



PHYTOPLANKTON

MICROSCOPIC MARINE PLANTS

Description: Phytoplankton are defined as microscopic marine algae. Like microscopic versions of plants on land, they are autotrophs, using chlorophyll to harvest sunlight and CO₂ to make energy and grow. Because they need sunlight, they inhabit the upper, sunlit portions of the ocean. They also require inorganic nutrients (such as phosphorous, nitrogen, etc.) to grow, just as terrestrial plants require fertilizer. As a byproduct of their photosynthesis, they produce oxygen, accounting for over 50% of all oxygen in earth's atmosphere. In spring in the ocean, as there is more sunlight available, temperatures are warmer, and there are more nutrients available due to upwelling of nutrients from winter storms, phytoplankton reproduce in huge quantities. These major events in the ocean are called phytoplankton blooms and are similar to blooms that can be observed in lakes that produce green films on the surface of the water.

Carbon Cycle: Phytoplankton turn inorganic carbon (in the form of CO₂) into organic carbon (sugars, etc.) using photosynthesis. They then release some of this organic carbon into the ocean for other organisms (especially bacterioplankton) to consume. This release can be intentional, through the release of certain organic nutrients to attract certain bacterioplankton, or unintentional via the death of the phytoplankton cell (being burst by viruses, grazing by zooplankton, etc.).

Ecosystem Role: Phytoplankton serve as the base of the food web for the marine microbial ecosystem. They are consumed by a variety of larger organisms, including zooplankton, jellies, and fish.

Key Terms

Autotroph: An organism that produces its own food from inorganic sources, either sunlight and CO₂ (photoautotrophs) or other inorganic chemicals (chemoautotrophs).

Upwelling: A process in which deep, cold water rises toward the surface, bringing nutrients from the bottom of the water body to the top.

Phytoplankton bloom: A high concentration of phytoplankton due to explosive growth.

Dinoflagellate: a single-celled organism with two flagella, mainly marine but can also be found in freshwater. Most dinoflagellates are autotrophic, some are heterotrophic and some mixotrophic.

Emiliana: A type of coccolithophore found in almost all ocean ecosystems. It is known for the large blooms it forms in nutrient-depleted waters in the middle of summer. Like all other coccolithophores, it is a single-celled phytoplankton covered with uniquely ornamented calcite disks called coccoliths.

Diatoms: Single-celled, free-living phytoplankton that are the only organism on the planet with cell walls composed of transparent silica. They are highly abundant in marine and freshwater systems.

Pseudo-nitzschia: A type of marine diatom known to be capable of producing the neurotoxin domoic acid which is responsible for the neurological disorder known as amnesic shellfish poisoning.

Asterionellopsis: An abundant type of diatom that lives in cooler waters in the ocean. Especially abundant in the surf zone near the coast.

Mixotroph: An organism that can use a mix of different sources of energy and carbon, both autotrophic and heterotrophic.

Trichodesmium: A type of cyanobacteria that are found in nutrient poor tropical oceans. They are known for being able to fix atmospheric nitrogen into ammonium, a nutrient needed by other organisms. They account for half of global marine nitrogen fixation. They can live either as individual filaments, with tens to hundreds of cells strung together, or in colonies consisting of tens to hundreds of filaments clustered together.

Zooxanthellae: They are photosynthetic single-celled dinoflagellates that usually live in symbiosis with diverse marine invertebrates including corals, jellies, and nudibranchs. During the day, they provide their symbiotic host with the organic nutrients from photosynthesis; in return, they receive nutrients, carbon dioxide, and an elevated position with access to sunshine.

Prochlorococcus: A type of very small (0.6 μm) unicellular marine photosynthetic cyanobacteria. These bacteria are probably the most abundant photosynthetic organism on Earth, found mostly in nutrient-poor ocean waters.

Synechococcus: A type of small (0.8 to 1.5 μm) marine and freshwater unicellular cyanobacteria. They are very widespread in the marine environment, found mostly in the nutrient-rich ocean waters.

More Resources

What are Phytoplankton?: <https://earthobservatory.nasa.gov/features/Phytoplankton>

Phytoplankton Blooms: The Basics: <https://floridakeys.noaa.gov/scisummaries/wqpb.pdf>

What is Upwelling?: <https://oceanservice.noaa.gov/facts/upwelling.html>

Zooxanthellae and Coral Bleaching: <http://ocean.si.edu/ocean-life/invertebrates/zooxanthellae-and-coral-bleaching>

Meet the obscure microbe that influences climate, ocean ecosystems, and perhaps even evolution:

<https://www.sciencemag.org/news/2017/03/meet-obscure-microbe-influences-climate-ocean-ecosystems-and-perhaps-even-evolution>

