Investigation 7
How much is too much?

Investigating the effect of salt on seed germination

Background information, photos, data, and instructions

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

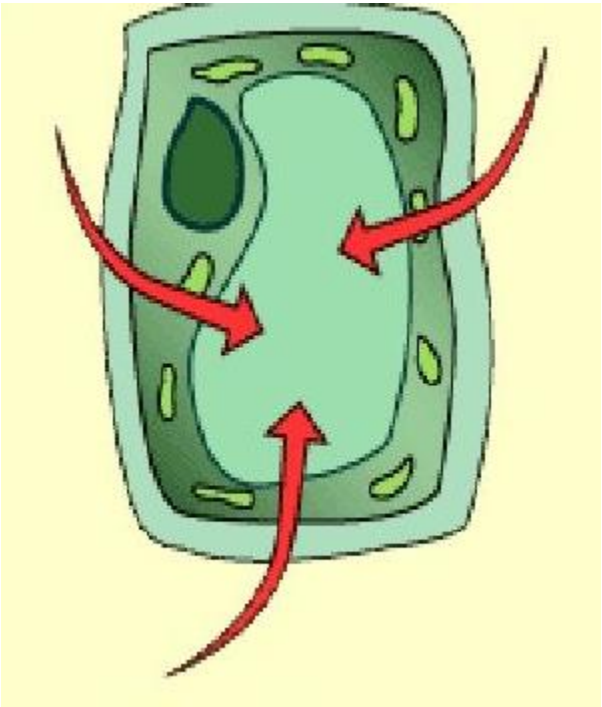
a field of lentil plants

lentils are produced in pods

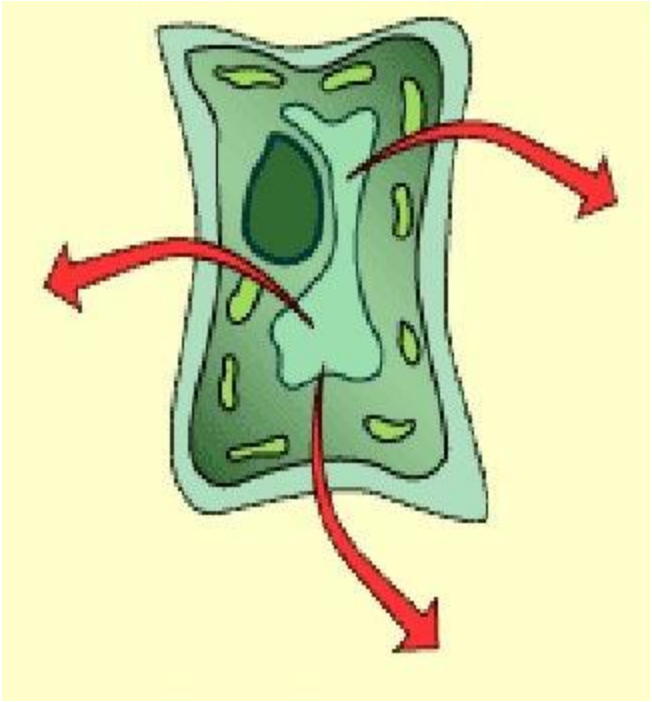
each lentil is a tiny bean

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 yourself, your lab instructors set it up. As you view the following photos, refer to the corresponding pages in your lab manual.

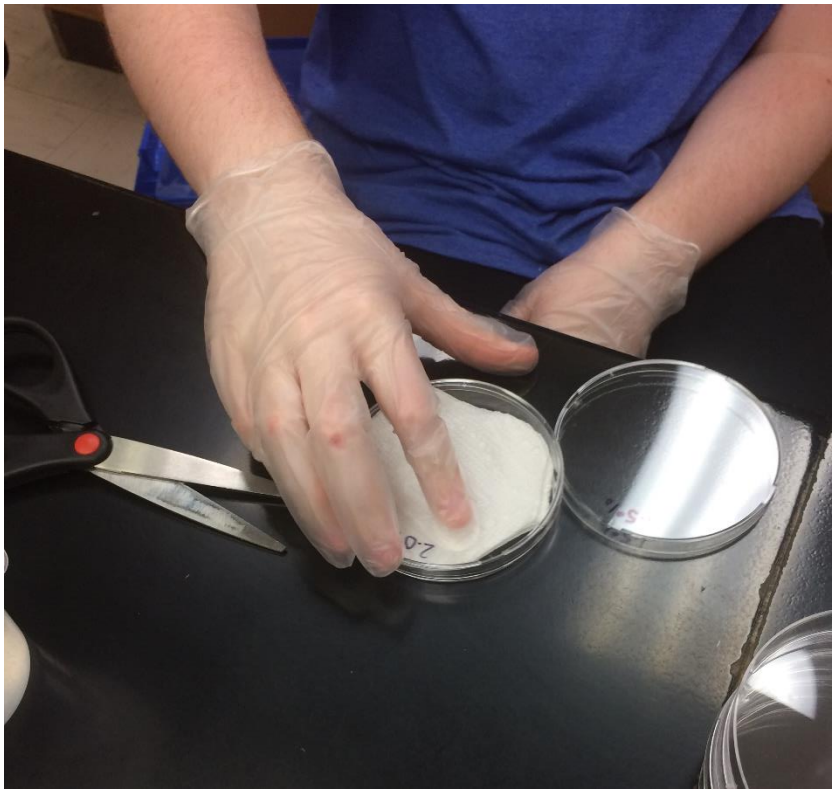
Step 1: Prepare your seeds for testing

counting out 80 lentils
(10 per salt concentration)

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

Step 2: Prepare germination chambers

cutting out three layers of paper towels for an absorbent surface



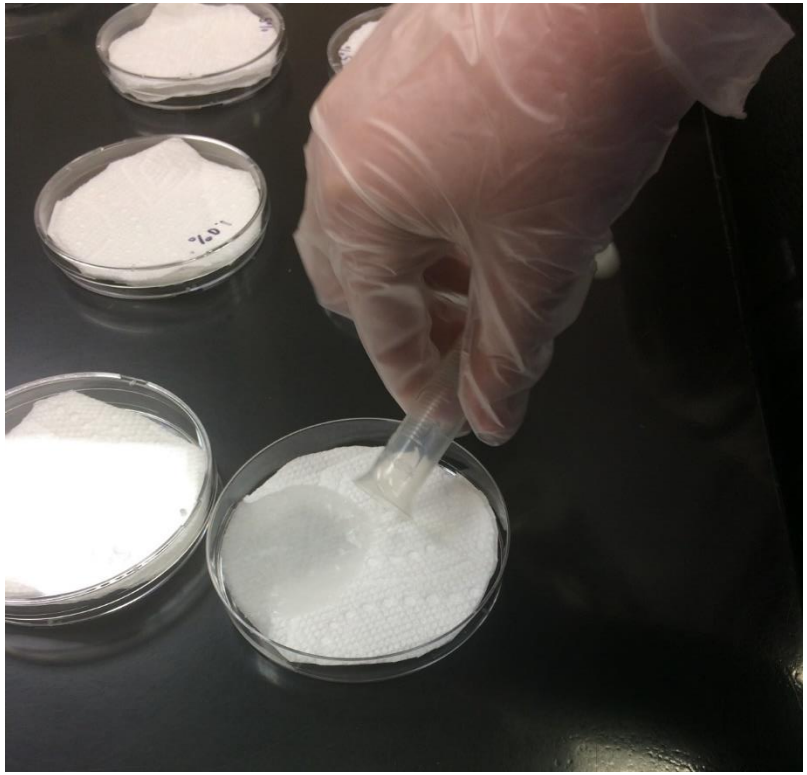
placing paper towel layers in each germination chamber

Step 3: 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%)

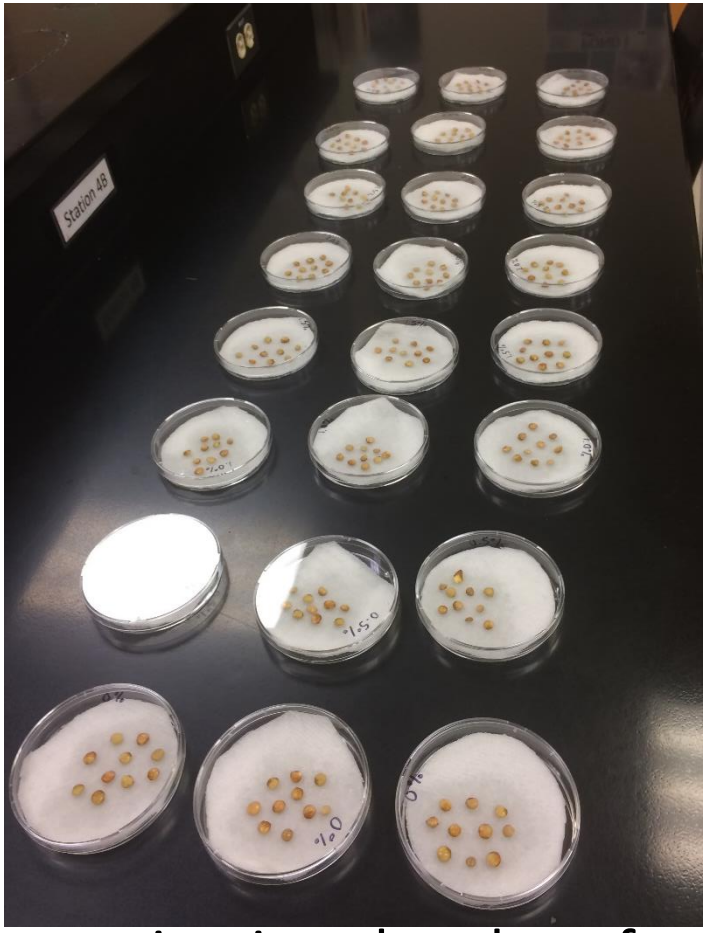
Step 4: Expose seeds to test solutions



pouring 8 ml of each test solution into corresponding germination chamber

placing 10 lentils in each chamber

We set up the investigation for six lab tables.



germination chambers for three lab tables

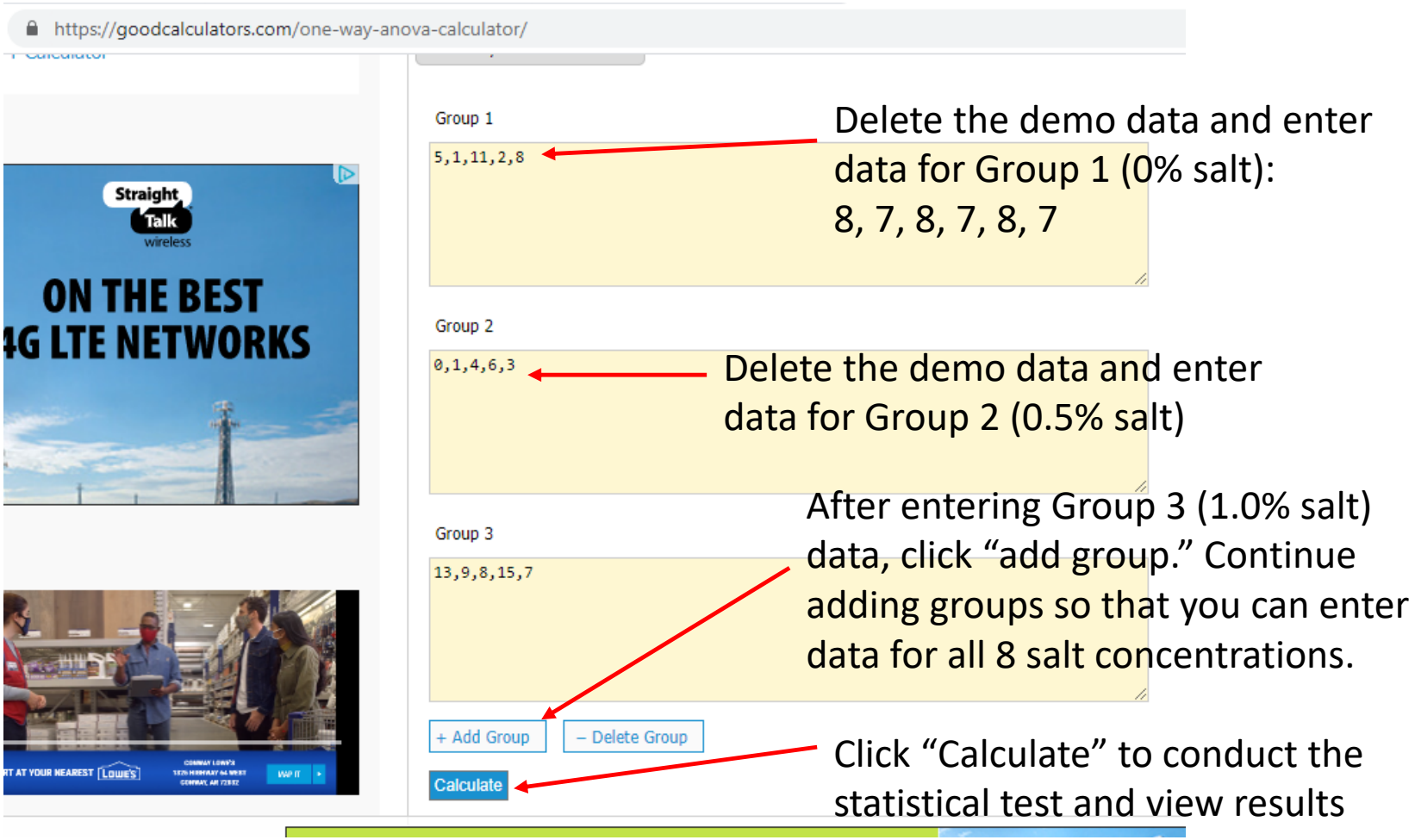
each table's germination chambers stored in a Ziploc bag to hold moisture…waiting several days to observe results

Before viewing the results of this experiment, you should examine the practice data at the bottom of p. 79 in your lab manual.

The table on p. 79 shows the number of seeds that germinated, out of 10 seeds that were incubated in various salt concentrations at room temperature for several days. (This is a sample data set so that you can become familiar with how to analyze the data.)

You will 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:Analysis of Variance Between Groups.



Scroll down below the blue “Calculate” button to view your results.

There are lots of results, but you should focus on:

1) the mean germination for each salt concentration (from the “Data Summary” chart). Copy the mean germination into the bottom row of your practice data table on p. 79

2) the P-value right above the “Data Summary” chart. If the number that follows “P-value = “ 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.

A very, very small P-value may round to 0

(in that case, the P-value is far below 0.05, so the difference is statistically significant)

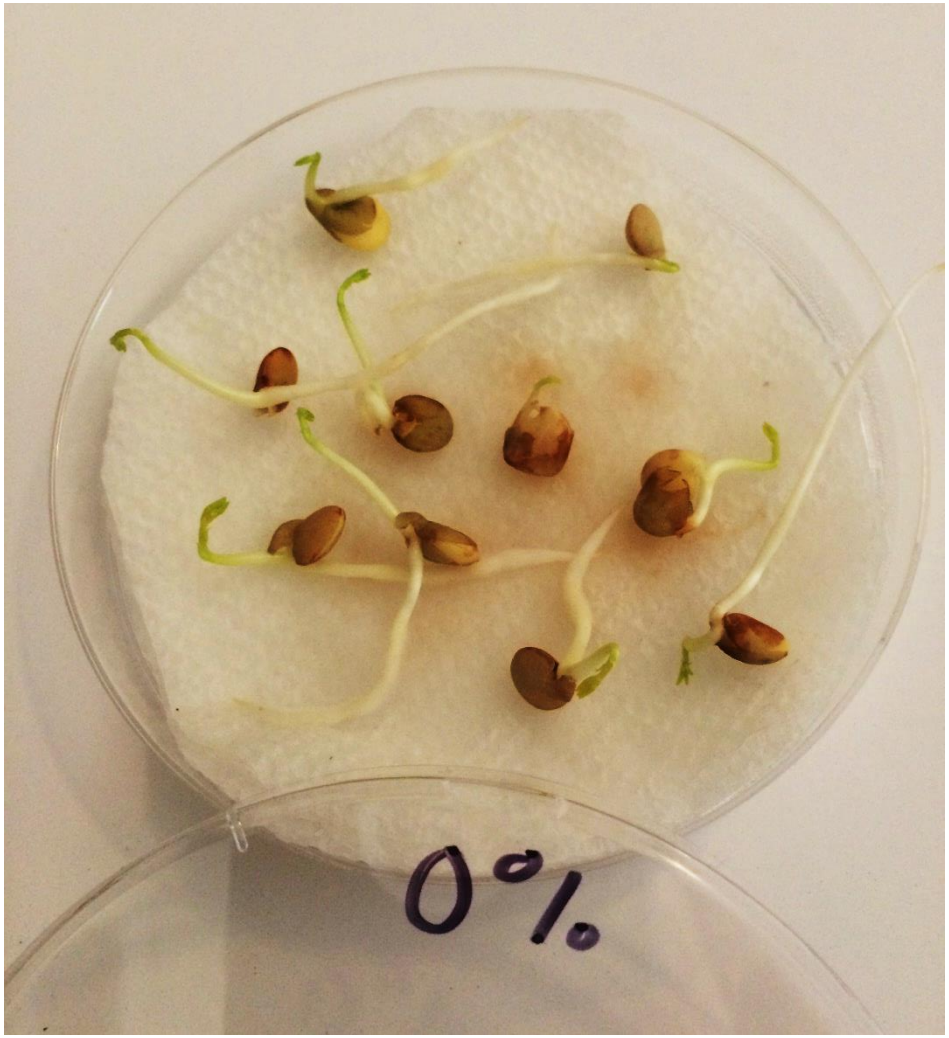
After analyzing the practice data, you're ready to view the actual results from this experiment and analyze them (exactly as you did for the practice data).

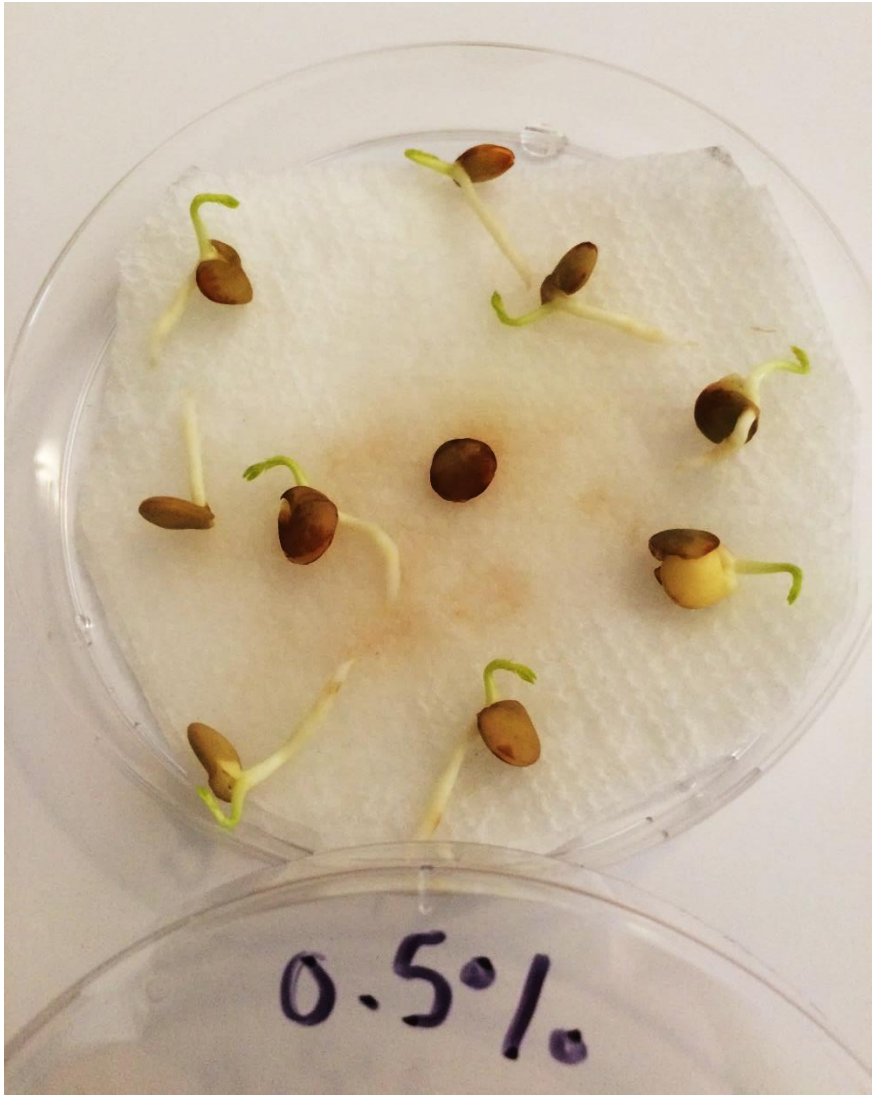
After four days, we counted the number of lentils that had sprouted in each germination chamber and recorded the data for the first five lab tables.
You should enter these data into the blank chart on p. 81 of your lab manual.

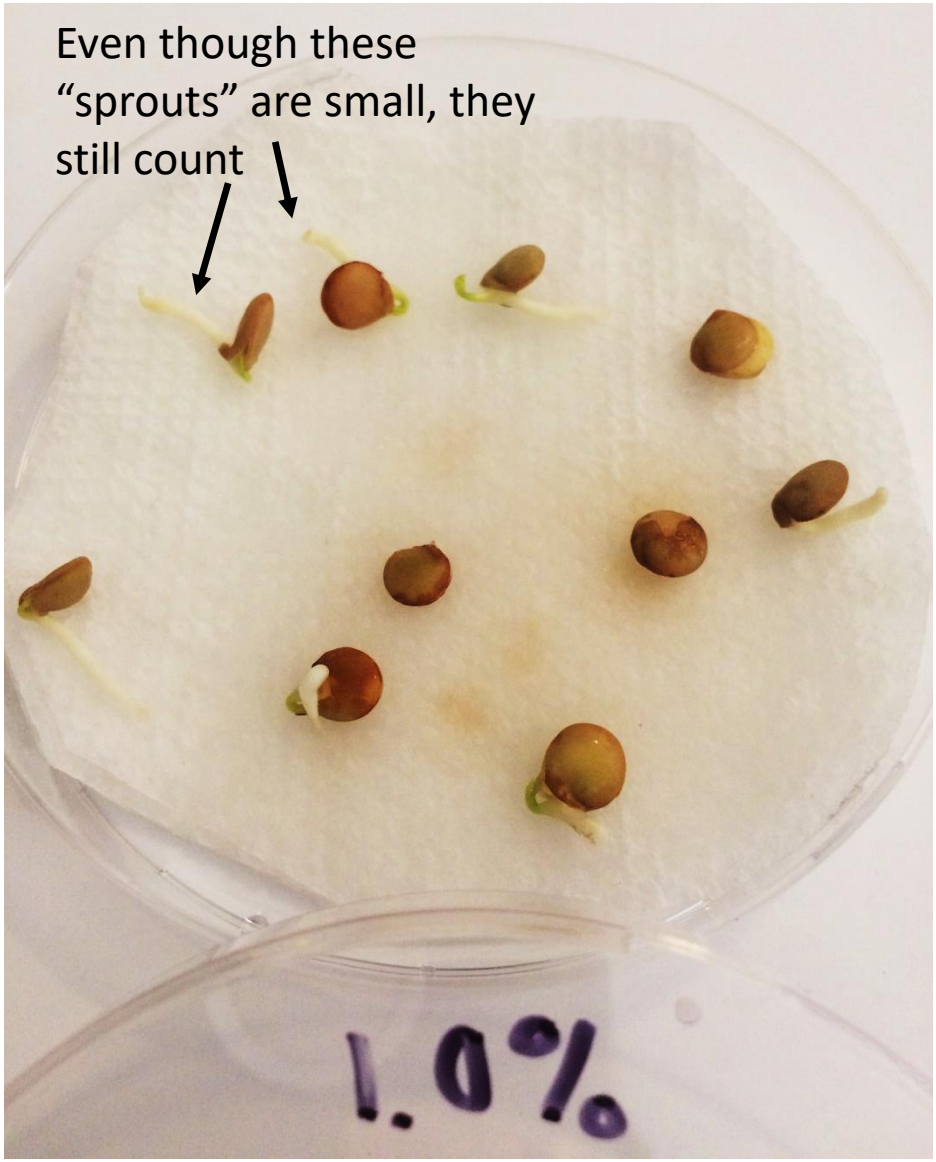
Lab table	0% (A)	0.5% (B)	1.0% (C)	1.5% (D)	2.0 % (E)	2.5% (F)	3.0% (G)	3.5% (H)
1	9	9	9	9	0	0	0	0
2	9	10	9	6	0	0	0	0
3	10	10	7	6	0	0	0	0
4	10	9	9	3	4	0	0	0
5	10	9	8	8	0	0	0	0
6	Table 6 data will come from the following photos							

To complete the bottom row of this data table, use the following pictures to count and record the number of seeds that sprouted in each salt concentration, enter those data into the blank chart, and include all six tables in your analysis.

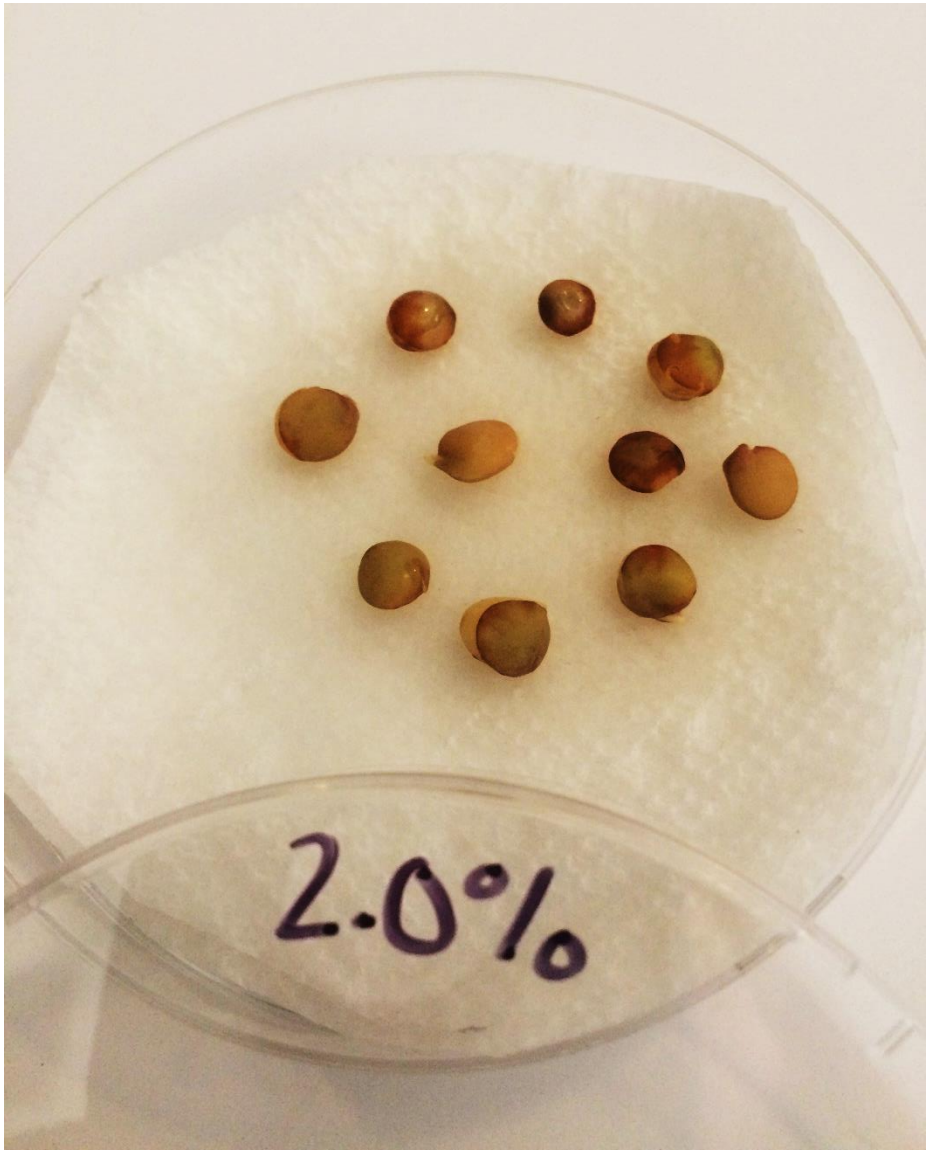
You should count any lentils that have sprouted, even if the “sprouts” are small.

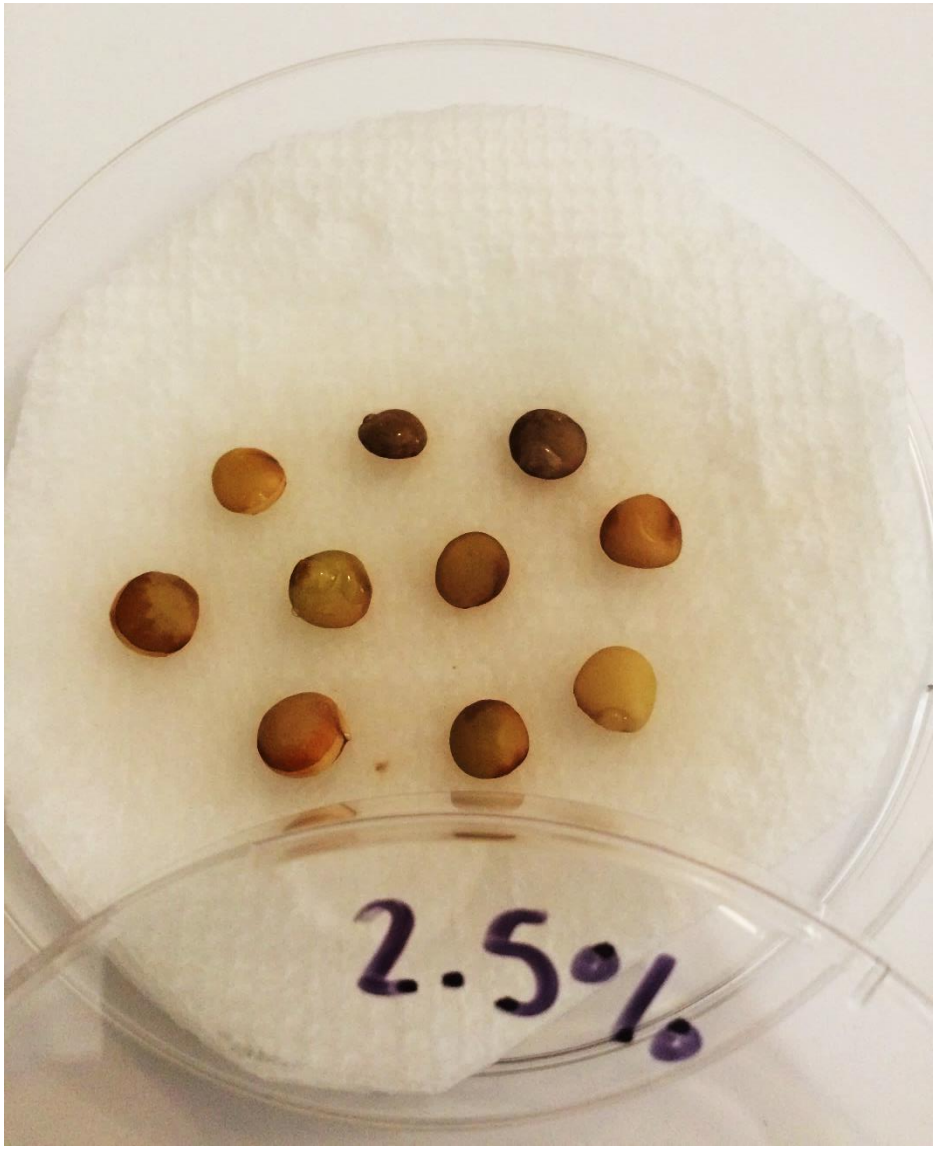


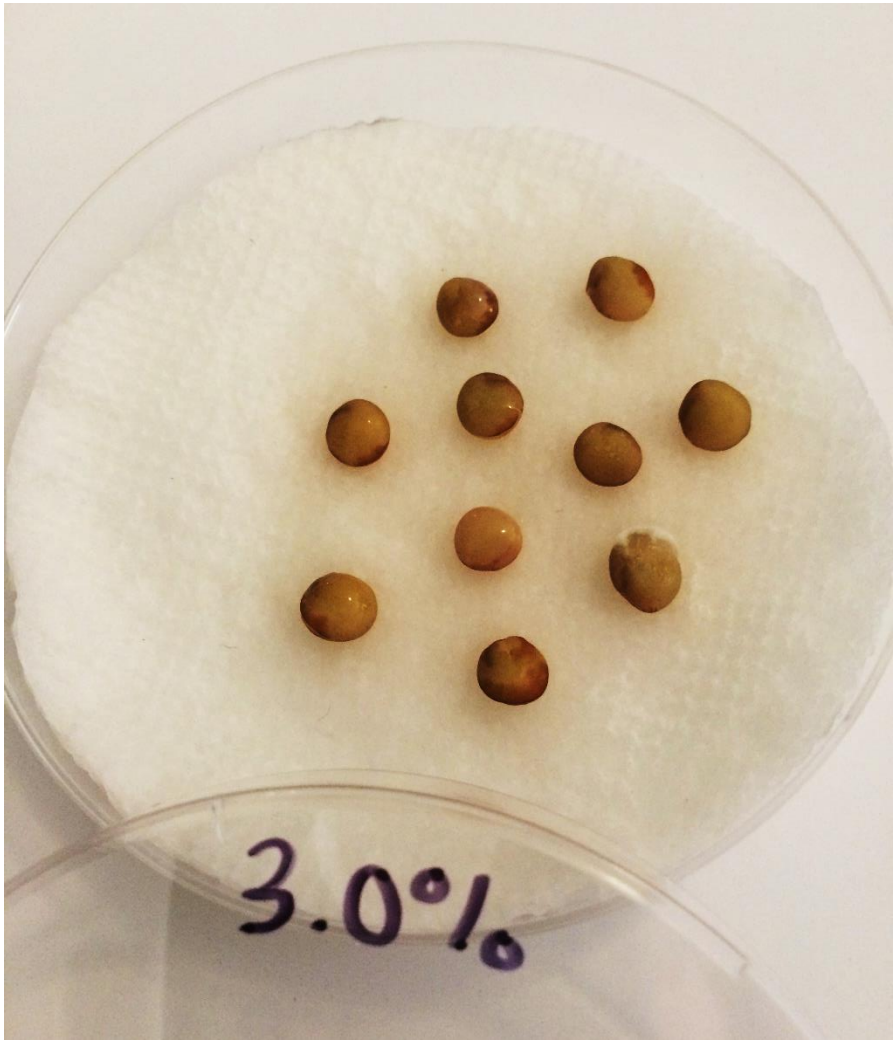


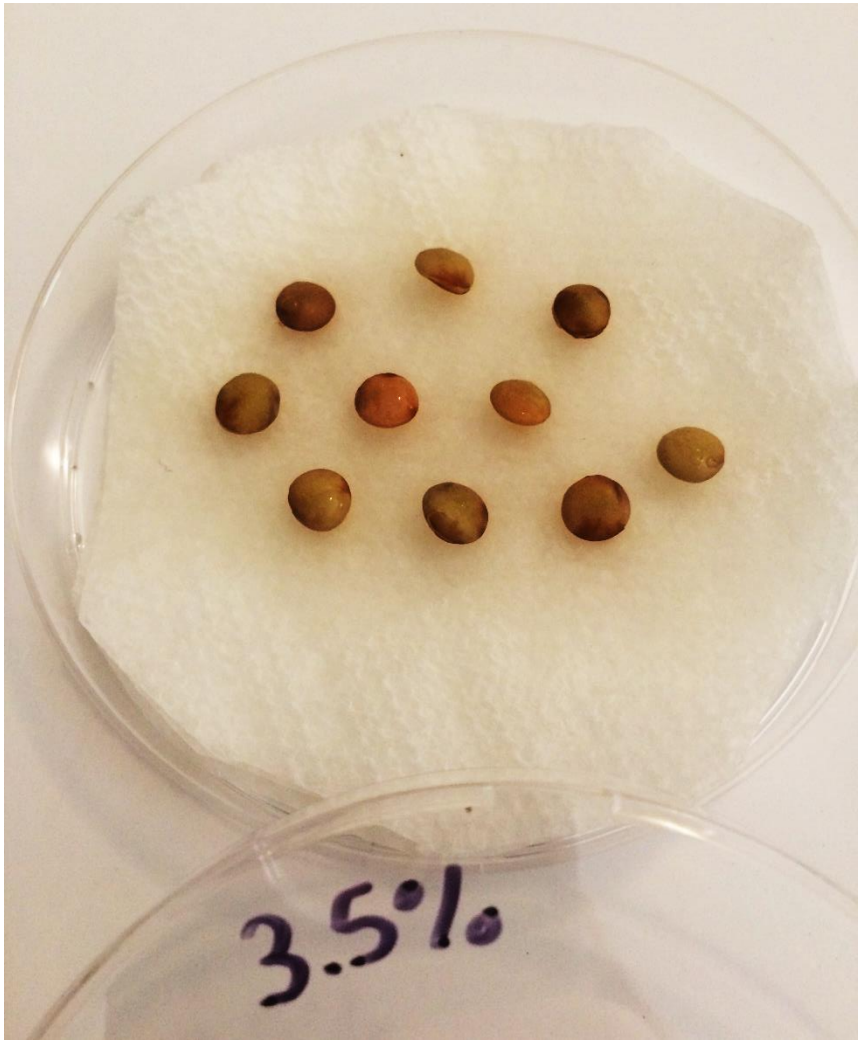

Even though these
“sprouts” are small, they
still count
1.0%


1.5%


2.0%


2.5%


3.0%


3.5%

Now, you should analyze the results from the table on p. 81 exactly as you did for the practice data
(using the ANOVA link, entering the data, and interpreting the results).

If the P-value is a very, very small number, it may be rounded to 0 (in that case, the P-value is far below 0.05, so the difference is statistically significant)

Complete the pre-lab assignment on p. 77 and the data sheets on pp. 79-82 in your lab manual.

You do NOT need to answer any questions on p. 83.

You will turn in your completed work at the start of your next in-person lab.