

# BIO 3 GENERAL BOTANY LECTURE MANUAL

Section 5038

Spring 2011



Instructor- Dr. Jeffery R. Hughey

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Section 5038, Spring 2011

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Front Cover image- *Calochortus albus* Benth.

# General Botany- Biology 3

## Lecture and Laboratory Schedule- Section 5038

Dr. Jeffery R. Hughey  
T/F Lecture- 1:00-2:15 PM, MER 1

Spring 2011, Hartnell College  
T/F Lab- 2:30-5:20 PM, MER 6

Date	Lecture and Lab Topics	Reading
January 25	Introduction to the course Introduction to the Lab, Scientific Method	Chapter 1 Topic 2
January 28	Why Study Plants? Dissecting and Compound Microscopes	Chapters 1, 2, 21 Topic 1
February 1	Systematics: The Science of Biological Diversity Herbarium and Dichotomous Keys	Chapter 12 Handout
February 4	Systematics: The Science of Biological Diversity Phylogeny exercise	Chapter 12 Handout
February 8	Prokaryotes: the Cyanobacteria Cyanobacteria	Chapter 13 Topic 11
<i>February 11</i>	<i>Lincoln's Day Observed, College Closed</i>	---
February 15	Fungi Fungi	Chapter 14 Topic 12
<i>February 18</i>	<i>Field trip to Pacific Grove to collect Mushrooms and Lichens</i>	
February 22	Heterotrophic Protista Protista I	Chapter 15 Topics 13, 14
February 25	Photosynthetic Protista Protista II	Chapter 15 Topics 13, 14
<i>March 1</i>	<i>Field trip to Carmel to collect Marine Algae: Low tide at 2:50 PM, -0.23</i>	
March 4	Bryophytes Bryophytes	Chapter 16 Topic 15
<b>March 8</b>	<b>FIRST EXAMINATION</b>	
March 11	Seedless Vascular Plants Seedless Vascular Plants	Chapter 17 Topic 16
March 15	Seedless Vascular Plants Seedless Vascular Plants	Chapter 17 Topic 16

March 18	Gymnosperms Campus walk and Seed Plants: The Gymnosperms	Chapter 18 Topic 17
March 22	Gymnosperms Seed Plants: The Gymnosperms	Chapter 18 Topic 17
March 25	Introduction to the Angiosperms Campus walk and Seed Plants: The Angiosperms	Chapter 19 Topic 18
March 29	Introduction and Evolution of the Angiosperms Seed Plants: The Angiosperms and Fruits	Chapters 19, 20 Topics 18, 19
April 1	Early Development of Angiosperms Early Development of Angiosperms <b>RESEARCH PROPOSALS DUE</b>	Chapter 22 Topic 20
April 5	Cells and Tissues of Angiosperms Cells and Tissues of the Plant Body	Chapter 23 Topic 21
<b>April 8</b>	<b>SECOND EXAMINATION</b>	
April 12	Angiosperm Roots The Root	Chapter 24 Topic 22
April 15	Angiosperm Shoots Primary Structure of the Stem and Leaf	Chapter 25 Topics 23, 24
<i>April 18-April 22</i>	<i>Spring Recess, College Closed</i>	---
April 26	Secondary Growth in Stems Woody Stems and Secondary Xylem	Chapter 26 Topics 25, 26
April 29	Ecology Transects and Quadrats	Chapters 31, 32 Handout
<i>May 3</i>	<i>Field trip to Toro Park to Study Vascular Plants &amp; Plant Ecology</i>	
May 6	Plant Hormones Growth Regulators	Chapter 27 Topic 27
May 10	External Factors and Growth External Factors and Growth	Chapter 28 Topic 28
May 13	Plant Nutrition and Soils Inorganic Nutrients Required by Plants	Chapter 29 Topic 29

May 17	Plant Genetics Genetics	Chapter 8 Topic 10
<b>May 20</b>	<b>PROJECT PRESENTATIONS, PROJECT REPORTS DUE</b>	
<b>May 24</b>	<b>FINAL LABORATORY EXAMINATION</b>	
<b>May 31</b>	<b>FINAL LECTURE EXAMINATION (3:00-6:00 PM) HERBARIA DUE</b>	

### COURSE DESCRIPTION

Introduction to the principles of plant biology with an emphasis on cytology, energetics, structure, function, reproduction, genetics, systematics, and plant growth. Detailed morphological study of cyanobacteria, fungi, photosynthetic and heterotrophic protists, bryophytes, and vascular plants.

### COURSE OBJECTIVES

1. Develop an appreciation for the botanical contributions of early explorers.
2. Investigate the commercial and ethnobotanical applications of plants.
3. Compare and contrast cellular plant diversity.
4. Identify the basic features of all plant cells.
5. Investigate the vital relationship between plants and the flow of energy.
6. Compare and contrast the photosynthetic pathways.
7. Examine the chromosomal basis for Mendelian genetics.
8. Investigate the structure of macromolecules and their role in plant function.
9. Isolate genetic material and analyze DNA sequences from lower and higher plants.
10. Investigate natural selection and its affects on populations.
11. Infer hypotheses by analyzing morphological and molecular phylogenetic data.
12. Investigate life histories of photosynthetic eukaryotes.
13. Identify diagnostic morphological characteristics of the major plant phyla.
14. Collect and curate botanical specimens from aquatic and terrestrial habitats.
15. Develop microscopy skills necessary for the examination of plant structures.
16. Investigate the affects of hormones on plant processes.
17. Examine the affects of macro and micronutrients on plant growth.
18. Investigate the interactions between plants and other organisms.
19. Investigate plant community and ecosystem development.
20. Investigate the adaptations plants have evolved to particular biomes.
21. Analyze the role of agriculture on human history and predict its role in the future.

## INSTRUCTOR INFORMATION

Instructor- Dr. Jeffery R. Hughey

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Web Address- [http://www.hartnell.cc.ca.us/faculty/jhughey/course\\_doc.htm](http://www.hartnell.cc.ca.us/faculty/jhughey/course_doc.htm)

Office Hours- Wednesday 1:00-2:00 PM, Thursday 5:00-6:00 PM, Friday 11:30 AM-12:30 PM

## REQUIRED TEXTBOOKS

Raven, P.H., Evert, R.F. and Eichhorn, S.E. *Biology of Plants: 7<sup>th</sup> Ed.* W.H. Freeman, New York, 2005.

Evert, R.F. and Eichhorn, S.E. *Laboratory Topics in Botany: 7<sup>th</sup> Ed.* W.H. Freeman, New York, 2005.

Hughey, J. Bio 3- General Botany Lecture Manual: Section 5038, Spring 2011.

## GRADING

Determination of grades in this course will be based on your performance on the following:

First Examination	100 pts.
Second Examination	100 pts.
Final Laboratory Examination	100 pts.
Final Lecture Examination	100 pts.
Herbarium	100 pts.
<u>Research Project</u>	<u>100 pts.</u>
Total	600 pts.

<u>Grade</u>	<u>Total Points Earned (Percentage)</u>	<u>Definition</u>	<u>Grade Points</u>
A	540-600 pts. (90-100%)	Excellent	4
B	480-539 pts. (80-89%)	Good	3
C	420-479 pts. (70-79%)	Satisfactory	2
D	360-419 pts. (60-69%)	Barely Passing	1
F	359 or fewer (59% or less)	Failing	0

## EXAMINATIONS

The Lecture portion of the examinations will consist of a combination of multiple choice, true or false, matching, short answer, and essay questions. Questions will come mainly from the lecture material, but will also be derived from assigned readings. Supply your own Scantron 882-E form and a number 2 pencil. The Laboratory portion of the examinations will focus on material in the lab manual and information from lab exercises and field trips. Laboratory questions generally require you to 1) identify plant structures and 2) name plant specimens.

### MAKE UP EXAMINATION POLICY

If you are unable to attend an examination please notify me by telephone, email, or in person prior to the test. If you fail to contact me in advance and you miss the examination, submit a written letter signed by the authority involved (doctor, policeman) that includes their phone number and an explanation. If you have a valid excuse, I will schedule an intellectually comparable make up oral or essay examination. *No make ups will be granted for the final examination without prior approval from Dr. Hughey.*

### HERBARIUM

A herbarium is a collection of pressed, boxed, or enveloped plant specimens. During scheduled field trips you will have the opportunity to collect specimens. You are required to assemble a herbarium of representative specimens of the major phyla. Herbarium grades will be based on comprehensiveness, identification accuracy, label correctness, aesthetics, and effort in comparison to your peers.

### RESEARCH PROJECTS

Botanical projects involve four steps. They can be performed individually or in groups of two.

- 1) Submit a research proposal (25 pts.). Proposals are due on April 1<sup>th</sup>, 2011 and should be typed. Your proposal needs to include: 1) title; 2) testable hypothesis; 3) what is known and unknown about your hypothesis; 4) the purpose of performing your experiment; 5) prediction of the results from your experiment; 6) materials you need to conduct the study and the methods you will use; 7) illustration/s of your methods; 8) a list of five references. Your proposal should be 2-3 pages.
- 2) Perform the research project. If you need equipment or reagents that you do not have, ask Joni Black our biology technician or check with me and we may be able to locate or order them for you.
- 3) Write a paper on the research project (40 pts.). Manuscripts are due on May 20<sup>th</sup>, 2011. They should include an abstract, introduction, materials and methods, results, discussion, conclusion, and reference sections. See Appendix A in your lab book for a description of these sections.
- 4) Present your research project to the class (35 pts.). Presentations will be given on May 20<sup>th</sup>, 2011. They can be presented using the chalkboard, PowerPoint slides, video, and/or the overhead projector. Presentations will be 8-10 minutes in length, and you will be timed.

### ATTENDANCE POLICY

Regular attendance and consistent study are your responsibility and the two factors that contribute most to a successful college experience. I expect you to attend all class sessions. Absence in excess of two weeks (consecutive or non-consecutive) may result in dismissal. What does that mean? If you miss five classes, you may be dropped from the class.

### DROPPING THE COURSE

It is your responsibility to drop the course. Do not assume that I will submit the drop for you if you decide to stop coming to class. Students that do not officially drop the course by May 6<sup>th</sup> will receive a letter grade based on their total earned points.

### CLASSROOM VISITORS

No one is permitted to attend this class unless he or she is a registered student.

### CONDUCT

Please show respect for your peers and your instructor. If I observe any student performing or aiding in any of the types of misconduct listed under “Codes of Student Conduct” on page 31 of the Hartnell Catalog, that student will be dropped from the course. Disruptive behavior will not be tolerated (this includes text messaging during class).

### INSTRUCTIONAL SUGGESTIONS

Course suggestions and requests that you feel will improve comprehension, retention, and cognition are warmly welcomed. Requests for less information, postponement of examinations, or easier examinations are not welcomed.

### SUPPLEMENTAL INSTRUCTION (SI) AND TEACHING ASSISTANTS

Jennifer Santillo will be assisting with instruction in the laboratory portion of the course. She will provide SI and tutorial assistance as well as study materials. Jennifer’s email is [santillo71@hotmail.com](mailto:santillo71@hotmail.com).

### SUGGESTIONS FOR DOING WELL IN BIOLOGY 3

- 1) Review your lecture and laboratory notes before coming to class
- 2) Study for examinations with a partner or in a group
- 3) Attend class and take complete notes
- 4) Outside of class study at least 10 hours per week
- 5) Attend SI sessions and participate in SI study group activities

### HARTNELL COLLEGE IS CLOSED ON THE FOLLOWING DATES

Friday 2/11, Monday 2/21, Thursday 3/31, Monday 4/18-Saturday 4/23, and Monday 5/30

## **Introduction to the Course**

Triticum- wheat.

Oryza sativa- rice cultivation.

Carl Linnaeus

Zea mays- corn.

Systematics

Cyanobacteria

Fungi

Protista

Bryophytes

Seedless Vascular Plants

Gymnosperms

Flowering Plants

Leaf morphology

Embryonic development

Roots and Shoots

Wood

Hormones

Nutrition

Genetics

## Why Study Plants? Chapters 1, 2, 21

### •Why not?

“To be \_\_\_\_\_, \_\_\_\_\_, and \_\_\_\_\_ is sufficient recommendation of a science to make it pleasing to me.” \_\_\_\_\_ (1811-1866)

### How do humans use plants?

#### Agricultural product as fodder

- Fodder- food that is fed to \_\_\_\_\_.
- \_\_\_\_\_ (Zea mays) is the most important crop in the United States.
  - \_\_\_\_\_% of this crop is consumed by animals.

#### Global O<sub>2</sub> from photosynthesis

- \_\_\_\_\_% comes from marine cyanobacteria.
  - Synechococcus
  - Synechocystis
- \_\_\_\_\_% comes from terrestrial systems.
  - \_\_\_\_\_% of this comes from tropical rainforests.

#### What is the role of the photosynthetic organism in the carbon cycle?

#### Primary Producers

**Photosynthetic organisms evolved 3.4 BYA and are responsible for the biological revolution**

•Increases in O<sub>2</sub> from photosynthesis had 2 consequences:

- 1) \_\_\_\_\_ - O<sub>2</sub> molecules in atmosphere converted to ozone (O<sub>3</sub>).  
•2.5 BYA
- 2) \_\_\_\_\_  
•Respiration- break down of molecules by oxidation.  
•Eukaryotic cells- appearance and proliferation of cells.  
-2.1 BYA

**Phytoremediation**

•The \_\_\_\_\_ of pollutants or waste by the use of \_\_\_\_\_ to break down undesirable substances.

- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_

- 
- Lemna gibba- duckweed.
  - Eichornia crassipes- water hyacinth.

**How do animals use plants?**

**Medicine in Ancient Times**

- \_\_\_\_\_ (3,350-3,140 BC)- frozen in ice, found in the Alps on the Italian-Austrian border.  
- \_\_\_\_\_ used as a laxative and as a natural antibiotic.
- The \_\_\_\_\_ used in Ancient Greece:  
-Anise, black hellebore, cassia, cucumber, wild root of (squirting cucumber), cumin, cyclamen, root of frankincense, germander, lettuce, wild myrrh, olive oil, opium, poppy, parsnip.

**Hippocrates (460-380 BC) \_\_\_\_\_ of medicine**

- Ancient Greek physician for the Medical School at \_\_\_\_\_.
- Wrote \_\_\_\_\_

**Medicine in Modern Times**

- \_\_\_\_\_ % of the \_\_\_\_\_ on the market is derived directly from plants.
- Drugs made from \_\_\_\_\_ prevent the rejection of transplanted hearts and other organs.
- The active ingredient in \_\_\_\_\_ was originally derived from \_\_\_\_\_ bark.
- Paclitaxel, a compound found in the Pacific yew tree, assists in the treatment of some \_\_\_\_\_.
- The rosy periwinkle helps treat \_\_\_\_\_.

- \_\_\_\_\_ . Ginkgo biloba is prescribed for depression, mental weakness or confusion, loss of memory, ringing of the ears.

### **Macromolecules (Primary Metabolites)**

### **Secondary Metabolites**

### **Plants in Space**

- \_\_\_\_\_ - a unicellular green alga.
  - \_\_\_\_\_ .
  - Process \_\_\_\_\_ (urine).
  - Life support system, \_\_\_\_\_ .

## Systematics: The Science Of Biological Diversity Chapter 12

• **Systematics**- the scientific study of biological \_\_\_\_\_ and its evolutionary history.

### Theophrastus (370-285 B.C.)

- Father of \_\_\_\_\_, student of Aristotle.
- Classified plants based on form.

- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_

### Carol von Linné (1707-1778)

- Swedish naturalist.
- \_\_\_\_\_
  - Plant descriptions.
  - Plant \_\_\_\_\_ - a two-term system of nomenclature.
    - \_\_\_\_\_ and \_\_\_\_\_ (specific epithet).
    - Example- catnip.
      - *Nepeta cataria* L.
      - "*Nepeta floribus interrupte spicatus pedunculatis*"

### Taxonomy

• **Taxonomy**- (gr. *taxis*- \_\_\_\_\_, *nomos*- \_\_\_\_\_) the science of the classification of organisms.

- Identifying, naming, classifying organisms.

- Domain
- Kingdom
  - \_\_\_\_\_ - phyta
  - \_\_\_\_\_ - phyceae
- Order- ales
  - \_\_\_\_\_ - aceae
- Genus
- \_\_\_\_\_

### Prokaryotes and Eukaryotes

### 3 Domains and 6 Kingdoms

#### Origin of Cells

#### Origin of Eukaryotic Cells

#### International Code of Botanical Nomenclature (\_\_\_\_\_)

• Aim- to provide a \_\_\_\_\_ method of naming taxonomic groups.

– Principle I- botanical nomenclature is \_\_\_\_\_ of zoological and bacteriological nomenclature.

– Principle II- names of taxonomic groups are determined by means of nomenclatural \_\_\_\_\_.

– Principle III- nomenclature of a taxonomic group is based upon \_\_\_\_\_ of publication.

• Naming- the purpose of giving a name to a taxonomic group is not to indicate its characters or history, but to \_\_\_\_\_ and to indicate its \_\_\_\_\_.

### Taxonomic Terminology

- \_\_\_\_\_ - a taxonomic group of any rank (plural: taxa).
- \_\_\_\_\_ - two or more names that apply to the same taxon.
- \_\_\_\_\_ - the original name of a taxon.
- Author/s- the \_\_\_\_\_ person or persons to \_\_\_\_\_ a taxon.
- Revisionary author/s- the person or persons that \_\_\_\_\_.
- \_\_\_\_\_ - the derivation, origin, or history of a word.
- Type Specimen- a specimen designated to serve as a reference point for a scientific name.
  - Holotype- \_\_\_\_\_.
  - Lectotype- \_\_\_\_\_.

**Chondracanthus exasperatus (Harvey et Bailey) Hughey 1996**

**Gigartina exasperata Harvey et Bailey 1851**

**Mazzaella laminarioides (Bory) Fredericq et Hommersand 1993**

**Iridaea laminarioides Bory 1828**

**Iridaea cornucopiae Postels et Ruprecht 1840**

**Iridaea boryanum Setchell et Gardner 1936**

**Mazzaella parksii (Setchell et Gardner) Hughey, Silva, et Hommersand 2001**

**Iridophycus parksii Setchell et Gardner 1937**

### Taxonomic Names

- Species names consist of the genus name, plus the specific epithet.
- Members of a species may be grouped into \_\_\_\_\_ or \_\_\_\_\_.

### How do you identify plants?

- Ask an \_\_\_\_\_.
- Use a \_\_\_\_\_.
- Compare plant with a written \_\_\_\_\_.
- Use books to picture I.D. specimens.
  - Photographs and \_\_\_\_\_.
- Use a \_\_\_\_\_.

### Dichotomous Keys

- A method employed for \_\_\_\_\_.
- A dichotomous key is constructed of a series of \_\_\_\_\_, each consisting of two separate statements.

1. Flowers white ..... Plant A
1. Flowers \_\_\_\_\_ or \_\_\_\_\_ ..... 2
2. Petals red ..... Plant B
2. \_\_\_\_\_ white ..... Plant C

## Systematics#2: The Science Of Biological Diversity Chapter 12

### Phylogeny

- Phylogeny- the evolutionary relationships among organisms.  
—Natural classification.
- Phylogenetic tree- a \_\_\_\_\_ diagram that represents a \_\_\_\_\_ of the \_\_\_\_\_ of a species or group of related organisms.

### Hominid Evolutionary Tree

### Tree of Homo sapiens L.

### Tree Terminology

- Root- \_\_\_\_\_.
- Branch- \_\_\_\_\_.
- Outgroup- \_\_\_\_\_.
- Ingroup- \_\_\_\_\_.
- Taxon- \_\_\_\_\_.
- Node- \_\_\_\_\_.

### Phylogenetic trees

- Cladogram
  - \_\_\_\_\_
  - \_\_\_\_\_
- \_\_\_\_\_ - shows divergence distances between taxa.

## Cladistics

• **Cladistics**- a method of \_\_\_\_\_ organisms on the basis of \_\_\_\_\_ characters.

- **Characters**- \_\_\_\_\_, chemical, developmental, and \_\_\_\_\_.
- **Homologous characters**- \_\_\_\_\_ of different species that are similar because they were inherited from a \_\_\_\_\_.
- **Outgroup**- a closely related taxon \_\_\_\_\_ the group that is being analyzed.
- \_\_\_\_\_ - the branching point on a tree.

## Molecular Characters (Data)

### Endosymbiotic Theory and the Evolution of Chloroplasts

• Photosynthetic eukaryotes and their \_\_\_\_\_ from the \_\_\_\_\_ of a \_\_\_\_\_ by a \_\_\_\_\_.

- A phagocytotic protozoan took up a cyanobacterium into a food vesicle.
- Instead of being digested, the cyanobacterium was retained as an endosymbiont.
- The protozoan provided the alga with protection, a stable environment, and mineral nutrients.
- The cyanobacterium produced carbohydrates for the protozoan.
- The cell wall of the cyanobacterium was lost through evolutionary selection.
- Food vesicle membrane= outer chloroplast membrane.
- Plasma membrane of cyanobacterium= inner chloroplast membrane.

**Support for the Endosymbiotic Theory**

- Chloroplasts are about the \_\_\_\_\_ as cyanobacteria.
- Evolve \_\_\_\_\_ in photosynthesis.
- \_\_\_\_\_ S ribosomes.
- \_\_\_\_\_ is the primary photosynthetic pigment in cyanobacteria and plants.
- Circular prokaryotic DNA without histones.
- \_\_\_\_\_

**Endosymbiosis in \_\_\_\_\_ and \_\_\_\_\_**

## Photosynthetic Prokaryotes- Chapter 13

### •Kingdom- Bacteria

- Phylum- \_\_\_\_\_
- Class- \_\_\_\_\_ phyceae
- Class- \_\_\_\_\_ phyceae

### Cyanophyta- Gram \_\_\_\_\_ Bacteria

- Gram positive- peptidoglycan layer; stains with crystal violet.
- Gram negative- peptidoglycan layer sandwiched by \_\_\_\_\_ and \_\_\_\_\_ layers; does not stain with \_\_\_\_\_.

### Prochlorophyceae

#### •Characteristics

- Chlorophylls \_\_\_\_\_ & \_\_\_\_\_
- \_\_\_\_\_ phycobilisomes
- Thylakoids in stacks of \_\_\_\_\_
- \_\_\_\_\_ ribosomes
- DNA microfibrils \_\_\_\_\_
- Polyhedral bodies
- Habitat
  - 1) Obligate symbionts, live within \_\_\_\_\_; 2) Planktonic filaments in \_\_\_\_\_ lakes.
- Example- \_\_\_\_\_

### Cyanophyceae

#### •Characteristics

- Chlorophyll \_\_\_\_\_
- \_\_\_\_\_
- Thylakoids occur \_\_\_\_\_
- 70s ribosomes
- DNA microfibrils \_\_\_\_\_
- Polyhedral bodies
- \_\_\_\_\_
- Habitat- \_\_\_\_\_.
- Examples- \_\_\_\_\_, Nostoc, \_\_\_\_\_, \_\_\_\_\_, Synechococcus, Synechocystis.

### Habits

#### •Unicells

- \_\_\_\_\_ - Synechocystis
- \_\_\_\_\_ of unicells- Aphanothece

• Rows of cells

– \_\_\_\_\_ filaments w/out sheath (trichome)- Oscillatoria

– Many \_\_\_\_\_ in 1 large sheath- Microcoleus

– \_\_\_\_\_ filaments with sheath- Lyngbya

– \_\_\_\_\_ branched filaments- Mastigocladus

– \_\_\_\_\_ branched filaments- Stigonema

– \_\_\_\_\_ -branched filaments- Scytonema

**Asexual Reproduction**

- \_\_\_\_\_ - internal division of the protoplast results in a mass of spores.
- \_\_\_\_\_ - filament breaks into 2 parts, each of which forms a new thallus.
- \_\_\_\_\_ - short sections of a trichome detach and form a new thallus.
- \_\_\_\_\_ - resting spores; cells that are resistant to unfavorable conditions.

**Heterocyst**

• Heterocyst- a \_\_\_\_\_ -walled large cell that \_\_\_\_\_ atmospheric \_\_\_\_\_ (diazotroph).

– Photosynthetically inactive.

– Their formation is \_\_\_\_\_ related to nitrogen concentration.

– \_\_\_\_\_ - cytoplasmic connections that transfer metabolites and ammonium.

### Movement in the Cyanobacteria

- \_\_\_\_\_ - active movement of an organism in contact with a solid substrate.  
–Mechanism- mucilaginous layer of microfibrils generates waves.
- \_\_\_\_\_ - active movement of an organism without contact with a substrate.  
–Mechanism- unknown.
- Why?
  - Positively phototactic- \_\_\_\_\_.
  - Positively chemotactic- \_\_\_\_\_.

### Symbiotic Associations

- \_\_\_\_\_ - cyanobacteria occur in about 8% of the species.
- \_\_\_\_\_ - the water fern; contains Anabaena in the dorsal lobe of its leaf.
- Colonial ascidian- sea squirt.
- Amoeba, protozoa, diatoms, green algae, mosses, liverworts, water molds, and \_\_\_\_\_.

### Stromatolites

- Stromatolite- \_\_\_\_\_-like deposition of \_\_\_\_\_ and trapped \_\_\_\_\_; formed by \_\_\_\_\_ and diatoms.
- Age- \_\_\_\_\_.
- \_\_\_\_\_ - \_\_\_\_\_-growth-deposition.
- \_\_\_\_\_-shaped in growth= \_\_\_\_\_ year.
- \_\_\_\_\_, Bahamas, \_\_\_\_\_.

### Cyanobacteria Produce Cyanotoxins

- \_\_\_\_\_ - alkaloids that target the nervous system.
  - Anatoxin and saxitoxin.
  - \_\_\_\_\_ - staggering, muscle twitching, gasping, and convulsions.
  - Anabaena, Aphanizomenon, Oscillatoria.
- \_\_\_\_\_ - large compounds that target the liver.
  - Microcystins and nodularins.
  - \_\_\_\_\_ - weakness, vomiting, diarrhea.
  - Anabaena, Microcystis, Oscillatoria, Nodularia, Nostoc.

## Fungi- Chapter 14

### Fungi

- Eukaryotic.
- \_\_\_\_\_ (rarely unicellular)
- Most are composed of \_\_\_\_\_ (fungal filaments).
- Nuclei occur in continuous \_\_\_\_\_.
- Heterotrophic- function as \_\_\_\_\_.
- Cell wall \_\_\_\_\_ and predominantly made of \_\_\_\_\_.
- Reproduction is \_\_\_\_\_ and sexual.
- Life cycle has a zygotic meiosis.
- Numbers- ~ \_\_\_\_\_ species described.
- Habitat- ubiquitous, but \_\_\_\_\_.
- Size- \_\_\_\_\_ scopic to \_\_\_\_\_ scopic.
- Storage product- \_\_\_\_\_.

### Phylum Chytridiomycota

- \_\_\_\_\_
- ~ \_\_\_\_\_ species.
- Habitat  
– Soil from desert, ditches, and banks of \_\_\_\_\_ and streams, rumen of large mammals.
- Motile \_\_\_\_\_ and \_\_\_\_\_ with a single whiplash flagellum.
- Example- \_\_\_\_\_.
- Sexual reproduction involves the formation of a \_\_\_\_\_.
- Asexual by zoospores.

### Life Histories

## Allomyces life history

### Phylum Zygomycota

- Aseptate

- ~ \_\_\_\_\_ species.

- Habitat

– Plant and animal tissue in soil, some are \_\_\_\_\_ on plants, insects, and small soil animals.

- \_\_\_\_\_.

- Example- \_\_\_\_\_ stolonifer (common \_\_\_\_\_ mold).

- Sexual reproduction involves the formation of a \_\_\_\_\_.

- Asexual by nonmotile spores.

## Rhizopus life history

### Phylum Ascomycota

- \_\_\_\_\_
- ~32,000 species.
- Habitat  
— \_\_\_\_\_, \_\_\_\_\_, plant \_\_\_\_\_.
- \_\_\_\_\_.
- Examples- Neurospora (powdery mildew), Morchella (morel), Saccharomyces (yeast).
- Sexual reproduction involves the formation of \_\_\_\_\_ on an \_\_\_\_\_.
- Asexual by budding, \_\_\_\_\_, \_\_\_\_\_.

## Phylum Basidiomycota

- \_\_\_\_\_
- ~22,000 species.
- Habitat  
— \_\_\_\_\_ litter.
- \_\_\_\_\_.
- Examples- \_\_\_\_\_ (mushroom), Puccinia (rusts), Ustilago (smuts).
- Sexual reproduction involves the formation of \_\_\_\_\_ on an \_\_\_\_\_.
- Asexual by budding, conidiospores, fragmentation.

## Gilled mushroom life history

## Lichens

- \_\_\_\_\_ biont and \_\_\_\_\_ biont.
- Mycobiont= part Ascomycota & Basidiomycota.
- ~13,000 species.
- Habitat  
—From the desert to the poles.
- \_\_\_\_\_.
- Examples- Caloplaca (\_\_\_\_\_), Parmelia (\_\_\_\_\_), Usnea (\_\_\_\_\_).
- Reproduction is by \_\_\_\_\_.

## Kingdom Protista Part 1- Chapter 15

### Heterotrophic Phyla

- Oomycota- \_\_\_\_\_.
- Myxomycota- \_\_\_\_\_.
- Dictyosteliomycota- \_\_\_\_\_.

### Oomycota- water molds

#### • Characteristics

- \_\_\_\_\_ cellular, \_\_\_\_\_ and filamentous.
  - \_\_\_\_\_ and parasitic.
  - Food reserve- \_\_\_\_\_.
  - \_\_\_\_\_ karyotic nucleus.
  - Zoospores- 1 \_\_\_\_\_ and 1 \_\_\_\_\_.
  - Cell wall \_\_\_\_\_/cellulose-like.
- Habitat- marine, freshwater, terrestrial.
  - \_\_\_\_\_ species.
  - Examples- \_\_\_\_\_ and \_\_\_\_\_.

### Saprolegnia life history

Phytophthora- sudden \_\_\_\_\_ disease, Ireland \_\_\_\_\_ famine, crop destruction.

## Myxomycota- plasmodial slime molds

### •Characteristics

- Streaming \_\_\_\_\_.
- Saprophytic and \_\_\_\_\_ bacteria, yeast, fungal spores.
- Food reserve- \_\_\_\_\_.
- \_\_\_\_\_ karyotic nucleus.
- Gametes- 2 unequal, apical, \_\_\_\_\_.
- \_\_\_\_\_ cell wall.

•Habitat- \_\_\_\_\_.

•700 species.

•Examples- \_\_\_\_\_.

## Dictyostelium- cellular slime mold

### Dictyostelium

## Dictyosteliomycota- cellular slime molds

### •Characteristics

- \_\_\_\_\_ -like cells that form \_\_\_\_\_.
- \_\_\_\_\_ bacteria.
- Food reserve- \_\_\_\_\_.
- \_\_\_\_\_ karyotic nucleus.
- Flagella- \_\_\_\_\_.
- Cell wall \_\_\_\_\_.

•Habitat- terrestrial.

•50 species.

•Examples- \_\_\_\_\_.

## Photosynthetic Phyla (the algae)

•Dinophyta- \_\_\_\_\_.

•Euglenophyta- \_\_\_\_\_.

•Cryptophyta- \_\_\_\_\_.

•Haptophyta- \_\_\_\_\_.

•Chlorophyta- \_\_\_\_\_ algae.

•Rhodophyta- \_\_\_\_\_ algae.

•Heterokontophyta- heterokont algae.

-Phaeophyceae- \_\_\_\_\_ algae.

-Chrysophyceae- \_\_\_\_\_ - \_\_\_\_\_ algae.

-Bacillariophyceae- \_\_\_\_\_.

## Dinophyta- dinoflagellates

### •Characteristics

- \_\_\_\_\_, colonial.
- Chlorophylls \_\_\_\_\_ and \_\_\_\_\_.
- Food reserve- \_\_\_\_\_ in cytoplasm.
- Thylakoids in \_\_\_\_\_.
- \_\_\_\_\_ karyotic nucleus.
- Flagella- 1 \_\_\_\_\_ and 1 \_\_\_\_\_.
- Cell wall with \_\_\_\_\_ in thecal plates.

•Habitat- marine and freshwater.

•4,000 species.

•Examples- \_\_\_\_\_, \_\_\_\_\_, Dinophysis,  
\_\_\_\_\_, Pfiesteria.

## Euglenophyta- euglenoids

### •Characteristics

- \_\_\_\_\_.
- Chlorophylls \_\_\_\_\_ and \_\_\_\_\_.
- Food reserve- \_\_\_\_\_ in cytoplasm.
- Thylakoids \_\_\_\_\_-3.
- \_\_\_\_\_ karyotic nucleus.
- 2 unequal flagella, long one with \_\_\_\_\_.
- No cell wall, \_\_\_\_\_.
- \_\_\_\_\_.

•Habitat- marine and \_\_\_\_\_; puddles, ditches, ponds, streams, lakes, rivers.

•1,000 species.

•Example- \_\_\_\_\_.

## Kingdom Protista Part 2- Chapter 15

### Cryptophyta- cryptomonads

#### •Characteristics

- \_\_\_\_\_ cellular.
  - Chlorophylls A & C, \_\_\_\_\_.
  - Food reserve- \_\_\_\_\_ within 2 chloroplast membranes.
  - Thylakoids in \_\_\_\_\_.
  - Eukaryotic nucleus.
  - 2 flagella, \_\_\_\_\_ (dbl. & single).
  - \_\_\_\_\_, proteinaceous periplast plates.
- Habitat- marine & freshwater.
  - 200 species.
  - Examples- \_\_\_\_\_.

### Haptophyta- haptophytes

#### •Characteristics

- Unicellular.
  - Chlorophylls A & C, \_\_\_\_\_.
  - Food reserve- \_\_\_\_\_ in vesicles.
  - Thylakoids in 3.
  - Eukaryotic nucleus.
  - 2 whiplash flagella and 1 \_\_\_\_\_.
  - \_\_\_\_\_, covered with scales of cellulose or calcium carbonate.
- Habitat- **marine** & freshwater.
  - 300 species.
  - Examples- \_\_\_\_\_ & Phaeocystis.

### Chlorophyta- green algae

#### •Characteristics

- \_\_\_\_\_ cellular and \_\_\_\_\_ cellular.
  - Chlorophylls A & \_\_\_\_\_, carotenoids.
  - Food reserve- \_\_\_\_\_ in chloroplast.
  - Thylakoids in 3-6.
  - Eukaryotic nucleus.
  - Highly variable; \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_-flagellated; whiplash when present.
  - Cell wall cellulosic.
- Habitat- marine & \_\_\_\_\_.
  - 17,000 species.
  - Examples- Ulva, \_\_\_\_\_, Chlorella, Volvox, Chara, \_\_\_\_\_, Closterium.

## Ulva life history

### **Charales- Coleochaete**

### **Rhodophyta- red algae**

#### **•Characteristics**

- \_\_\_\_\_ cellular.
  - Chlorophylls A & \_\_\_\_\_, phycobilins.
  - Food reserve- \_\_\_\_\_ in cytoplasm.
  - Thylakoids occur \_\_\_\_\_.
  - Eukaryotic nucleus.
  - \_\_\_\_\_ flagella.
  - \_\_\_\_\_.
  - Cell wall with cellulose & galactans.
- Habitat- \_\_\_\_\_ & freshwater.
- 6,000 species.
- Examples- Polysiphonia, \_\_\_\_\_, Batrachospermum, \_\_\_\_\_.

## **Heterokontophyta- heterokonts**

Phaeophyceae- \_\_\_\_\_ algae

### • Characteristics

- \_\_\_\_\_ cellular.
- Chlorophylls A & C, \_\_\_\_\_.
- Food reserve- mannitol & laminarin in \_\_\_\_\_.
- Thylakoids in 3.
- Eukaryotic nucleus.
- 2 flagella, 1 tinsel & 1 whiplash.
- Cell wall cellulosic with \_\_\_\_\_.

• Habitat- \_\_\_\_\_.

• 2,000 species.

• Examples- Fucus, \_\_\_\_\_, Laminaria, Nereocystis, Ectocarpus, \_\_\_\_\_.

### **Laminaria life history**

## **Chrysophyceae- golden-brown algae**

### •Characteristics

- \_\_\_\_\_ cellular, colonial.
- Chlorophylls A & C, \_\_\_\_\_.
- Food reserve- chrysolaminarin in \_\_\_\_\_.
- Thylakoids in 3.
- Eukaryotic nucleus.
- Most= 2 flagella, 1 tinsel & 1 whiplash.
- Cell wall cellulosic, silica, or none.

•Habitat- marine and \_\_\_\_\_.

•1,000 species.

•Examples- Dinobryon, \_\_\_\_\_.

## **Bacillariophyceae- \_\_\_\_\_**

### •Characteristics

- \_\_\_\_\_ cellular, \_\_\_\_\_.
- Chlorophylls A & C, \_\_\_\_\_.
- Food reserve- chrysolaminarin in \_\_\_\_\_.
- Thylakoids in 3.
- Eukaryotic nucleus.
- No flagella, \_\_\_\_\_ 1 tinsel on male gamete.
- Cell wall is silica and made of \_\_\_\_\_.

•Habitat- \_\_\_\_\_ and freshwater.

•100,000 species.

•Examples- Acnantes, Bacillaria, Licmophora, \_\_\_\_\_, \_\_\_\_\_.

## **Frustule Morphology**

## Bryophytes- Chapter 16

•What is the name of the group we are studying today and tomorrow?

- A) flowering plants
- B) fungi
- C) bacteria
- D) mosses
- E) don't care, where are the snacks?

•True or false.

- \_\_\_\_\_ Bryophytes are plants.  
\_\_\_\_\_ Bryophytes grow only in the water, but not on land.

•Which of the following is not true of plants?

- A) they are mostly autotrophic
- B) they are primarily terrestrial
- C) they have the same photosynthetic pigments as brown and red algae
- D) they are multicellular
- E) still don't care, where is the popcorn?

**Kingdom Plantae-** \_\_\_\_\_

- \_\_\_\_\_ trophic (mostly).
- \_\_\_\_\_ with advanced tissue differentiation.
- \_\_\_\_\_ alternation of generations, where the
  - Diploid phase ( \_\_\_\_\_ phyte) includes an embryo.
  - Haploid phase ( \_\_\_\_\_ phyte) produces gametes by mitosis.
- Chlorophylls \_\_\_\_\_ & \_\_\_\_\_, carotenoids.
- Starch stored inside chloroplasts.
- Habitat- primarily \_\_\_\_\_.
- \_\_\_\_\_ present.
- Male and female gametangia present.
- Photosynthetic tissues produced by an \_\_\_\_\_ meristem.
- Sporangia with a \_\_\_\_\_.
- \_\_\_\_\_ present.
- ~330,000 species.

•True or false.

- \_\_\_\_\_ 'Bryo' is greek for moss.  
\_\_\_\_\_ Liverworts and hornworts are bryophytes.  
\_\_\_\_\_ The moss sporophyte is nutritionally dependent on the female gametophyte.  
\_\_\_\_\_ Water is not required for fertilization in mosses.

### Bryophytes

- Bryo- *gr.* \_\_\_\_\_.
- Liverworts, hornworts, and mosses.
- \_\_\_\_\_ dominant.
- Sporophyte matrotrophic and \_\_\_\_\_ (6-16 weeks).
- \_\_\_\_\_ required for fertilization.

- Sexual reproduction involves \_\_\_\_\_ and \_\_\_\_\_.
- Biflagellated sperm.
- Asexual reproduction by \_\_\_\_\_ and \_\_\_\_\_.
- Plasmodesmata present.
- Rhizoids in most.
- \_\_\_\_\_ in most (not the hornworts).
- \_\_\_\_\_ or stomata-like structures present.
- ~16,000 species.

•**True or false.**

\_\_\_\_\_ Liverworts because they are shaped like a liver and look glandular were used to treat liver disease in earlier times.

\_\_\_\_\_ The specimen marked 'A' is a leafy liverwort and the one marked 'B' a thalloid liverwort.

**Hepatophyta-** \_\_\_\_\_

- Hepato- *gr.* \_\_\_\_\_.
- Sporophytes \_\_\_\_\_ stomata, but have pores.
- Specialized conducting tissue \_\_\_\_\_.
- Gametophytes thalloid or leafy.
- Rhizoids \_\_\_\_\_ celled.
- \_\_\_\_\_ of all living plants.
- Sporangium with \_\_\_\_\_ capsule, elaters present in some to disperse spores.
- Most cells contain \_\_\_\_\_ chloroplasts.
- Habitat- \_\_\_\_\_, some aquatic, temperate and tropical.
- 6,000 species.
- Examples- *Marchantia* and \_\_\_\_\_.

**Marchantia Antheridia**

**Marchantia Archegonia**

•**True or false.**

\_\_\_\_\_ Below you can see male gametophytes.

**Life history of Marchantia**

**Anthocero phyta-** \_\_\_\_\_

- Antho- *gr.* \_\_\_\_\_, keras- *gr.* \_\_\_\_\_.
- Sporophytes \_\_\_\_\_ stomata.
- Specialized conducting tissue \_\_\_\_\_.
- Gametophytes \_\_\_\_\_.
- Rhizoids \_\_\_\_\_ celled.
- Sporangia dehisce to disperse spores, elater-like structures present.
- Most cells contain a \_\_\_\_\_ chloroplast.
- Sporophyte with basal intercalary \_\_\_\_\_.
- Habitat- moist temperate and tropical.
- 100 species.
- Example- \_\_\_\_\_

• **Hornwort sporophytes** \_\_\_\_\_.

- A) are nutritionally dependent on the female gametophyte
- B) are primarily terrestrial
- C) lack stomata
- D) contain a sporangium
- E) all of the above

• **True or false.**

- \_\_\_\_\_ Anthoceros is an example of a true moss (Phylum Bryophyta).  
\_\_\_\_\_ Hornwort gametophytes are thalloid.

**Bryophyta-** \_\_\_\_\_

- Sporophytes \_\_\_\_\_ stomata.
- Specialized conducting tissue- \_\_\_\_\_ and nonlignified \_\_\_\_\_.
- Gametophytes \_\_\_\_\_.
- Rhizoids \_\_\_\_\_.
- Sporangia with dehiscent capsules.
- Most cells with \_\_\_\_\_ chloroplasts.
- Habitat- \_\_\_\_\_ and \_\_\_\_\_, temperate and tropical, some aquatic.
- 9,500 species.
- Example- Polytrichum, Sphagnum, \_\_\_\_\_.

**3 Moss Classes**

- Bryidae- \_\_\_\_\_ mosses, Polytrichum.
  - Protonema with a \_\_\_\_\_ of cells with slanted cross walls.
  - Leafy gametophytes develop from minute budlike structures.
- Sphagnidae- \_\_\_\_\_ mosses, Sphagnum.
  - Protonema with \_\_\_\_\_ of cells that is one layer thick.
  - Gametophytes with clusters of branches, 5 per node.
  - \_\_\_\_\_ capsular operculum.
- Andreaeidae- \_\_\_\_\_ mosses, Andreaea.
  - Protonema with \_\_\_\_\_ of cells.
  - Capsule dehisces by splitting in four.
  - Rhizoids occur in 2 rows.
  - \_\_\_\_\_ or \_\_\_\_\_ regions on \_\_\_\_\_.

## Moss life history

• **Moss sporophytes** \_\_\_\_\_.

- A) are nutritionally dependent on the female gametophyte
- B) are aquatic and terrestrial
- C) have multicellular rhizoids
- D) include Polytrichum, Sphagnum, and Mnium
- E) all of the above

• **True or false.**

- \_\_\_\_\_ Moss sporophytes contain stomata.
- \_\_\_\_\_ Moss gametophytes are thalloid and leafy.

## Seedless Vascular Plants- Chapter 17

### • True or False.

- Nonvascular plants include the algae and bryophytes.
- Vascular plants include lycophytes, ferns, gymnosperms, and flowering plants.
- Xylem and phloem are the names of musical instruments from Istanbul.

### Vascular Tissue System

- \_\_\_\_\_ - plant tissue that conducts water and minerals.
  - Tracheary elements
    - \_\_\_\_\_
    - \_\_\_\_\_
- \_\_\_\_\_ - plant tissue that conducts food (mainly \_\_\_\_\_).
  - \_\_\_\_\_ elements

### Lycopodium life history

### Vascular Plant Terminology #1

- Leaves- photosynthetic, principal \_\_\_\_\_ of the stem.
  - \_\_\_\_\_ - small leaves that contain a single strand of vascular tissue.
  - \_\_\_\_\_ - large leaves that contain multiple strands of vascular tissue.

### Vascular Plant Terminology #2

- Homosporous- production of one type of spore from \_\_\_\_\_ kind of sporangium.
- Heterosporous- production of two types of spores from \_\_\_\_\_ different kinds of sporangia.

**Vascular Plant Terminology #3**

- \_\_\_\_\_ - a modified leaf that bears sporangia.  
 — \_\_\_\_\_ - a structure that produces spores.

**Vascular Plant Terminology #4**

- \_\_\_\_\_ - a modified leaf that bears microsporangia.  
 — Microsporangia- a \_\_\_\_\_.
- \_\_\_\_\_ - a modified leaf that bears megasporangia.  
 — Megasporangia- a sporangium that produces \_\_\_\_\_.

**Vascular Plant Terminology #5**

- \_\_\_\_\_ - a reproductive structure consisting of nonphotosynthetic sporophylls; a \_\_\_\_\_.  
 — \_\_\_\_\_ - a microsporangiate cone.  
 — \_\_\_\_\_ - a megasporangiate cone.

**•True or False.**

- Microphylls are photosynthetic leaves that contain a single strand of vascular tissue.
- Homospory exists when two types of spores are produced from the same sporangium.
- A sporangium is a structure that produces flagellated gametes.
- A megasporophyll is a modified leaf that bears mega-discounts on megasporangia.
- Megastrobili or microstrobili?

**Seedless Vascular Plants**

**•Representatives (425-370 MYA)**

- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_

**Seedless Vascular Plants**

**•Phyla (Living today)**

- \_\_\_\_\_ - club mosses, resurrection plant, quillworts.
- \_\_\_\_\_ - ferns and the fern allies (whisk ferns and horsetails).

**Lycopodiophyta- lycophytes**

- Lykos- *gr.* \_\_\_\_\_, pous- *gr.* \_\_\_\_\_.
- \_\_\_\_\_ present.
- Plants + or - \_\_\_\_\_ branched.
- Sporangia on or in the \_\_\_\_\_ of sporophylls on strobili.
- \_\_\_\_\_ sporous & \_\_\_\_\_ sporous.
- Distribution- global.
- Habitat- \_\_\_\_\_, deserts, aquatic.
- ~1,200 species.
- Examples- Lycopodium, \_\_\_\_\_, \_\_\_\_\_.

**Selaginella**- the resurrection plant (Selaginellaceae) is \_\_\_\_\_ sporous.

**Isoetes**- the quillwort (Isoetaceae) is \_\_\_\_\_ sporous.

• Match spore type on the right to lycophyte family on the left.

- |                                         |                  |
|-----------------------------------------|------------------|
| 1. <u>Lycopodiaceae (Lycopodium)</u>    | a. Homosporous   |
| 2. <u>Selaginellaceae (Selaginella)</u> | b. Heterosporous |
| 3. <u>Isoetaceae (Isoetes)</u>          |                  |

**Pteridophyta- ferns and fern allies.**

- Pteri- *gr.* \_\_\_\_\_ or \_\_\_\_\_.
- Leaves- \_\_\_\_\_ phylls, scalelike, & \_\_\_\_\_ phyll-like.
- \_\_\_\_\_ branching patterns.
- Sporangia in \_\_\_\_\_, lateral, or on sporangiophores in strobili.
- Heterosporous & homosporous.
- Distribution- global, \_\_\_\_\_.
- Habitat- all habitats, > species in \_\_\_\_\_.
- ~11,000 species.
- Examples- Polypodium, \_\_\_\_\_, \_\_\_\_\_.

**Pteridophyte Orders**

- Ophioglossales and Maratiales- \_\_\_\_\_ sporangiate ferns.
- Psilotales- \_\_\_\_\_ sporangiate ferns.
- Filicales- homosporous \_\_\_\_\_ sporangiate ferns.
- Equisetales- homosporous with strobilus.
- Marsileales and Salviniiales- heterosporous \_\_\_\_\_ sporangiate ferns.

**Psilotales-** \_\_\_\_\_.

- **Psilos- gr.** \_\_\_\_\_.
- **Leaves-** \_\_\_\_\_-like.
- **Eusporangiate.**
- **Sporangia lateral.**
- \_\_\_\_\_ branched.
- **Homosporous.**
- \_\_\_\_\_ roots, stems.
- **Distribution-** \_\_\_\_\_ & subtropical.  
–Alabama, \_\_\_\_\_, Florida, Louisiana.
- **Habitat-** epiphytic or on rich soils.
- \_\_\_\_\_ species, ? total.
- **Example-** \_\_\_\_\_.

**Psilotum-** Psilotales

## **Filicales**

- Falic- *L.* \_\_\_\_\_.
- Leaves- \_\_\_\_\_ phylls, fronds.
- Homosporous and leptosporangiate.
- Sporangia usually in \_\_\_\_\_.
- \_\_\_\_\_ branching, but not dichotomous.
- Roots and stems.
- Distribution- global, \_\_\_\_\_.
- Habitat- \_\_\_\_\_ epiphytic, \_\_\_\_\_ on soil.
- ~10,500 species.
- Example- \_\_\_\_\_.

## **Polypodium- Filicales**

### **Equisetales- horsetails**

- Equis- *L.* \_\_\_\_\_, saeta- *L.* \_\_\_\_\_.
- Leaves- microphyll-like, scaly.
- Homosporous.
- Sporangia on sporangiophores in a strobilus.
- \_\_\_\_\_ leaves, but not dichotomous.
- Roots and stems (ribbed and jointed).
- Distribution- global.
- Habitat- along streams in moist sites.
- ~ \_\_\_\_\_ species.
- Example- \_\_\_\_\_.

### **Equisetum- Equisetales**

#### **True or False.**

- Psilotum is heterosporous.
- Filicalean ferns are heterosporous.
- Horsetails are heterosporous.
- Ferns and fern allies all have a dominant sporophyte (2N) that alternates with a nearly microscopic gametophyte (N).
- The Filicales have megaphyll leaves.
- There are two types of sporangia found in the ferns, Eusporangiate and Heterosporangiate.

## Gymnosperms- Chapter 18

### •Which of the following is not a gymnosperm?

- A) pine
- B) cycad
- C) ginkgo
- D) poppy
- E) redwood

### Naked versus Enclosed Seed Plants

#### •Gymnosperms

- Gymno- *gr.* \_\_\_\_\_.
- Sperma- *gr.* \_\_\_\_\_.

#### •Angiosperms

- Angiosperm- *gr.* \_\_\_\_\_.
- \_\_\_\_\_ - *gr. seed.*

### Extant Gymnosperms

#### •Match the common name on the right to the phylum on the left.

- |                   |                |
|-------------------|----------------|
| -1) Cycadophyta   | a. ginkgo      |
| -2) Ginkgophyta   | b. conifers    |
| -3) Coniferophyta | c. cycads      |
| -4) Gnetophyta    | d. gnetophytes |

### Cycadophyta

- Cycas- *gr.* \_\_\_\_\_.
- \_\_\_\_\_, but \_\_\_\_\_ vessel elements.
- Sperm present, \_\_\_\_\_.
- \_\_\_\_\_ leaves.
- Pollen tube \_\_\_\_\_ with the egg cell.
- Ovulate (megasporangiate) & microsporangiate cones simple & on \_\_\_\_\_ plants.
- 11 genera & 140 species.
- Examples- \_\_\_\_\_ & \_\_\_\_\_.

### Ginkgophyta

- Yin- *ch.* \_\_\_\_\_, hing- *ch.* \_\_\_\_\_.
- \_\_\_\_\_, but \_\_\_\_\_ vessel elements.
- Sperm present, \_\_\_\_\_.
- \_\_\_\_\_ leaves.
- Pollen tube \_\_\_\_\_ with the egg cell.
- Ovulate & microsporangiate cones on \_\_\_\_\_ plants; \_\_\_\_\_ seeds.
- \_\_\_\_\_ genus & \_\_\_\_\_ species.
- Examples- \_\_\_\_\_ = maidenhair tree.

## Coniferophyta

- Con- gr. \_\_\_\_\_, fer- L. \_\_\_\_\_.
- \_\_\_\_\_, but no vessel elements.
- \_\_\_\_\_.
- \_\_\_\_\_ like or \_\_\_\_\_ like leaves.
- Pollen tube \_\_\_\_\_ with egg cell.
- Ovulate & microsporangiate cones on \_\_\_\_\_ plant; ovulate cones compound.
- 70 genera & 630 species.
- Examples- \_\_\_\_\_, Picea, \_\_\_\_\_, Abies, Cupressus.

Pinus- pine (Pinaceae).



## Introduction to the Angiosperms- Chapter 19

### Angiosperms- Anthophyta

- \_\_\_\_\_, but parasitic and saprophytic representatives.
- Enclosure of ovules within \_\_\_\_\_.
- Ovule- the structure in seed plants that contains the \_\_\_\_\_, with \_\_\_\_\_ cell; including nucellus and integuments.
- Presence of \_\_\_\_\_ in seeds.
- Flower present with \_\_\_\_\_ (microsporophylls) & \_\_\_\_\_ (megasporophylls).
- Species- 300,000-450,000

### Monocotyledones- \_\_\_\_\_

- Flower parts- \_\_\_\_\_ s.
- Pollen- \_\_\_\_\_ aperture.
- Cotyledons- \_\_\_\_\_.
- Leaf venation- \_\_\_\_\_.
- 1° vascular bundles in stem- \_\_\_\_\_.
- 2° growth \_\_\_\_\_ vascular cambium.
- Examples- \_\_\_\_\_, lilies, irises, \_\_\_\_\_, cattails, palms.

### Dicotyledones- \_\_\_\_\_

- Flower parts- \_\_\_\_\_ s & \_\_\_\_\_ s.
- Pollen- \_\_\_\_\_ aperture.
- Cotyledons- \_\_\_\_\_.
- Leaf venation- \_\_\_\_\_.
- 1° vascular bundles in stem- \_\_\_\_\_.
- 2° growth \_\_\_\_\_ vascular cambium.
- Examples- \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_.

### Flower Anatomy

Sepals-

Petals-

Pedicel-

Stigma-

Style-

Ovary-

Receptacle-

Anther and filament-

**Ovary Position**

- \_\_\_\_\_ - whorls attached below the ovary.
- \_\_\_\_\_ - stamens and petals adnate to the calyx, forming a tube (hypanthium) at the base of the ovary.
- \_\_\_\_\_ - whorls attached above the ovary.

**Epigyny in Malus (apple) flower**

**Mature Anther with 4 Microsporangia**

**Mature Embryo Sac- 8 nuclei, 7 celled structure**



## Evolution of Angiosperms- Chapter 20

### Rafflesia arnoldii

- Flower- the reproductive structure of angiosperms; a \_\_\_\_\_ shoot that bears sporophylls.

### Evolutionary Trends Among Flowers

- Flowers have gone from \_\_\_\_\_ indefinite parts to having \_\_\_\_\_ parts that are definite in number.
- Floral \_\_\_\_\_ have \_\_\_\_\_ over time.
- Floral parts have become \_\_\_\_\_.
- Floral \_\_\_\_\_ has become \_\_\_\_\_.
- Carpels have gone from \_\_\_\_\_ and incompletely closed to pistil-shaped and sealed.
- Ovary has gone from \_\_\_\_\_ to \_\_\_\_\_.
- Perianth has gone from having indistinct sepals and petals to having a distinct calyx and corolla.
- Flowers have gone from \_\_\_\_\_ (actinomorphic) to \_\_\_\_\_ (zygomorphic) symmetry.

### Floral Evolution

- \_\_\_\_\_ and \_\_\_\_\_ have coevolved.  
– Coevolution- the \_\_\_\_\_ of adaptations in 2 or more interacting populations.
- Insect pollination is \_\_\_\_\_ efficient than passive pollination.
- \_\_\_\_\_, flies, \_\_\_\_\_.
- \_\_\_\_\_ are the most important group of visiting insects.

### Bird and bat-pollinated flowers

- Produce copious \_\_\_\_\_.
- Usually bright \_\_\_\_\_ and \_\_\_\_\_ in color.  
– Birds have a good sense of color.
- Flowers usually have very \_\_\_\_\_.  
– Smell not developed in birds.

### Wind pollinated flowers \_\_\_\_\_ produce nectar.

- Water soluble \_\_\_\_\_ compounds with two six-carbon rings linked by a three-carbon unit.
- Occur in the \_\_\_\_\_ of plant cells.
- The most important pigments in floral coloration are the \_\_\_\_\_ (red, violet, and blue) and the \_\_\_\_\_.

### Asteraceae and Orchidaceae

- Asteraceae  
– \_\_\_\_\_ have flowers closely bunched together in a head.
  - \_\_\_\_\_ species.
  - Ovary with \_\_\_\_\_ ovule
  - \_\_\_\_\_ and \_\_\_\_\_ flowers.

• Orchidaceae

– Orchid flowers are showy and zygomorphic.

- \_\_\_\_\_ species.
- Ovary with \_\_\_\_\_ of ovules.
- Cuplike lower petal.

**Fruit Related Terminology**

• Fruit- a \_\_\_\_\_.

- \_\_\_\_\_ - the enlarged basal portion of a carpel.
- \_\_\_\_\_ - the vessel that encloses the ovule/s; forms the gynoecium.
- \_\_\_\_\_ - the structure that contains the female gametophyte with egg cell, including the nucellus and integuments.
- \_\_\_\_\_ - a mature ovule.
- \_\_\_\_\_ - chambers in the ovary that contain the ovules.

**Fruit Classification**

• Fruit derived from \_\_\_\_\_ than 1 pistil

– \_\_\_\_\_ fruit- develop from a cluster of mature ovaries produced by a cluster of mature flowers.

- \_\_\_\_\_.

– \_\_\_\_\_ fruit- develop from several separate carpels of a single flower.

- Raspberry, strawberry, \_\_\_\_\_.

**Simple Fruit Types- fruit derived from \_\_\_\_\_ pistil**

- \_\_\_\_\_
  - Berries- fleshy inner layer. Tomatoes, banana, grapes.
    - \_\_\_\_\_ - a berry with a thick, leathery, inseparable rind. Cucurbitaceae.
    - \_\_\_\_\_ - a berry with a thick, leathery, separable rind. Citrus.
  - \_\_\_\_\_ - fleshy hypanthium. Pear, apple.
  - \_\_\_\_\_ - stony endocarp. Peach, cherry, olive.
- \_\_\_\_\_
  - \_\_\_\_\_ - tissue of the mature ovary wall splits open, freeing the seeds.
    - Legume- dehisces along 2 sutures.
  - \_\_\_\_\_ - tissue of the mature ovary wall remains sealed with seeds remaining in the fruit.
    - Nut- hard pericarp, usually one-seeded.
    - Achene- small. dandelion.

**Fruits and seeds have evolved in relation to their dispersal agents**

- Wind-borne fruits & seeds.
- \_\_\_\_\_.
- Fleshy for animal dispersal.
- Attachment to \_\_\_\_\_.

## Early Development of the Plant Body- Chapter 22

### True or False

- \_\_\_\_\_ Embryogenesis is the formation of an embryo.  
\_\_\_\_\_ The developing embryo in angiosperms is photosynthetic.

### **Embryogenesis**

- Embryogenesis- formation of an embryo.
- The first two divisions are \_\_\_\_\_ and establish embryo \_\_\_\_\_.
  - \_\_\_\_\_ - chalazal pole.
    - Consists of an \_\_\_\_\_ that gives rise to an \_\_\_\_\_, which will eventually give rise to the mature embryo.
  - \_\_\_\_\_ - micropylar pole.
    - Consists of a \_\_\_\_\_ that gives rise to a \_\_\_\_\_.
- Establishment of polarity fixes the structural axis on which the lateral appendages will be later arranged.

### **Embryo Proper and the Primary Meristems**

- The embryo proper is tissue that differentiates to form \_\_\_\_\_ primary meristems.
- Primary Meristems
  - \_\_\_\_\_ - forms the epidermis of the plant by periclinal divisions of the outer cells of embryo proper.
  - \_\_\_\_\_ - forms the vascular tissue of the plant by vertical divisions.
  - \_\_\_\_\_ - forms the ground tissue of the plant by vertical divisions.

- \_\_\_\_\_ The apical meristem in angiosperms \_\_\_\_\_.
- A) is a region of tissue at the tip of shoots and roots that is responsible for programmed cell death.
  - B) is a region of tissue at the tip of shoots and roots that forms new cells.
  - C) coordinates hormone production much like the brain in mammals
  - D) produces the bark we see on trees
  - E) none of the above

### Apical Meristems

- Apical Meristem- \_\_\_\_\_.
- As the embryo matures new cell formation gradually becomes restricted to the apical meristems.
- Shoot Apical Meristem- positioned \_\_\_\_\_ the two embryonic leaves in \_\_\_\_\_ and \_\_\_\_\_ in \_\_\_\_\_.
- \_\_\_\_\_ - embryonic root.

### Seed Terms

- Hypocotyl- \_\_\_\_\_.
- Hypocotyl-root axis- an undistinguished radicle.
- \_\_\_\_\_ - stemlike axis above the cotyledons.
- \_\_\_\_\_ - the first bud of an embryonic shoot.
- \_\_\_\_\_ - the fruit wall, which develops from the wall of the ovary.

**Garden Bean- food is stored in \_\_\_\_\_.**

**Castor Bean- food is stored in \_\_\_\_\_.**

**Onion and Maize- food is stored in \_\_\_\_\_.**

- \_\_\_\_\_ Which of the following effects seed germination?
- A) water
  - B) oxygen
  - C) light and temperature
  - D) hormones
  - E) all of the above

## Seed Germination

• Dependent on \_\_\_\_\_ and \_\_\_\_\_ factors.

– External ( \_\_\_\_\_ )

- Water
- Oxygen
- Temperature
- Light

– Internal ( \_\_\_\_\_ )

- Hormones- gibberellins.

• \_\_\_\_\_ - cotyledon/s are carried above ground level.

• \_\_\_\_\_ - cotyledon/s remain underground.

Examples-

### True or False

\_\_\_\_\_ The onion has an epigeous type of seed germination.

## Cells and Tissues of the Plant Body- Chapter 23

### Origin of Primary Tissues

- Primary growth- formation of \_\_\_\_\_ .  
–Primary plant body.

### Growth and Development

- \_\_\_\_\_ - the sum total of events that lead to the formation of the plant body.
- Growth- an \_\_\_\_\_ in size.  
–Cell \_\_\_\_\_  
–Cell \_\_\_\_\_
- \_\_\_\_\_ - regions of tissue at the tips of shoots and roots that forms new cells.  
–Meristematic tissue.
- Much of the plant undergoes unlimited or prolonged growth of the apical meristems= \_\_\_\_\_.

### Morphogenesis and Differentiation

- Morphogenesis- the \_\_\_\_\_.
- \_\_\_\_\_ - a process by which a relatively unspecialized cell undergoes a progressive change to form a more \_\_\_\_\_ cell.

## Internal Organization of the Plant Body

• Tissue- a group of \_\_\_\_\_ organized into a structural and functional unit.

• Tissue System- a tissue or \_\_\_\_\_ organized into a structural and functional unit; larger units of the plant body.

• There are \_\_\_\_\_ Tissue Systems

- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_

### Ground Tissue

- \_\_\_\_\_
  - Polyhedral to round in shape.
  - Occur throughout the plant body.
  - Photosynthesis, storage, and secretion.
- \_\_\_\_\_
  - Elongate in shape.
  - Occur beneath the epidermis in young stems.
  - Support young growing tissues.
- \_\_\_\_\_ - fibers and sclereids.
  - Long or stellate in shape.
  - Occur throughout the plant body.
  - Support (strengthen) and storage.

### Vascular Tissue #1

• Xylem- principal \_\_\_\_\_ tissue in vascular plants; \_\_\_\_\_ at maturity; lignified.

• Tracheary Elements

- \_\_\_\_\_ - elongate and tapering; pits, but no perforations; seedless vascular plants, gymnosperms, and some angiosperms.
- \_\_\_\_\_ element- elongate; pits and perforations; angiosperms.

## Vascular Tissue #2

- Phloem- principal \_\_\_\_\_ tissue in vascular plants; living at maturity; not lignified.
- Gymnosperm Sieve Elements
  - Sieve cell- elongate & tapering; with sieve areas.
  - \_\_\_\_\_ cell- elongate & tapering; delivers substances to sieve cells.
- Angiosperm Sieve Elements
  - Sieve-tube element- elongate & tapering; with a sieve plate.
  - \_\_\_\_\_ cell- variable; delivers substances to sieve-tube elements.

## Dermal Tissue

- \_\_\_\_\_ - outermost cell layer of the \_\_\_\_\_ plant body.
  - Variable in shape; guard cells and trichomes.
  - \_\_\_\_\_ of plant body.
  - Protective (cuticle and water loss) and aeration (stomata).
- \_\_\_\_\_ - \_\_\_\_\_ protective tissues.
  - Rectangular in shape; cork cells.
  - \_\_\_\_\_ epidermis.
  - Protective and aeration (lenticels); replaces epidermis.

## The Root: Structure and Development- Chapter 24

### Roots

• Root- the \_\_\_\_\_, normally occurs below ground.

#### • Root Functions

- \_\_\_\_\_.
- \_\_\_\_\_ of water, minerals, inorganic ions.
- \_\_\_\_\_.
- \_\_\_\_\_.

#### • Two types of root systems

- \_\_\_\_\_ - a stout, tapering main root from which smaller lateral roots arise; deep; gymnosperms & dicots.
- \_\_\_\_\_ - arise from stem similar to lateral roots; shallow; monocots.

### Root Penetration

• Root depth and distance depend on \_\_\_\_\_:

- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_

• \_\_\_\_\_ - those involved in uptake of water and minerals occur usually in the upper 1 meter of the soil.

• Rootcap- a thimble like mass of \_\_\_\_\_ cells that covers the root and \_\_\_\_\_ mucigel.

• The \_\_\_\_\_ in young roots absorbs \_\_\_\_\_ and \_\_\_\_\_.

• Root Hairs- \_\_\_\_\_ of epidermal hairs that facilitate absorption.

### Primary Development of the Root Tip

• Region of cell \_\_\_\_\_

- ~1 mm in length.
- Apical meristem.

• Region of cell \_\_\_\_\_

- ~2 mm in length.
- Cells elongate, functional xylem starts to develop and phloem is mature.

• Region of \_\_\_\_\_

- ~2 mm-variable in length.
- Root hairs are produced, functional xylem and phloem are present.

Name the 3 primary meristems seen on this slide: \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_

### **Eudicot versus Monocot Roots**

#### • Eudicots

- Vascular cylinder \_\_\_\_\_.
- Cortical cells sometimes retained for life, but some shed due to secondary growth.

#### • Monocots

- Vascular cylinder in \_\_\_\_\_ with \_\_\_\_\_.
- Cortical cells retained for life, because they lack secondary growth.

### **Cortex and Vascular Cylinder**

Match the following cortical and vascular terminology to their definitions.

- |                         |                                                                                           |
|-------------------------|-------------------------------------------------------------------------------------------|
| 1. Cortex               | a. 1 or more layers of nonvascular cells surrounding the vascular tissue of the root.     |
| 2. Vascular cylinder    | b. empty spaces among cortical cells; essential for aeration of the root cells.           |
| 3. Pericycle            | c. a region of the primary wall containing suberin that is impermeable to water and ions. |
| 4. Intercellular spaces | d. the innermost layer of the cortex.                                                     |
| 5. Epidermis            | e. contains xylem, phloem, and pericycle.                                                 |
| 6. Exodermis            | f. consists mostly of ground tissue that occupies the greatest area of the root.          |
| 7. Endodermis           | g. the outermost layer of cells.                                                          |
| 8. Casparian Strip      | h. the outermost layer of the cortex that is one or more cell layers in depth.            |

**Lateral Roots Arise from the \_\_\_\_\_**

**Effects of Secondary Growth on the Primary Body of the Root**

• Secondary Growth in roots consists of:

- 1) Secondary vascular tissues (secondary xylem and phloem) from \_\_\_\_\_.
- 2) Periderm, mostly cork tissue from \_\_\_\_\_.

**Root Modifications**

- \_\_\_\_\_ - roots produced from aboveground structures.
- \_\_\_\_\_ - negatively gravitropic roots that aerate the root system.
- \_\_\_\_\_ - specialized storage organs consisting of parenchyma and vascular tissue. Carrot, sweet potato, sugarbeet.

## The Shoot: Primary Structure and Development- Chapter 25

### The Shoot

- Shoot- the \_\_\_\_\_, consisting of stem and leaves.
  - Stem- the above ground \_\_\_\_\_ of vascular plants.
  - Leaf- the principle \_\_\_\_\_ of the stem.
    - Foliage leaf- photosynthetic organ.
- \_\_\_\_\_ - the part of the stem where one or more leaves are attached.
- \_\_\_\_\_ - the region of the stem between two successive nodes.
- \_\_\_\_\_ - an embryonic shoot protected by young leaves.

**Primordium**- \_\_\_\_\_

**Pith**- \_\_\_\_\_

### Modified Stems

- \_\_\_\_\_ - modified leaves that spirally coil and aid in stem support.
- \_\_\_\_\_ - runners; stems that grow horizontally on the soil surface, often giving rise to new plants at the nodes.
- \_\_\_\_\_ - hard, woody, sharp-pointed modified stems, arise from the axils of leaves.
- \_\_\_\_\_ - hard, woody, sharp-pointed modified leaves or leaf-parts.
- \_\_\_\_\_ - a small non-woody, sharp-pointed outgrowth of bark or the epidermis.

### Underground Stems

- \_\_\_\_\_ - a horizontal stem that grows at or below the soil surface.
- \_\_\_\_\_ - an enlarged, short, fleshy underground stem, forms at the tip of a rhizome. i.e. Potato.
- \_\_\_\_\_ - a shortened underground stem covered by enlarged fleshy storage leaves. i.e. Onion and garlic.
- \_\_\_\_\_ - a thickened underground stem with small papery leaves. i.e. Gladiolus and Crocus.

### Leaf Arrangement

- \_\_\_\_\_ - the arrangement of leaves on a stem.
  - \_\_\_\_\_ - leaves are attached to an underground stem or rhizome.
  - \_\_\_\_\_ - 2 leaves attached at each node, borne on opposite sides of the stem.
  - \_\_\_\_\_ - 1 leaf attached at each node.
  - \_\_\_\_\_ - 3 or more leaves at each node.

### Leaf Morphology

- Blade- \_\_\_\_\_.
- Petiole- \_\_\_\_\_ portion.
- \_\_\_\_\_ - scalelike or leaflike appendages at the base of leaves.
- \_\_\_\_\_ vs. \_\_\_\_\_ Leaves
  - Simple- blades \_\_\_\_\_.
  - Compound- blades \_\_\_\_\_ into leaflets.
    - \_\_\_\_\_ compound- leaflets arising from both sides of the axis.
    - \_\_\_\_\_ compound- leaflets diverge from the tip of the petiole.

## Leaf Histology

- \_\_\_\_\_ - the \_\_\_\_\_ tissue of the leaf specialized for photosynthesis.
  - \_\_\_\_\_ parenchyma- upper cells.
  - \_\_\_\_\_ parenchyma- lower cells.

## Leaf Abscission

- Abscission- \_\_\_\_\_.
- Structural and chemical (ethylene) changes result in the formation of an abscission zone:
  - \_\_\_\_\_ layer
  - \_\_\_\_\_ layer
- Magnesium ions, sugars, amino acids.

## Secondary Growth in Stems- Chapter 26

### Seasonal Growth Cycles

- \_\_\_\_\_ - a plant whose life cycle is completed in a single growing season.
- \_\_\_\_\_ - a plant whose life cycle is completed in two growing seasons; flowering and fruiting occurs in the second year.
- \_\_\_\_\_ - a plant whose vegetative portion of the life cycle lives year after year.

### Secondary Growth

- At the beginning of each growing season primary growth is resumed and secondary tissues \_\_\_\_\_.
- Secondary Growth- an \_\_\_\_\_ in thickness ( \_\_\_\_\_ ) to the plant body as a result of the activity of \_\_\_\_\_ lateral meristems:
  - \_\_\_\_\_ Cambium
  - \_\_\_\_\_ Cambium

### Vascular Cambium

- Vascular cambium- a cylindrical sheath of \_\_\_\_\_ cells that produces secondary xylem & phloem.
- Consists of two forms of highly vacuolated cells:
  - \_\_\_\_\_ initials
  - \_\_\_\_\_ initials

- Vascular rays

- Pathways for the movement of \_\_\_\_\_ substances and water.
- Storage of starch, protein, and lipids.

### Wood- Secondary Xylem

• Wood uses- shelter, fire, weapons, furniture, tools, paper, boats, wheels.

• Wood is classified as:

- \_\_\_\_\_ wood- magnoliids and eudicots.
- \_\_\_\_\_ wood- \_\_\_\_\_.

### Conifers- softwoods

• Tracheary elements- \_\_\_\_\_ only.

### Magnoliids and Eudicots- hardwoods

• Tracheary elements- tracheids and \_\_\_\_\_.

### Periderm

• Periderm- outer tissue that replaces the epidermis as the protective covering of the plant.

- \_\_\_\_\_ - meristem that produces the periderm.
- \_\_\_\_\_ (phellem)- secondary tissue that cuts toward the outside of the cork cambium; dead at maturity; suberin; impermeable to water and gases.
- \_\_\_\_\_ - secondary tissue that is cut towards the inside of the cork cambium; living at maturity; no suberin; permeable.

• Lenticel- spongy regions on the cork surfaces of stems, \_\_\_\_\_, and other plant parts that allow for \_\_\_\_\_ exchange.

• Bark- collective term for all tissues outside the \_\_\_\_\_ cambium.

- \_\_\_\_\_ phloem
- \_\_\_\_\_

### External Features of Woody Stems

## Heartwood vs. Sapwood

- Heartwood- the part of the wood in a living tree that contains \_\_\_\_\_ cells; nonconducting wood.
- Sapwood- the part of the wood in a living tree that contains \_\_\_\_\_ cells and reserve materials; \_\_\_\_\_ wood.

## Growth Rings Result from the Periodic Activity of the Vascular Cambium

- \_\_\_\_\_ rings- a layer of growth in secondary xylem or phloem.
- \_\_\_\_\_ rings- a growth layer that represents one season's growth.
- Early wood
  - Less dense than late wood.
  - Produced during period of rapid growth.
  - Wide cells with thin walls.
- \_\_\_\_\_ wood
  - \_\_\_\_\_.
  - Produced during periods of \_\_\_\_\_ growth.
  - \_\_\_\_\_ cells with \_\_\_\_\_ walls.

## Bristlecone Pine (Pinus longaeva)

- Oldest living tree
  - \_\_\_\_\_ years in age- oldest living.
  - \_\_\_\_\_ years in age- oldest.
- Native to the White Mountains of eastern California.
- The bristlecone pine is a sensitive \_\_\_\_\_ gauge.
  - 3,500 B.C.- 1,300 B.C. warm summers.
  - 1,300 B.C.- 200 B.C. cold summers.
- \_\_\_\_\_ - the study of growth rings and historical time.

## Ecology- Chapters 31 and 32

### Ecological Definitions

- **Ecology**- the study of the \_\_\_\_\_ between \_\_\_\_\_ and the \_\_\_\_\_.
  - Interactions (or \_\_\_\_\_) determine the abundance and distribution of organisms.
    - \_\_\_\_\_ - the size, shape, and location that a population occupies.
    - \_\_\_\_\_ - the number of individuals in a given area and their density.

### Ecology Deals with 3 Levels

- \_\_\_\_\_ - a single organism.
- \_\_\_\_\_ - a group of individuals of the same species occupying a given area.
- \_\_\_\_\_ - all the organisms inhabiting a common environment and interacting with one another.

\_\_\_\_\_ - **How many in California?** \_\_\_\_\_

- **Coastal Sage Scrub= CSCR** (Little summer heat), 12-25 inches of precipitation.
  - Summer fog/overcast is common. Summer temperatures from 80-100°F. Winter temperatures drop to 27-30°F.
  - Common Plants**
    - Buckwheat (*Eriogonum* spp., notably *E. fasciculatum*), California Lilac (*Ceanothus* spp.), Manzanita (*Arctostaphylos* spp.), Monkey flowers (*Diplacus* spp., the drought tolerant types), Gooseberry and Currant (*Ribes* spp.), Coyote Brush (*Baccharis* spp.).
  - Soil and climate notes**
    - A mixture of diverse soils, from acidic sand on hard pan (Manzanita country) to alkaline clays (largely converted to annual weeds).

• **Ecosystem**- \_\_\_\_\_.

- \_\_\_\_\_ - the major regional ecosystems.

### Abiotic and Biotic Factors

- **Abiotic**- characterized by the absence of life; \_\_\_\_\_.
  - \_\_\_\_\_
  - \_\_\_\_\_
  - \_\_\_\_\_
  - \_\_\_\_\_
  - \_\_\_\_\_ - ph, texture, gas exchange, salinity, leaching.
  - \_\_\_\_\_
- **Biotic**- of or relating to life; \_\_\_\_\_.
  - \_\_\_\_\_ - space, substrate, light, nutrients.
  - \_\_\_\_\_

### Latitude

## Elevation

## Principle of Competitive Exclusion

## Plant-Herbivore Interactions

### Succession

- Succession- \_\_\_\_\_
  - \_\_\_\_\_ succession- the initial \_\_\_\_\_ of \_\_\_\_\_ or bedrock by pioneer species (lichens, mosses, ferns, herbaceous plants).
  - \_\_\_\_\_ succession- \_\_\_\_\_ in the plants and animals that live in a community after the initial colonization.

### Opportunistic vs. Late Successional Forms

#### • r-selected

- Colonizers on newly-cleared surfaces.
- Life history- ephemerals, annuals, simple veg. life history.
- Size- \_\_\_\_\_.
- Growth- \_\_\_\_\_.
- Reproduction- high output, \_\_\_\_\_ offspring, low cost/unit.
- Energy storage- uniform throughout.

#### • K-selected

- Invade pioneer communities on predictable basis.
- Life History- complex, perennials, seasonal reproduction.
- Size- \_\_\_\_\_.
- Growth- \_\_\_\_\_.
- Reproduction- low output, \_\_\_\_\_ offspring, high cost/unit.
- Energy storage- \_\_\_\_\_ distributed

## Regulating Growth and Development- Chapter 27

### Hormones

• Hormone- *gr. to* \_\_\_\_\_. \_\_\_\_\_ substances produced in \_\_\_\_\_ amounts that regulate and coordinate metabolism, growth, and morphogenesis.

#### \_\_\_\_\_ Classes of Plant Hormones

- \_\_\_\_\_
  - Leaf primordia, young leaves, developing seeds.
  - Polarly (unidirectionally) and nonpolarly.
- \_\_\_\_\_
  - Root tips.
  - From roots to shoots via xylem.
- \_\_\_\_\_
  - Most tissues in response to stress.
  - Diffusion from site of synthesis.
- \_\_\_\_\_ acid
  - Mature leaves and roots, seeds.
  - From leaves in phloem and from the roots in the xylem.
- \_\_\_\_\_
  - Young tissues of the shoot and developing seeds.
  - Xylem and phloem.

### Darwin and Darwin

### Boysen-Jensen

- \_\_\_\_\_ is the only plant hormone known to be transported polarly.
- Polar transport is \_\_\_\_\_ (toward the base).

### Auxin Provides Chemical Signals That Communicate Information Over Long Distances

- \_\_\_\_\_ - inhibitory influence of the apical bud upon lateral buds.

Auxin Plays a Role in the \_\_\_\_\_ and \_\_\_\_\_ of Vascular Tissue

Auxin \_\_\_\_\_ Development

**Auxin** \_\_\_\_\_ **the Formation of Lateral and Adventitious** \_\_\_\_\_

**Auxin** \_\_\_\_\_ **Abscission**

\_\_\_\_\_ **Auxins Kill Weeds- Herbicides**

**Ethylene Plays a Role in** \_\_\_\_\_

**Ethylene May** \_\_\_\_\_ **or** \_\_\_\_\_ **Cell Expansion**

**Cytokinins** \_\_\_\_\_ **Cell Division**

**Cytokinins** \_\_\_\_\_ **Leaf Senescence**

**Cytokinins** \_\_\_\_\_ **the Growth of Lateral Buds**

**Abscisic Acid (ABA)** \_\_\_\_\_ **Seed Germination**

**Abscisic Acid Plays a Role as a** \_\_\_\_\_ **-to-** \_\_\_\_\_ **Signal**

**Abscisic Acid is Responsible for** \_\_\_\_\_

- Gibberellin (GA) causes \_\_\_\_\_ mutants to grow \_\_\_\_\_.
- Gibberellin causes \_\_\_\_\_ of \_\_\_\_\_ by stimulating cell division and elongation.

**Gibberellin Plays Multiple Roles in**

- 1) Breaking \_\_\_\_\_
- 2) In \_\_\_\_\_

**Gibberellin Can Cause \_\_\_\_\_**

**Gibberellin Affects \_\_\_\_\_ Development**

**Additional Chemical Signals**

- \_\_\_\_\_ - required for normal growth of most plant tissue.
- \_\_\_\_\_ - signal in defense responses to plant pathogens.
- \_\_\_\_\_ - plant growth regulation and defense.
- \_\_\_\_\_ - growth and development; mitosis and meiosis.
- \_\_\_\_\_ - long-distance signal that activates chemical defenses against herbivores.
- \_\_\_\_\_ - signal in hormonal and defense responses.

## External Factors and Plant Growth- Chapter 28

• Tropism- \_\_\_\_\_.

• Phototropism- the curving of a growing shoot \_\_\_\_\_  
- \_\_\_\_\_?

• Gravitropism- the response of shoot or root to \_\_\_\_\_.  
-1st \_\_\_\_\_  
-2nd \_\_\_\_\_

• Thigmotropism- the response to \_\_\_\_\_ with a solid object.

• Heliotropism- the orientation of \_\_\_\_\_ and \_\_\_\_\_ to the \_\_\_\_\_.  
-Turgor pressure changes of the \_\_\_\_\_.

• Pulvinus- \_\_\_\_\_ thickening at the base of the petiole or petiolule.

### Growth response unrelated to the direction of the external stimulus

• \_\_\_\_\_ Movement- gr. *nastos*= closed-pressed.

- \_\_\_\_\_  
- \_\_\_\_\_

• \_\_\_\_\_ morphogenesis

• Nyctinasty- the \_\_\_\_\_ and \_\_\_\_\_ movement of leaves in response to daily rhythms (night and day).

• Thigmomorphogenesis- the \_\_\_\_\_ in response to mechanical stimuli.

## Plant Nutrition and Soils- Chapter 29

### Plant Nutrition

- Plant Nutrition- \_\_\_\_\_ from \_\_\_\_\_ of all raw materials required for essential biochemical processes.
- More than \_\_\_\_\_ have been identified in plants.
- 1880s- ten chemical elements were designated as \_\_\_\_\_ for plant growth.
  - Carbon, hydrogen, oxygen, potassium, calcium, magnesium, nitrogen, phosphorus, sulfur, iron.
- 1900s- manganese, zinc, copper, chlorine, boron, molybdenum, and finally nickel.

### Essential Elements

Three criteria are used to judge essentiality

- 1) If it is needed for the plant to \_\_\_\_\_.
- 2) If it is part of \_\_\_\_\_ or constituent of the plant that is itself essential.
  - a. Magnesium in chlorophyll molecule.
  - b. Nitrogen in proteins.
- 3) If \_\_\_\_\_ appear in the absence of the element.

### 2 Types of Essential Elements

- \_\_\_\_\_ - required in large amounts.  
\_\_\_\_\_ mg/kg or > of dry matter.
- \_\_\_\_\_ (trace elements)- required in very small amounts.  
100 mg/kg of dry matter.

Certain plants contain unusually high and low amounts of specific elements.

### Macronutrient Functions

_____ Sulfur	a. ATP, nucleic acids, phospholipids.
_____ Phosphorus	b. chlorophyll molecule.
_____ Magnesium	c. amino acids and coenzyme A.
_____ Calcium	d. cell walls, cofactors, cellular membrane.
_____ Potassium	e. almost all chemical molecules, 96% of the plant.
_____ Nitrogen	f. amino acids, proteins, nucleotides, nucleic acids, chlorophylls.
_____ Oxygen, Carbon, and Hydrogen	g. osmosis and ionic balance, stomatal activity.

### Micronutrient Functions

- \_\_\_\_\_ - nitrogen fixation and nitrate reduction.
- \_\_\_\_\_ - enzyme functioning in nitrogen metabolism.
- \_\_\_\_\_ - involved in some REDOX reactions.
- \_\_\_\_\_ - activator or component of many enzymes.
- \_\_\_\_\_ - enzyme activator, membrane integrity, oxygen release in PSN.
- \_\_\_\_\_ - Ca<sup>2+</sup> utilization, nucleic acid synthesis, membrane integrity.
- \_\_\_\_\_ - chlorophyll synthesis.
- \_\_\_\_\_ - osmosis and ionic balance.

Sulfur

Phosphorus

Magnesium

Calcium

Potassium

Nitrogen

Molybdenum

Copper

Chlorine

Zinc

Manganese

Boron

Iron

**Soil**

• Soil- primary \_\_\_\_\_ (inorganic ions), \_\_\_\_\_, suitable \_\_\_\_\_  
\_\_\_\_\_, and \_\_\_\_\_ for plants.

—Provides a chemical and physical environment for plant growth.

—Minerals- naturally occurring inorganic compounds that are usually composed of two or more elements. i.e.- Quartz (SiO<sub>2</sub>), Calcite (CaCO<sub>3</sub>).

**Soil Layers (Horizons)**

• Soils consists of at least 3 \_\_\_\_\_ (layers)

A Horizon= \_\_\_\_\_ soil.

B Horizon= \_\_\_\_\_ soil.

C Horizon= \_\_\_\_\_.

\_\_\_\_\_ = below the horizon layers.

**Soils Are Composed of Solid Matter and Pore Space**

• Solid Matter- fragments of rock and minerals in the soil.

- |                      |                |
|----------------------|----------------|
| _____ 1. Coarse Sand | a. < 2 μm      |
| _____ 2. Fine Sand   | b. 2-20 μm     |
| _____ 3. Silt        | c. 200-2000 μm |
| _____ 4. Clay        | d. 20-200 μm   |

• Pore Space- the space around the soil particles.

- \_\_\_\_\_
- \_\_\_\_\_

## Genetics and Heredity- Chapter 8

### Mendel Studied 7 Characters in the Garden Pea (Pisum sativum)

- Flower \_\_\_\_\_ Pod \_\_\_\_\_
- Flower \_\_\_\_\_ Pod \_\_\_\_\_
- Seed \_\_\_\_\_ Stem \_\_\_\_\_
- Seed \_\_\_\_\_

### Mendel's Methods

- Cross-pollination- the transfer of \_\_\_\_\_ from one plant to the \_\_\_\_\_ of another.
  - Self-pollination
  - Artificial cross-pollination
- Monohybrid crosses- an experimental cross between individuals that \_\_\_\_\_.
- First ( \_\_\_\_\_ ) and second ( \_\_\_\_\_ ) generations.

### Mendel's F<sub>1</sub> Observations

- One of the traits could be seen in the F<sub>1</sub> generation= \_\_\_\_\_
- One of the traits could not be seen in the F<sub>1</sub> generation= \_\_\_\_\_

### Genetic Terminology

- \_\_\_\_\_ - an organisms traits.
- \_\_\_\_\_ - an organisms genetic makeup.
- \_\_\_\_\_ - identical alleles for a gene.
- \_\_\_\_\_ - two different alleles for a gene.

### Genetic Terminology #2

- \_\_\_\_\_ - one of 2 or more alternative forms of the same gene.
- \_\_\_\_\_ - a sequence of DNA that codes for a protein.
- \_\_\_\_\_ - the position on a chromosome occupied by a gene.

### Mendel's F<sub>2</sub> Observations

- Flower color  
-Purple:white                      705:224                      \_\_\_\_\_

### Mendel's Dihybrid Cross

- 315:108:101:32 = \_\_\_\_\_



Corn- *Zea mays*

Genetically Engineered Rice- what does it contain? \_\_\_\_\_

### Genetic Engineering

• Genetic Engineering- the technique of \_\_\_\_\_, \_\_\_\_\_, or \_\_\_\_\_ genes to a DNA molecule.

– Improvements in crops

- \_\_\_\_\_
- Resistance to \_\_\_\_\_
- Resistance to \_\_\_\_\_

### Transgenic Plants

- Tomato with \_\_\_\_\_ and without.
- Transgenic tomatoes with and without \_\_\_\_\_.
- Petunia with and without \_\_\_\_\_.
- Tobacco with and without a \_\_\_\_\_.

### Transfer of Genes

Tissue Culture

*Agrobacterium tumefaciens*

• Genomics- a field of genetics that attempts to understand the \_\_\_\_\_, \_\_\_\_\_, function, and \_\_\_\_\_ of genetic information in a whole organism.

*Arabidopsis thaliana*

• Genome- all of the genetic information of an organism.