Algae Challenge 2008:

Can you handle the *Halimeda* heat?

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Marine algae, or seaweed, are in the Kingdom Protista, and are not considered "true plants". Unlike plants, most algae ***do not*** have vascular tissue, a high level of organ differentiation, or protective layers of cells surrounding their reproductive structures. However, most algae ***do*** make their own food through photosynthesis. The size of algae range from tiny microscopic life to giant ocean kelps. They live in the driest deserts, the coldest tundras, and all types of waters.

Marine algae are divided into 3 divisions: Chlorophyta (green algae), Rhodophyta (red algae), and Phaeophyta (brown algae). A number of diagnostic characteristics divide the algae into these different divisions.

ACTIVITY

Identify algae to division and genera. Memorize the information for each division. Each group must develop 10 questions and participate in the Algae Challenge.

MATERIALS

- Loose marine algae
- Lab handout
- Notecards (10 for each group)

PROCEDURE

1. As a class, read through and discuss the diagnostic characteristics for each division of algae. Review each alga and the associated information.

2. Divide the class into groups of four.

3. Decide on your group name and write it up on the board. It must have an algal relevance.

4. Each group must develop 10 questions using any of the information provided on algae. The questions and answers must be written CLEARLY on one side of the card. Anything is fair game! You can also use the live algae as props for the questions.

5. Each group will then compete in the Algae Challenge (similar to Jeopardy). A participant from each group will compete head-on in a battle to the bitter algal end using questions randomly selected from each group. Each person in the group must take turns participating. Winning answers will get one point. The team with the highest score by the end of class gets a PRIZE.

Division Chlorophyta
Kingdom Protista ?

How many are there? about 500 genera with 8000 species.

How old are they? 400 to 500 million years old with some at 600 myo.

Where are green algae found?

- 90 %of species in freshwater habitats
- 10 % marine species are predominantly tropical species; many are here in Hawai'i.

What pigments do they possess?

- Chlorophyll a and Chlorophyll b
- Certain tropical genera possess siphonoxanthin & siphonein.

What storage product is made? Starch

Cell wall features?

- Cellulose fibrils embedded in an amorphous matrix of polysaccharide.
- The polysaccharides are of at least two types: pectic substances or xylan-mannan polymers.

Cell and thallus complexity?

- Many species of unicells exist as free living adults.
- There are also multicellular complex thalli.
- These macrophtyes typically have swimming unicells as life-history components (gametes or spores).

Amazing Alga of the Day: *Halimeda*
Halimeda is a calcified green alga that can grow in sand or on rocks. Despite the appearance of having different structures, the entire alga is ONE CELL! It has calcium carbonate in its segments, and makes sand when it dies. Around the islands of Maui, Lanai, Molokai, and Kahoolawe, the species *Halimeda kanaloana* forms meadows in the sand from 30 to 300 ft. depths. These meadows provide important habitat for fish and invertebrates. Pretty cool!

Helpful Hints
Chlorophyta are typically light to dark green in color. Some of the Chlorophyta are all one cell, or unicellular, even though they look like a big multicellular plant. Examples of Chlorophyta include *Ulva* (sea lettuce), *Halimeda*, and *Codium*.

How many are there? about 600 genera with 5500 morphological species.

How old are they? 590 million years old for those with calcification.

Where are red algae found?

- 10 %of species in freshwater habitats.
- 90 % marine species with tropical sites predominantly red algae.
- In Hawai'i, about 70 % of our marine algal species are red algae.
- These algae can produce substantial biomass and several species calcify (like corals).

What pigments do they possess?

- Chlorophyll a and phycobilins
- Certain tropical genera possess ability to synthesize orange carotenoids that appear to protect plants from too much sun.

What storage product is made?

- Floridean starch with alpha 1,4 linked glucans.
- This starch lacks the amylose unbranched portion of "starch"**.**

Cell wall features?

- Cellulose fibrils embedded in an amorphous matrix of polysaccharide.
- The polysaccharides are of at least two types: agar or carrageenan.

Cell and thallus complexity?

- A few species are unicells but show no sexual reproduction.
- Unicells lack flagella; they can not swim.
- There are multicellular complex thalli; the majority of them grow via apical cell division.
- These macrophtyes typically have non-swimming unicells as life-history components (gametes or spores).

Helpful Hints

The Rhodophyta range greatly in color from red to purple to light brown to even green! Their pigments allow them to change color depending on nutrient levels and the amount of sunlight available. Examples of common red algae include the invasive algae *Hypnea musiformis* and *Acanthophora spicifera*, and the native algae *Amansia* and A*paragopsis*. The hard pink stuff on the rocks in the intertidal is a kind of calcified pink algae called crustose coralline algae, or nongeniculate coralline algae.

How many are there? about 265 genera with about 2000 species.

How old are they? probably not more than 200 million years old with some at 65 myo.

Where are brown algae found?

- 1 % of species in freshwater habitats.
- 99 % are marine species.
- In tropical areas, a few brown algal species can produce substantial biomass.

What pigments do they possess?

- Chlorophyll a, Chlorophyll c and Fucoxanthin.

What storage product is made?

- Laminarin, a beta 1,3 linked glucan polymer.
- Mannitol, a sugar alcohol.

Cell wall features?

- Cellulose fibrils embedded in an amorphous matrix of polysaccharide.
- The polysaccharide is predominantly alginate.

Cell and thallus complexity?

- NO unicells exist as free living adults.
- All are multicellular complex thalli.
- These macrophtyes typically have swimming unicells as life-history components (male gametes or spores).

Helpful Hints

The Pheaophyta are usually brownish to yellow in color and can be leafy in appearance. Examples of common brown algae are *Padina*, *Sargassum*, *Dictyota* and *Dictyopteris*. In tropical areas, *Sargassum* forms large beds from the intertidal to subtidal, and creates important habitat for fish and invertebrates. Large brown algae in temperate waters are called kelps, and form large kelp forests.

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