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Volvox carteri

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cellular organisms - Eukaryota - Viridiplantae - Chlorophyta - Chlorophyceae - Chlamydomonadales - Volvocaceae - Volvox - Volvox carteri

- Brief facts
- Life cycle
- Asexual reproduction



- Asexual vs sexual reproduction

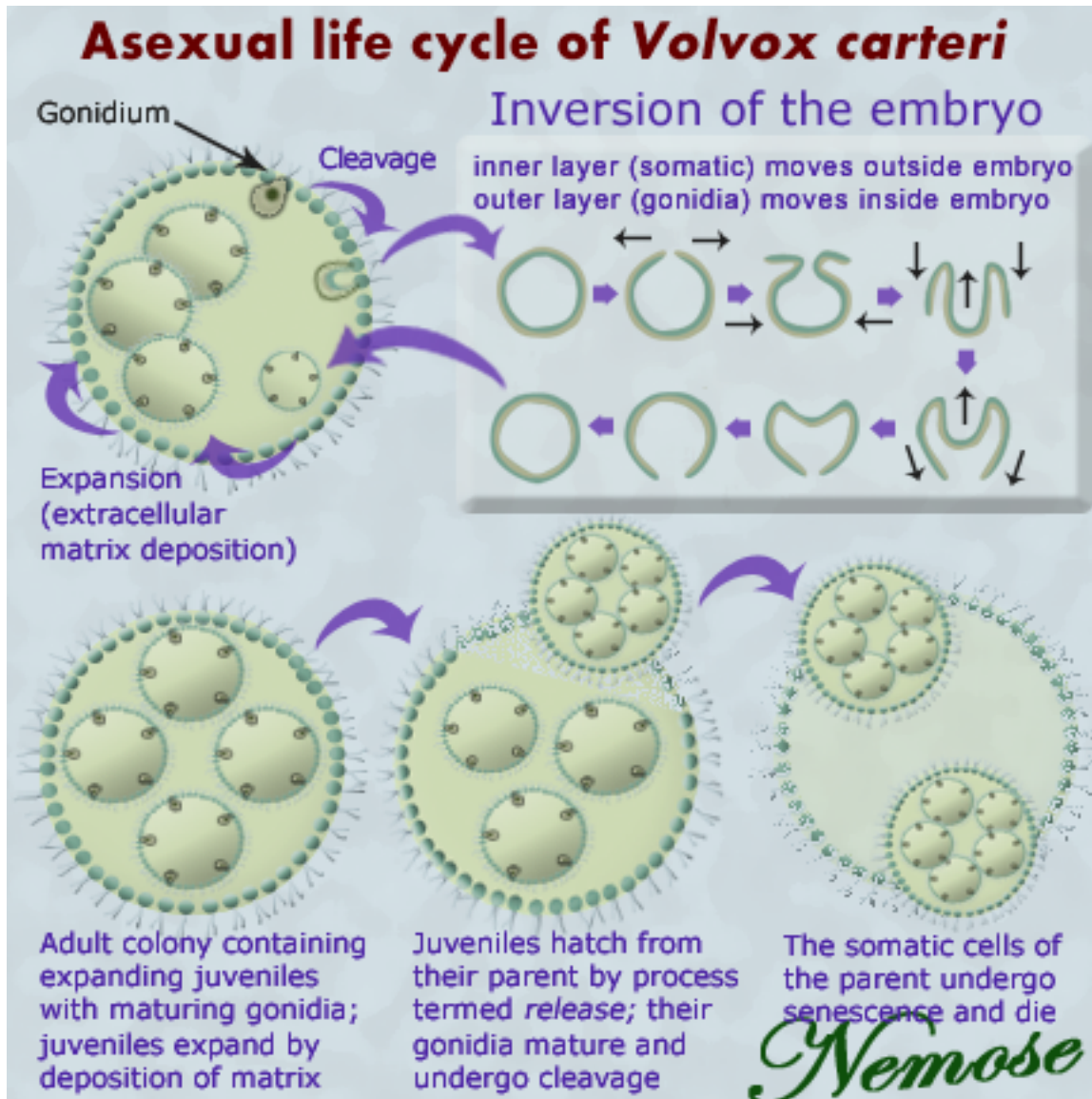


- References

Brief facts

- Volvox is a spherical multicellular green alga, which contains many small biflagellate somatic cells and a few large, non-motile reproductive cells called gonidia, and swims with a characteristic rolling motion with a distinct anterior and posterior.

- The name **Volvox** comes from the Latin *volvere*, to **roll**, and **-ox**, as in *atrox*, **fierce**.
- A medium in which the organism would thrive and reproduce in captivity was discovered only in the 1960s. Only after that it became possible to exploit Volvox as a laboratory model system.
- In nature Volvox is found in ponds and ditches.



Life cycle

Volvox has 2 modes of reproduction: sexual and asexual.

- sexual

in nature *V. carteri* reproduces sexually at least once each year when temporary ponds where the organism lives start to dry out in the heat of late summer; the stimulus for switching from the asexual to the sexual mode of reproduction is known to be a sex-inducing pheromone, a 32-kDa glycoprotein triggers sexual development of gonidia at concentrations as low as 10^{-16} M.

- o **sexual induction**

gonidia that have been exposed to the sex-inducing pheromone for at least 6–8 h before the initiation of embryonic cleavages modify their developmental program and produce sexual progeny containing immotile eggs or motile sperm, depending on the genetic sex of the individual; the sexual cycle is initiated by a heat shock that causes the somatic cells of the asexual *Volvox* spheroid to produce the sex-inducing pheromone; the level of pheromone is then further amplified by the ability of sperm cells to produce more sex-inducing pheromone

- o **gametogenesis MeSH**

the 64–128 cell transition in sexual females, and the 128–256 cell transition in sexual males; in sexual males, somatic cells (smaller spheres) and androgonidia (larger spheres) arise in a 1:1 ratio; androgonidia undergo further cleavages to form sperm packets, each containing 64 or 128 sperm; when the gametes are mature, sperm packets are released into the surroundings

- o **zygote MeSH**

on contact with females, the sperm packets break up into individual sperm, which can fertilize the eggs. The resulting diploid zygotes have tough cell walls that can resist drying, heat

and cold. When favourable conditions cause the zygotes to germinate, they undergo meiosis to produce haploid males and females that reproduce asexually until the sex-inducing pheromone induces the sexual cycle again

- **asexual**

males and females are indistinguishable in their asexual form; under standard conditions, the asexual life cycle takes 48 h and is synchronized by a 16 h light–8h dark cycle

- **embryogenesis MeSH**

- **cleavage**

embryogenesis takes ~8 hours; mature gonidia undergo a rapid series of cleavage divisions (11–12 divisions), some of which are asymmetric: the larger cells resulting from these unequal divisions will become the gonidia of the next generation, whereas the smaller cells will become part of the somatic cell population; at the end of cleavage, the embryo is inside out with respect to the adult configuration: its gonidia are on the outside and the flagella of its somatic cells are pointing towards the interior of the hollow sphere

- **inversion**

the morphogenetic process of inversion taking place at the end of embryogenesis returns the embryo to its adult configuration through a series of cell movements that resemble the

gastrulation of animal embryos

- expansion

the juveniles expand by deposition of extracellular matrix

- release

juveniles hatch from their parent spheroid

- juvenile

organism with immature gonidia

- adult

organism with mature gonidia

- senescent MeSH

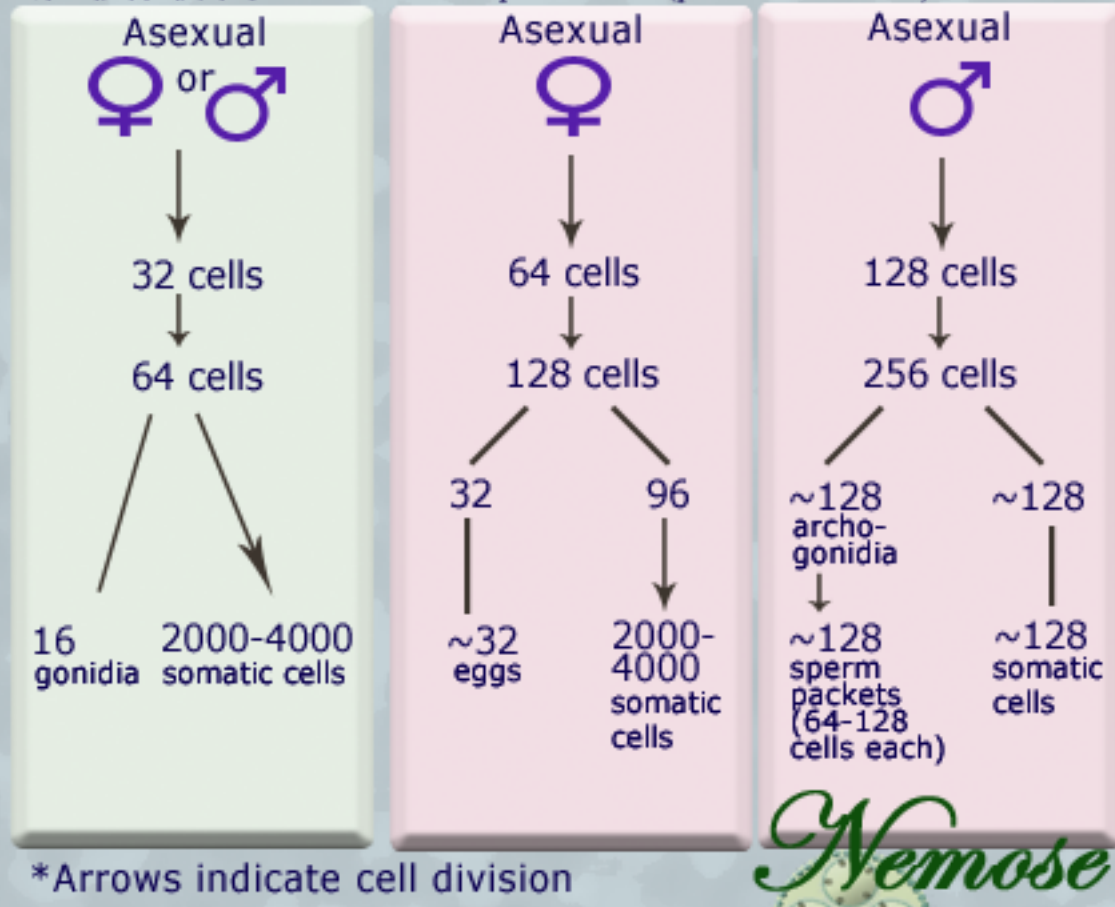
somatic cells of the parent, lacking reproductive cells and thus being incapable of further cleavage, undergo senescence and die

Asexual vs sexual life cycle of *Volvox carteri*

Gonidium 1 cell (1 n)

Normal conditions

Hardship conditions (pheromone release)



References

Articles

- Hallmann A, Godl K, Wenzl S, Sumper M. The highly efficient sex-inducing pheromone system of *Volvox*. *Trends Microbiol.* 1998 May; 6(5): 185-9. **PMID: 9614342**
- [PubMed free full text articles: major topic "Volvox"](#)

Websites

- [CELL BIOLOGY: ON VOLVOX](#)
 - [Wikipedia: Volvox](#)
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