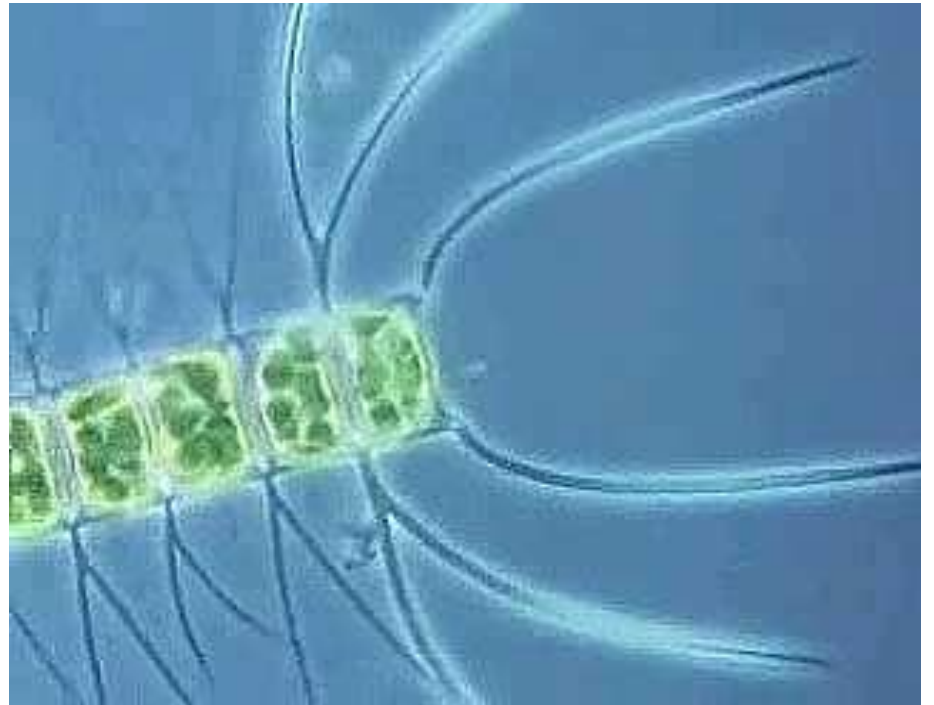


Biology and culture of Diatoms



Introduction

- Diatoms (Class: *Bacillariophyceae*) are unique microscopic algae containing **silica** and having distinct geometrical shapes.
- They are **unicellular**, **eukaryotic** and **photosynthetic organisms**.
- Their cell size ranges between **5 μm –0.5 mm**. They occur in **wet or moist places where photosynthesis is possible**.
- Diatoms are either planktonic (free-floating) or benthic (attached to a substratum) in Nature.
- Diatoms are mostly non-motile; as their relatively dense cell walls cause them to readily sink however, some benthic diatoms have a specialized raphe system that secretes mucilage to attach or glide along a surface.
- They are also known to form biofilms, i.e., layers of tightly attached cells of microorganisms.

- Diatoms are solely responsible for about **20–25% of global oxygen production**, i.e., approximately every fourth breath of oxygen we inhale.
- Diatoms alone account for around **40%** of the **phytoplankton** on Earth which implies **20–25%** global **net primary production**.
- In certain species of diatoms, **auxospores** are specialised cells that are produced at key stages in their cell cycle or life history. **Auxospores** typically play a role in growth processes, sexual reproduction or dormancy.
- **Binary fission** ("division in half") is a kind of asexual reproduction. It is the most common form of reproduction in prokaryotes such as bacteria. It occurs in some single-celled Eukaryotes like the Amoeba and the Paramecium. In **binary fission** DNA replication and segregation occur simultaneously.

Class

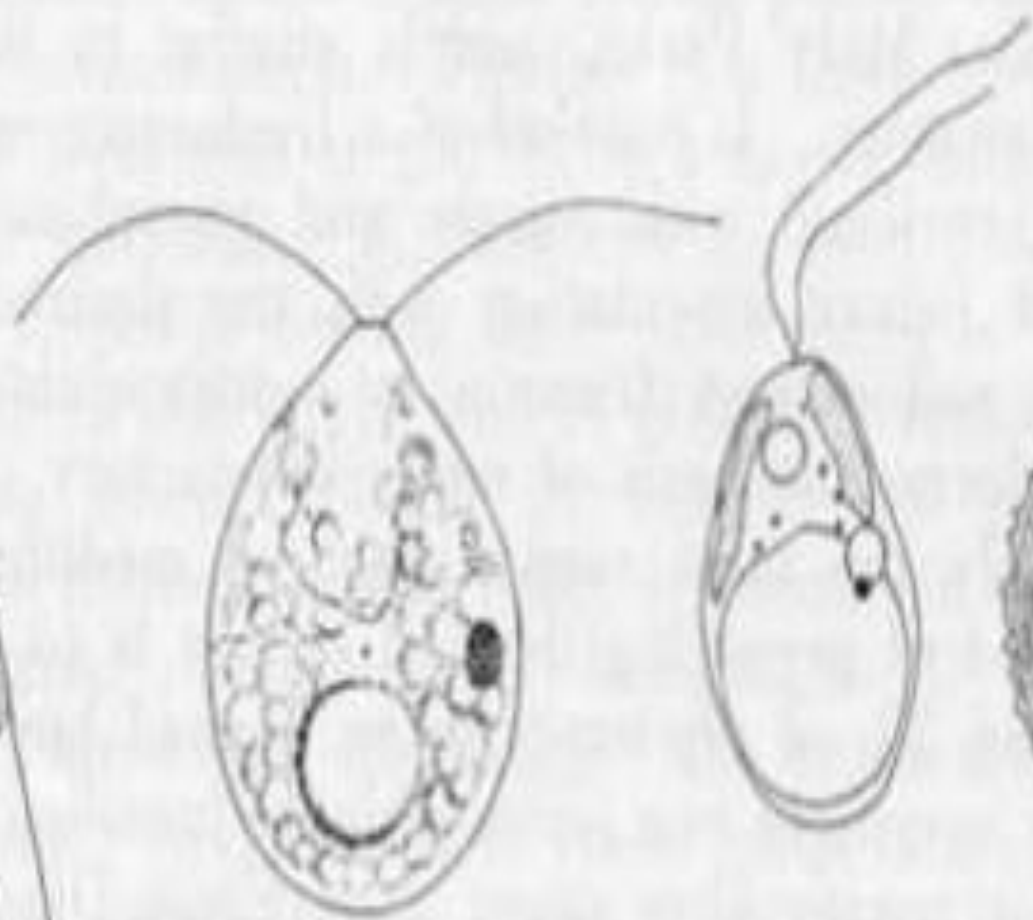
Bacillariophyceae (Diatoms)

Genus

Skeletonema, Thalassiosira, Phaeodactylum, Chaetoceros, Nitzschia, Cyclotella, Isochrysis, Dunaliella



PHAEODACTYLUM



DUNALIELLA



ISOCHRYSIS

Distribution

- Diatoms are an extremely diverse group with around 200 genera comprising of around **10– 12 thousand known species**.
- Diatoms occur in diverse habitats and are found across **marine, freshwater** as well as some **terrestrial habitats**.
- There are also very few **heterotrophic diatom** species that **survive in dark conditions**.
- Each diatom species exhibits a specific **environmental tolerance**.
- Thus, diatoms form species assemblages corresponding to the habitat condition. Several diatom species show a global distribution.

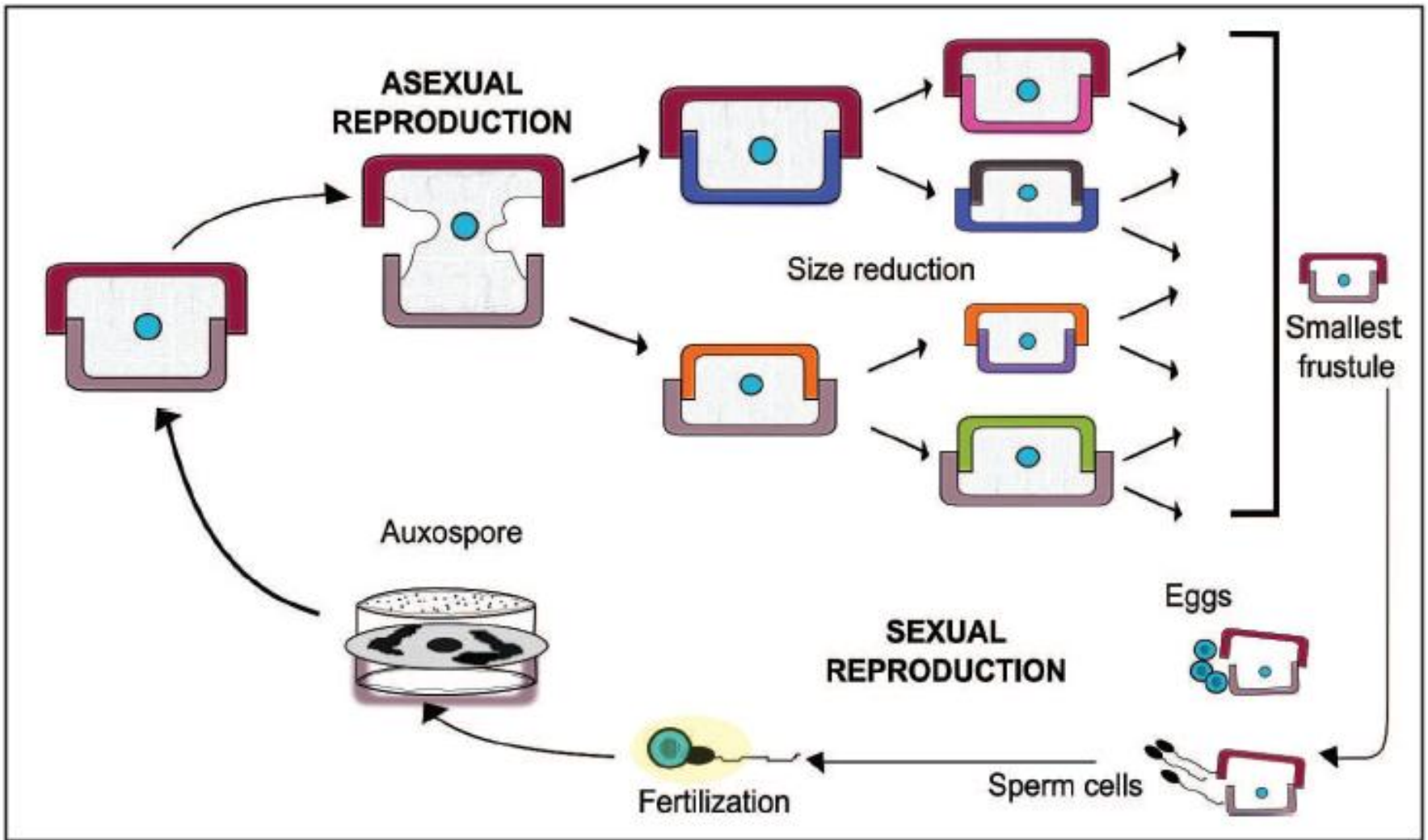
Life cycle

- **Reproduction**

- Reproduction among these organisms is asexual by **binary fission**, during which the diatom divides into two parts, producing two "new" diatoms with identical genes.
- Each new organism receives one of the two frustules - one larger, the other smaller - possessed by the parent, which is now called the epitheca; and is used to construct a second, smaller frustule, the hypotheca.
- The diatom that received the larger frustule becomes the same size as its parent, but the diatom that received the smaller frustule remains smaller than its parent.
- This causes the average cell size of this diatom population to decrease. It has been observed, however, that certain taxa have the ability to divide **without causing a reduction in cell size**.
- Nonetheless, in order to restore the cell size of a diatom population for those that do endure size reduction, sexual reproduction and auxospore formation must occur.

- **Cell division**

- Vegetative cells of diatoms are diploid (2N) and so meiosis can take place, producing male and female gametes which then fuse to form the zygote.
- The zygote sheds its **silica theca** and grows into a **large sphere** covered by an organic membrane, the **auxospore**.
- A new diatom cell of maximum size, the initial cell, forms within the auxospore, thus beginning a new generation.
- Resting spores may also be formed as a response to unfavourable environmental conditions with germination occurring when conditions improve.
- **Thus, each daughter cell contains the valve from the parent as epivalve and a newly-synthesized hypovalve**



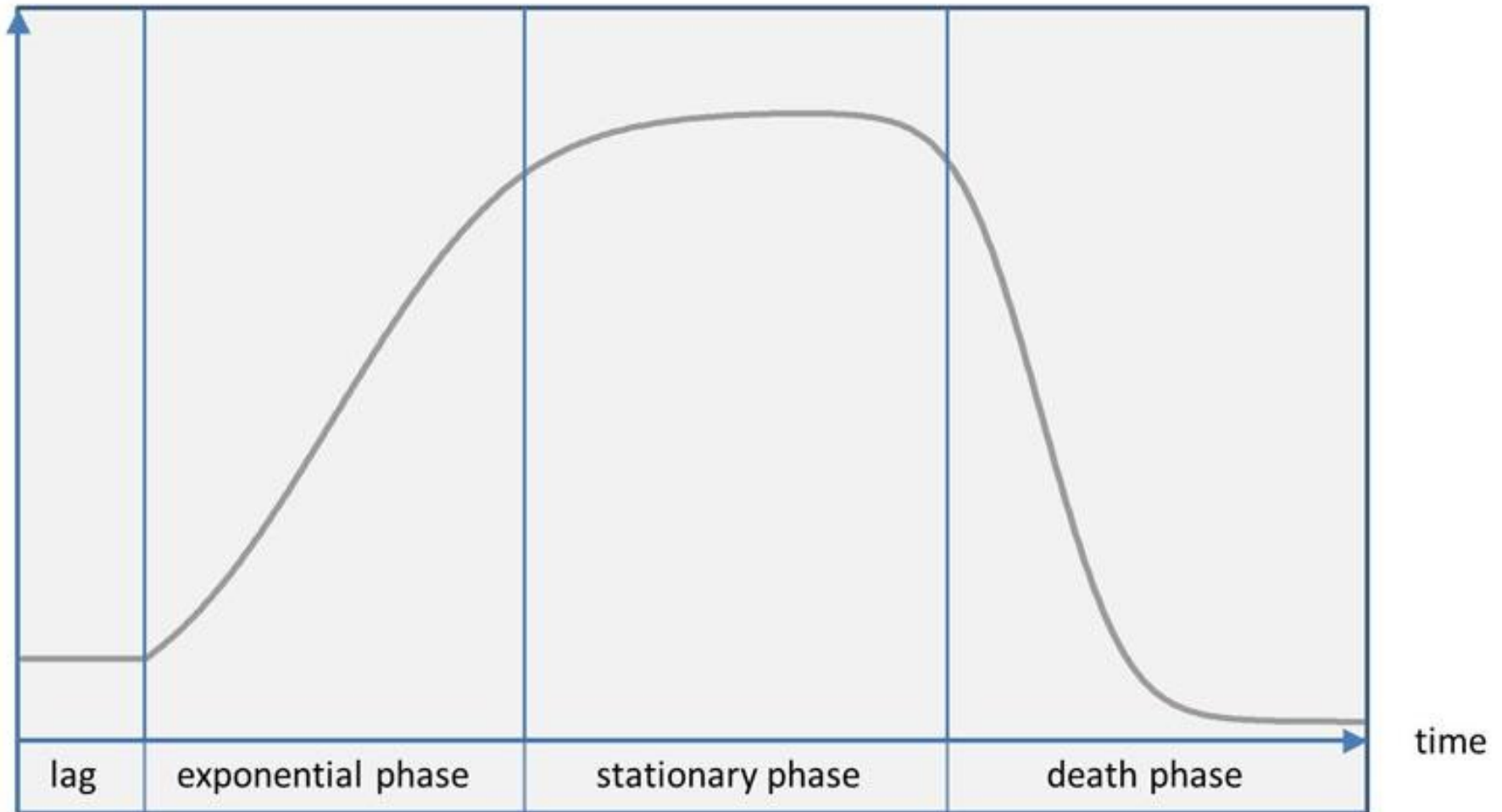
A **frustule** is the hard and porous cell wall or external layer of [diatoms](#). The frustule is composed almost purely of [silica](#), made from [silicic acid](#), and is coated with a layer of organic substance, which was referred to in the early literature on diatoms as [pectin](#), a fiber most commonly found in cell walls of [plants](#)

Culture

- In shrimp hatchery , the most suitable natural live feed mainly comes from the diatom group of family Bacillariophyceae. *Skeletonema costatum* and *Chaetoceros spp.* are preferred over other varieties of diatoms particularly during the early stages of larval development.
- This is because these diatom have cell dimension ranging between **10-24 micron**, shrimp larvae in protozoa stage can consume it.
- In nature, the availability of *Chaetoceros cells* is uncertain due to seasonal variation.
- It was observed that *Chaetoceros cells* are available in **Gulf of Kutch during December to March**, but in **summer** and **monsoon** it occurs occasionally.
- During the month of **February** the sea water was **filtered through sieve** and the **filtrate was observed under the microscope**.
- It was observed that when water sample collected during the **incoming tide, the cells of *Chaetoceros* were found in good numbers** as compared to the sample collected during receding tide.

- The cells of *Chaetoceros* were isolated using micropipette. The enrichment media was prepared
- using following inorganic nutrients
- **a) Sodium nitrate** 16 mg/l
- **b) sodium silicate** 10 mg/l
- **C) Potassium dihydrogen orthophosphate** 6 mg/l
- **d) EDTA- Na₂** 8 mg/l
- For making stock solution, the above nutrients were dissolved in 1 litre of distilled water.
- FRP tank of 400 l capacity were used for culture. The tank was filled with filtered sea water and was aerated. The tanks were kept open in the sunlight so it was an outdoor culture .
- The isolated cells of *Chaetoceros* were added in the well aerated culture tank. The enrichment media which was prepared as a stock solution was used @ 1 ml/litre .
- Aeration was provided throughout the culture period.

Log (number of diatoms)



The month of May , the peak bloom was obtained in just 6 hours after the inoculation with very short stationary phase. The cultured *Chaetoceros cells* were used for feeding to shrimp larvae at protozoa stage.