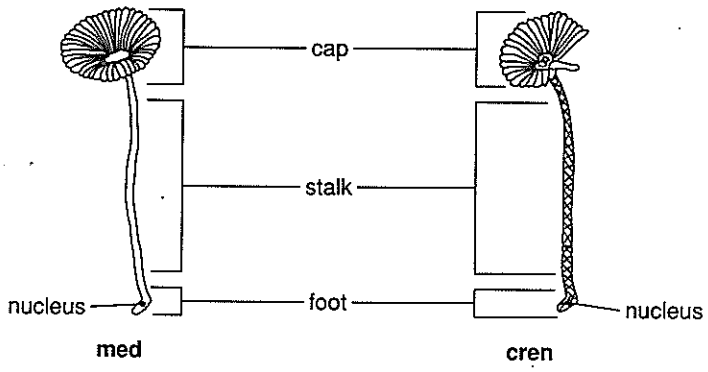
Name _____ Class _____ Date _____

Determining the Role of the Cell Nucleus

Biologists have performed experiments to determine if the characteristics of a cell are controlled by its nucleus. In other words, they tried to show a cause-and-effect relationship between the nucleus (cause) and cell characteristics (effect). In this activity you will examine an experiment that provides evidence for this relationship using a single-celled green alga called *Acetabularia*.

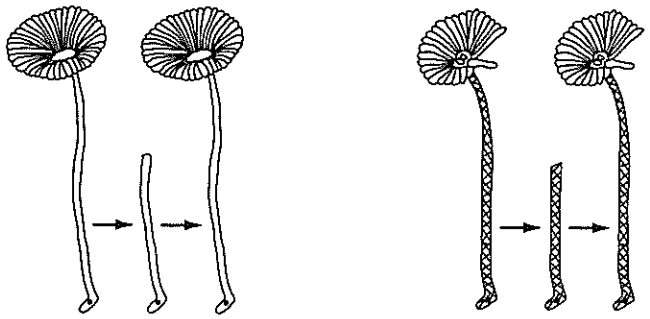
Acetabularia is an unusual alga found in warm ocean waters like those in the Gulf of Mexico. Figure 1 shows two species of *Acetabularia: A. mediterranea* (*med* for short) and *A. crenulata* (*cren* for short). These algae are unusual for single-celled organisms. They are large (up to 9 centimeters in length) and have specialized parts that are easy to identify. The shape of their caps can be used to distinguish between species.

Figure 1



If the cap is removed from the cell, a new cap grows in its place.

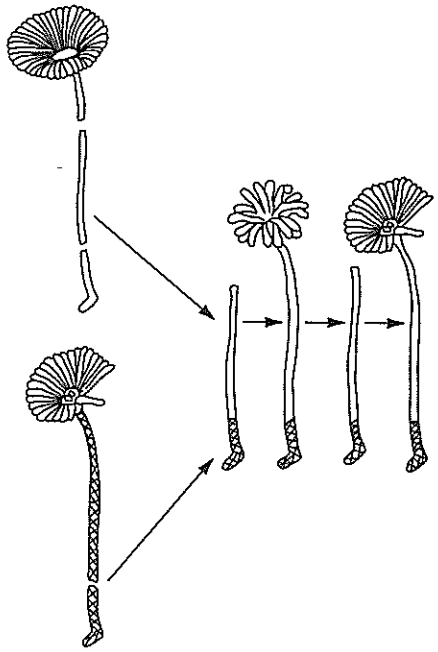
Figure 2



Dr. Joachim Hammerling, a biologist, hypothesized that the alga's nucleus was responsible for the shape of the cap. He performed the following experiments to test his hypothesis.

Dr. Hammerling removed the cap and the stalk from each species of alga, which left only the base. He then grafted a *cren* stalk onto the *med* base. Soon, a new cap grew on the grafted stalk. It had characteristics of both the *med* and the *cren* caps. This intermediate cap was then cut off and a new cap grew in its place. Although the new cap had grown on top of the *cren* stalk, it was clearly a *med* cap. This experiment was repeated using a *cren* base and a grafted *med* stalk. One of the experiments is summarized in Figure 3.

Figure 3



1. What do the final results of these experiments suggest about the role of the nucleus?

_____

_____

2. The intermediate caps have characteristics of both species. Form a hypothesis to account for the intermediate caps. Relate the hypothesis to the role of the nucleus.

_____

_____

3. Suppose the alga's nucleus was located in the stalk. Predict the results of the experiments.

_____

_____

4. Suppose a *cren* stalk was grafted onto a *med* base and always formed a *cren* cap. How would you interpret this result? Refer to the role of the nucleus.

_____

_____

Name _____ Class _____ Date _____

CHAPTER 20

Multicellular Algae
Section 20–3

SKILL ACTIVITY
Making comparisons

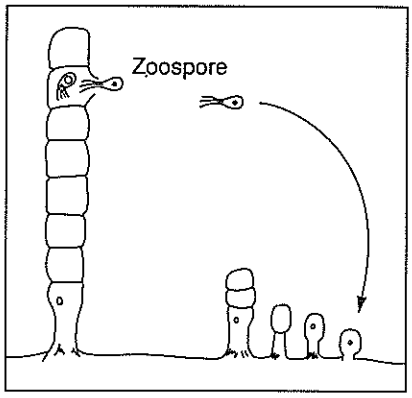
Reproduction in Algae and Fungi

Algae and fungi rely on both sexual and asexual means of reproduction. Unless these mechanisms are examined closely, their similarities and differences can be overlooked. In this activity you will compare the reproductive strategies of algae and fungi.

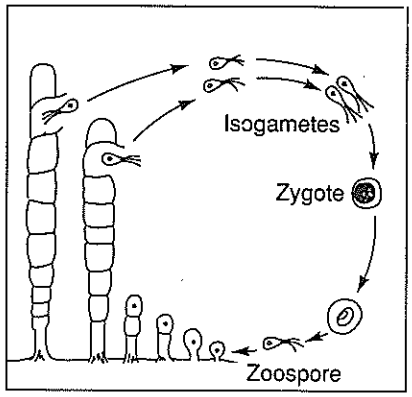
Diagrams A, B, C, and D of Figure 1 show asexual and sexual reproduction in an alga and a fungus. Below each diagram indicate which type of reproduction is depicted.

Figure 1

Reproduction: Green Alga, *Ulothrix*

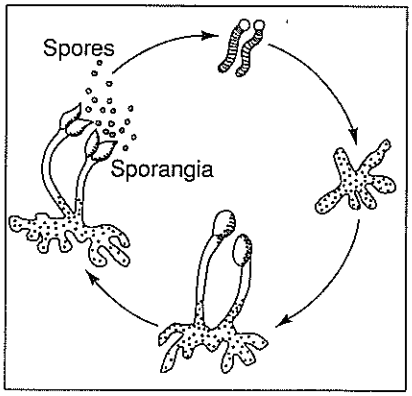


A. _____

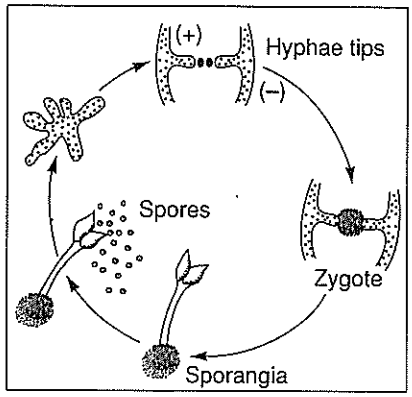


B. _____

Reproduction: Bread Mold



C. _____



D. _____

1. How does zygote formation in the alga differ from zygote formation in the fungus?

_____

_____

2. What asexual structure in the alga corresponds to the spore in the fungus?

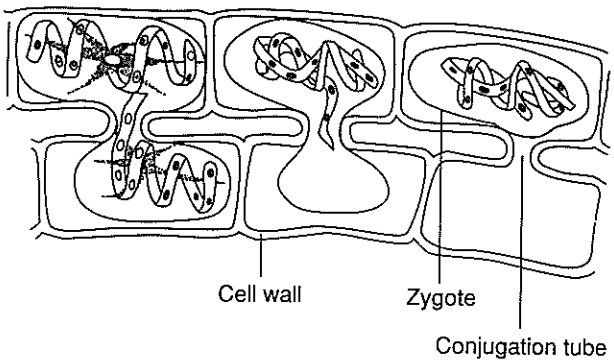
3. In the alga, sexual reproduction results in the development of the zoospore, which is also part of asexual reproduction. How does this compare with the same process in the fungus?

4. **a.** In which algal structure does meiosis occur?

b. In which fungal structure?

Spirogyra is a filamentous green alga found in ponds, lakes, and streams. During sexual reproduction, two filaments come to lie side by side. Conjugation tubes grow to link cells in opposite filaments. Through the conjugation tubes, the cells of the "male" filament flow to fuse with the cells of the "female" filament. Each fusion results in a dark zygote in a chamber of the female filament. After a period of dormancy, the zygotes are released into the water. They then undergo meiosis and germinate to produce new haploid filaments.

Figure 2



Sexual Reproduction: *Spirogyra*

5. **a.** Compare the diagram of sexual reproduction of the alga *Spirogyra* in Figure 2 with the diagram of sexual reproduction of the bread mold in Figure 1. How are the processes the same?

b. How are they different?

Name _____ Class _____ Date _____

CHAPTER 20

VOCABULARY REVIEW

Multicellular Algae

Word Game

On the lines below, write the word or words that best fit the description on the left. When you are finished, the boxed-in letters will spell out one of the topics discussed in the chapter. Fill in that word or phrase in the space provided.

1. Compound derived from certain seaweeds, which is used to grow bacteria in the laboratory _ _ _ _ □
2. Genus name for the multicellular green alga known as sea lettuce _ □ _ _
3. Phylum containing red algae _ _ _ _ _ _ _ _ □ _
4. Male gamete _ _ □ _ _
5. Genus name for the world's largest alga _ _ □ _ _ _ _ _ _
6. Fusing of gametes to form a diploid zygote _ _ □ _ _ _ _
7. Production of identical reproductive cells _ _ _ _ □ _ _
8. Kingdom that contains all multicellular algae _ _ _ _ □ _ _
9. Red accessory pigment _ _ _ _ _ _ □ _ _ _
10. Production of two different kinds of gametes _ _ _ _ _ □ _ _ _ _
11. Group of attached cells that lack specialized structures _ _ _ _ □ _

12. Diploid stage of a plant that produces spores

13. Specialized cells that attach certain algae to the bottom of a lake or pond

14. Female gamete

15. Autotrophs that live in or near water

16. Single-celled green algae

17. Gas-filled swellings on algal blade

18. Light-absorbing compounds found in many algae

19. Phylum containing brown algae

20. Haploid stage of a plant that produces gametes

21. Long, threadlike colony of green algae

22. Haploid cell produced during asexual reproduction

23. Brown accessory pigment

24. Kingdom that contains most single-celled algae

Life cycle that switches back and forth between haploid and diploid generations