

# Unit 3

## Marine Bacteria, Protists, and Plants

# Unit Essential Question

- Which bacteria, protist, and plants are important in the marine environment?

# Concept 1:

## Bacteria, Monerans, and Prokaryotes

- Lesson Essential Questions:
  1. What is the importance of autotrophic bacteria to the food web?
  2. What is the connection between chemotrophic bacteria and hydrothermal vents?
  3. What is the importance of cyanobacteria to the evolution of life on Earth?

# Bacteria

- Believed to be one of the oldest life forms.
- Capable of processes that no other organisms are able to do.
- Can cause diseases.
- Can be autotrophic, heterotrophic, and chemotrophic.
  - Trophic has to do with how an organism gets nutrients and energy.

# Bacteria

- Autotrophic means organisms that can create their own energy from an outside source.
- Heterotrophic means organisms that need to eat in order to take in energy.
- Chemotrophic means organisms that are autotrophic and make their energy from chemicals in their surroundings.

- Bacteria are the base of the food web in all underwater hydrothermal vents.

# Hydrothermal Vents

- Hydrothermal vents are cracks deep in the ocean floor where magma heated water flows out from.
  - This water contains chemicals from deep within Earth.
  - Chemotrophic bacteria are able to turn these chemicals into energy and serve as food for communities of organisms that would not normally be able to survive that deep in the ocean.

# Cyanobacteria

- Cyanobacteria is a specific type of bacteria that are incredibly important primary producers in many marine environments.
  - Scientists believe that cyanobacteria are responsible for creating most of the oxygen in our atmosphere.
  - Scientists also believe that cyanobacteria evolved into chloroplasts found in photosynthetic organisms.

# Concept 2:

## Plant-Like Protists

- Lesson Essential Questions:
  1. What is the structure and function of diatoms?
  2. How are diatoms and dinoflagellates different?
  3. What are the economic uses of diatomaceous earth?
  4. What is the role of autotrophic bacteria?

# Concept 2:

## Plant-Like Protists

- What do you need to know?
  1. What are plankton?
  2. What are phytoplankton?
  3. What are diatoms?
  4. What are dinoflagellates?
  5. What is diatomaceous earth?
  6. What does bacteria have to do with protists?

# Phytoplankton

- Plankton are microscopic organisms that drift in the ocean unable to swim.
- Phytoplankton are any type of plankton that is able to carry out photosynthesis.
  - phytoplankton are basically autotrophic plankton.

# Diatoms

- Diatoms are single-celled phytoplankton that have a hard cell wall made of silica (sand). They are the most common phytoplankton.
  - This cell wall acts like glass allowing large amounts of light to enter each cell.
  - They are able to convert 50% of the sunlight they absorb into usable energy.
  - Always autotrophic.

# Dinoflagellates

- Dinoflagellates are phytoplankton that are characterized by flagella (tail like structures) that allow them to orient themselves or swim short distances.
  - They are the second most common phytoplankton.
  - They are generally larger than diatoms.
  - A few are heterotrophic.
  - Capable of bioluminescence, the ability to emit light.

# Diatomaceous Earth

- Diatomaceous earth is earth material “dirt” that is made up of the fossilized remains of diatoms.
  - Diatomaceous earth is used as an abrasive and filtration powder for pools.

# Brown Algae

- Brown algae is a specialized group of protists that are multicellular and can grow as large as 79 feet tall.
  - Giant Kelp is the largest example of brown algae.
  - Brown algae is found in toothpaste and ice cream.
  - [Kelp Cam](#)
  - [Plant Protists](#)

# Concept 3:

## Animal-Like Protists

- Lesson Essential Questions:
  1. How can you classify zooplankton by motility?
  2. What is the role of zooplankton in the food chain as it relates to reproductive numbers?

# Concept 3:

## Animal-Like Protists

- What do you need to know?
  1. What are zooplankton?
  2. What is motility?
  3. What are reproductive numbers?

# Zooplankton

- Zooplankton are planktonic (non-swimming) organisms that eat phytoplankton or other heterotrophic plankton.
  - Zooplankton are classified by motility, or how they move.
    - Cilia, flagella, and pseudopods.

# Zooplankton Motility

- Cilia are short, hair-like structures that surround an organism that are used to move the organism or to move water past the organism.

# Zooplankton Motility

- Flagella are the same in zooplankton as they are in phytoplankton, they are tail-like appendages that are used to move organisms through the water.

# Zooplankton Motility

- Pseudopods are long extensions of the organisms body that are used to catch food and move the organism through the water.
  - Pseudopods can be similar to threads, needles or blobs extending from the organism.

# Zooplankton in the Food Web

- Zooplankton are primary consumers. That means that they are the first heterotrophs in most marine food webs.
- The reproductive number of zooplankton helps determine how well a food web is doing.
  - The term reproductive numbers refers to the rate at which an organism reproduces.

# Zooplankton in the Food Web

- If zooplankton have a high reproductive number than it can be a sign that the food web is doing well.
- If zooplankton have a low reproductive number than it can be a sign that the food web is not doing well.

# Concept 4:

## Structure and Function of Seaweed

- Lesson Essential Questions:
  1. What are the structural adaptations on seaweed?
  2. What are pneumatocysts?
  3. What is sargassum?
  4. What are the economic values of and uses of seaweed?

# Adaptations

- Adaptations are any variations or differences that make an organism better suited to its environment.

# Seaweed

- Seaweed is a general term for brown, red, and green algae.
- Seaweed is structurally very similar to land plants however they have some special adaptations that allow them to survive underwater:
  - Blade, stipe, holdfast, and pneumatocysts.

# Seaweed Structures

- The blades on seaweed are similar to leaves on a land plant.
  - Blades allow the seaweed to take in sunlight and turn it into energy (photosynthesis).
  - Blades also allow the seaweed to take in minerals, nutrients, and water.

# Seaweed Structures

- The stipes on seaweed are similar to the stems on land plants.
  - They provide structure for the plant to be able to grow up.
  - Stipes are strong and “leathery” which allows the seaweed to move freely in the ocean waves without breaking off.

# Seaweed Structures

- The holdfasts on seaweed are similar to roots on land plants.
  - Holdfasts allow the seaweed to anchor onto solid substrates on the ocean floor.
  - Holdfast are different from roots because they do not absorb water for the plant like roots do.

# Seaweed Structure

- The pneumatocysts on seaweed are unlike any structure on land plants.
  - Pneumatocysts are gas filled structures at the base of each blade that help the blades float up toward the surface and support the seaweed.

# Sargassum

- Not all seaweed is anchored to the bottom of the ocean. Some seaweed floats in large “drift rafts”.
- Sargassum is a type of seaweed that is not anchored and drifts throughout the ocean on ocean currents
  - Sargassum creates large floating ecosystems that are important for marine life.

# Concept 5 :

## Major Divisions of Seaweed

- Lesson Essential Questions:
  1. What are the three major divisions of seaweed?
  2. How are the three major divisions classified?

# Seaweed Divisions

1. Phaeophyta is brown algae.
  - They live in mostly cold water, with lots of nutrients, and water movement.
  - Considered protists.
  - They are colored brown by the pigment fucoxanthin.
  - There are 1500 species of phaeophyta.
  - Kelp and sargassum are both phaeophyta.

# Seaweed Divisions

## 2. Rhodophyta is red algae.

- They live in fresh and salt water. Some species can live in deeper water than any other seaweed.
- Considered plants.
- They are colored red by the pigment phycoerythrins.
- There are over 4000 species of Rhodophyta.
- Some species help hold coral reefs together.

# Seaweed Divisions

## 3. Chlorophyta is green algae.

- They live in freshwater, saltwater, and even on land.
- Considered plants.
- They are colored green by the pigment chlorophyll b.
- There are over 7000 species of chlorophyta.
- They can even live on other organisms.

# Concept 6:

## Marine Flowering Plants

### Lesson Essential Questions:

1. What are anthophyta?
2. What organisms are provided habitat by seagrasses?
3. What is the role of mangrove trees in the Florida coastal environment?

# Marine Flowering Plants

- Anthophyta are any plants that have flowers.
  - There are far less marine flowering plants than land flowering plants, however, they play an important role in the health of the ocean.
  - All marine plants are primary producers, they also produce oxygen, and provide important habitats for other marine organisms.

# Seagrasses

- Seagrasses are a type of marine flowering plant that grows completely underwater (submerged) in shallow waters.
  - Seagrass meadows serve as homes for young fish, crustaceans, and other animals.
  - Manatees also depend on seagrasses to graze on.
  - Seagrasses also filter nutrients out of the ocean from land run-off.

# Mangroves

- Mangroves are also marine flowering plants that grow partially in ocean water. They begin growing underwater and eventually grow out of the water (emerge).
- There are three types of mangroves: Red mangroves, Black mangroves, and White mangroves.

# Mangroves

- Mangroves serve three important roles to the coastal environment:
  1. They provide protection and food for young marine animals, acting as a nursery for many marine species.
  2. They filter runoff water and prevent toxins from entering into the ocean.
  3. They hold sediments in place with their roots which reduces erosion and slows down waves.