

# WORKSHEET 1

NAME

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LAB SECTION

## Exercise A: Dissecting microscopy

What specimens did you collect in the field (1pt each)

- 1.
- 2.
- 3.
- 4.

Zoom in on another specimen and draw it here. Indicate the scale using a millimeter ruler. Is this a whole organism? Is it plant, fungal, or animal? (5pts)

Draw one of your specimens under low power in the dissecting microscope? Label any known parts and indicate the scale using a millimeter ruler. (4pts)

## Exercise B: Wet mount microscopy

Draw some organisms from a wet mount of pond water, or wetted soil. Indicate scale. Are these animal-like, plant-like or fungus-like? (5pts)

## Exercise C: Fixed slide microscopy

Choose a slide from the fixed slide box and write the name and draw what you see at low power (40x). Draw an inset of the same slide at high power (400x), indicate where this image comes from. (5pts)

## WORKSHEET 2 (Exercise 1A,B,D)

NAME

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### Exercise A: Plants without walls

What is the purpose of cellulose and pectinase, what component are you removing to make protoplasts?

Draw one of your protoplasts. Where is the plasma membrane and nucleus?

### Exercise B: Cells

Draw and label a living plant cell from aloe. Follow instructions from pages 2-3. Label your drawing.

### Plastids

Observe and compare eliooplasts and chromoplasts from different plants. What kinds of shapes and sizes do you find?

### Plasmodesmata

What are plasmodesmata? Draw a picture of two cells connected by plasmodesmata from tomato or pepper.

## WORKSHEET 2 (Exercise 1A,B,D)

### Exercise D: Crystals

In the 4 spaces below draw crystals from pineapple, dumbcane, ficus and elephant's ear. Are these druse, raphide or crystaloliths?

## WORKSHEET 3

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### Exercise A: Cell Division

1. Draw an overview of an onion root tip in a prepared slide under 10X magnification. Point out with an arrow where most of cell division is occurring.

2. Draw one cell undergoing mitosis in a prepared slide of an onion root tip under 40X magnification. How do you know it is undergoing mitosis?

3. What stages of mitosis do you see in the prepared slide? How do you determine what stages of mitosis the cells are in?

4. Draw an overview of a squashed onion root tip under 10X magnification. Point out with an arrow where most of cell division is occurring.

5. Draw one cell undergoing mitosis that you saw in a squashed onion root tip under 40X magnification. What stage of mitosis is it in?

6. What are the differences that you saw between the prepared slide and the squashed root tip? Did you see the same stages of the cell life cycle?

Note: You will turn in worksheet 2-2 (page 23) when you collect data from exercise 2C.

# WORKSHEET 4

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LAB SECTION

## Exercise A: Tissues

1. Draw parenchyma cells from a potato slice. Where are the amyloplasts?

2. Draw a Sambucus stem. Where are collenchyma cells? Where is the Pith? How does Sambucus collenchyma compare to Celery?

3. What cells stain with phloroglucinol in pyrus? Draw one of these cells.

4. Draw the cells you find in macerated wood tissue. Identify vessels, tracheids, fibers and parenchyma.

5. How are fibers arranged in Yucca leaves? How do these fibers differ from other fiber types such as found in cotton or hemp?

6. Fill out worksheet 3-1 (page 35) for different kinds of fibers.

**BONUS:**

Locate stone cells in prepared slide of Pyrus and draw it below. What features do you see when using polarizing light filters?

**BONUS:**

Compare macerated angiosperm wood to macerated pine wood. What cell types are different between these woods?

## WORKSHEET 5

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### Exercise 3C: Paper making

1. Describe the paper-making process. What would happen as paper gets repeatedly recycled?

3. Look at the 3 slices through oak wood (*Quercus*). Looking at the radial section, what are the long narrow cells tapered at either end? Where are vessels and fibers most abundant? Look at the tangential section, how does this view differ from the other two?

### Exercise 15A&B (page 199):

2. Draw and compare cross-sections of *Tilia* and *Pinus* stems. Where are the phloem, xylem and vascular cambium? What is left of the pith, cortex and epidermis? What are rays?

4. Examine the other wood types. List each and identify if they are ring-porus or diffuse porous. What is the difference between summer and spring wood? Why do trees have these growth rings?

5. What are some of the basic properties of hard and soft woods? What kind of differences do you see among the wood samples on display?

BONUS (exercise 15E)

Examine a tree core. How old is your tree? Did it have a good life? Compare good years to poor years for growth.

## WORKSHEET 6

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### Exercise 4A&B

1. Draw roots from 3 different species as seen in the rootview chamber. How might different root architectures help plants get water?

2. What are root hairs? Where are they found in radish seedlings?

3. Where is starch stored in Parsnip roots?

4. Draw a cross section of buttercup root at low magnification. What is the steele?

5. Look at the young buttercup endodermis at high magnification. Describe where the casparian strip is located.

6. How are vascular bundles arranged in Asparagus stems compared to Helianthus? How is this arrangement related to wood?

7. Look at a vascular bundle of a corn stem at high power. Draw it here. What liquids pass through the xylem and phloem? Label these tissues.

**BONUS**

Look at the modified roots (and stems) of elodea, orchid, taraxacum and the haustoria of cuscuta. How has their anatomy been altered? For what purpose?

## WORKSHEET 7

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### Exercise 4C, 5A

1. Examine a cross section of a leaf. Draw palisade cells and spongy cells.

2. Examine a leaf epidermal peel. Compare the number of stomata present in the upper and lower epidermis.

3. Draw a stomata and neighboring cells. What is the function of the guard cells

4. What happened to the atmospheric gasses (O<sub>2</sub>, CO<sub>2</sub>) during photosynthesis in your experiment?

5. Do living plants need oxygen? What experimental evidence leads you to your conclusion?

**Exercise 5B: Photosynthesis- saving for another day.**

Draw a Variegated leaf grown in light after staining with iodine.

Draw a Variegated leaf grown in darkness after staining with iodine.

Draw a solid green leaf grown in light after staining with iodine.

Draw a solid green leaf grown in darkness after staining with iodine.

What is the effect of light on starch production? How does variegation affect photosynthesis?

# WORKSHEET 8

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LAB SECTION

## Exercise 6A, 7A&B

1. Draw cut-away view of a flower labeling all parts. Where are the stamen, pistils, sepals and petals? Where are male and female parts?

2. Fill in the following for four of the flowers on display

Flower 1

Flower 2

Flower 3

Flower 4

How many flowers in the inflorescence

Describe the fragrance

How many sepals and petals

What color is the pollen

What color are the petals

3. What is the botanical definition of a fruit? Why is this sometimes different from the common definition? Name some fruits that have been commonly classified as vegetables.

4. What are the three layers of the carpel found in fruits? How are these different in berries, drupes, hesperidium and pepos?

**Choose 4 unknown fruits (including at least 1 fleshy and 1 dry); draw and identify the fruit type using the flowchart on page 85, include all steps in the identification.**

Fruit 1

Fruit 2

Fruit 3

Fruit 4

What are aggregate and multiple fruits? How are these different from simple fruits?

## WORKSHEET 9

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LAB SECTION

### Exercise 8A Genetic diversity

1. Describe the differences and similarities among these vegetables

2. Which vegetables are most similar to each other, divide the vegetables into 4 groups based on similarity.

4. Now look up each vegetable by species. How does your grouping compare to species groups?

**Exercise 8B: Do they really belong to the same species?**

1. Pose a hypothesis about the relatedness of turnip and Fast Plants (same or different species).

2. Make a prediction about the appearance of the F1 generation if fertile offspring is produced. i.e. which parent will they most resemble?

3. Describe what plants from the F1 generation actually look like. (you will complete this section in a later lab)

4. What can you conclude about the relatedness of turnip and Fast Plants?

Complete exercise 10 and turn in pages 137 to 144.

## WORKSHEET 10

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LAB SECTION

### Exercise 11A Grasses

1. Sketch a grass plant, include both vegetative (leaf, root, stem) and reproductive (flower) parts.

2. What tissues and structures give grasses support and flexibility?

3. What are some adaptations of grasses against herbivory?

4. What are the parts of the grass grain? Where does flour come from?

**Exercise 11B: Baking of bread**

**Dough characteristics**

Flour type	Consistency	Elasticity	Color	Stickiness	Mean increase in diameter	Other notes

**Bread characteristics**

Flour type	Taste	Texture	Color	Comments	Rating (1-5) 1 being best

Where did bread flour come from and when? What is hybridization? How does hybrid wheat compare to flour from other grasses?

## WORKSHEET 11

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LAB SECTION

### Exercise 12A Legume morphology

1. Draw a legume flower and label all flower parts. Are the petals of the Keel fused together? Is the standard inside or outside of the wings?

2. Remove the petals from the flower and examine the reproductive parts. Describe the stamen. Are they fused or separate? How many carpels? Draw the carpels.

3. Draw a peanut, bean, pea or other legume seed. What are the largest organs of the seed? How does the legume seed compare to grass seeds? What part of the plant is a seed pod?

### Exercise 12B: Nitrogen

4. Draw a cross section of a pea or bean root nodule. Where are the bacteria?

5. What is a symbiotic mutualistic relationship? Why are bacteria living inside the plant? Would it surprise you that the plant sent signals into the soil to attract bacteria? Why would it do so?

### Exercise 12D Lather up, soap making

6. What hazardous chemicals are you using in the preparation of soap? What precautions are you taking? What would happen to your skin in the event of a chemical spill? How would you deal with a spill if it happened?

## WORKSHEET 12

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### Exercise 13A Plastic

1. Record your observations as you synthesize the oobleck plastic. Describe the consistency of the plastic as you stir it slowly and quickly.

### Exercise 13B Starch grains

2. Why does the banana or potato change color when adding iodine solution?

3. Draw stained starch grains from euphorbia, potato, or arrowroot.

### Exercise 13C Storage organs

4. What are examples of different starch storage organs? Draw 3 examples and identify organ type (bulb, rhizome, tuber, corn, etc).



## WORKSHEET 13

NAME \_\_\_\_\_

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LAB SECTION \_\_\_\_\_

### Exercise 14A Herbs and spices

Herb Name	Part of the plant	Describe the odor

### Exercise 14B essential oils

Oil name	Identity
A	
B	
C	
D	
E	

### Exercise 14C Hot peppers

Pepper name: \_\_\_\_\_ Mark the box with a Y if the volunteers taste the capsaicin.

Pepper1	1:10	1:100	1:1000	1:10,000	1:100,000	Comments
1						
2						
3						
4						
5						
Pepper 2	1:10	1:100	1:1000	1:10,000	1:100,000	Comments
1						
2						
3						
4						
5						

Answer the following questions in the next lab: What is the effect of garlic on E. coli? Is garlic as effective as ampicillin? What happens when you roast garlic?

## WORKSHEET 14

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LAB SECTION

### Exercise 18A Fungal diversity

1. What are the fungi? Draw and describe 3 of the fungal fruiting bodies on display. Examine using a dissecting microscope.

2. Examine plate cultures of *Aspergillus*, *Penicillium*, *Rhizopus* and *Coprinus*. What differences can you see in the pattern of growth and the shape of the mycelia?

4. Examine prepared slides of *Aspergillus*, *Penicillium*, or *Rhizopus*. Draw a sporangiophore or conidiophore. How do these fungi reproduce?

5. Examine a slide of fungal pathogens Puccinia or Ustilago infecting their host. Draw the site of infection. Which parts are fungal and which are plant?

6. Examine a slide of VAM fungi? How does this fungal infection help the plant? What similarities can you see between mutualistic and pathogenic fungi?

### Exercise 18B: Airborne fungi

1. What places inside a building do you expect are the most contaminated with fungal spores?

2. **Answer the following in lab 15.** What kinds of fungi and bacteria did you find? Draw their colony shape and indicate color? How many different species did your plate collect? Which places had the highest number of colonies? Which places had the greatest variety of fungi?

## WORKSHEET 15

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LAB SECTION

### Exercise 16 Shrimp bioassay

1. What is the purpose of having both seawater and methanol controls in this experiment?

2. Why is it necessary to test the chemical at different concentrations?

3. Which extracts showed significant bioactivity in the brine shrimp bioassay? At what concentrations?

4. Do your results support or refute the claims made for herbal remedies?

### Exercise 17: Bioactive drugs

5. What conclusions can be drawn about the effects of the bioactive drugs tested upon the pulse rate of the California blackworm? Do your findings substantiate the effects reported in the medical literature? Why or Why not?

6. Did you observe any conflicting recordings in testing a drug or extract at different concentrations? How can you explain these conflicts?