

Investigation 7

How much is too much?



Background information, photos, data,
and instructions for Spring 2020

In this investigation, we will conduct an experiment to answer the question, “Does salt affect the germination of lentils?”



a field of lentil plants



lentils are produced in pods

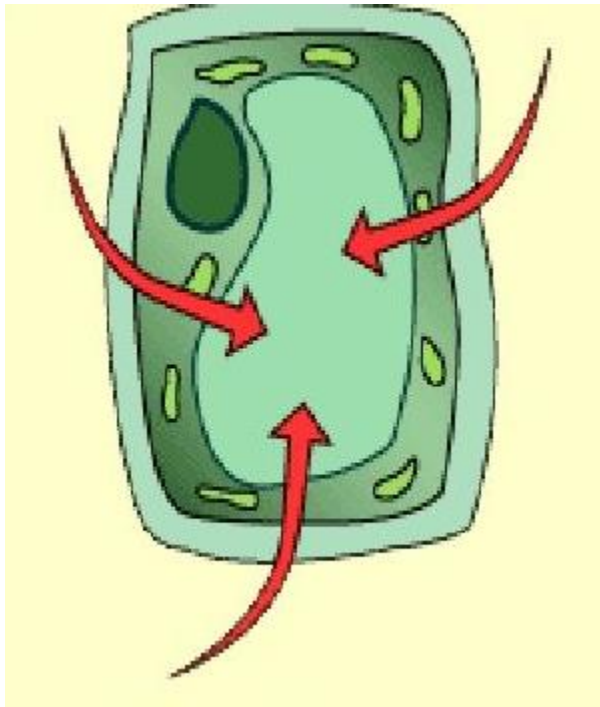


each lentil is a tiny bean

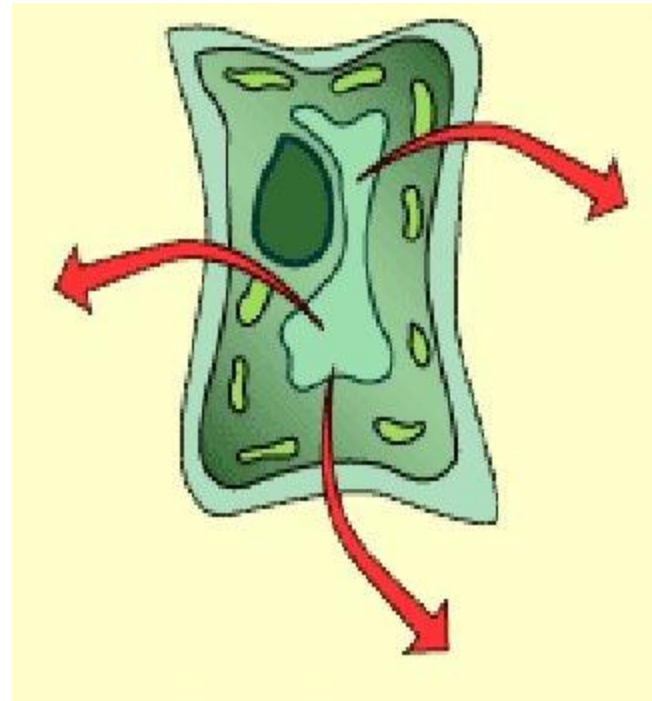
Seed germination requires warmth and water



For a seed to sprout,
its cells must absorb
water by osmosis
(arrows show water
movement)



In salty conditions,
osmosis causes
water to flow OUT
of cells instead of
into them



Since you won't be able to set up this investigation, your lab instructors set it up before Spring Break.

Step 1 (p. 77): Prepare your seeds for testing



counting out 80 lentils
(10 per salt concentration)

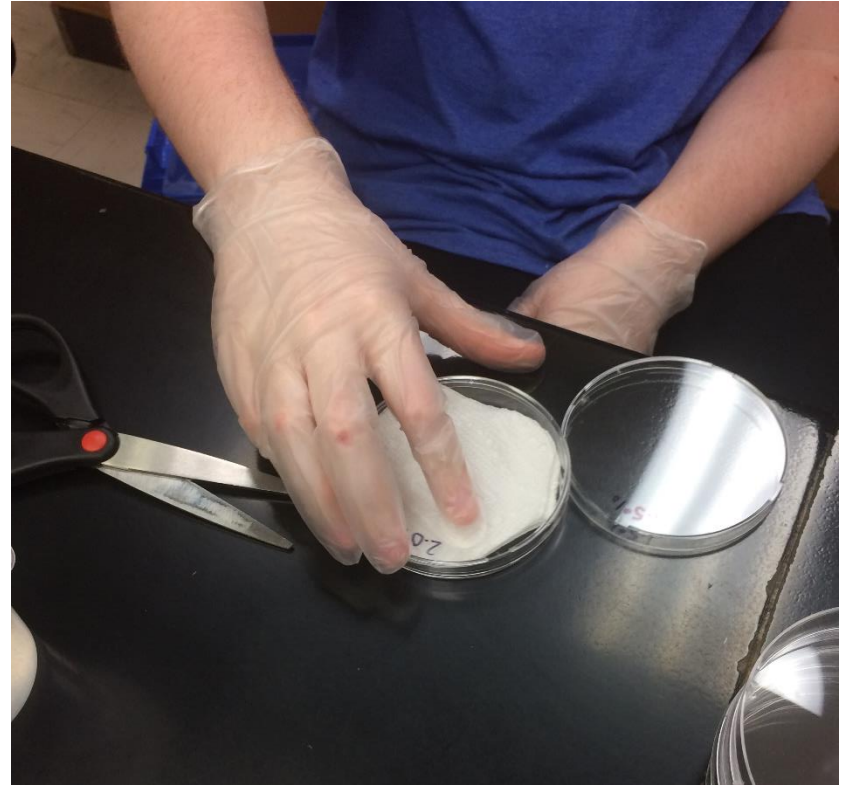


soaking lentils in bleach
solution to kill mold spores
that can interfere with
germination

Step 2 (p. 77): Prepare germination chambers



cutting out three layers of paper towels for an absorbent surface



placing paper towel layers in each germination chamber

Step 3 (p. 77): Prepare test solutions

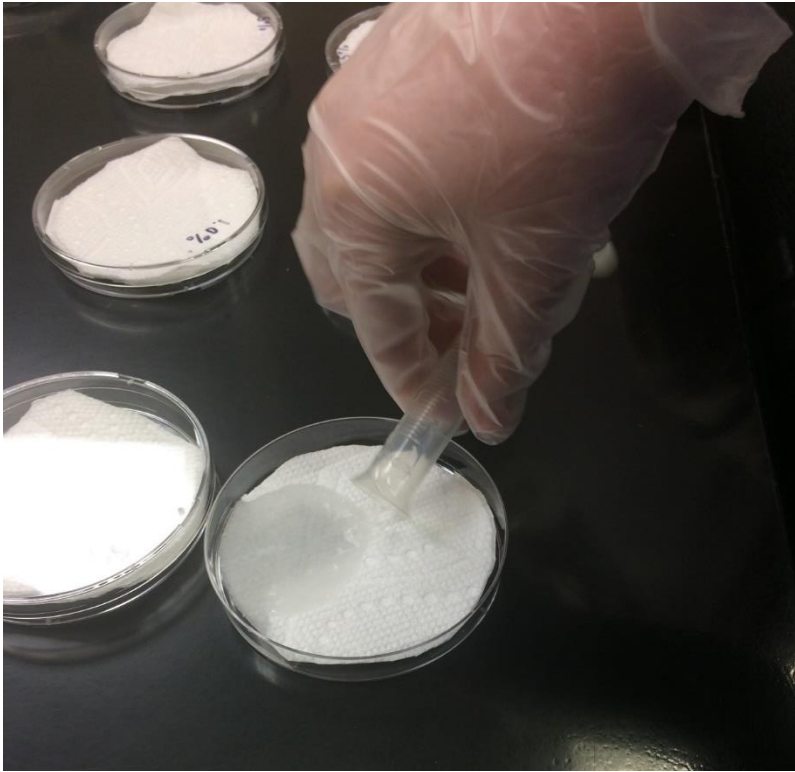


using graduated cylinder to measure 100 ml of water for each salt solution



using electronic balance to weigh the exact amount of salt needed for each salt solution (0%-3.5%, from chart at bottom of p. 77)

Step 4 (p. 78): Expose seeds to test solutions



pouring 8 ml of each test solution into corresponding germination chamber



placing 10 lentils in each chamber

We set up the investigation for all six lab tables.



germination chambers for
three lab tables



each table's germination
chambers stored in a Ziploc bag
to hold moisture...waiting
several days to observe results

Before viewing the results, you should complete the part I data sheet (p. 81).

The chart on p. 81 contains sample (practice) data that you will enter online. Make these hand-written edits on your chart headings.

Number of seeds that germinated, out of 10 seeds that were incubated in various concentrations of salt solution at room temperature for several days.

Table Group	Salt (Group)							
	0% A	0.5% B	1.0% C	1.5% D	2.0% E	2.5% F	3.0% G	3.5% H
1	8	8	7	6	8	6	6	6
2	7	7	8	7	7	7	7	7
3	8	8	7	8	7	7	7	7
4	7	7	7	6	7	7	6	6
5	8	8	8	8	6	6	7	7

The lab manual refers to an Excel spreadsheet, but you will actually use online resources to calculate mean (average) seed germination and determine if salt has a significant effect on germination.

Your online tool for calculating means and comparing them statistically is at <https://uca.edu/biology/biology-1400-01-02/>.
When you open that page, click on ANOVA.

Enter 8 here (because there are 8 salt concentrations)

ANOVA: How many groups? Size of largest group?

You are about to enter your data for a ANalysis Of VAriance. For this to make sense you should have several groups of data (at least 3; maximum: 26).

Number of groups:

Each group includes a certain number of data items. (Often all the groups have the same number of items, but that is not required.) What is the size (i.e., the number of items) of largest group? (maximum: 99)

Size of largest group:

There is no harm in over estimating the group size: blanks will be ignored. You do need to correctly enter the number of groups.

Enter 6 here (because there are 6 lab tables that reported results)

How to enter the data

Data Entry: ANOVA

Enter in the below set of boxes your data for each group (order makes no difference within a group) and then click on the **Calculate Now** button. Empty boxes will be ignored.

Data for Group A

$A_{01}=8$ $A_{02}=7$ $A_{03}=8$ $A_{04}=7$ $A_{05}=8$

$A_{06}=7$ $A_{07}=$ $A_{08}=$ $A_{09}=$ $A_{10}=$

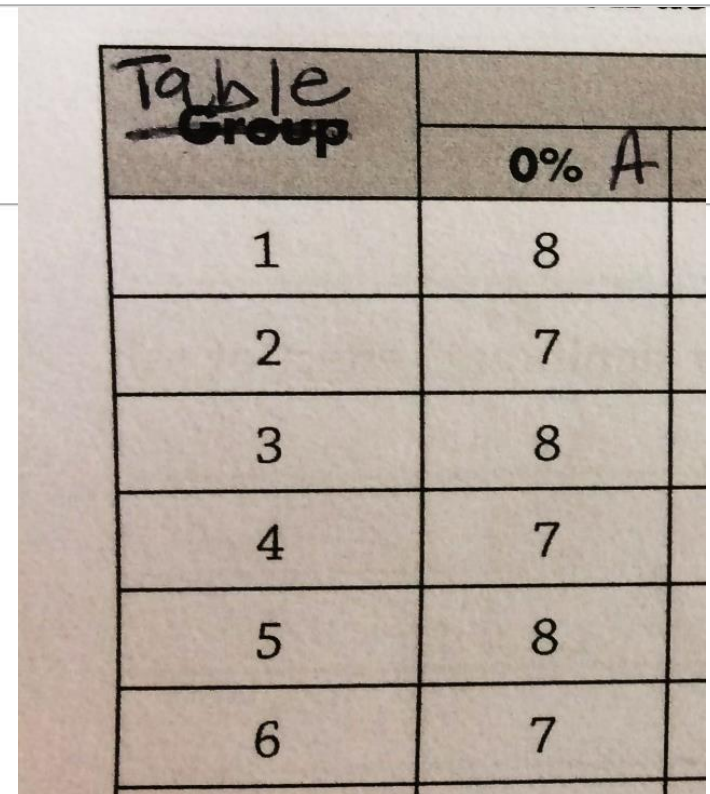
Data for Group B

$B_{01}=$ $B_{02}=$ $B_{03}=$ $B_{04}=$ $B_{05}=$

$B_{06}=$ $B_{07}=$ $B_{08}=$ $B_{09}=$ $B_{10}=$

Don't worry about these extra boxes—leave them blank

Continue by entering 0.5% data in Group B, and so on



A handwritten table with the following structure:

Table Group	0% A	
	1	8
2	7	
3	8	
4	7	
5	8	
6	7	

After entering all the data, scroll back to the top and click
“Calculate Now”

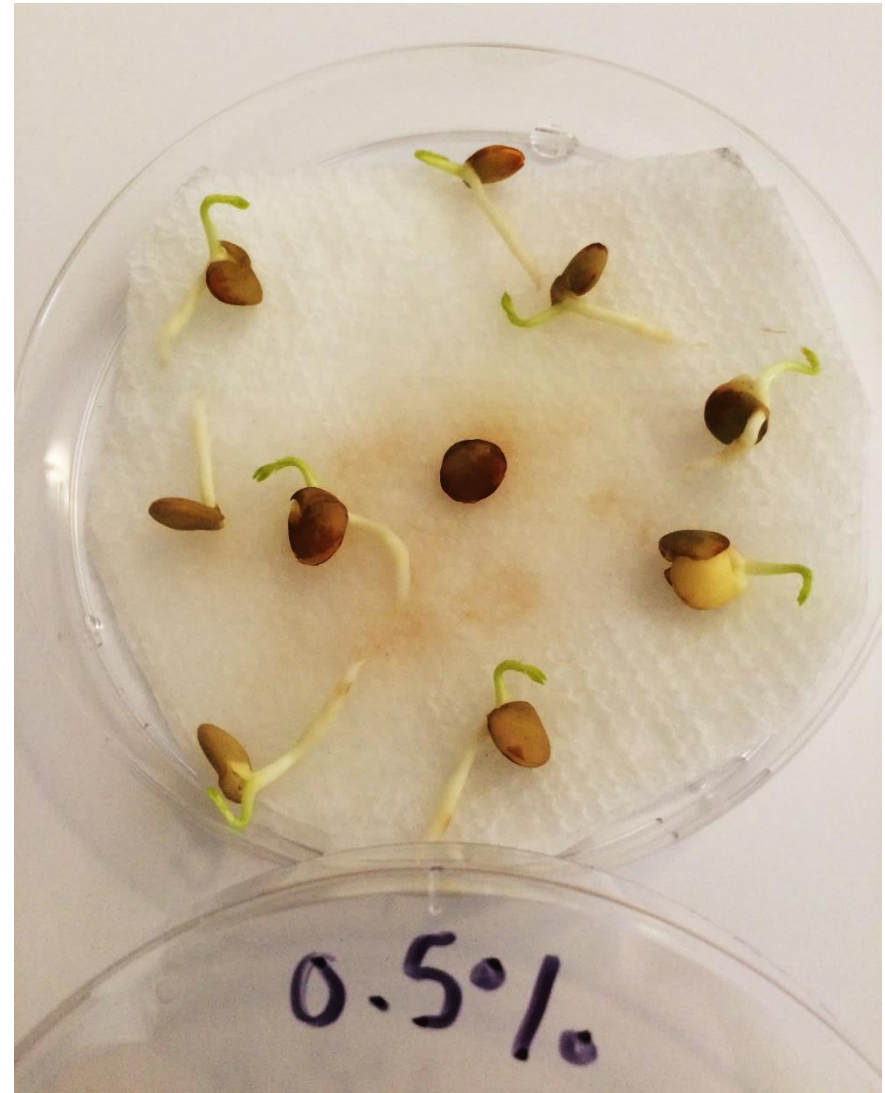
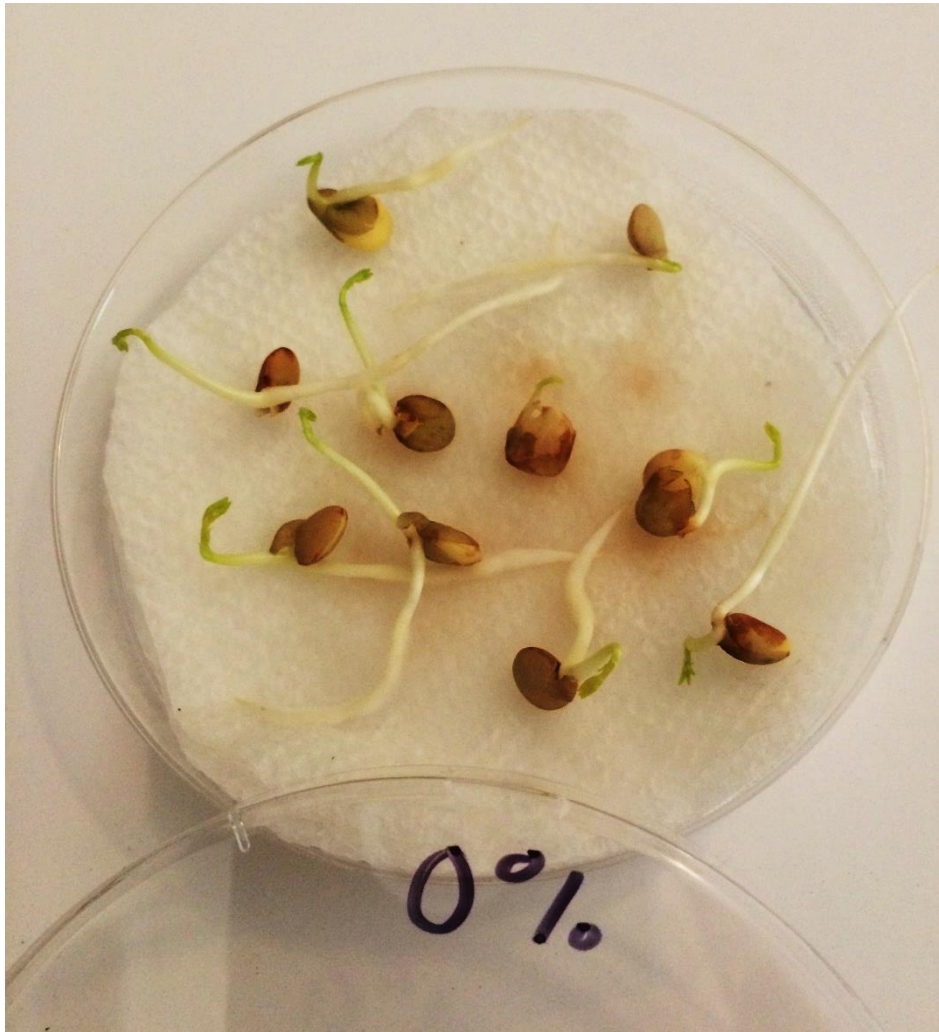
If you get an error, double check your data entry

The report that opens next will have a lot of information, but all you need is the **mean germination** for each salt concentration (copy that onto p. 81) and the statement near the top that says, “**The probability of this result, assuming the null hypothesis, is...**” If the number that follows is greater than 0.05, the effect of salt on seed germination is NOT statistically significant. If the number is 0.05 or below, the effect of salt on seed germination IS statistically significant.

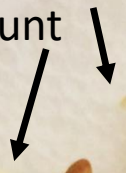
After completing the part I data sheet, you're ready to view the results and analyze them (exactly as you did for the practice data).

You'll use the part II data sheet for that.

For the sixth lab table, use the following pictures to count and record the number of seeds that sprouted in each salt concentration. You should count any lentils that have sprouted, even if the “sprouts” are small.



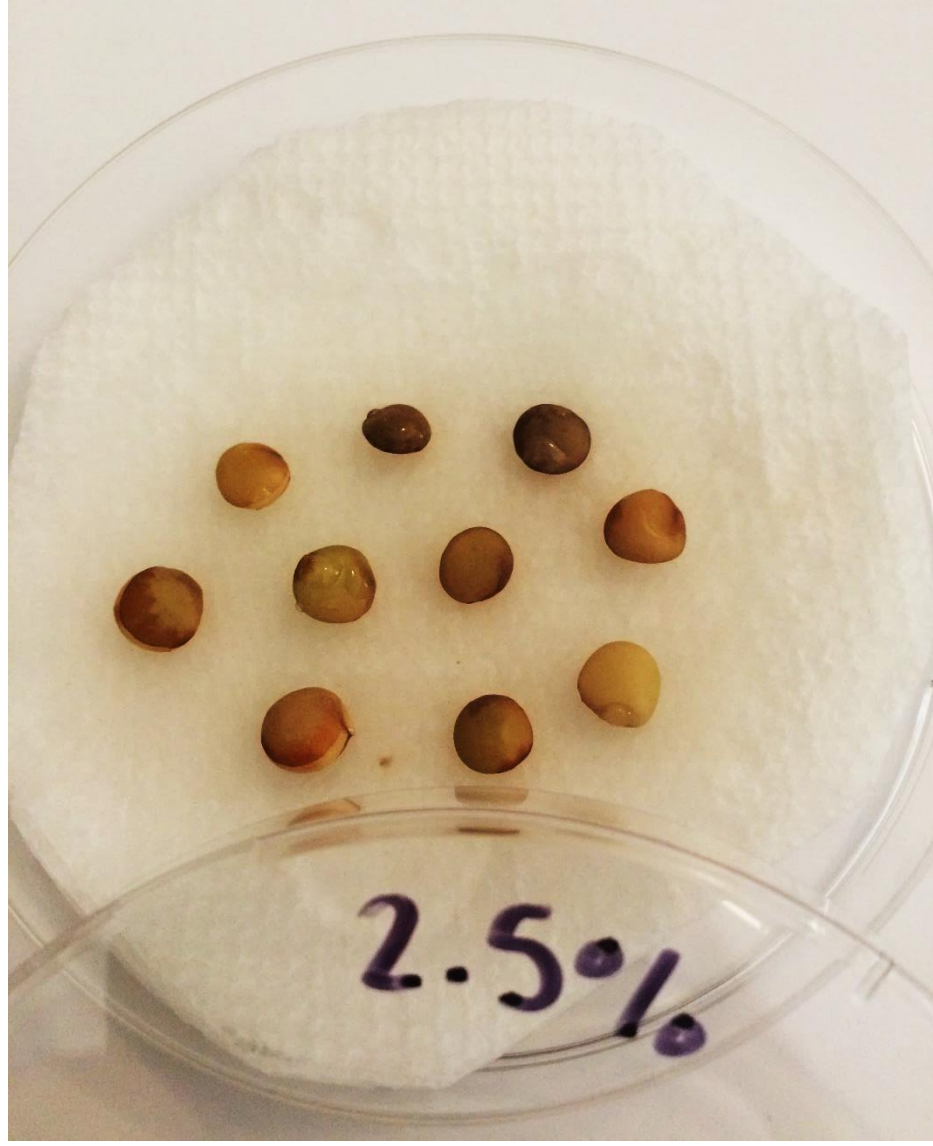
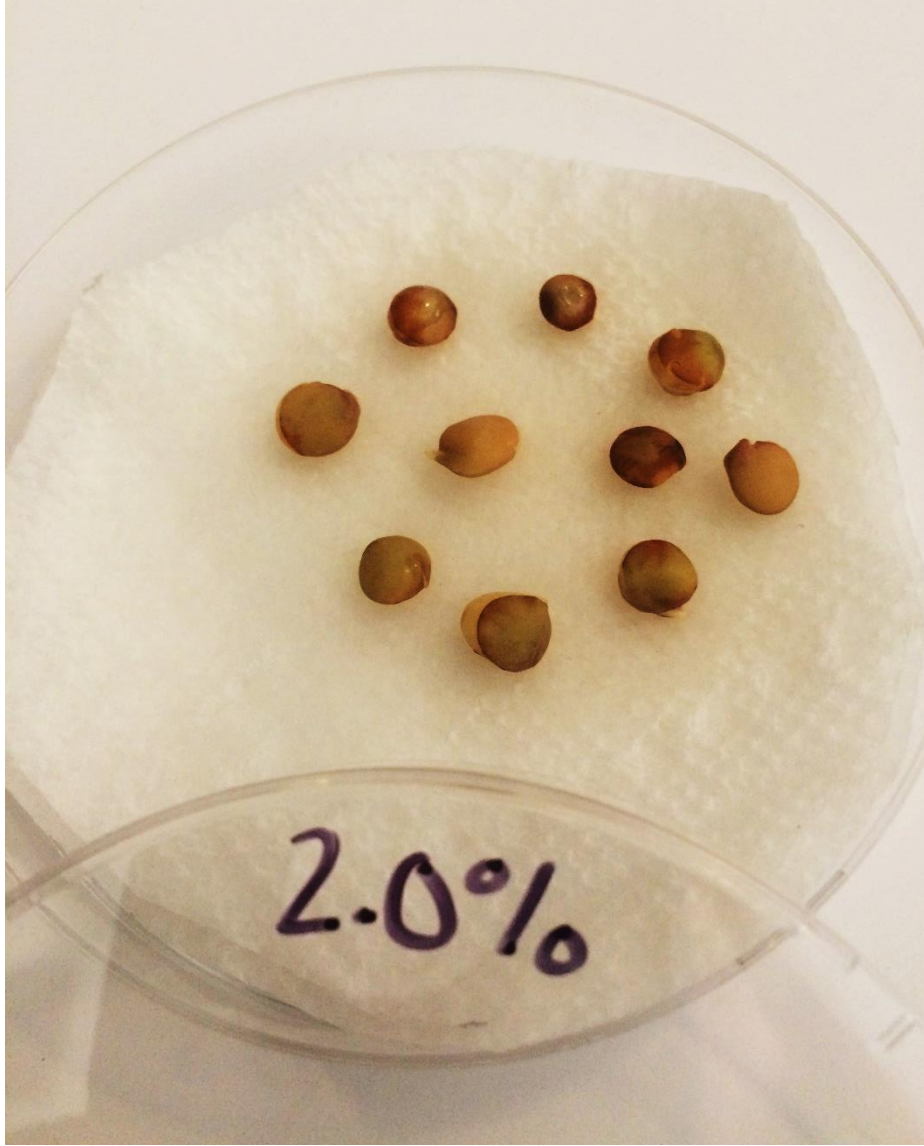
Even though these
"sprouts" are small, they
still count

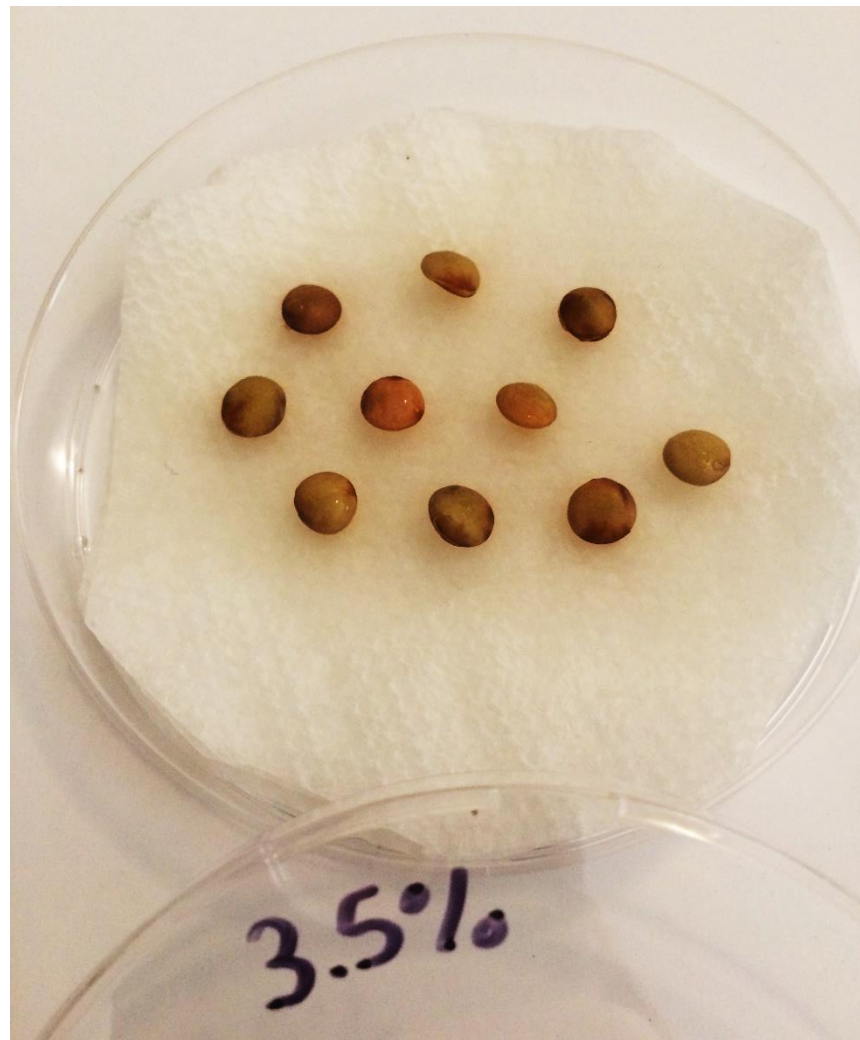
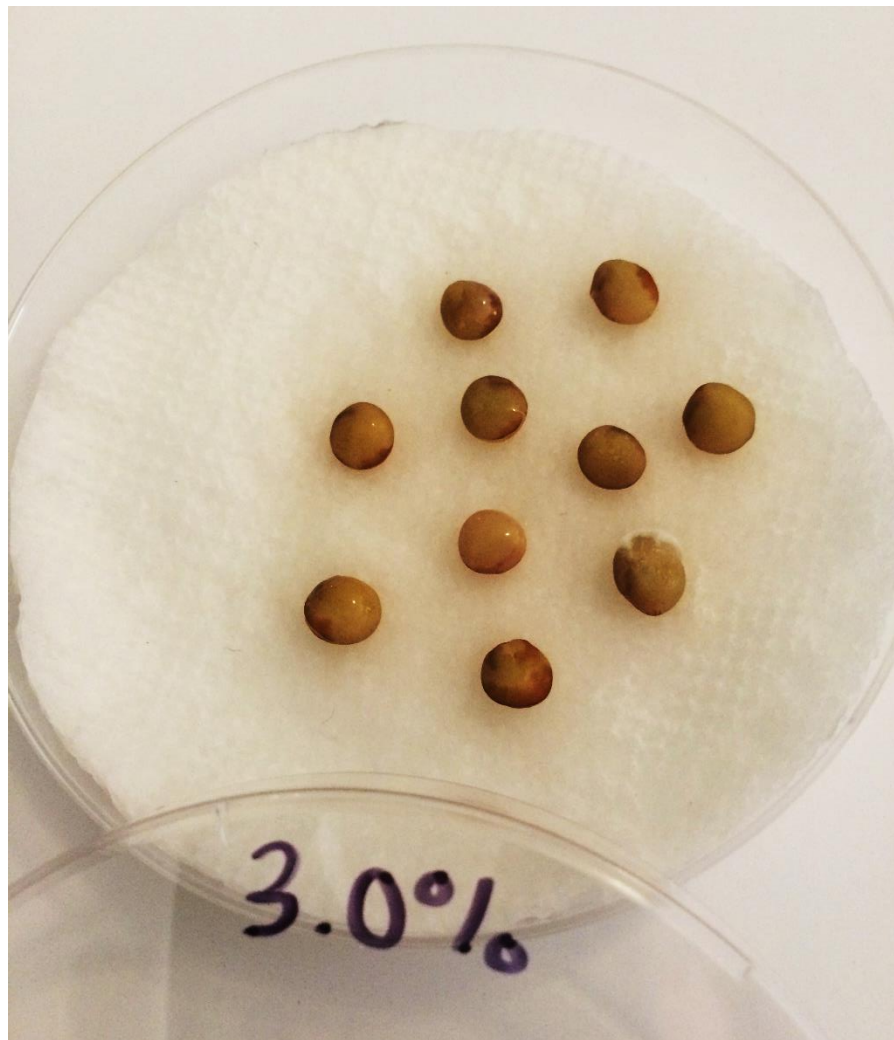


1.0%



1.5%





Complete the part II data sheet
(including p. 85). Please put your name
on p. 85, even though it is also on the
first page.

Your instructor will indicate how and
when you should submit your work.