after pollen tube dis Synergids in a pollinated flower. B. Synergids after pollen tube discharge. (after nd Fisher, 1968)



Other synergid functions:

Synergid structure is indistinct following degeneration, and synergid function after pollen tube entry has received little attention.

However, in addition to pollen tube attraction, cessation of pollen tube growth, and pollen tube tip rupture, other biological events prior to fertilization have been reported in synergids.

As previously discussed, the tube tip breaks and discharges its contents into the degenerated synergid.

<u>A second biological function involves decomposition</u> of the male germ unit. The two sperm cells in a pollen tube are connected to each other and associated with a vegetative nucleus in an assemblage known as the male germ unit (MGU). The MGU allows the transport of the two sperm cells in the narrow space of the pollen tube (Dumas et al. 1994). However, the connection between the sperm cells must be broken, allowing them to separately fuse with either the egg or the central cell, and this connection seems to be broken in the degenerated synergid.





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X bodies:-

- Embryologists observed two darkly stained oval bodies in the synergid which has received the pollen tube discharge . since nature of these bodies is not clear they were called as X bodies .
- These bodies have been variously intrepreted as remains of vegetative nucleus, cytoplasm of sperms , the adjacent nucellar cells and remains of degenerated megaspore etc.

Jensen 1972 intrepreted one of them as the remains of vegetative nucleus nad the other as remains of synergid nucleus.

In Plumbago where there are no synergids , only one X body is visible

in Plumbago which lack synergids, the egg cell carries out the function of synergids

<u>Syngamy:</u>

- The molecular mechanism of gametic fusion is not very clear. Fusion of egg with sperm nucleus is called syngamy
- Detailed account of gametic fusion is lagging due to short duration of these process and difficulty in catching the materials at the correct stage
 Male gametes may be spherical ,ellipsoidal rod shaped or vermiform . Frequently they may change their shape after their discharge into the embryosac .

- In Nicotiana the sperms are elongated in the beginning but just before fertilization they become spherical. There is some slight difference between the two male gametes
- In Lilium and Fritillaria the sperm involved in syngamy is slightly smaller than the one involved in triple fusion. The reverse condition is seen in Vallisneria and Cardiospermum

The most careful account of gametic fusion is given by Gerasimova in *Crepis cappillaris*.

- At the time of its approach to the egg nucleus male nucleus has the appearance of a continous thread rolled into a ball.
- The ball begins to unwind and spread out its entire surface adjacent to the nuclear membrane of the egg
 It then gradually immerses itself within the egg nucleus meanwhile the nucleolus arises from it at first as a scarcely visible ,weakely stained dot which gradually increases in size



- At the same time the body of the sperm becomes more porous and breaks up loosing its continuity.
- Very soon the male nucleolus becomes indistinguishable from female and its presence is detected by the presence of 2 nucleoli.
- Finally the male nucleolus increases in size and fuses with the female nucleus thus closing the phenomenon of sexual fusion

- The fusion of 2nd male gamete to secondary nucleus take place almost similarly
- According to Gerassinova triple fusion is more quick than syngamy
- Gerassinova- Navashina 1960 described 3 types of syngamy. According to them , at the time when two nuclei come in contact with each other , the egg nucleus is in the state of deep mitotic rest , wheras the male nucleus is at telophase of the previous mitosis

TYPE 1- PREMITOTIC: the sperm nucleus fuses immediately on coming in contact with the egg nucleus, and the zygote divides subsequently eg:Poaceae **TYPE2 : POST MITOTIC:** the sperm nucleus and the egg nucleus remain in contact for a while and fuse only after both of the nuclei have entered into division eg: lily, fritillaria

TYPE 3 : INTERMEDIATE : the sperm nucleus fuses with the egg nucleus after completing the previous mitosis . Even after fusion of the nuclear membranes the contents of the two nuceli show incomplete mixing .

POLYSPERMY OR MULTIPLE FUSION

- Normally, a single pollen tube enters the embryosac and the embryosac receives only 2 sperms from a pollen tube.
- Two pollen tubes have been recorded in Ulmus, Oenothera.
- The entry of additional pollen tubes naturally results in the release of supernumerary male gametes in the embryosac

POLYSPERMY

- The release of more than two sperms into the embryo sac is called polyspermy
- It may be due to :
 - * The presence of more than two sperms in the pollen tube
 - Entry of more than one pollen tube into the embryo sac

POLYSPERMY.....

Polyspermy leads to the fusion of sperms with cells other than egg. i.e.
Synergids
Antipodals

Polyspermy results in the formation of more than one embryo in the embryo sac

HETEROFERTILIZATION

If the sperms involved in syngamy and triple fusion are derived from different pollen tubes it is called as heterofertilization

