Name______________________ Pre-Lab: Plant Diversity

1) For each of the following, indicate whether it is a sporophyte or a gametophyte. See the life cycle diagrams in your lab manual for help.

a) The antheridium of mosses.
b) The archaegonium of mosses.
c) The archaegonia of fern.
d) The trunk of a tree.
e) The wrinkly outside shell of a peanut.
f) A pollen grain from a daisy.
g) A pine needle.

2) Give an example of a gametophyte you can see without a microscope.

Plant Diversity -2

Plant Diversity I

Note: There are four parts to this lab: the diversity of plant life cycles set up in lab, the greenhouse visit, comparing Monocots and Eudicots and preparing your experiment for growth measurements next week. There will be a laboratory practical exam after these two labs and everything you learn from now until then regarding plants in lab could be on it. Focus today on plant life cycles.

Purpose

To observe and analyze the diversity of plants through studying four major land plant groups.
Identify the parts of plants at different life stages.
Dissect a flower (second week) Bring one in next week!
Identify structure of plants: stems, leaves, roots, xylem, phloem, etc.

Introduction

The Kingdom Plantae is characterized by multicellular, autotrophic (primarily but there are exceptions), sexually reproducing eukaryotes. Their cells have pigment-containing plastids. The main photosynthetic organelle contains chlorophyll a and b and is called a chloroplast. Plants have well defined cell walls made of cellulose. Reproduction in plants is characterized by alternation of generation which you will exam in different plant phyla. There are 10 extant phyla (see *Campbell's* Table 29.1)

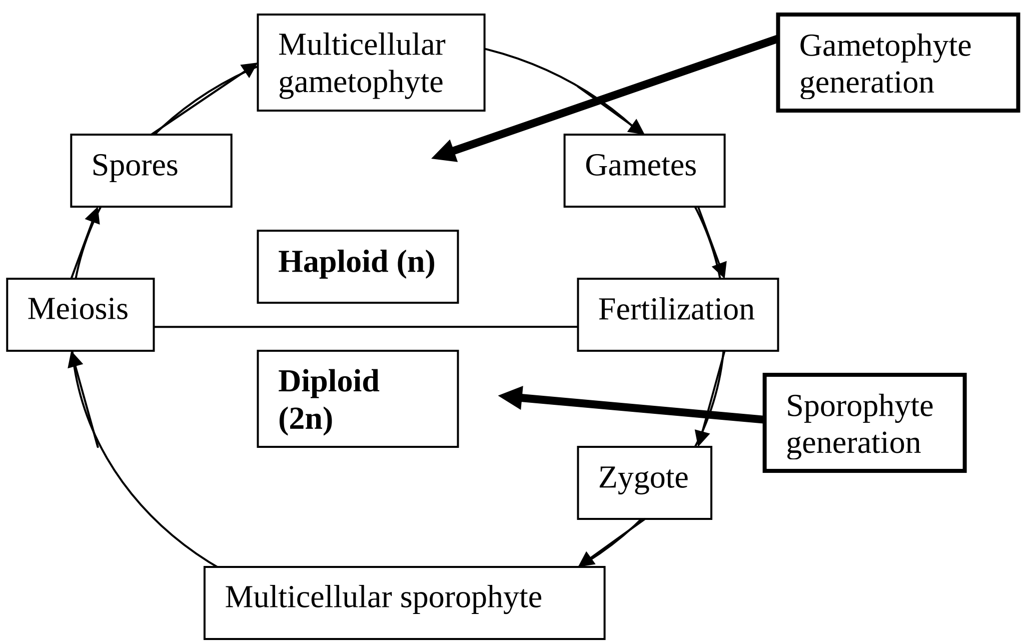
Photosynthesis:

$$6CO_2 + 12H_2O + \text{light energy} \longrightarrow C_6H_{12}O_6 + 6O_2 + 6H_2O$$

Plants are the dominant form of photosynthetic life on land. Algae, both microscopic forms and larger seaweeds, are the dominant photosynthetic life forms in fresh water and marine environments.

The best context within which to examine the plant material in this lab exercise is the increasing complexity of plants as they have become better adapted to terrestrial environments. The earliest land plants were obligated to live in moist environments. They didn't need or have water-conducting roots or vascular tissues like xylem. Modern mosses and liverworts are still like that. Reproductive strategies and structures have also changed with increasing adaptation to terrestrial environments. The gametophyte stage is less pronounced in the more evolved plant taxa. Plant embryos in these taxa are packaged in containers that can withstand prolonged desiccation. We call these containers seeds. General characteristics of the plant groups are listed in the table below followed by a generalized life cycle diagram.

Plant	**True Roots?**	**Dominant generation**	**Haploid N or Diploid 2N**	**Spores? N or 2N?**	**Seeds?**	**Flowers?**
Moss	No	Gametophyte	Haploid –N	Yes – N	No	No
Fern	Yes	Sporophyte	Diploid -2N	Yes – N	No	No
Pine	Yes	Sporophyte	Diploid – 2N	Yes – N	Yes	No
Lily	Yes	Sporophyte	Diploid – 2N	Yes – N	Yes	Yes



All plants have life cycles that continually alternate a sporophyte generation with a gametophyte generation. The sporophyte produces spores through meiosis which germinate and grow into the gametophyte. The gametophyte produces gametes through mitosis that fuse during fertilization to form the zygote which grows into the sporophyte. All parts of the plant in the sporophyte generation are diploid and have two sets of chromosomes in each cell except for the spores. All parts of the plant in the gametophyte generation are haploid and have one set of chromosomes in each cell. Organisms that have the alternation of generations must have multicellular individuals in both generations.

Though you will have two weeks to learn the life cycles of these land plant groups and draw diagrams of them, you are encouraged to do as much today as possible. You will also learn about the structure roots, stems and leaves and the structural differences between Monocots and Dicots. You will answer also questions in the greenhouse and perform the plant growth lab, which follows this one.

Part I: Plant Diversity Drawings: Look at the plants and microscope slides in the lab. Draw what you see, using the textbook as a guide.

Lab assignments: You must draw the 22 pictures listed below and use them to study for the lab practical. Your TA will check to make sure you have done this. Label drawings with sizes indicated on each. The table below helps to identify by plant type what should be included, indicate any features in {braces} in the table below: (macroscopic - how it looks to the naked eye; microscopic = how it looks in the microscope).

Type of Plant	Gametophyte	Sporophyte
Moss: Bryophyta	*macro Leafy green plant *micro slide of stem x-section with no vascular bundles	*macro stalk and capsule *micro spores in capsule (cross section of capsule with spores)
Fern: Pterophyta	*micro male c. fern gametophyte on plates and hermaphrodite forms	*micro {stem vasculature} {fronds with "sori" containing spores} *macro fern plant
Pine: Coniferophyta	*micro of both megagametophyte (in ovule) and microgametophyte (pollen)	*macro female cone & male cones Pine branches Stem vasculature
Angiosperm : Angiospermae	*micro of both megagametophyte (in ovule) and microgametophyte (pollen)	*macro flowering plant *micro leaf cross section vasculature of stem

Lab Check list of Drawings/Task

1) Male g'phyte c-fern_____
2) Hermaphrodite g'phtye c-fern_____
3) Sporophyte c-fern_____
4) Moss macro g'phyte_____
5) Moss micro g'phyte {no vascular bundles}_____
6) Moss macro s'phyte_____
7) Moss micro s'phtye {spores in capsule}_____
8) Fern micro male g'phyte_____
9) Fern micro hermaphrodite g'phyte_____
10) Fern micro s'phyte {vasculature}_____
11) Fern macro s'phyte {spores in sori}_____
12) Pine micro mega g'phyte (in ovule)_____
13) Pine micro micro g'phyte (pollen)_____
14) Pine macro female cone_____
15) Angio micro mega g'phyte (in ovule)_____
16) Angio micro micro g'phyte (pollen)_____
17) Angio micro leaf cross section {vasculature}_____
18) Dissected flower_____
19) Fern life cycle_____
20) Moss life cycle_____
21) Pine life cycle_____
22) Angiosperm life cycle_____
23) Brought in a flower_____

PART II. Greenhouse Tour

Diversity of Plant Adaptations

The greenhouse is on the fourth floor of the Science Building. As you enter the potting room and work area, the first glasshouse on the left is a tropical room, the second and third contains teaching and research materials. **Before visiting the greenhouse,** look over the questions below. When you get to the greenhouse, wander through all the rooms before you look for plants that will enable you to answer the questions. Some of the questions require the use of your text or other reference for their answer. The answers to these questions will be due in your next lab.

1. Leaves are not the only photosynthetic organs of plants. What other kind of photosynthetic structure have you seen in a greenhouse plant? Give two examples with genus and species names.

2. What plants in the greenhouse do you find that are specialized for defense against herbivores and what adaptations do they exhibit? Give two different examples with genus and species names.

3. All plants require mineral nutrients (nitrogen, phosphorus, potassium, etc.). Terrestrial and epiphytic plants obtain these in different ways. How do these plants differ in the way they get their nutrients? Give examples of each type found in the greenhouse.

4. Give two examples, with genus and species names, of plants found in the greenhouse that you might also find in the supermarket in one form or another.

5. In the greenhouses, there are several plants which are part of the *Lamiastraceae* or mint family. Surprisingly, these all look and smell very different. What can you observe that is the same in all these plants?

6. The middle greenhouse contains samples of psilotum and selaginella. What phyla of plants do these represent? You may need to look these up in *Campbell*.

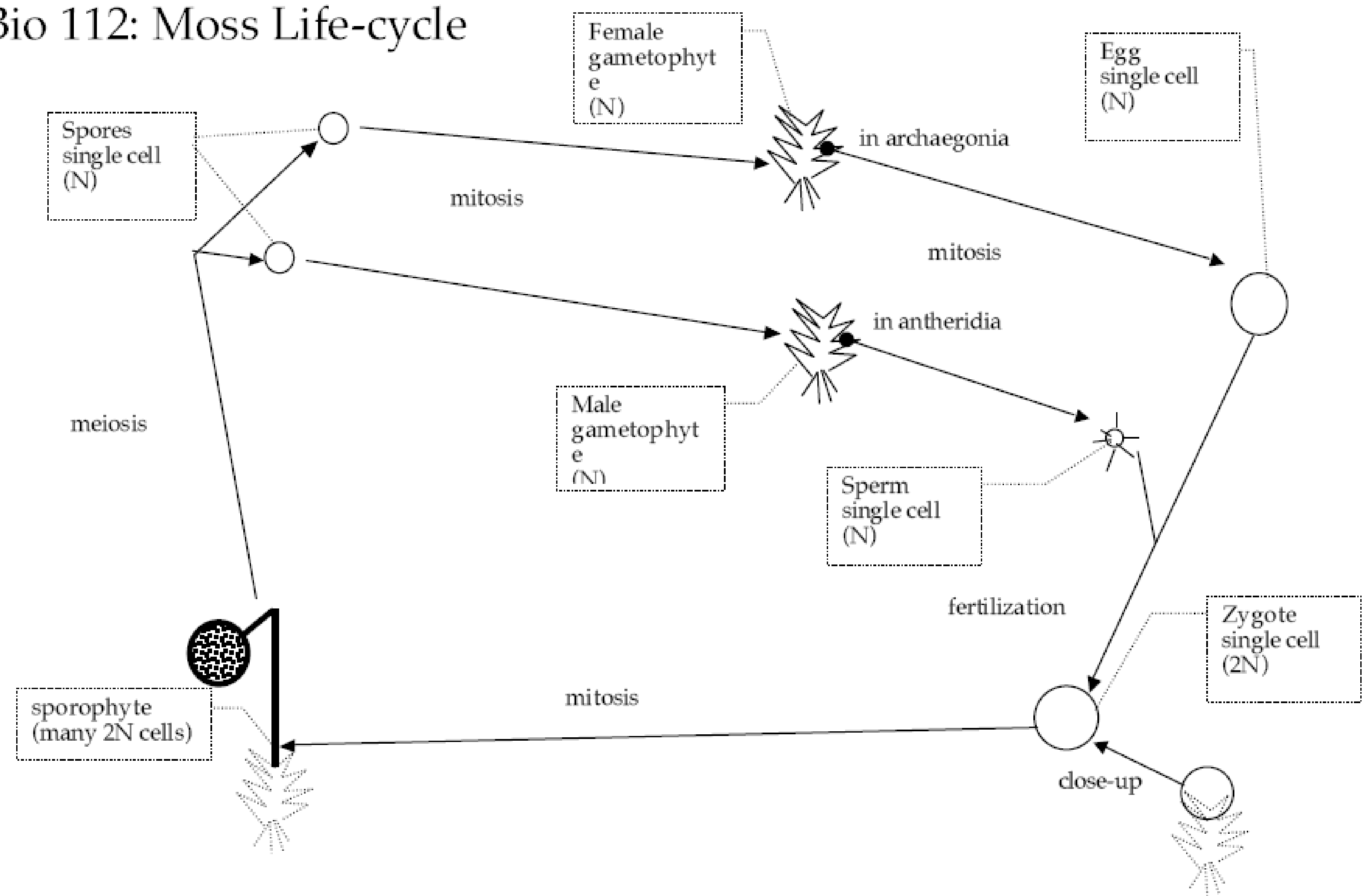
7. In the greenhouse, you will find the following plants:

sea onion   oleander   sweet potato   shell ginger

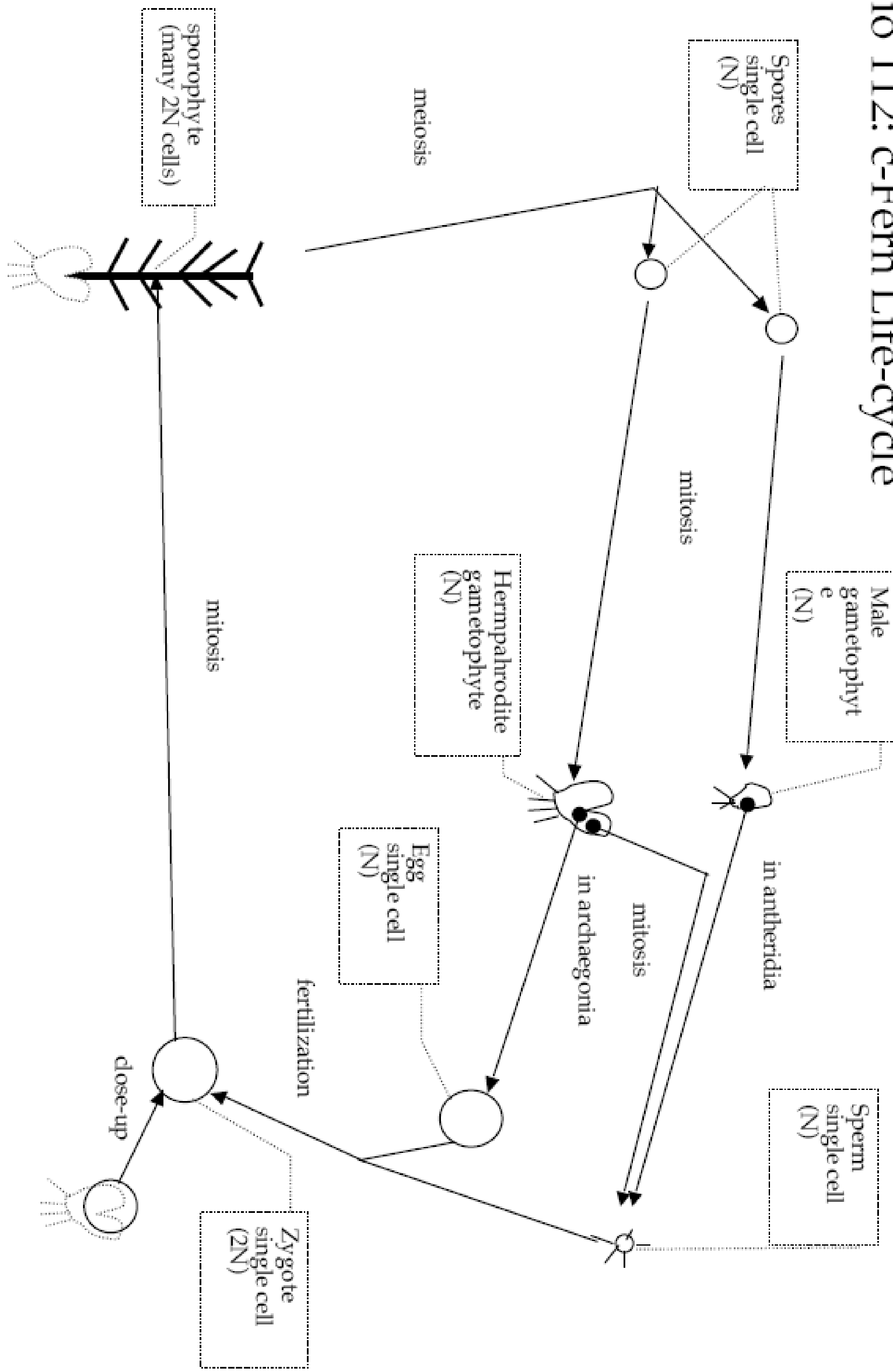
Based on the leaf vein morphology, which of these are monocots and which are dicots?

8. In the greenhouse are several succulent plants. What do they have in common? Is this an example of convergent evolution? Why/why not? How are these advantageous in dry climates?

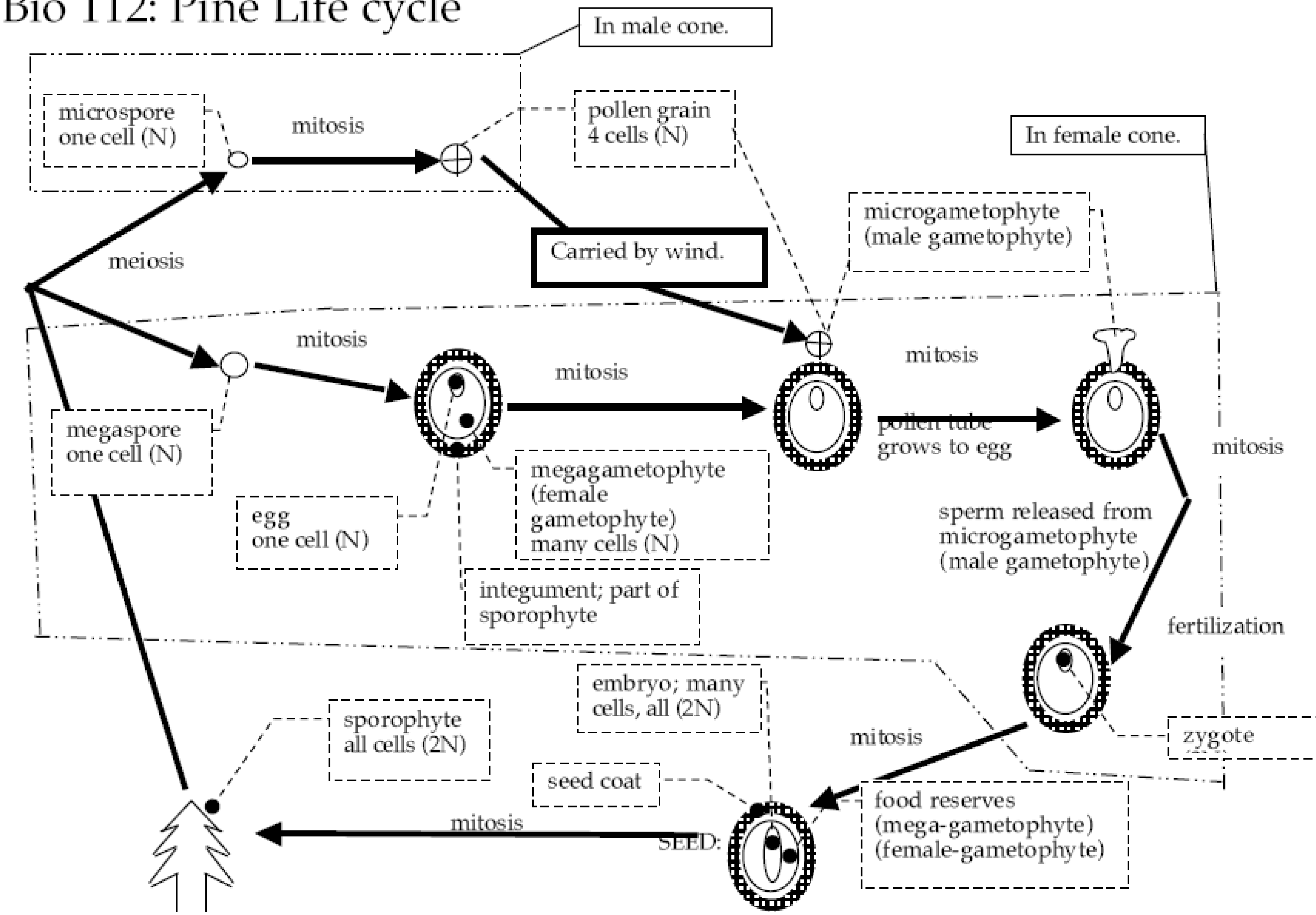
Bio 112: Moss Life-cycle



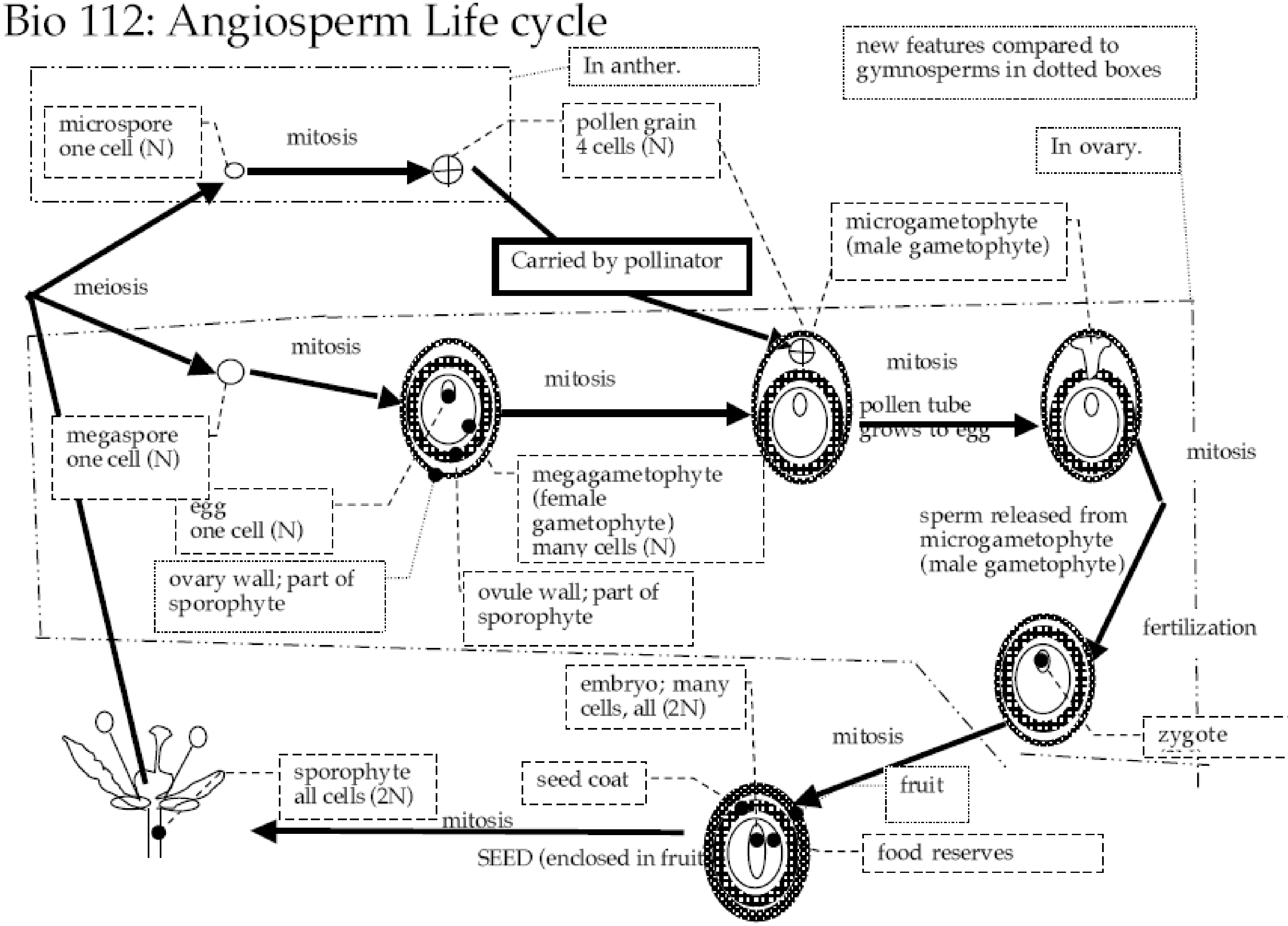
Bio 112: c-Fern Life-cycle



Bio 112: Pine Life cycle



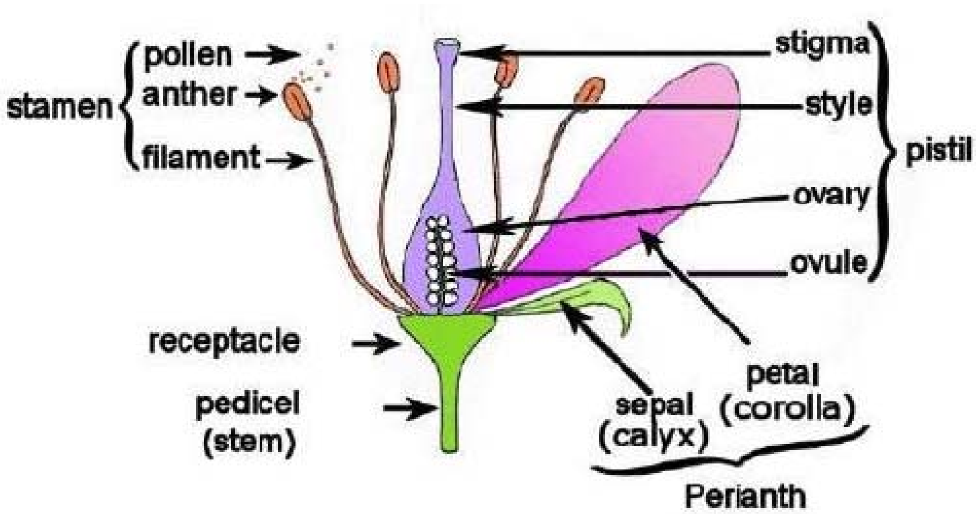
Bio 112: Angiosperm Life cycle



Part III Angiosperm Diversity and Structure: Monocot vs. Eudicots (Dicots)
A. There are two major divisions in the Angiosperma- the Monocots (e.g. Corn, grasses, Palm trees) and the Eudicots (Roses, Oak trees, Maple trees).
Compare and draw the following structures of plants from each group; use your atlas for additional pictures and diagrams:

1. Number of cotyledons (embryonic leaves)
2. Leaf venation
3. Stem vascular tissue (How are the xylem and phloem arranged?)
4. Root structure and cross section
5. Numbers of flower organs.

B. Flower anatomy: Exam the flower you brought it. Before you cut it count the flower parts. Is a moncot or a eudicot? Include the name of the plant and the size of the flower. You must draw and label your dissected flower as well as diagrams of the lily anthers and stamen from prepared slides.



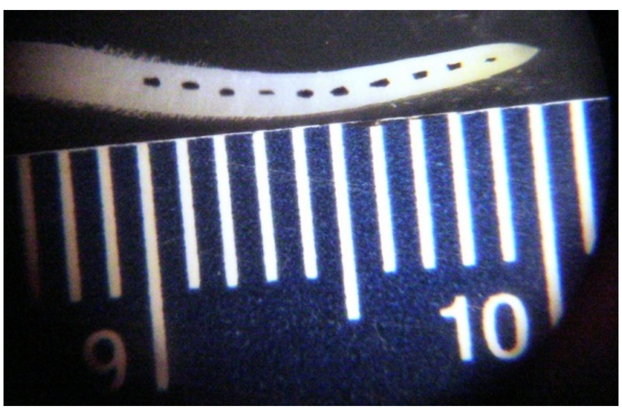
1. **Flower Dissection**
   Cut your flower down the center into the stem with the scalpel to open it up. Make a drawing of your flower. Label all of the parts you can identify using your text as a guide. Label the following parts: Carpel (Stigma, Style, Ovary); Stamen (Anther, Filament); Sepal, Petal, Ovule. NOTE: Not all flowers have all of the parts listed, if the flower you brought in lacks some of these parts, look at more flowers. Why might some individual flowers lack some of these parts?

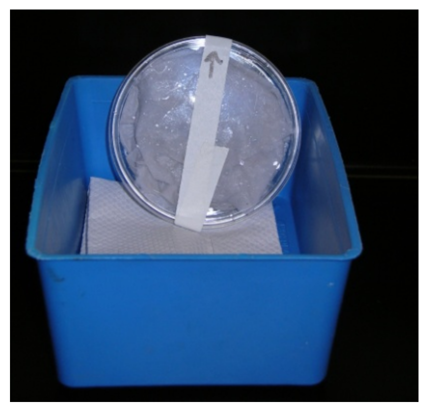
Part IV. Localization of Plant Growth (set up week one, measure week two)
To determine how a root grows, we will mark the last centimeter of pea root tips with ink at 1 millimeter intervals. We will pack these seedlings in a growth chamber for one week and then in the next lab, we'll measure the distances between each marked interval to see if root growth is localized in one area of the root or consistent throughout the root.

A. Select six germinating pea seeds, each having a fairly straight root about 1.5 – 2 cm long.

B. Blot the roots with a Kim wipe to remove any excess moisture and lay them on the stage of a dissecting microscope against a millimeter ruler. Or you may mark the root tips by eye without a microscope if you can.

C. Starting from the tip of each root, carefully mark off 10 – 1 mm intervals with India ink using the tip of a toothpick. Don't put a mark on the very tip; see picture below. Make the marks as small as possible.





D. Lay the seedling down on the Kim wipe for 5 minutes to allow the ink to dry.

E. You will use a plastic Petri dish as a moist chamber to conduct this experiment. Line the Petri dish with paper towels and spray them with water. Align seeds at the top of the dish allowing the roots room to grow.

Cover with wet paper towels. Have the paper towels saturated with water but not soaking in pools of water. Tape the dish shut; mark the top of the dish where the seeds are with an arrow pointing up and your group name. Stand the plate on its side with the seeds up with the others in a plant box.