

BSCI 442, Plant Physiology

- Why study plants?
- What are plants?
- What is plant physiology?
- Goals of the course
- Introductions
- Organization of the course



Life on earth depends on plants

• **Primary producers:** Green plants provide the world's supply of **food**.

• **Plants provide the world's supply of O_2 in the atmosphere.**

• **Plant diversity is essential to the survival of biotic communities.**



Life with plants Cont.

• **Plants provide fiber e.g. cotton, flax –linen, paper, cardboard.**

• **Plants provide medicine**

• **Plants generate energy**



What are plants?

- The only eukaryotic organism that can make their own food.
- Non-motile.



Chlamydomonas moewusii Gaillard



Cell with flagella 10 micrometers

Plants come in all shapes and sizes

Chara, Chlamydomonas, Pitcher plant, Giant Sequoia









Moss, fern (Marsilea), cycas, pine





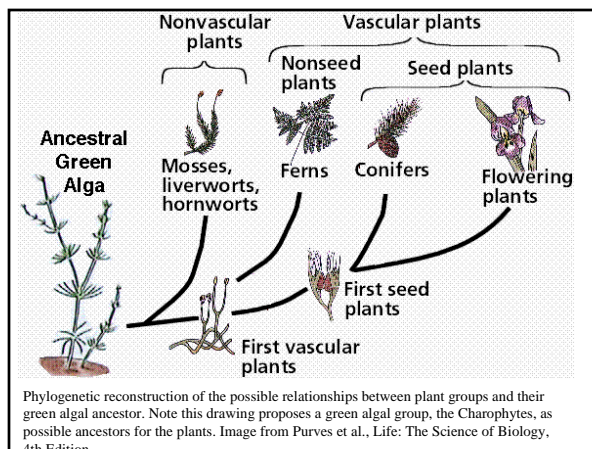
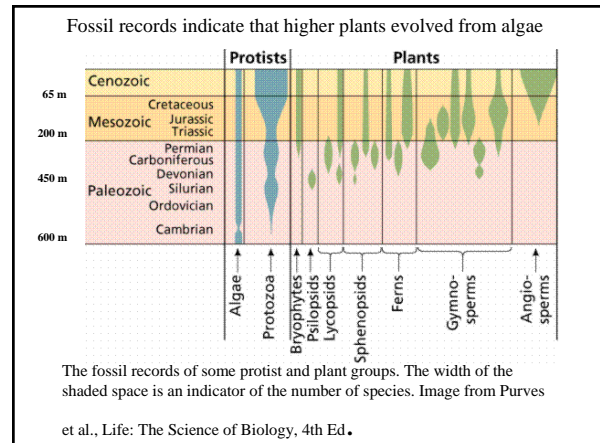
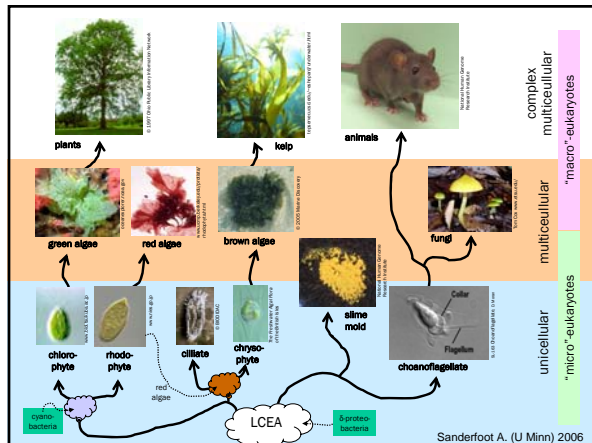
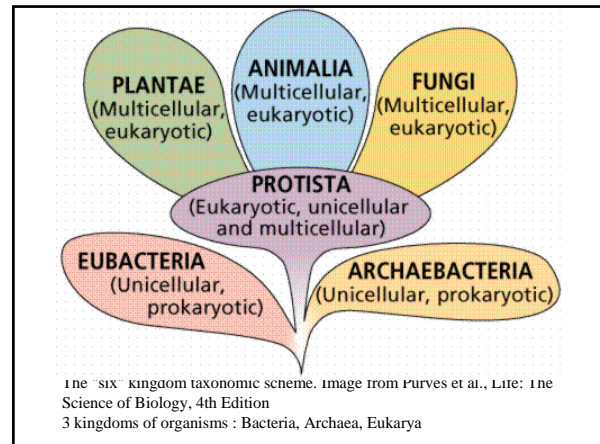
Seed plants are the most successful land plants

1. Gymnosperms (naked seeds)
2. Angiosperms or flowering plants (contained seed)

Why?

Most advanced and dominant, because of their reproductive features.

- Embryo is protected and can survive harsh environment
- Fertilization does not depend on water. Pollen and seeds are dispersed by wind or insect.
- Plants have developed vascular tissues, so they can survive on land and reach great heights.



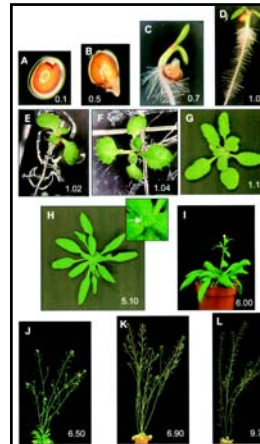
Plants are convenient organisms to study fundamental processes in biology

- Genetics
- Cell Biology: mitosis
- Physiology: How do plants sense and respond to the environment?

What is Plant Physiology?

Study of how plants grow, develop and adapt and why plants behave in a particular way.

Goal: to understand a process from the whole plant to the cell, molecular and genetic level.



Life of a land plant

- How do plants that cannot move get their essential nutrients?
- How do plants convert solar energy to food (chemical) energy?
- How do plants survive harsh winters or summers?
- How do plants respond to stimuli from hormones or from the environment?
- How do plants reproduce, protect and nourish their young?
- How do plants ward off disease-causing microbes? or develop defenses?

Picture taken from: Boyes et al. 2001. Plant Cell

The first complete genome of a model plant was sequenced in 2000.

Nature **408**, 796-815 (14 December 2000) | doi: 10.1038/35048692

Analysis of the genome sequence of the flowering plant *Arabidopsis thaliana*

The Arabidopsis Genome Initiative

The genome contains 30,700 genes encoding proteins from 11,000 families, similar to the functional diversity of *Drosophila* and *Caenorhabditis elegans*— the other sequenced multicellular eukaryotes. This is the first complete genome sequence of a plant .

Understand Living Processes at the Physical, Chemical, Molecular & Genetic Level

Plant

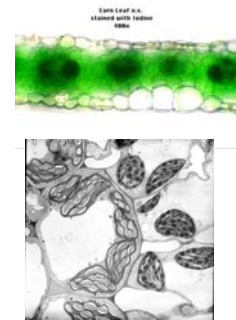
Leaf

Cell

Organelle

Molecules: e.g. enzymes

Gene



Why?

Better understanding of plant biology will prepare one to face many challenges

1. Major challenges

- Feed a world population
- Agriculture: develop crops that are disease-resistant and stress-tolerant.
- Health: produce medicines and improve nutritional value
- Environment: Preserve plant diversity which is essential for the survival of all living organisms.
- Provide energy

2. Plant biotechnology is one way to address these challenges.

We need technical and scientific information to understand and evaluate the potential of this new technology.

3. Our health & choices

Shop and prepare food

health supplements

Goals of the Course

- To understand how plants grow, develop, reproduce and survive.
- To better understand basic concepts and life processes of all organisms
- To gain a working knowledge of biology so one can make educated decisions and judgements in one's professional and personal life.
- To stimulate and promote independent thinking.