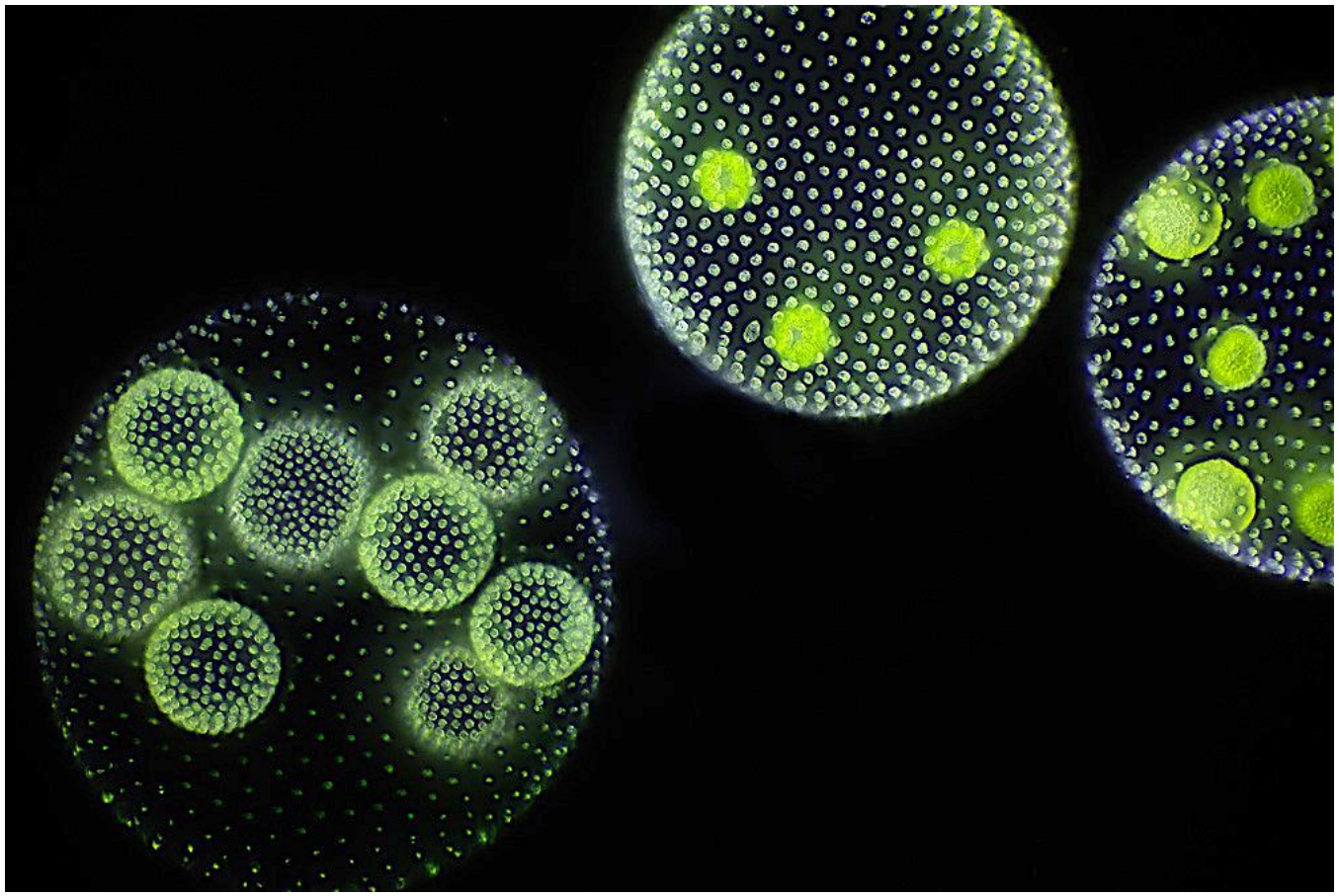
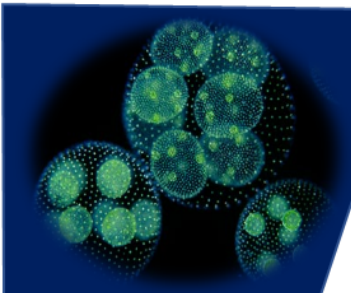


VOLVOX

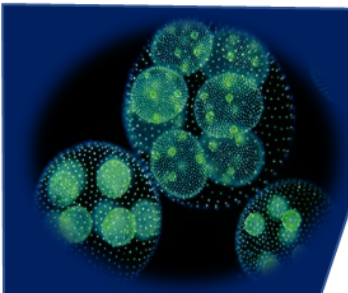
Anto Joseph



Taxonomic position

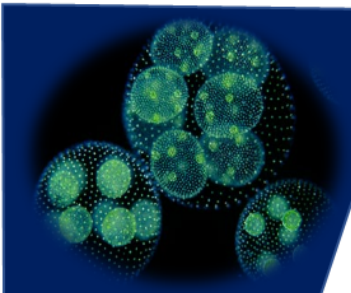
According to Bold and Wynne (1978)

- Division – Chlorophycophyta
- Class – Chlorophyceae
- Order – Volvocales
- Family – Volvocaceae
- Genus – *Volvox*



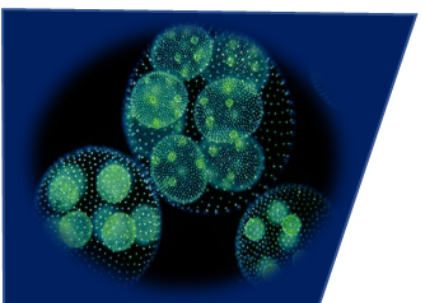
Volvox

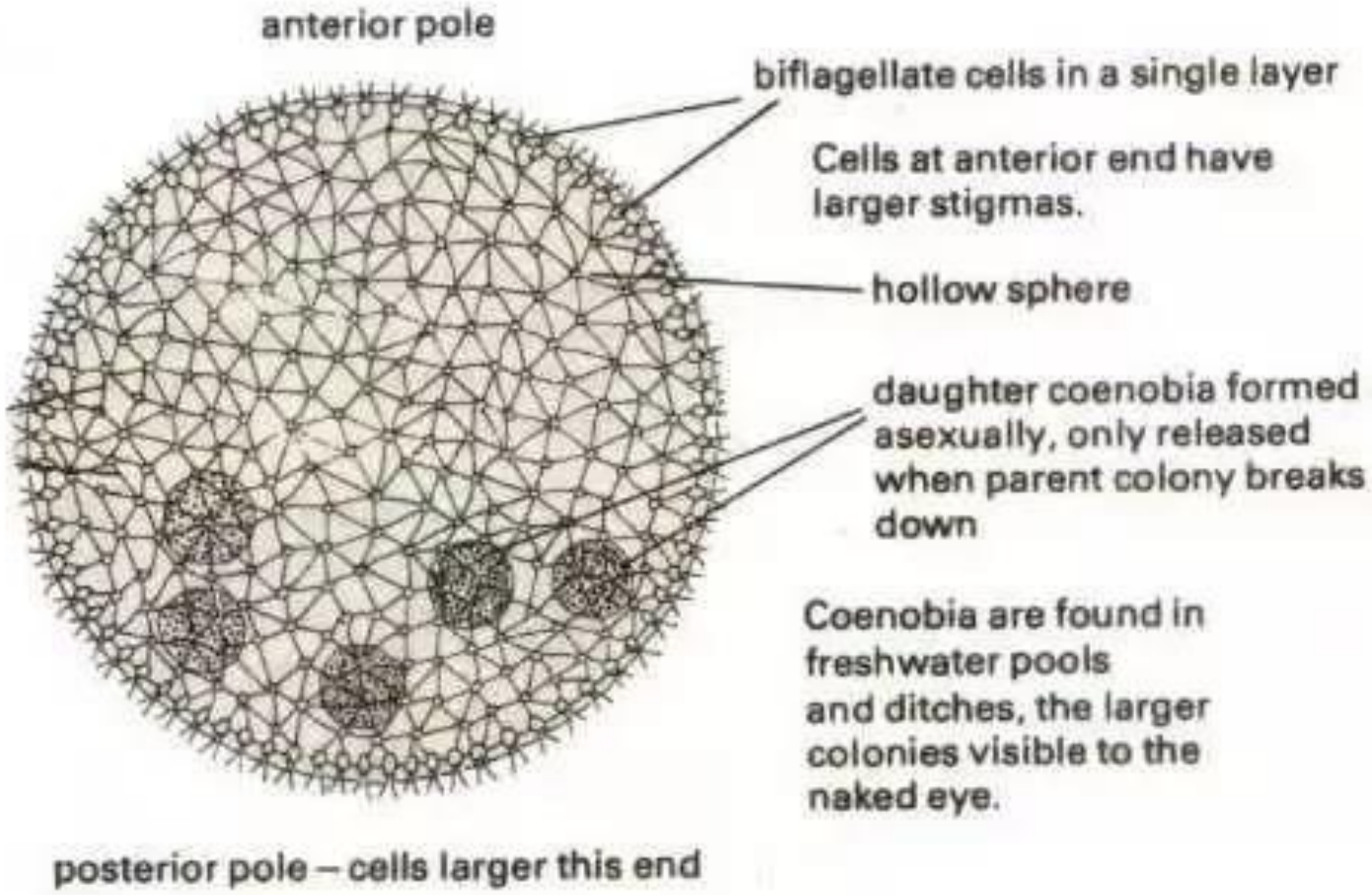
- Fresh water, free swimming, Coenobial form.
- Inhabits in ponds, pools, ditches all over the world.
- The Volvox colonies appear as green rolling balls on surface of water.

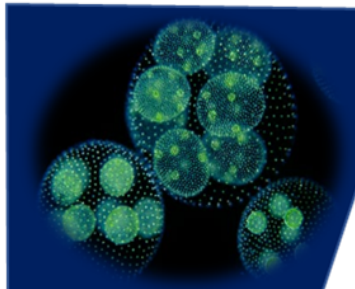


Structure

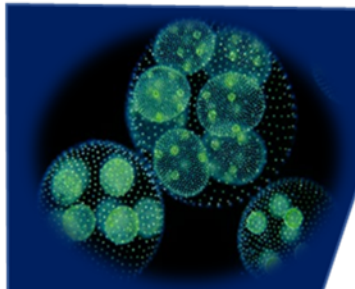
- Volvox thallus is a motile colony with definite shape and number of cells.
- This habit of thallus is called coenobium.
- The colony is hollow, spherical or oval in shape and the size of colony is about the size of a pin head.
- The number of cells in a colony is fixed.
- Depending upon the species of Volvox the cells can be 500-60,000.
- The central part of colony is mucilaginous and the cells are arranged in a single layer on periphery of the colony




anterior pole
biflagellate cells in a single layer
Cells at anterior end have larger stigmas.
hollow sphere
daughter coenobia formed asexually, only released when parent colony breaks down
Coenobia are found in freshwater pools and ditches, the larger colonies visible to the naked eye.
posterior pole – cells larger this end

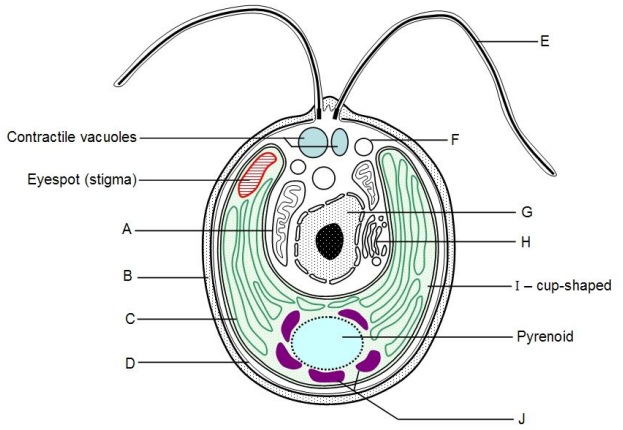


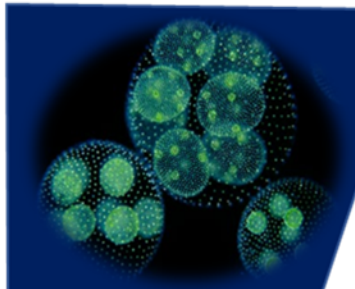
- The cells of anterior end possess bigger eye spots than those of posterior end cells.
- The cells of posterior side become reproductive on maturity.
- Thus, spherical or round colony of Volvox shows clear polarity.
- The cells of *Volvox* colony are *Chlamydomonas* type.
- Every cell has its own mucilage sheath.
- The cells are connected to each other through cytoplasmic strands.



- The cells are biflagellate, the two flagella are equal, whiplash type and project outwards.
- Each cell contains one nucleus, a cup shaped chloroplast with one or more pyrenoids, an eye spot and 2-6 contractile vacuoles.

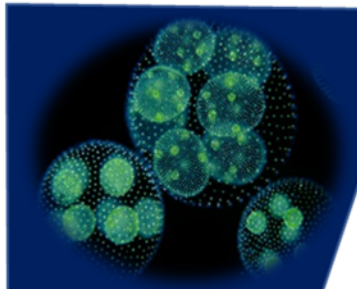
- The cells of colony are independent for functions like photosynthesis, respiration and excretion.
- The movement of colony takes place by co-ordinated flagellar movement. The reproduction is common to the coenobium.





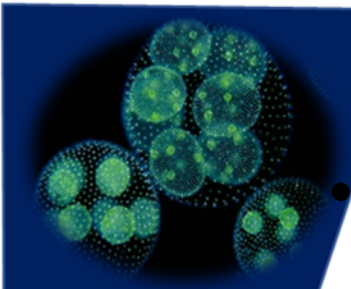
Reproduction

- Volvox reproduces both asexually and sexually.
- The asexual reproduction takes place under favourable conditions during spring and early summer.
- In Volvox mostly the cells of posterior part of colony take part in reproduction.
- These reproductive cells can be recognized by their larger size, prominent nuclei, dense granular cytoplasm, more pyrenoids and absence of flagella.



Asexual reproduction

- During asexual reproduction some cells of the posterior part of colony become reproductive.
- These cells enlarge up to ten times, become rounded and lose flagella.
- These cells are called gonidia (Sing, gonidium).
- The gonidia lose eye spot.
- Pyrenoids increase in number.
- The gonidia are pushed towards interior of the colony.
- The first division of gonidium is longitudinal to the plane of coenobium and this forms 2 cells



- The second division is also longitudinal and at right angle to the first, forming 4 cells.
- By third longitudinal division all the four cells divide
- These 8 cells are arranged in curved plate-like structure and are called **plakea stage**.
- Each of these 8 cells divides by longitudinal division forming 16 cells arranged in the form of a hollow-sphere.
- The sphere is open on exterior side as a small aperture called phialopore.
- The cells at this stage continue to divide till the number of cells reaches the characteristic of that species.
- The cells at this stage are naked and in close contact with each other.
- The pointed anterior end of cells is directed towards inside.

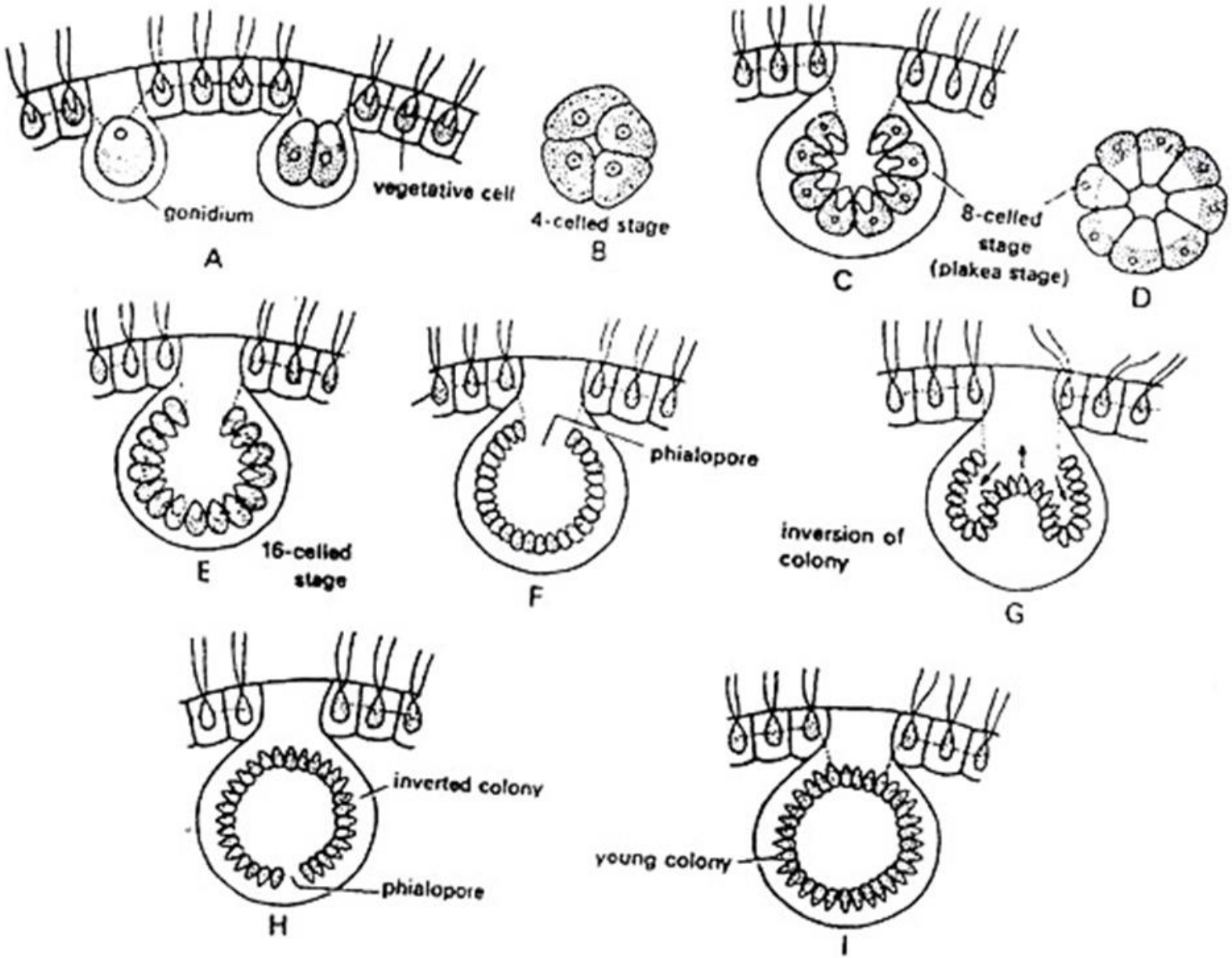
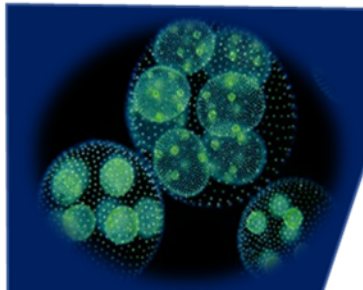
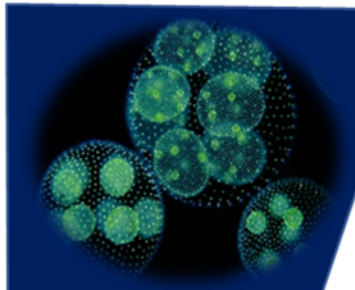


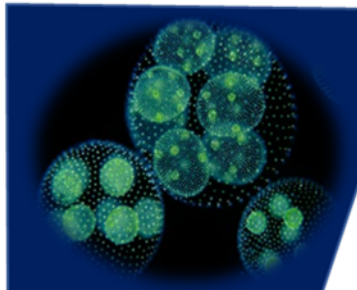
Fig. 2. (A–I) *Volvox*. Asexual reproduction in *Volvox*



- The next step is called inversion of colony.
- The inversion of colony starts with formation of a constriction opposite to phialopore.
- The cells of posterior end along with constriction are pushed inside the sphere, till the whole structure comes out of the phialopore.
- After inversion, the anterior pointed end of the cell faces periphery.
- The phialopore gets closed, and makes the anterior part of the colony.
- After inversion the cells develop cell wall, flagella and eye spot. The cells become separated due to development of gelatinous sheath around each cell. This newly developed colony is called daughter colony

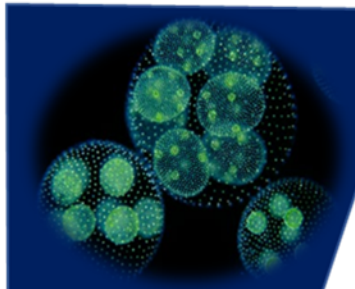


- The daughter colonies are released in water after the disintegration of parent colony or through the pores.
- Sometimes next generation of daughter colonies develop while the colonies are still attached to the earlier parent colony.



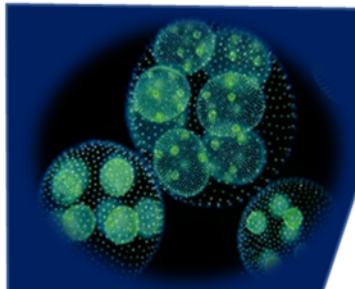
Sexual reproduction

- Oogamous type
- Reproductive cells mostly differentiate in the posterior part of colony.
- These cells enlarge, lose flagella and are called gametangia.
- The male reproductive cells are called antheridia or androgonidia
- Female reproductive cells are called oogonia or gynogonidia.

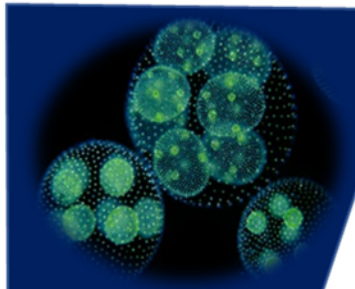


Development of antherozoids

- The development of antheridium starts with formation of antheridial initial or androgonidial cell mostly in posterior side of the colony.
- The initial cells enlarge, lose flagella, protoplasm becomes dense and nucleus becomes larger.
- The antheridial initial shifts inside towards cavity and remains connected to other vegetative cells through cytoplasmic strands.



- The protoplast of antheridial initial divides, longitudinally to form 16-512 elongated cells.
- The cells remain in plate like structure or arrange in a hollow sphere.
- The inversion of cells also takes place as in asexual reproduction.
- Each cell differentiates in to antherozoid or spermatozoid



- The antherozoid is spindle shaped, elongated, bi-flagellated structure containing two contractile vacuoles, nucleus, cup shape chloroplast, pyrenoid and eye spot.
- It is pale yellow or green in colour. The antherozoids are released individually or sometimes in groups.

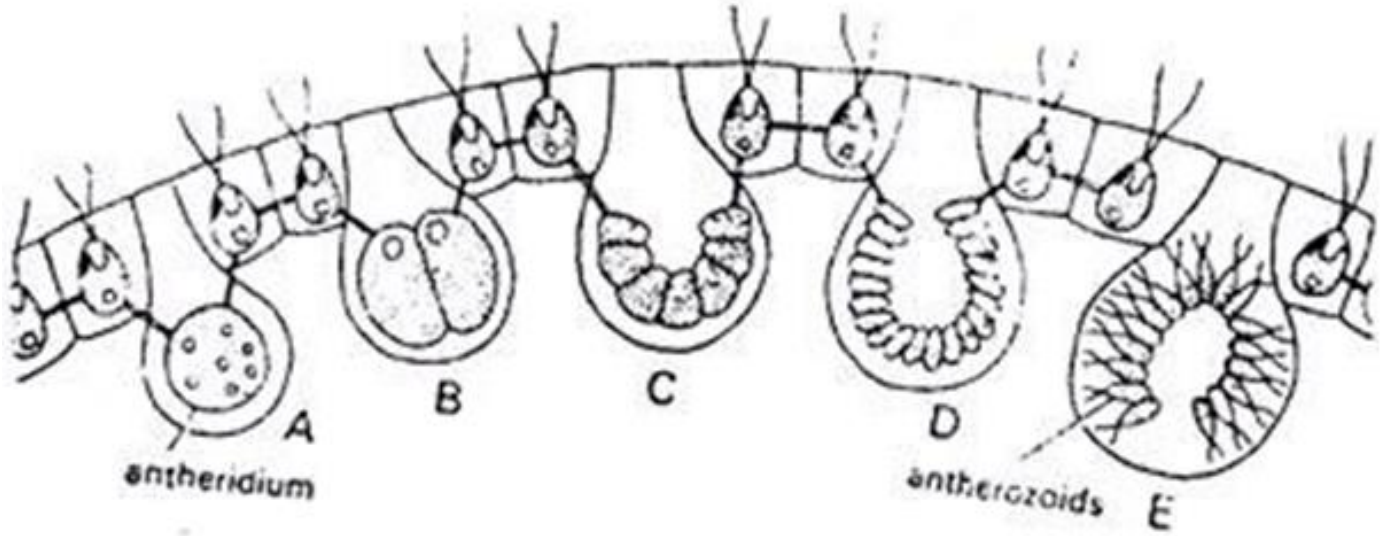
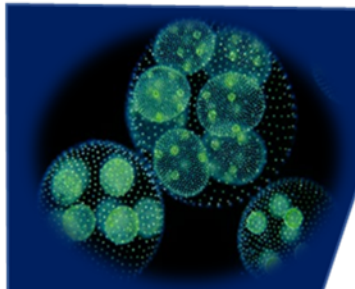


Fig. 4. (A–E). *Volvox*. Development of antherozoids



Development of Oogonium

- The oogonia also differentiate mostly in posterior side of the colony.
- The oogonial initials enlarge, nucleus becomes larger, protoplast becomes dense, flagella are lost, eye spot disappears and many pyrenoids appear.
- The mature oosphere or ovum is round or flask shaped structure.
- The egg is uninucleate structure, the beak of flask shape oogonium functions as receptive spot.

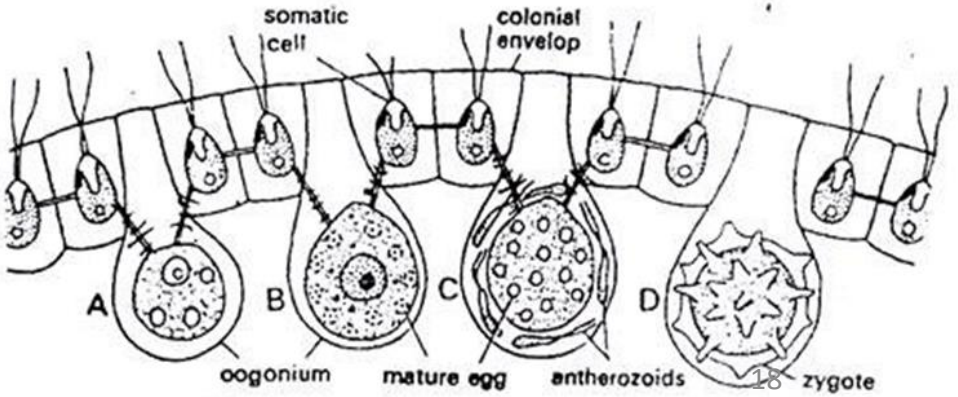
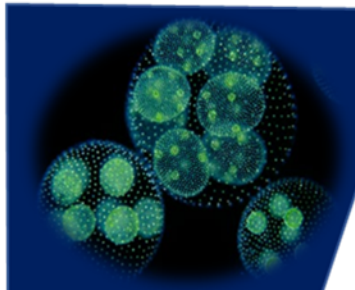
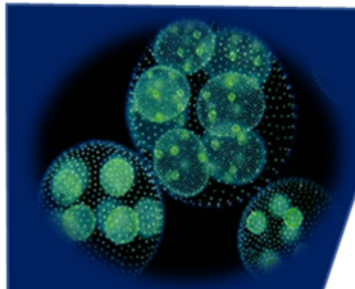


Fig. 5. (A–D). *Volvox*. Oogonium and fertilization

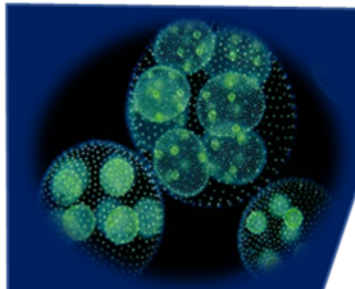


Fertilization of Volvox

- After liberation from antheridium, the antherozoids swim freely on surface of water. Due to chemotactic response the antherozoids reach the oogonia.
- Some antherozoids enter each oogonium. Only one antherozoid enters inside the oogonium through receptive spot.
- After this plasmogamy i.e., fusion of male and female cytoplasm and karyogamy i.e., fusion of male and female nuclei take place. This results in formation of diploid zygote

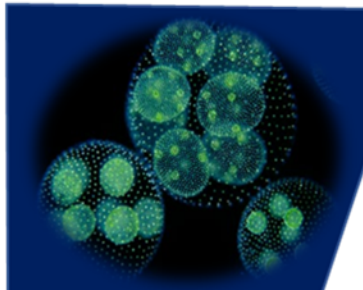


- The diploid zygote secretes a three layered thick wall.
- The layers of the wall are exospore, mesospore and endospore.
- The outer exospore is thick.
- The mesospores and endospores are thin and smooth.
- The zygotes are released by the disintegration of parent colony.
- Then zygotes undergo a period of dormancy.

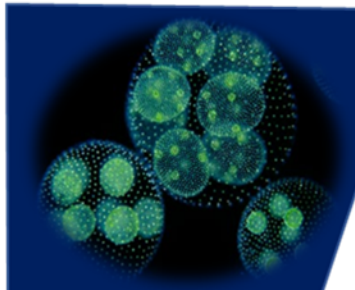


Zygospore (Oospore) germination

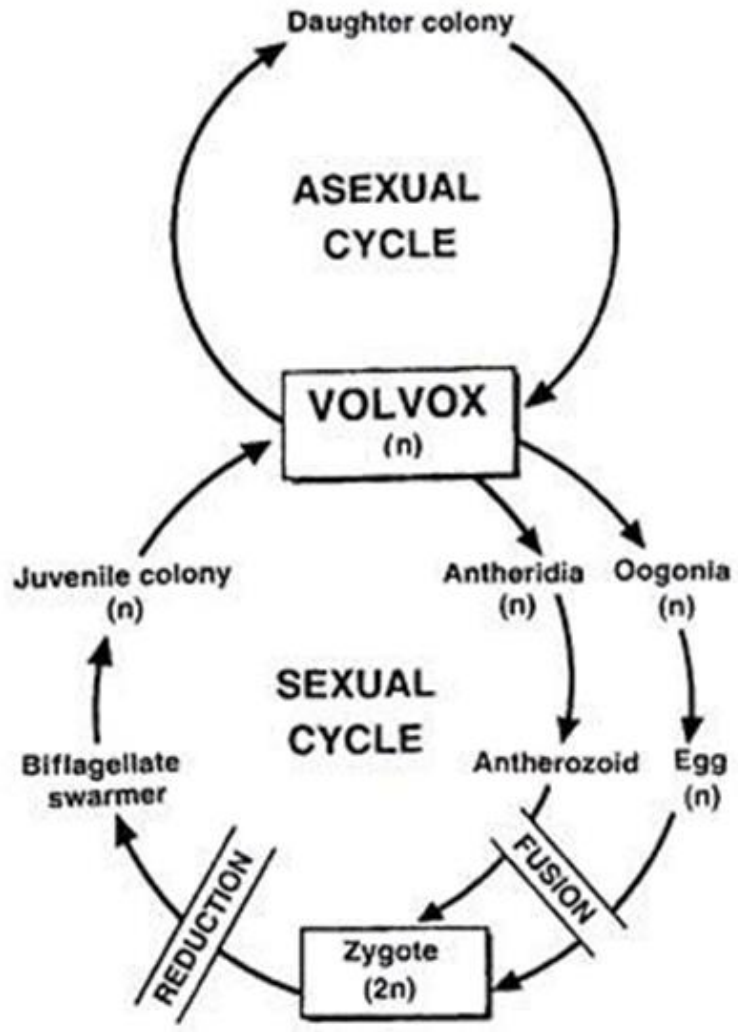
- During the return of favourable conditions, the outer two layers of the zygospore brake and the inner layer is extruded in the form of a vesicle.
- Before this, the single diploid nucleus of the cell divides by meiosis to form 4 haploid nuclei.
- The daughter nucleus enter the vesicle and produce biflagellate meiozoospores.



- After some times these meiozoospores withdraws flagella and the protoplast gets rounded.
- It undergoes a number of successive longitudinal divisions to form specific number of protoplasmic bits.
- After inversion, produce a colony of individual cells as exactly as in the case of asexual reproduction.



Life cycle


Daughter colony
ASEXUAL CYCLE
VOLVOX (n)
Juvenile colony (n)
Antheridia (n)
Oogonia (n)
SEXUAL CYCLE
Biflagellate swarmer
Antherozoid
Egg (n)
REDUCTION
FUSION
Zygote (2n)