

## Chapter 29: Plant Diversity I: How Plants Colonized Land

**29.1** *Identify key derived characters of plants.*

**29.2** *Characterize the life cycles of nonvascular plants.*

**29.3** *Describe characteristics and reproductive processes of seedless vascular plants.*

The movement of plants onto land required many adaptations, which are discussed in this chapter. The first land plants were more closely tied to water than later groups, so focus on the adaptations which allow successive groups to exploit new terrestrial habitats. Life cycles are the second important topic in this chapter with new terminology that helps to describe alternation of generations in plants. We will lead you through the most important parts of this chapter, focusing on adaptations for terrestrial life and plant life cycles.

**Study Tip:** The opening figure again provides a succinct summary of the “big picture” for this chapter.

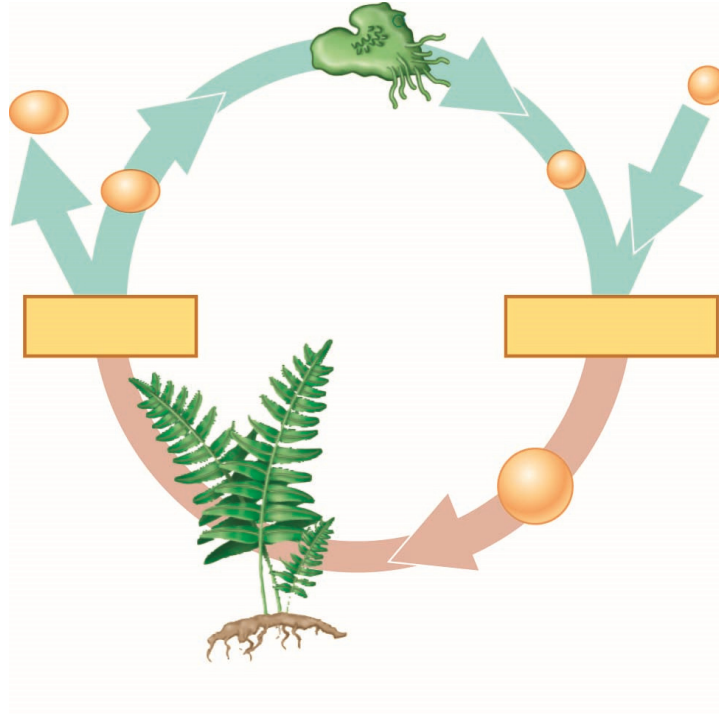
- a. Plants colonized land over 400 million years ago. Which group of algae is believed to be the ancestor of land plants?
- b. What are two adaptations that facilitate life on land?

### **Concept 29.1** *Plants evolved from green algae*

**LO 29.1:** *Identify key derived characters of plants.*

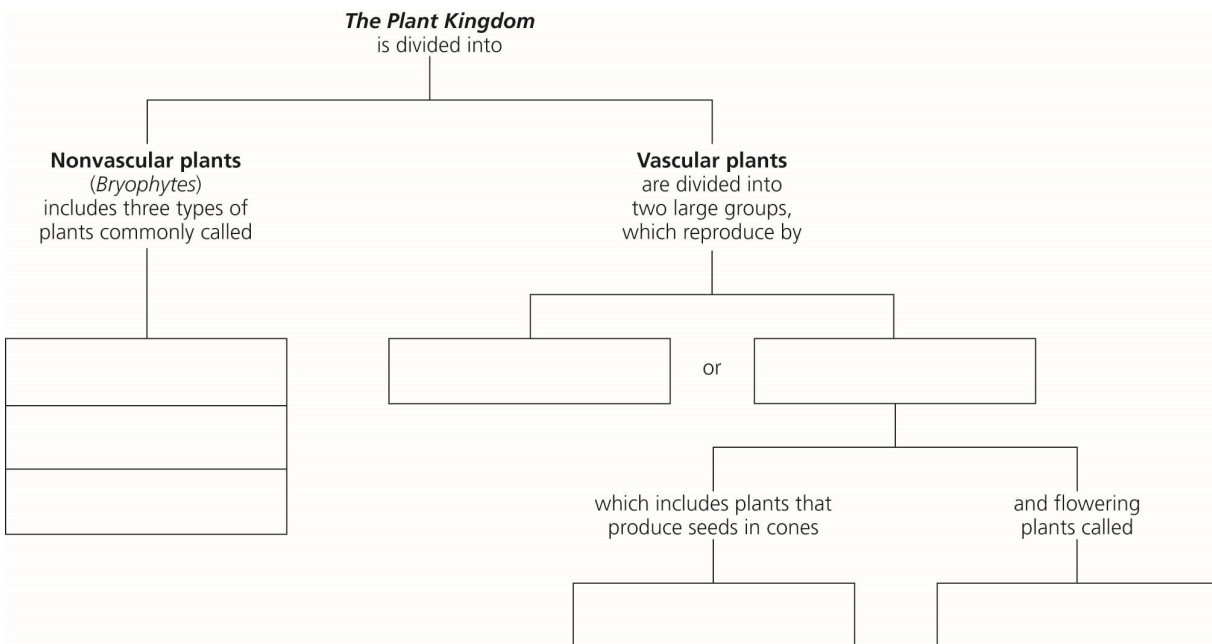
1. Read carefully to find the five key traits plants share with green algae. List them here.
2. Some plants share production of *sporopollenin* with the *charophytes*, a lineage of green algae. What is sporopollenin, and why is it important for life on land?

3. Figure 29.5 in your text presents a number of important terms for you to understand. To help you focus on what you need to pull from this figure, refer to the first section on *alternation of generations*. Label the following: *gametophyte*, *gamete*, *fertilization*, *zygote*, *mitosis*, *sporophyte*, *meiosis*, *spore*,  $n$ , and  $2n$ . After labeling, answer the following questions.



- Sexual life cycles always feature two key events. What are they? (Hint: Figure 13.6 on p. 258.)
- If the gametophyte has 16 chromosomes, how many chromosomes are in the sporophyte?
- In animals, the direct result of meiosis is a gamete. In plants, what is directly produced by meiosis?
- Alternation of generations is a feature of the plant clade. Name the two generations that alternate.
- Which plant generation is haploid and which is diploid?
- What is produced by the gametophyte generation?
- What is produced by the sporophyte generation?

4. In order to learn about plants and their adaptations to life on land, there are derived traits you will need to know and how they contribute to a terrestrial lifestyle.
  - a. What are *sporangia*?
  - b. What are *spores*? How are they an adaptation to life on land?
  - c. What is the *cuticle*? How is it an adaptation to life on land?
  - d. What are the *apical meristems*? How do they contribute to life on land?
  - e. What are *stomata*?
  - f. What is *vascular tissue*?
  - g. What is a *seed*?
  - h. What are *gymnosperms*? Give an example.
  - i. What are *angiosperms*? Give an example.
5. Now let's organize the plant groups. Refer to your text and Figure 29.10 to complete the concept map that follows to show how plants are grouped. (*Note that this is not a phylogenetic tree but rather a look at the "big picture."*)



Revise the concept map by adding the two groups of vascular plants that reproduce with spores.


6. Again refer to Figure 29.10 in your text. We are going to use it to reinforce what you have learned about cladistics. To analyze it, you may need to go back to Figure 26.10.
- What is a clade?
  - Do the three groups of nonvascular plants you identified in question 5 form a clade?
  - Which two groups of nonvascular plants are most closely related?
  - Are ferns more closely related to club mosses or to seed plants? Explain.
  - Do seed plants form a clade? Explain.

**Concept 29.2** *Mosses and other nonvascular plants have life cycles dominated by gametophytes*

**LO 29.2:** *Characterize the life cycles of nonvascular plants.*

An important feature of plants is *alternation of generations*. Let's look further at the process with a specific group of plants, the mosses. Use Figure 29.11 in the text to locate and label the following: *male gametophyte*, *antheridia*, *female gametophyte*, *archegonia*, *egg*, *zygote*, *sporophyte*, *rhizoid*, *sporangium* and *spores*. Note the haploid and diploid part of the life cycle.



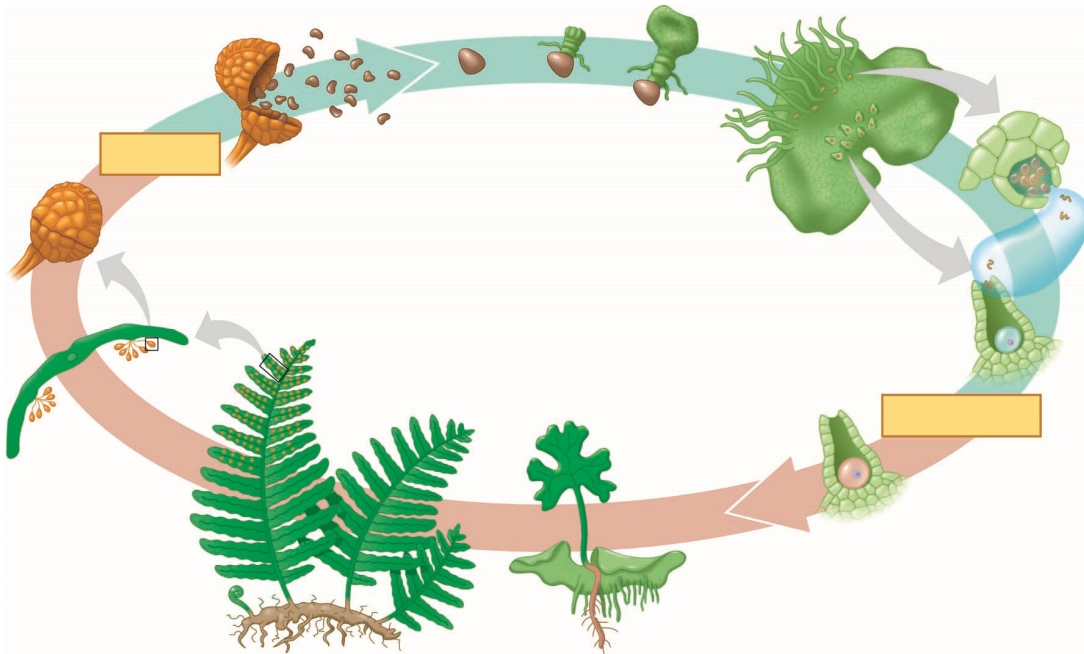
7. What is made in the *antheridium*? \_\_\_\_\_ in the *archegonium*? \_\_\_\_\_
  8. What is made by the *gametophyte* generation?
  9. What is made by the *sporophyte* generation?
  10. Where does meiosis occur?
  11. In animals, the gametes are formed by meiosis. In plants, what cells are formed by meiosis?
  12. How are spores dispersed?
  13. How does the sperm reach the egg?
  14. On this picture of moss, label the sporophyte and the gametophyte.
    - a. Which generation is *haploid*?
    - b. Which generation is *diploid*?
  15. How do mosses absorb water? How is it distributed?
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16. Which moss generation is *dominant*? \_\_\_\_\_ It is larger, longer-living, independent, and photosynthetic. It is the generation that you will always see.

**Concept 29.3** *Ferns and other seedless vascular plants were the first plants to grow tall*

**LO 29.3:** *Describe characteristics and reproductive processes of seedless vascular plants.*

17. Like the Bryophyta, ferns are most common in damp environments. What feature of their reproduction requires them to live in a moist habitat for at least part of the year?
18. What are the two types of *vascular tissue*? What does each transport?

19. *Ferns* are vascular plants. Why can vascular plants grow to be very tall, but nonvascular plants are all tiny?
20. *Lignified* vascular tissue allows vascular plants to grow very tall because it adds strength. How does this give vascular plants a competitive edge?
21. What are the functions of *roots*?
22. What is the function of *leaves*?
23. To summarize, only plants with vascular tissue can have true roots, stems, and leaves. Ferns and their relatives are seedless vascular plants. You will see examples of club mosses, horsetails, and more in Figure 29.19 of your text. Which of the plants pictured there have you seen?
24. Let's conclude this chapter with a look at the life cycle of a fern. Use this to solidify your understanding of *alternation of generations*. Label the following elements on the diagram below: *sporangium*, *meiosis*, *spore*, *gametophyte*, *antheridium*, *archegonium*, *sperm*, *egg*, *fertilization*, and *zygote*.



25. Which generation is dominant in ferns? Is it haploid or diploid?
26. Throughout this chapter, we have looked at problems of a terrestrial life faced by plants. Use the following chart to summarize the solutions that are seen to some of these problems.

Problem	Solution/Adaptation
1. Obtain water	
2. Transport water	
3. Transport products of photosynthesis	
4. Prevent desiccation of embryo	
5. Prevent desiccation of plant body	
6. Support against gravity	
7. Protect embryo	
8. Transport sperm	
9. Increase surface area for photosynthesis	

*Test Your Understanding, p. 635*

*Now you should be ready to test your knowledge. Place your answers here:*

1. \_\_\_\_\_ 2. \_\_\_\_\_ 3. \_\_\_\_\_ 4. \_\_\_\_\_ 5. \_\_\_\_\_ 6. \_\_\_\_\_