13.1 Vascular Plant Structure and Function

Recall that plants can be placed into two major divisions: vascular plants and nonvascular plants. Table 1 summarizes the key features of four plant taxa.

<table>
<thead>
<tr>
<th>Taxon</th>
<th>Waxy cuticle</th>
<th>Vascular tissue</th>
<th>Pollen grains</th>
<th>Seeds</th>
<th>Flowers and fruits</th>
</tr>
</thead>
<tbody>
<tr>
<td>mosses</td>
<td>X</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>ferns</td>
<td>X X</td>
<td>-</td>
<td>X</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>gymnosperms</td>
<td>X X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>angiosperms</td>
<td>X X X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

In Chapter 10, you learned about some of the features that allowed some early nonvascular plants to survive on land. You also learned about the specific features of vascular plants that permitted them to be extremely successful and form the basis of terrestrial ecosystems. This chapter will concentrate on the biology of vascular plants.

Photosynthesis, the process by which plants synthesize their own carbohydrates, is the most important distinguishing feature of the plant kingdom. It is these carbohydrates which supply both stored chemical energy and building blocks for cell growth and reproduction. They also provide the food for all other organisms through food webs. Photosynthesis is a cellular process. How do plants, like angiosperms, ensure that their green cells receive the sunlight, carbon dioxide, and water needed for photosynthesis? How do they distribute the manufactured carbohydrates to all their cells? How do plants store these products?

Cells of all multicellular organisms are organized into tissues, tissue systems, organs, and organ systems. These structures enable plants to successfully photosynthesize, grow, and reproduce (Figures 1 and 2).

**Figure 1**

Cells of all complex plants are organized into tissues, tissue systems, organs, and organ systems that enable the plants to carry out the basic processes of life, such as photosynthesis, distribution and storage of carbohydrates, growth, and reproduction.

**Meristems**

Unlike animal cells, which have many kinds of cells that undergo division, plant cells divide by mitosis only in specific regions called meristems. The meristems at the root tips and shoot tips are called apical meristems. In spermatophytes, root and shoot systems begin to form in the tiny embryo within the seed. As the seed...
germinates, cells at the root and shoot tips divide by mitosis and elongate. Meristems at locations other than the root and shoot tips form complete or incomplete cylinders of tissue within roots and stems. Cell division in these cylinders, called the lateral meristems, causes an increase in the diameters of roots and stems. **lateral meristems:** cylindrical regions in roots and stems. They are responsible for all increases in diameters of roots and stems.
vascular cambium: a lateral meristem which is responsible for creating new xylem and phloem tissue.

primary growth: all plant growth originating at apical meristems resulting in increases in length, as well as growth originating at the lateral meristems in the first year of a plant’s life.

secondary growth: plant growth originating at lateral meristems which results in increased diameters of roots and stems in the second and all subsequent years of a plant’s life.

SUMMARY Vascular Plant Structure and Function

1. The cells of complex plants are organized into tissues, tissue systems, organs, and organ systems.
2. Primary growth is growth in length and occurs at apical meristems, plus at the lateral meristems during a plant’s first year.
3. Secondary growth is growth in diameter and occurs at lateral meristems of plants which live more than one year.
4. Cells produced by meristematic tissue differentiate into all other plant tissues.