Botany: Part I Overview

Overview of Plants & Plant Structure

The Study Of Botany Derives Components From Each Of The Four Big Ideas In Biology

- Big Idea 1: The process of evolution drives the diversity and unity of life
- Big Idea 2: Biological systems utilize free energy and molecular building blocks to grow to reproduce & to maintain dynamic homeostasis
- Big Idea 3: Living systems store, retrieve, transmit, and respond to information essential to life processes
- Big Idea 4: Biological systems interact, and these systems and their interactions possess complex properties.

Characteristics of Land Plants

- Eukaryotic
- Autotrophs
- Cell Wall - cellulose
- Alternation of Generations
- Embryophytes – protected embryo

Adaptations for Moving on To Land

- Prevention from dehydration-Evolution of waxy cuticle
- Method to obtain water and minerals-Evolution of roots
- Increase in size and support-Evolution of xylem fortified with lignin
- Method of reproduction without water-Evolution of pollen and pollination strategies.
- Method of protecting embryo from dehydration-Evolution of the seed

Bryophytes

- Nonvascular land plants
- Mosses, liverworts and hornworts
- Gametophyte (n) is photosynthetic, dominant generation
- Typically ground-hugging plants (Why?)

Ferns

- Seedless vascular plants
- Horsetails and ferns
- Sporophyte (2n) is dominant generation
- Most common in damp areas due to flagellated sperm that must swim to reach eggs

Gymnosperms

- "Naked" seeds not enclosed in ovaries
- Conifers, gingkos, and cycads
- Sporophyte (2n) is the dominant generation
- Seeds are exposed on modified leaves that usually form cones

Angiosperms

- Flowering plants
- Pecan trees, roses, peach trees, tomatoes
- Sporophyte (2n) generation is dominant
- Flowers and fruit
- Most abundant of all plant species

Plant Structure and Function

A simple body plan underlies the diversity of plant forms that exist today.
Hierarchy of Plant Organization

Systems - root and shoot

Reproductive system - flowers

Root system

Vegetative system - stems and leaves

Organs: Roots

Roots – anchor a vascular plant to the soil, absorb minerals and water, and often store carbohydrates

Root Adaptations

Each of these evolutionary root adaptations increase plant survival in a given environment.

Organs: Stems

Stems – lift leaves and reproductive structures

Stem Adaptations

Some plants have stems with additional functions, such as food storage and asexual reproduction. These are examples of modified stems.

Organs: Leaves

Leaves – the main photosynthetic organs

Leaf Adaptations

Some plant species have leaves with adaptations that function in support, protection, storage, or reproduction in addition to photosynthesis.

Plant Tissues

<table>
<thead>
<tr>
<th>Tissue</th>
<th>Components</th>
<th>Function</th>
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<tbody>
<tr>
<td>Dermal</td>
<td>Epidermis</td>
<td>Protection, Prevent water loss</td>
</tr>
<tr>
<td>Ground</td>
<td>Parenchyma, Collenchyma</td>
<td>Metabolism, Storage, Support</td>
</tr>
<tr>
<td>Vascular</td>
<td>Phloem, Xylem</td>
<td>Transport water, products of photosynthesis</td>
</tr>
</tbody>
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Location of Tissue Types

Which tissue type in most abundant in plants?

How is this representative of "form fits function"?

Dermal Tissue

Forms epidermis, usually one cell layer

Some cells differentiate:

- Stomata – pores for gas exchange
- Trichomes – leaf hairs, protect against herbivores and damaging solar radiation
- Root hairs – increase root surface area

Epidermal cells of the shoot system secrete a waxy cuticle that limits water loss, reflects damaging solar radiation, and form a barrier against pathogens

Ground Tissue

Ground tissue is the most abundant tissue

Cells differentiate:

- Parenchyma – most abundant, carry out photosynthesis, store protein and starch
- Collenchyma – elongated, thick cell walls, provide support
- Sclerenchyma – thick cell walls reinforced with lignin, programmed cell death, cell walls remain to provide support

Vascular Tissue

Transport System

Xylem – carries water and minerals from roots to rest of plants, composed of dead cells

Phloem – is composed of living cells, moves carbohydrates from production sites to where they are either used or stored

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Botany: Part I Overview STUDENT HANDOUTS