

**SECTION REVIEW**

In this section you were introduced to algae. Algae are a diverse group of unicellular, colonial, or multicellular photosynthetic organisms that live in or near a source of water. Like land plants, algae have a cell wall and contain chlorophyll *a* as well as other pigments. Unlike most land plants, algae lack roots, stems, leaves, and an internal system of tubes to move water and materials throughout their tissues.

Algal structure, reproduction, and pigment are adapted to life under water. For example, a number of chlorophylls and accessory pigments allow algae to absorb many wavelengths of light. This enables algae to obtain energy for photosynthesis even though much light energy is absorbed by the water that surrounds them.

**Staying Alive: Finding the Main Ideas**

Algae show many adaptations that enable them to survive in a watery environment. Yet on dry land these adaptations might mean that the algae could not survive. Discuss ways in which each of the following adaptations contributes to the survival of algae in water and might not contribute to the survival of algae on dry land.

1. Thin leaflike structures: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
  
2. No waterproof covering: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
  
3. No stemlike structures: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

4. No system of internal tubes: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

5. Accessory pigments: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**Out of Step: Building Vocabulary Skills**

In each of the following sets of terms, three of the terms are related. One term does not belong. Determine the characteristic common to three of the terms and then identify the term that does not belong.

1. Carbon dioxide, light, oxygen, wastes: \_\_\_\_\_

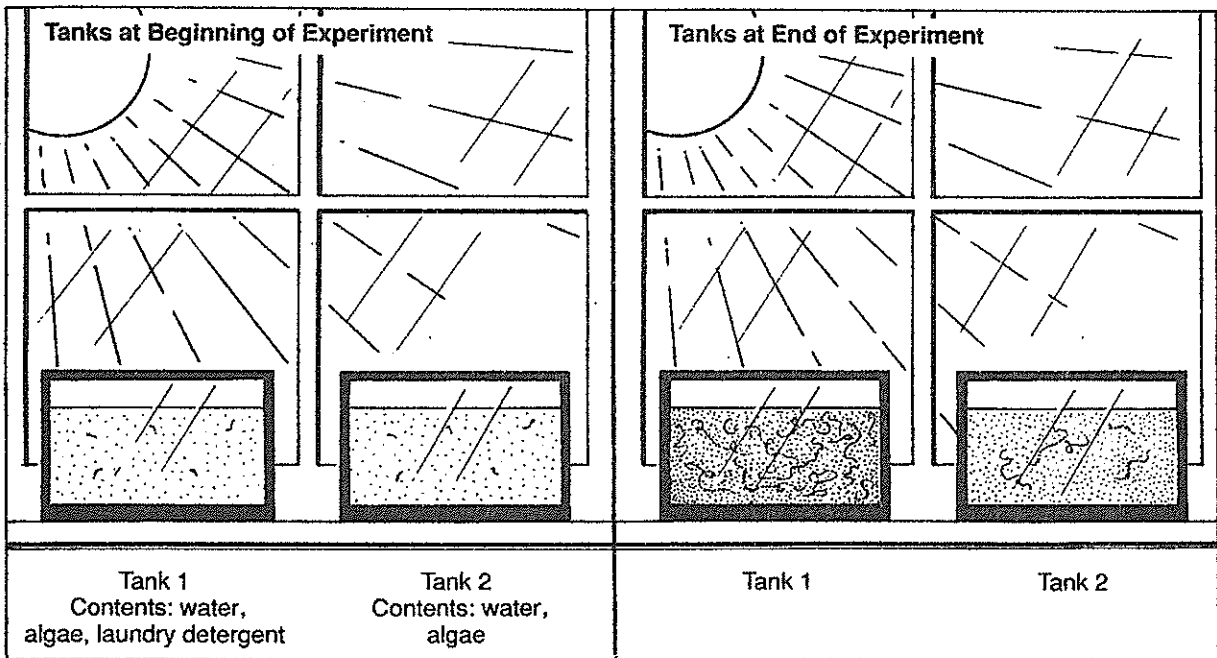
\_\_\_\_\_

2. Streams, ponds, lakes, deserts: \_\_\_\_\_

3. Roots, stems, cell walls, leaves: \_\_\_\_\_

**Formulating a Hypothesis**

Examine the experiment shown in the accompanying illustration.



The student who performed this experiment came to the following conclusion: Plant growth was greater in the tank that contained laundry detergent than in the tank that did not.

1. Based on the conclusion, what was the original hypothesis in this experiment?

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2. What was the variable in this experiment? \_\_\_\_\_

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3. What assumptions can you make about the size of the tank, the amount of sunlight shining on the tank, and the number of algae placed in the tank at the beginning of the experiment? \_\_\_\_\_

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4. Which of the tanks is the control? \_\_\_\_\_

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5. Based on this experiment, another scientist states that all plants will grow better if they are watered with soapy water. Is this reasonable? Why? \_\_\_\_\_

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 **Concept Mapping**

The construction of and theory behind concept mapping are discussed on pages vii-ix in the front of this Study Guide. Read those pages carefully. Then consider the concepts presented in Section 20-1 and how you would organize them into a concept map. Now look at the concept map for Chapter 20 on page 198. Notice that the concept map has been started for you. Add the key facts and concepts you feel are important for Section 20-1. When you have finished the chapter, you will have a completed concept map.

**Section 20-2 Groups of Algae**

(pages 435-439)

**SECTION REVIEW**

In this section you learned about the three groups of multicellular algae. Algae are placed into three groups based on their color and the form in which they store food.

Green algae belong to the phylum Chlorophyta. These algae are found primarily in moist areas on land and in fresh water. All green algae contain chlorophylls *a* and *b*, store food in the form of starch, and have reproductive cycles that include sexual and asexual stages. Some species of green algae, such as *Chlamydomonas*, live as single cells. Others—*Gonium*, *Volvox*, *Spirogyra*, and *Oedogonium*, for example—are colonial. And still others, such as *Ulva*, are multicellular. Some scientists believe that the ancestors of land plants resembled living species of green algae.

Brown algae, which belong to the phylum Phaeophyta, are marine plants that are found in

cool shallow coastal waters of temperate or arctic areas. Brown algae contain chlorophylls *a* and *c* and a brown accessory pigment called fucoxanthin. Brown algae store food in the form of special starches and oils. Examples of brown algae include kelp, *Sargassum*, and *Fucus*.

Red algae live in ocean waters from the far north to the tropics. These algae can live in deep water because they have special pigments that are able to trap the energy in light that penetrates ocean depths. All red algae contain chlorophyll *a* and reddish pigments called phycobilins. Some species of red algae also contain chlorophyll *d*. Most species of red algae are multicellular. All species have complicated life cycles. Examples of red algae include Irish moss (*Chondrus crispus*), coralline algae, and *Porphyra*.

**Name That Alga: Finding the Main Ideas**

"It's not easy being green," laments Kermit the Frog, a popular television character. But color is everything for algae. It is one of the main characteristics scientists use to group these plants. Two characteristics are given for each of five "mystery" algae. Based on these characteristics, identify the color of each alga in the space provided.

1. Single cell that contains chlorophylls *a* and *b*: \_\_\_\_\_
2. Long plant with gas-filled bladders: \_\_\_\_\_
3. Plant that contains chlorophylls *a* and *c* and stores food in the form of an oil:  
\_\_\_\_\_
4. A colony of cells that contains chlorophylls *a* and *b*: \_\_\_\_\_
5. Contains chlorophylls *a* and *d* and phycobilins: \_\_\_\_\_

**Separate the Terms: Building Vocabulary**

Explain the differences between the words or terms that follow. In some cases the members of the pair have very different meanings. In other cases the difference in meanings is small. Use the spaces provided for your answers.

1. Multicellular algae, colonial algae: \_\_\_\_\_

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2. Multicellular algae, unicellular algae: \_\_\_\_\_

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3. Green algae, red algae: \_\_\_\_\_

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4. Marine algae, freshwater algae: \_\_\_\_\_

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5. Chlorophyll, accessory pigments: \_\_\_\_\_

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**How Big Is Big?: Making Calculations**

Some of the larger species of brown algae can grow as much as 10 centimeters in a single day. Use your calculator to compute how long a kelp plant that grows 10 centimeters a day will be in the times shown below. Assume that the growth of this plant will not stop as long as it is alive. Begin your calculations with a plant 1 centimeter long. After each calculation, convert the length you calculated into football fields. (*Hint: 1 meter equals about 1.09 yards. Round off to two significant figures.*)

Time	Length in Centimeters	Length in Football Fields (100 yards)
One day		
One week		
One month (30 days)		
One year (365 days)		
Two years		
Five years		

**Concept Mapping**

The construction of and theory behind concept mapping are discussed on pages vii–ix in the front of this Study Guide. Read those pages carefully. Then consider the concepts presented in Section 20–2 and how you would organize them into a concept map. Now look at the concept map for Chapter 20 on page 198. Notice that the concept map has been started for you. Add the key facts and concepts you feel are important for Section 20–2. When you have finished the chapter, you will have a completed concept map.

**Section 20-3**     **Reproduction in Algae**     (pages 440-441)

**SECTION REVIEW**

As you discovered in this section, the life cycles of most algae are much more complicated than the simple kinds of sexual reproduction that occurs in familiar animals. Algae, like other plants, typically have a life cycle that involves alternation of generations. Most algae also shift back and forth between a sexual reproduction stage that involves the production of gametes and an asexual reproduction stage that produces haploid cells called zoospores.

Asexual reproduction permits a species to colonize a new area relatively rapidly and permits the development of a population from a single individual. Sexual reproduction requires two individuals of opposite sexes to start a

population; it increases the genetic variation present in a population of organisms. This increased genetic variation allows populations to adapt to changes in the environment. In algae, sexual reproduction often produces a resting stage that is capable of surviving harsh conditions that would kill a growing plant.

In the second part of this section you examined the life cycles of three different kinds of algae: the unicellular green alga *Chlamydomonas*, the multicellular green alga *Ulva*, and the multicellular brown alga *Fucus*. You also were introduced to a number of terms that describe reproduction in algae and other organisms.

**Methods of Reproduction: Finding the Main Ideas**

Both sexual and asexual reproduction offer advantages and disadvantages for a species. Listed below are certain environmental situations. For each situation, decide whether it would be more advantageous for an alga to undergo sexual or asexual reproduction. Explain your answers in the space provided.

1. A green alga lives in a pond that is beginning to freeze. \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

2. A factory that manufactures fertilizer accidentally releases plant fertilizers into a nearby lake. There is now a great deal of food for the green algae that live in the lake.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

3. A pond in a desert goes through alternating dry periods and wet periods during the year.


\_\_\_\_\_  
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\_\_\_\_\_

4. A population of small fish with huge appetites for algae are released by mistake in a small pond. All the algae are eaten except for one plant. Suddenly all of the fish die.

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 **Defining Terms: Building Vocabulary**

Define the following words or phases in your own words.

1. Alternation of generations: \_\_\_\_\_

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2. Diploid: \_\_\_\_\_

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3. Haploid: \_\_\_\_\_

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4. Isogamy: \_\_\_\_\_

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5. Heterogamy: \_\_\_\_\_

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6. Sporophyte: \_\_\_\_\_

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7. Gametophyte: \_\_\_\_\_

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8. Egg: \_\_\_\_\_

\_\_\_\_\_

9. Sperm: \_\_\_\_\_

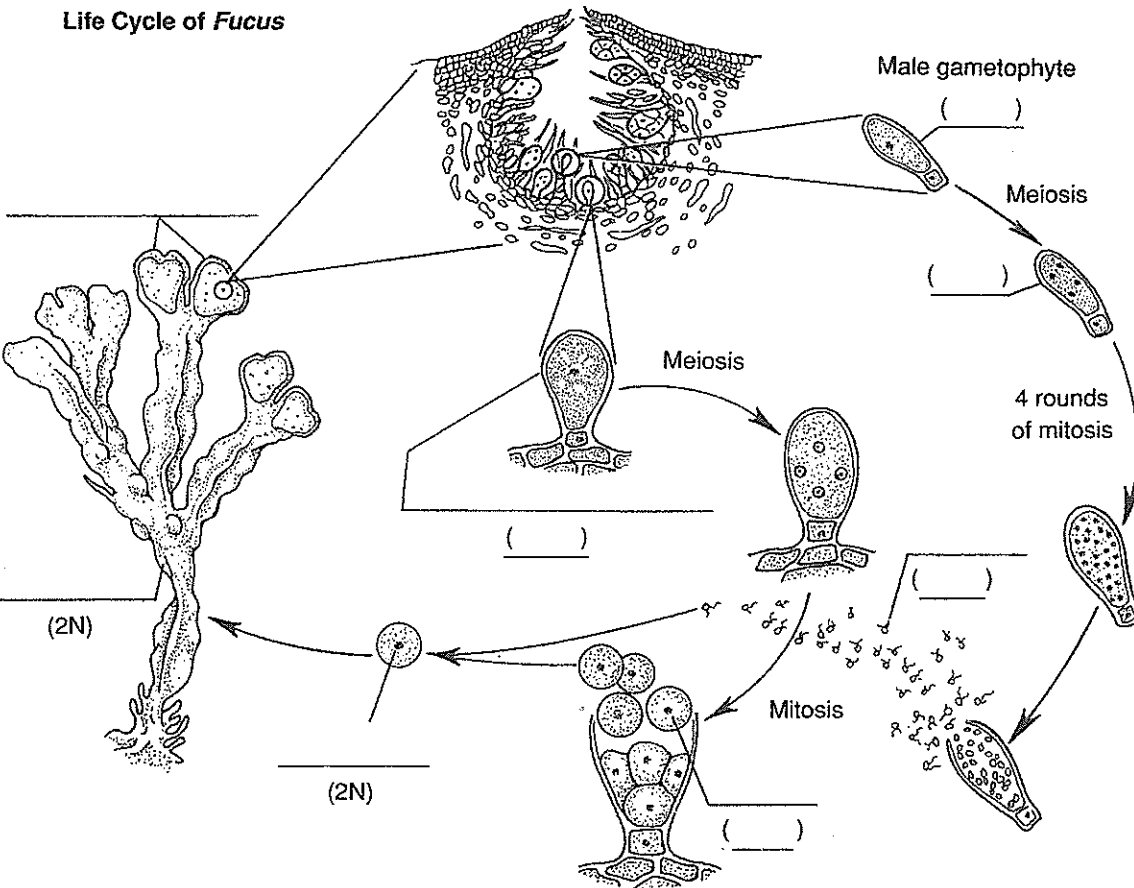
\_\_\_\_\_

10. Zoospore: \_\_\_\_\_

\_\_\_\_\_

**Interpreting Diagrams: Using the Main Ideas**

Fill in the labels and indicate the diploid (2N) and haploid (N) stages in this diagram of the life cycle of the brown alga *Fucus*.



**Concept Mapping**

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**Section 20-4** **Where Algae Fit into the World** (pages 442-443)

**SECTION REVIEW**

Algae are a vital part of the natural world. They are a source of food for terrestrial organisms such as humans and for aquatic organisms such as fishes, sea urchins, and snails. They also provide homes for many different animals, ranging from tiny crustaceans to sea otters.

Algae produce much of the Earth's free oxygen. Oxygen is produced as a waste product of photosynthesis. The algae that live in the waters of our planet perform an estimated 50 to 75 percent of all the photosynthesis that occurs on Earth.

People use algae and the chemicals produced by algae in many different ways. Some

species of algae are rich in Vitamin C, iron, iodine, and other nutrients and are used as food supplements. Other chemicals produced by algae are used to treat certain human diseases.

Algae are also used in the manufacture of many food products: ice cream, relishes, salad dressings, chip dips, and canned chow mein, to name a few. Products as diverse as tooth-pastes, hand lotions, finger paints, plastics, waxes, deodorants, and transistors contain algae. In the scientific laboratory, a substance extracted from algae is used to make a culture medium upon which microorganisms are grown.

**A World Without Algae: Using the Main Ideas**

The following places use products containing algae or substances produced by algae. Describe what would happen in each place if there were no algae or the products of algae. How might these changes affect your life?

1. The supermarket: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

2. A locker room in a gymnasium: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

3. A medical research laboratory: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

**Concept Mapping**

The construction of and theory behind concept mapping are discussed on pages vii-ix in the front of this Study Guide. Read those pages carefully. Then consider the concepts presented in Section 20-4 and how you would organize them into a concept map. Now look at the concept map for Chapter 20 on page 198. Notice that the concept map has been started for you. Add the key facts and concepts you feel are important for Section 20-4. When you have finished the chapter, you will have a completed concept map.