The Plant World

A. Introduction to plants

Reflect on the properties of life and apply them to plants.

Continue our themes of asking how this group of organisms contribute to local / global ecology and human biology.

B. What is a plant?

Plants are --

- multicellular
- terrestrial
- sessile
- photoautotrophs

But to go farther and deeper, we need to reflect on the opportunities and challenges of having these features. These features also interact with one another.

What are the opportunities and challenges of being multicellular?

What are the opportunities and challenges of living on land?

What are the opportunities and challenges of being sessile?

What are the opportunities and challenges of being photoautotrophic?

Our study of the biology of plants should be viewed as an exploration of the adaptations (or solutions) of plants in response to these opportunities and challenges.
C. **The importance of reproductive life cycles in the evolution of plants**

Life cycles, including **alternation of generations**, were prominent features of the biology of protists and remain so in plants.

Why are life cycles important to understanding plant biology?

[Reflect back to *Laminaria* and also review Fig. 29.2]

D. **Overview of the origin of plant evolutionary adaptations using phylogeny.**

The origin and subsequent diversification of plants as multicellular, terrestrial, sessile, photosynthetic organisms can be appreciated by noting **major events** on the phylogeny of plant lineages –

**FIG. 29.3 and Handout**

- Plant version of alternation of generations
- Becoming Terrestrial
- Evolution of Vascular tissues
- Evolution of Seeds
- Evolution of Flowers

E. **A focus on adaptations in Angiosperms**

The origin of adaptations in angiosperms positioned them to have an explosive evolutionary radiation. The following are major features --

- Continued evolution of Vascular tissues and Flowers
- Evolution of Fruits
- Elaboration of alternation of generations
- Co-evolution with animals
F. Roles of plants in Local/Global Ecosystems and in Human Biology

Plants are the primary producers in the food webs of most terrestrial ecosystems in the world.

What is a food web, what is the role of a primary producer?

[ FIGS. 54.1, 54.2, and 54.5 ]

Plants play a critical role in nutrient cycling in most terrestrial ecosystems in the world.

What is this role?

[ FIG. 54.10 and 54.11 ]

Plants have played and continue to play a large role in transforming and regulating our planet’s atmospheric gases on a global scale.

What roles did plants play at the onset of their origin?

What roles do plants play now?

[ FIG. 30.10 ]

Plants are central to human biology. Reflect on every single thing in your life that is directly effected by plants or plant biology. List specific examples in the following categories --

Nutrition
Maintenance of homeostasis
The habitats in which we live
In support of “making a living”
In support of culture
In support of health and medicine
The Angiosperm Body – how angiosperms are constructed

A. The concept of FORM and FUNCTION

Form and function are integrally related. The structure of an organism (cells, tissues, organs) supports its functions. Physiology (function) emerges from form.

The evolutionary adaptations of organisms always involve both form and function.

B. ROOTS and SHOOTS – adaptations to living on land

Root systems and Shoot systems provide both structural support of the entire angiosperm body on land, but they also provide the basis for transport of materials within plant bodies.

REVIEW FIG. 35.4

What comprises the ROOT SYSTEM and what are it’s major functions ?

What comprises the SHOOT SYSTEM and what are it’s major functions ?

C. Organization of Plant Tissues

The cells of plant bodies are organized into tissues that contribute to the structures (we might call organs in animals).

FIG. 35.12
Dermal Tissues – including the epidermis – are the layer of cells and cell products (e.g., non-living cuticle layers) that comprise the outer surfaces of plants.

What are the major functions of such a tissue?

Vascular Tissues are those specialized cells and cell products that comprise the transportation systems within plants.

What are the major functions of such a tissue?

Ground Tissues are those specialized cells and cell products that provide general support, filling in around vascular and dermal tissues.

What are the major functions of such a tissue?

D. Structural adaptations in plant cells

Plant cells have some uniform features, but also are specialized.

Compare the Cell Wall versus the Protoplast

Review plant cell structure (FIG. 7.8 and 35.9).

Refer to FIGURE 35.10 and also text & other figures for the following:

Parenchyma cells are basic, mostly unspecialized cells. What do they look like and what do they do?
Collenchyma cells are support cells of young or growing portions of the plant. What do they look like and what do they do?

Sclerenchyma cells have the strongest, thickest cell walls and provide the most significant support of the plant. What do they look like and what do they do?

Tracheids and vessel cells are designed for water transportation. What do they look like and what do they do?

Sieve-tube cells are designed for food transportation. What do they look like and what do they do?

E. Plant Growth – an overview

Life spans and life cycles – With respect to growth and annual cycles –

Plants have indeterminate growth

Plants completing their life in one year are annuals

Plants continuing their life for multiple years are perennials

Meristems – Plants can continue growing throughout their lives (unlike most animals), because they have persistent embryonic tissues that are maintained.

Apical meristems – where are they and what do they do?

Lateral meristems – where are they and what do they do?
Primary Growth – Apical meristematic regions – in roots and shoots – contribute to the production of the primary plant body.

Primary growth and tissues of a ROOT – Review FIG. 35.15 and 35.16 and make sure you understand the form and function of the following –

- zones of growth
- primary meristems (protoderm, procambium, ground)
- stele and pith
- lateral roots

Primary growth and tissues of a SHOOT – Review FIG. 35.18, 35.19, and 35.20 and make sure you understand the form and function of the following –

- zones of growth
- primary meristems (protoderm, procambium, ground)
- apical vs. bud meristems
- leaf primordia and structures

Secondary Growth – lateral meristematic regions – in roots and shoots – contribute to growth in girth.

Vascular cambium effectively lays down a secondary system of vascular bundles and support tissues near the periphery of the stem/roots.

Cork cambium lays down a secondary layer of tissues (bark) that replace the epidermis.