Plant Diversity

Objective

To observe and analyze the diversity of plants by looking at 4 major land plant groups.

Procedure

You will have 3 lab periods to complete these exercises.

Part I: c-fern Embryos

First lab session: Look at the c-ferns growing in the petri dishes you fertilized a week ago. You should be able to see small sporophytes growing out of the gametophytes. You may be able to tell "polka-dot" from normal (see the first c-fern lab in the Microscope lab section); note the phenotype of the sporophyte and gametophyte as best you can.

Part II: Plant Diversity

First and second lab sessions: Look at the plants and microscope slides in the lab. Draw what you see, using the textbook and Lab Atlas as a guide. See under Study Guide for the pictures you should have.

Part III: Greenhouse

Second Lab session: Go to the greenhouse with your lab section and answer the questions listed under Lab Report.

Part IV: Flower Dissection

Second session: Bring in a flower and dissect it. Draw the parts you can find and compare it to the flower in figure 30.7 of *Campbell*, pages 126 - 130 of the Lab Atlas, or the ones you can find in the on-line lab manual. See under Study Guide for the pictures you should have.

Part V: Life-cycle Discussion

Second lab session: Complete the table on page PlantDiv-3 with brief descriptions, etc. as appropriate.

Part VI: Lab Practical Exam

Third Lab session: This will be a closed-book exam where you will be asked to identify various plant samples based on Parts I, II, IV, and V of this lab.

Other resources:

Life cycle diagrams for selected plants can be found at the end of this section.

In the OLLM or this lab, there are a set of links to Botany and Plant Diversity sites that you may find useful for reference.

Chapter 6 of the Lab Atlas contains very useful photos for this material; you should certainly bring it to lab.

To be effective, your **Study Guide** should contain:

(1) Labeled drawings of the following:
Your pictures should also 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 {phylum*}	**Gametophyte**	**Sporophyte**
Moss {bryophyta}	*macro *micro {no vascular bundles}	*macro *micro {spores in capsule}
Fern {pterophyta}	*micro {male and hermaphrodite forms}	*micro {spores in "sori"} {vasculature} *macro
Pine {coniferophyta}	*micro of both megagametophyte (in ovule) and microgametophyte (pollen) *micro showing pollen in male "cone"	*macro of female cone
Angiosperm {angiospermae}	*micro of both megagametophyte (in ovule) and microgametophyte (pollen)	*micro of leaf cross section {vasculature}

* You will need to know the names of these phyla for the Lab Practical Exam.

(1) You should also have a sketch of each of the 4 types of plant. On these pictures, draw arrows to indicate where each of the things in the table above can be found. For example, if you were doing this with a human, and we asked for a drawing of brain cells, you would:

(2) You should also have drawings of the peanut and pine nut with the following labeled:
- embryo
- seed coat (if present)
- endosperm or cotyledons

(3) Drawing(s) of the flower you brought in. Label all parts that you can find. Include the name of the plant and the size. You will be responsible for knowing the parts of the flowers brought in by your classmates – your TA will tell you which ones.

(4) A copy of the table on page PlantDiv-3.

Part V: Life-cycle Discussion

Complete the table on page with brief descriptions, etc. as appropriate:

	S-phyte	spore	male G-phyte	female or hermaph. G-phyte	gametes	fertiliz-ation	zygote	seed
N/2N?								
# of cells								
Moss								
Fern								
Pine								
Angiosperm								

Part VI: Lab Practical Exam

In the third lab session, you will take the lab practical exam. During this exam, students will rotate through a series of stations each of which will have a plant sample that you saw in lab previously. You will have a set amount of time at each station (usually 2-3 minutes). During that time, you will answer a question based on that sample. No notes will be allowed and no communication will be allowed between any students during this exam.

At a typical station, you would find a familiar plant sample with a pin pointing to a particular part of the sample and a question. Samples can include any of the items listed in the Study Guide on the following page. Typical questions could include:

- To which phylum does this sample belong?
- What part(s) of the plant's life cycle are present at the pin?
- Which part(s) of the plant's life cycle are not present at the pin?
- What part of the plant is indicated by the pin?
- etc.

You will rotate through the stations at the direction of your TA. When the time is up for a particular station, you will have to move on to the next station even if you are not finished with the current station. There will be 10-20 stations, each worth 3-5 points. Part credit may be awarded in certain circumstances.

The first two lab sections are designed to prepare you for this exam. Experience has shown that using the lab time to prepare a study guide as described on the previous pages will provide the best preparation for this exam. Because you will have to recognize the plant parts and put them into their life-cycle contexts, you should make your own drawings of these samples.

This will also help you to prepare for the Plant Exam in lecture.

Tips from Bio 112 Spring 2008 Students

On the course evaluation in Spring 2008, I asked students the following two questions:

1) Did you do all the drawings listed in the Plant Study Guide? Of the 122 students who responded, 95 (78%) said yes.

2) Whether or not you did the drawings, do you think that doing the drawings helped (or would have helped if you had done them) you to learn the material for the Lab Practical Exam? Here, 75% said yes.

Conclusion: your fellow students did the drawings and found them useful; that is why I recommend it highly.

Procedure & Policies

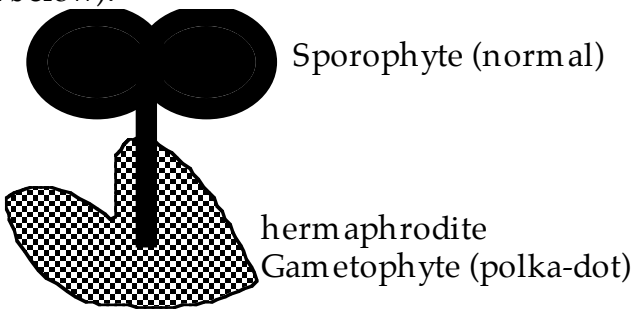
- Any special arrangements must me made in advance of the lab.
- The Exam will be revised for each lab meeting time (Tues AM, Tues PM, Weds AM, Weds PM, Thurs AM, and Thurs PM).
- Lab sections that meet at the same time will take the Exam together.
- Students will not be allowed to make up labs without written permission from Brian White.
- The Lab Practical Exam will take place in the regular Bio 112 lab rooms as follows:
    - All students waiting to take the Exam should go to W-2-032 even if their lab meets regularly in W-3-030.
        - Students are free to study or talk in W-2-032 as they wait for their turn to take the Exam.
        - Once the first group of 12 students has completed the Lab Practical Exam:
            - no students will be allowed to *enter* W-2-032; students who arrive later than this will not be allowed to take the Exam.
            - no students will be allowed to *leave* W-2-032; any student who leaves the room will not be allowed to take the Exam.
    - Groups of 12 students will be brought by a TA from W-2-032 to W-2-030 where they will take the Lab Practical Exam.
        - The Exam will consist of 12 stations, each with one question worth 5 points.
        - The Exam will begin with one student at each station; you will rotate through them so that each student sees each station.
        - No note sheets, textbooks, cell phones, etc. will be allowed in the Exam. If you are found with any of these, you will receive a score of 0 for the Exam.
        - No talking with other students is permitted during the Exam; students caught talking will receive a score of 0 for the Exam.
        - Each student will have exactly 2 minutes at each station. You may not go on to the next station until the TA tells you to do so; when the TA tells you to move to the next station, you must move on even if you are not finished with that station.
    - After the group of 12 students has completed the exam, they will be dismissed from W-2-030; they should not talk with the students waiting to take the exam in W-2-032.

Lab report

- Must be typed; handwritten reports will not be accepted. Hand-drawn and labeled drawings are fine; photographs are **not** acceptable.
- Due in the week specified on the syllabus at the start of the lab session you are currently in. This is a firm deadline.
- Although you will perform these activities as a group, each member of the group must turn in an individual lab report. Each person's report must be in his or her own words as much as possible.
- Your lab report must contain answers to the following questions:

c-ferns:

(1) Suppose you found a normal sporophyte growing out of a polka-dot hermaphrodite gametophyte (shown below).



a) What is the genotype of the hermaphrodite gametophyte?
b) What is the genotype of the sporophyte?
c) What will be the genotypes of the spores produced by this sporophyte and in what ratio will they be produced?
d) Could you find a polka-dot sporophyte growing out of a normal gametophyte? Why or why not?

Greenhouse Questions

2. 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.

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

4. 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.

5. 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.

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 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?

8. 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?

(9) 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?

Preparation for Exam II

Students often have trouble writing full-credit answers to the "give three differences between X and Y" questions that appear on the plant exam. The following are full-credit and partial-credit answers taken from actual exams and student responses. You should discuss these as a class to help you to understand how to write full-credit answers to these kinds of questions.

1) Give one major difference between the male gametophyte of moss and angiosperm.

Full-credit answer:
a) "The male gametophyte of angiosperm is a grain of pollen that has 4 cells whereas the make gametophyte of a moss has many cells."

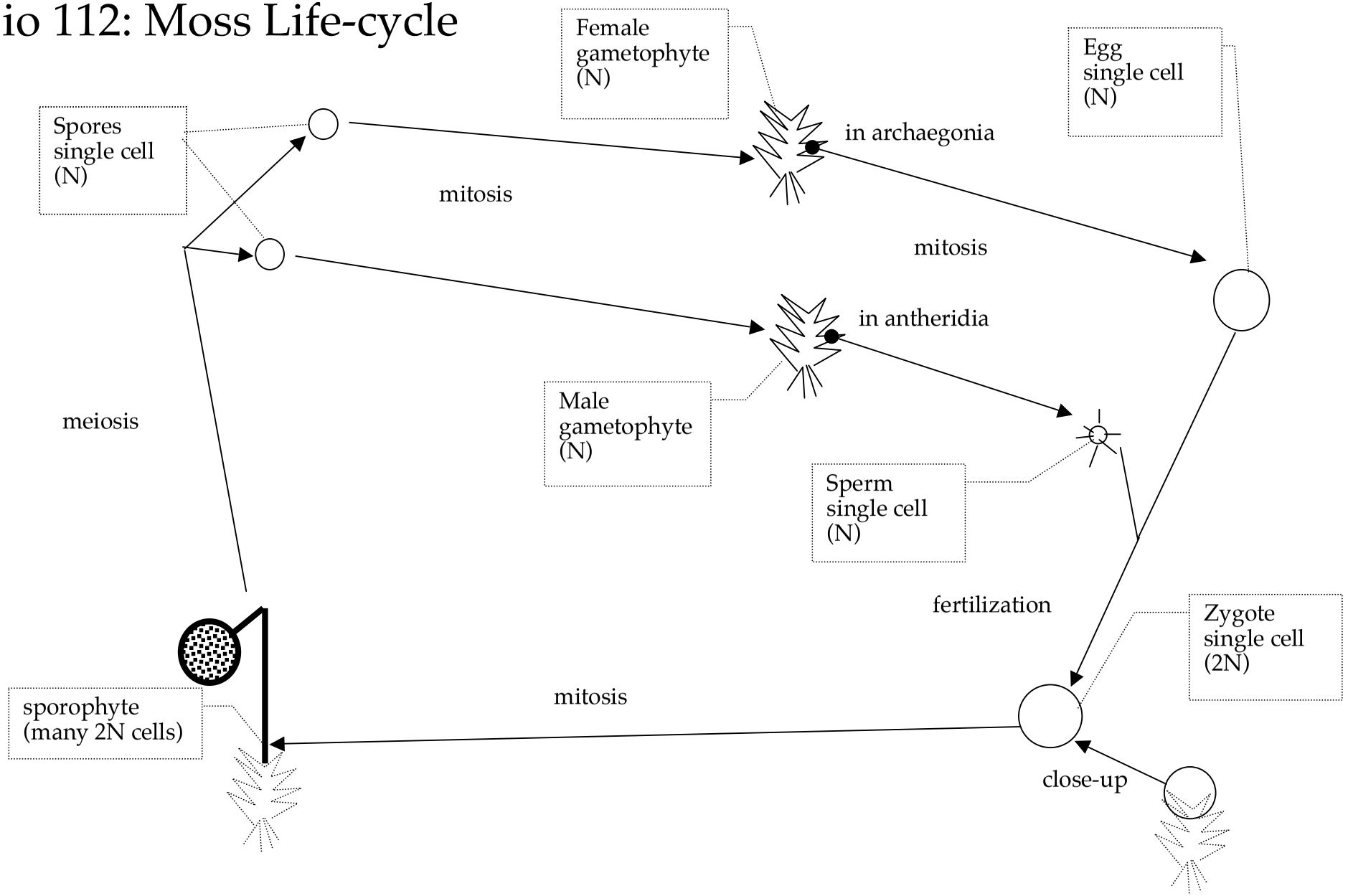
Answers that received no credit:
b) "Male gametophytes are haploid. The predominant form of angiosperm is diploid."
c) "Moss - most ancestral type of land plant, little or no vascular system therefore hard to transport H_2O/minerals throughout plant. Angiosperm: pollen made in anther an megaspore in ovary."
d) "The moss needs H_2O for fertilization; angio can use wind".

2) Give three major differences between an angiosperm seed and a moss spore.

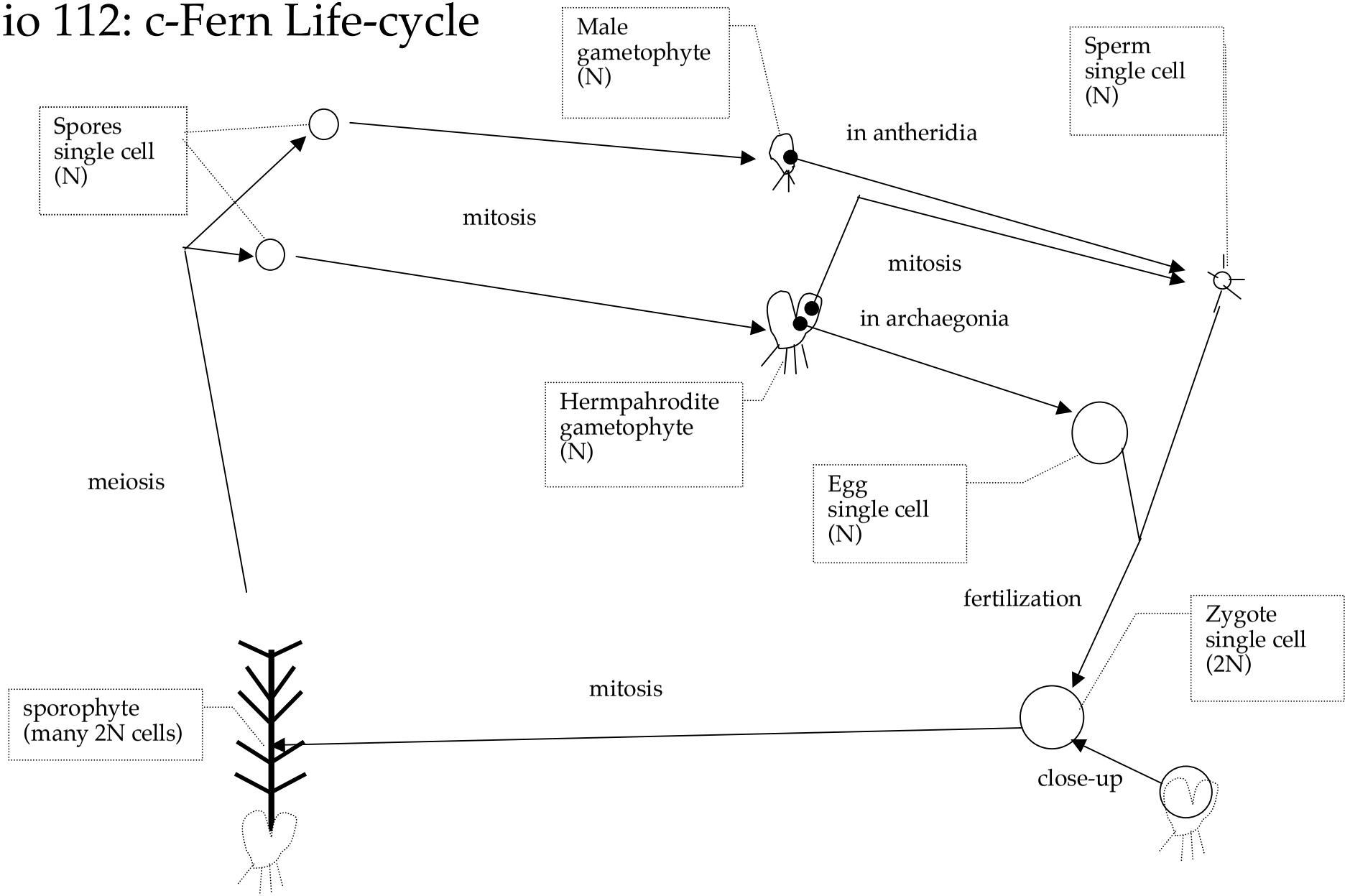
Full-credit answer:
a) "Angiosperm seed is diploid and moss spore is haploid."

Answers that received no credit:
c) "Moss spore needs H_2O for fertilization and angiosperm seed doesn't need H_2O for fertilization."
d) "Angiosperm seed: diploid immature sporophyte. Moss spore: are haploid gametophyte."
e) "Seed is made up of sporophyte and gametophyte but spore made up of sporophyte only."

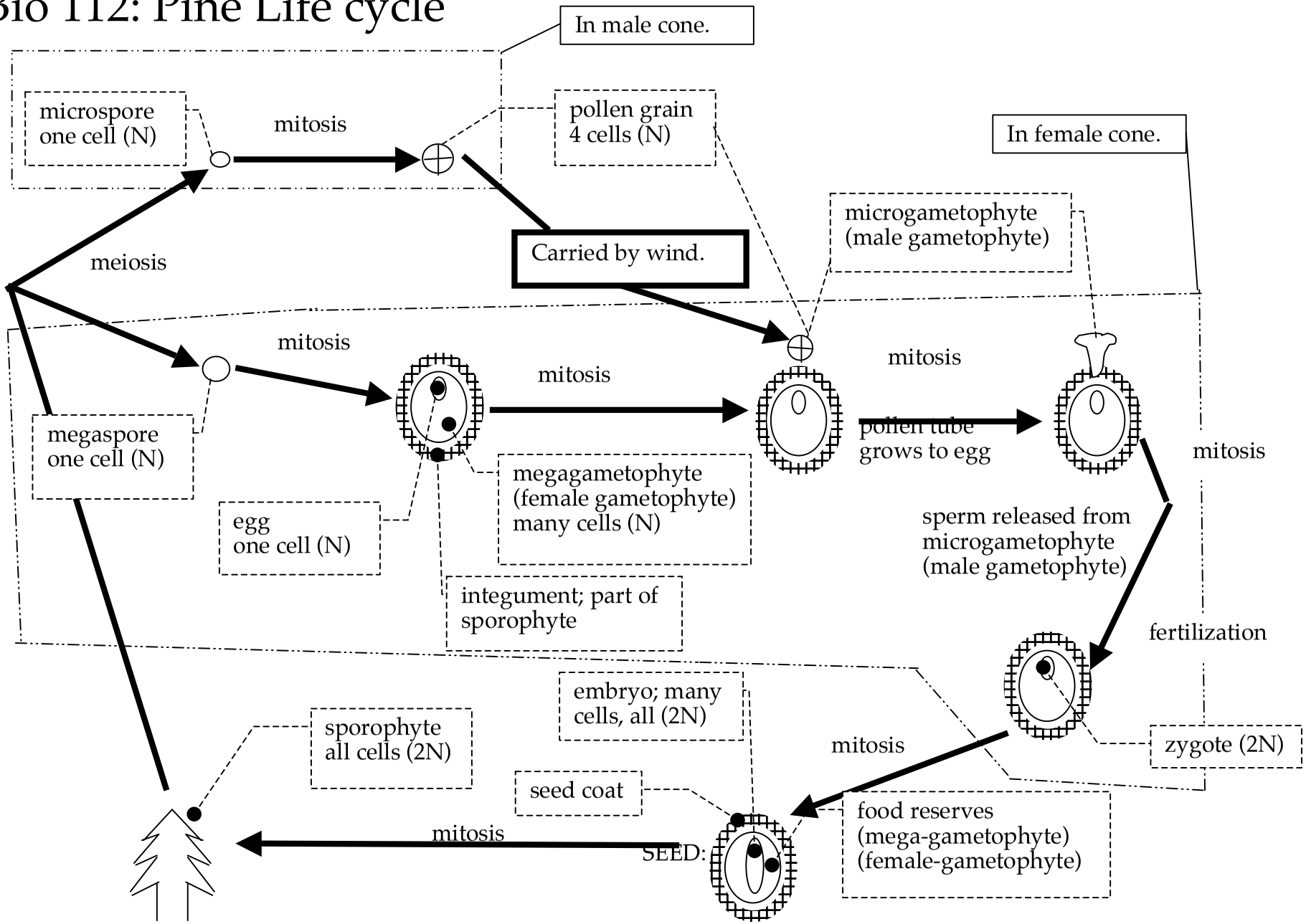
Bio 112: Moss Life-cycle



Bio 112: c-Fern Life-cycle



Bio 112: Pine Life cycle



Bio 112: Angiosperm Life cycle