Special Characteristics of Ferns

Pre-Lab Discussion

Ferns belong to a group of plants that are "true" land plants. These plants have specialized tissues called **vascular** (conducting or "plumbing") **tissues** that transport water and the products of photosynthesis throughout the plant. For this reason, these plants are called vascular plants. Vascular plants can grow much larger than plants without vascular tissues. When comparing cellular organization, ferns lie between mosses and more complex vascular plants, such as trees.

Ferns belong to the **Phylum Tracheophyta** and grouped together into the **Class Filicineae** because they produce **spores** instead of **seeds**. Plants reproducing using seeds are grouped into the **Classes Gymnospermae** and **Angiospermae**. These two classes are distinguished from one another on the basis of where the seeds are found on the plant (ie. cones vs. flowers).

Most ferns do not have sturdy, erect stems. Instead a thick stem runs horizontally under the soil. It is usually covered with scales. Underground stems of this type are called **rhizomes**. Inside the rhizomes are vascular tissues that carry water and food through the plant. Fern rhizomes live from year to year. They gradually grow outward through the soil and produce numerous roots and leaves each season. Because of the creeping rhizomes, ferns are often found in large clumps.

Unlike mosses, ferns do have **true roots**. Clusters of roots develop from the rhizome. They anchor the fem in place and absorb water from the soil.

The leaves of ferns are usually large and are called **fronds**. The fronds die in the winter and a new set develops from the rhizome each spring. A frond consists of 3 parts: a **blade**, a **rachis**, and a **stipe**. The large expanded part of the fern is the blade. The midrib that supports the blade is the rachis. The stipe is the stalk that attaches the rachis to the rhizome. The blade is usually divided into many leaflets that are arranged in 2 rows along the sides of the rachis.

As new fronds develop in the spring they unroll from tightly coiled buds produced by the rhizome. Because they look like the curved end of a violin, these young fronds are called **fiddleheads**. The fiddleheads of some (not all!) ferns are edible.

When the fern is mature, raised brown dots appear on the lower surfaces of the blades. These "dots" are called **sori** (singular = **sorus**). Each sorus contains a cluster of sporangia (spore cases). These sporangia produce thousands of dust-like **spores**.

Sporangia are very sensitive to the amount of moisture in the air. Under certain conditions the sporangia tear open and spores are shot out in a manner similar to that of sling-shot. If a spore lands in a warm damp place, it germinates and develops into the first of cells of the **gametophyte generation**.

A fern gametophyte starts as a short filament of cells with a few rhizoids to anchor it. It then widens into a flat sheet of cells called a **prothallus** (pro = early; thallus a plant body). The prothallus is heart- shaped and smaller that a dime in diameter! It has rhizoids, but **no root**, **stems** or **leaves**. Most people have never seen fern prothalli, because they are so tiny and short-lived. The function of the prothallus is to produce gametes.

Both the male and female sex organs develop on the under surface of the prothallus. The male sex organs, **antheridia** are found near the apex or point of the heart-shaped prothallus, among the rhizoids. They are dome-shaped and produce the **male gametes** which are spirally-coiled sperm cells. The sperm have many flagella to help them swim to the site of the female gametes. The female sex organs, **archegonia** are located near the notched end of the heart-shaped prothallus. They are shaped like a flower vase and contain one **female gamete** or **egg cell**.

Because the sperm swim, water is required for fertilization! The sperm swim to the nearby female archegonium, enter, and fuse with the egg. Only a single sperm fertilizes each egg. The resulting **zygote** is the first cell of the **sporophyte generation**.
While still inside the archegonium, the zygote begins to grow into the sporophyte. At fist ft is parasitic on the prothallus, absorbing its food and water from it. In a few days the sporophyte produces a leaf, root, and stem and contains chlorophyll. It can now produce its own food and is no longer dependent on the gametophyte. As the sporophyte develops, the tiny prothallus withers and dies.
In this investigation, you will observe some of the characteristics of ferns. You will also examine how ferns reproduce.

Procedure:

Part A: Characteristics of the Sporophyte Fern

1. Examine a whole sporophyte fern plant. Use Figure 1 to identify the structures of a fern.

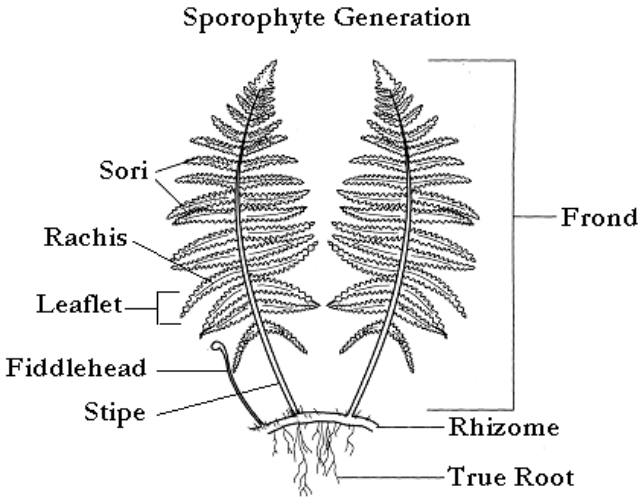

Figure 1

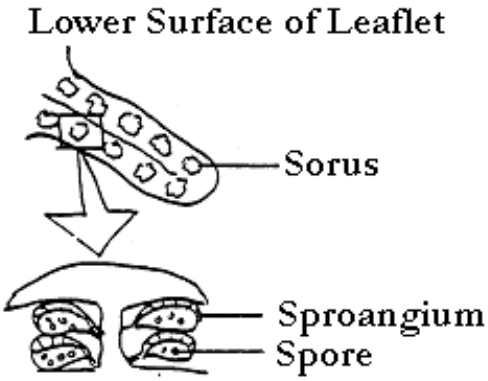

Figure 2

2. Locate the horizontal stem structure called the rhizome.
3. Notice how the fern leaves, or fronds, arise from the rhizome. Note the shape of the frond and the presence of veins in the stem part.
4. Examine the underside of the frond for brownish-yellow spots. These spots are called sori (singular, sorus).

Part B: Characteristics of the Gametophyte Fern

1. Obtain the fern frond that contains sori.
2. Examine a single sorus. Use Figure 2 to identify the structures of a sori.

Observations:

Fern Frond

Total Magnification:

Discussion:

1. Which phylum do ferns belong to?

2. What do members of this phylum all have in common.

3. List 3 different examples of plants that belong to this phylum.

4. In ferns, which generation is dominant? How does this contrast to mosses?

5. Is the gametophyte plant haploid or diploid? Explain your answer.

6. Instead of a woody stem, how are fern leaves connected?

7. How are the vascular tissues arranged in the fern rhizome?

8. Why can you not kill a fern by cutting off the fronds at ground level?

9. What are fiddleheads?

10. Explain how ferns are still dependent upon a wet environment.

11. Explain how ferns are less dependent upon a set environment than mosses.

12. Why are ferns found in a greater range of habitats than mosses or liverworts?

13. Considering the large number of spores that are produced by a single frond o a fern plant, why do you think there are not more fern plants growing on Earth?

14. Why is it advantageous for the spores to be located on the bottom surface of the fern fronds?

15. Many flowering plants have leaves that are very similar in appearance to fern fronds. Although these plants are not true ferns, some of them are called ferns. The asparagus fern is an example. How would you determine whether such a plant was a fern?

Conclusion: Label the fern life cycle diagram. Label the sporophyte and gametophyte generations.