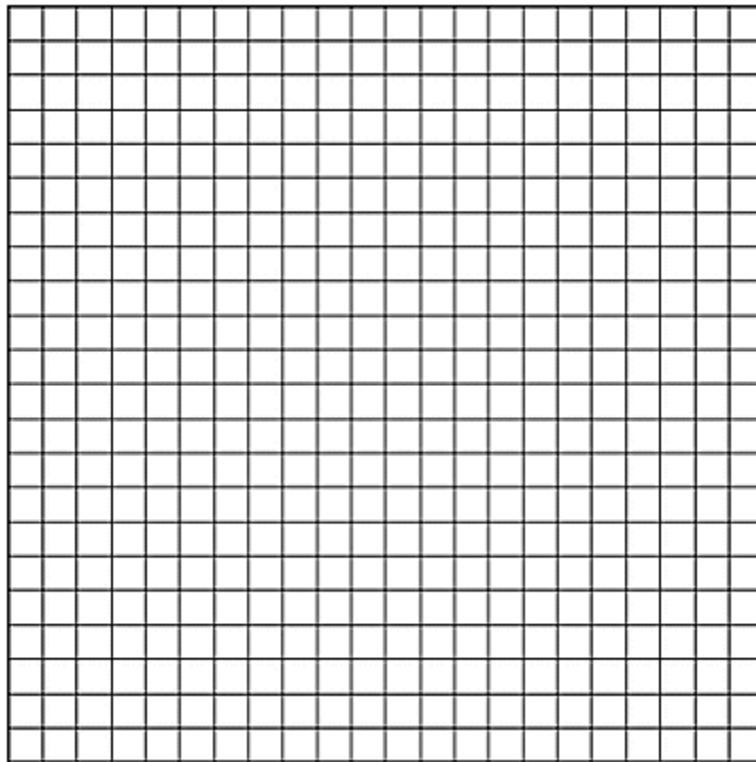


Lab 1 Artificial Selection

The purpose of a particular investigation was to see the effects of varying salt concentrations of nutrient agar and its effect on colony formation. Below are the results

Trail	No Treatment	1% salt	3% salt	5% salt	7% salt	9% salt
1	47	41	25	28	24	5
2	46	42	32	23	21	6
3	34	32	28	21	18	3
4	57	44	24	25	17	2
5	41	39	27	25	21	4

Determine the mean for each treatment and graph the results.



Determine the standard deviation for the treatment with 0% salt and 3% salt and then perform a t-test to determine if the difference between the means of these two trials is significant.

Predict how many colonies would be on a agar plate that contained 9% salt and the colony originated from the plate with 9% salt.

Explain how this is an example of artificial selection

Explain how this may happen as an example of natural selection

Lab 2 Hardy-Weinberg

1. The frequency of two alleles in a gene pool is 0.19 (A) and 0.81 (a). What is the percentage in the population of heterozygous individuals? What is the percentage of homozygous recessives? Assume that the population is in Hardy-Weinberg equilibrium.
2. An allele W , for white wool, is dominant over allele w , for black wool. In a sample of 900 sheep, 891 are white and 9 are black. Estimate the allelic frequencies in this sample, assuming that the population is in equilibrium.
3. In a population that is in Hardy-Weinberg equilibrium, the frequency of the recessive homozygote genotype of a certain trait is 0.09. What is the percentage of individuals homozygous for the dominant allele?
4. In a population that is in Hardy-Weinberg equilibrium, 38 % of the individuals are recessive homozygotes for a certain trait. In a population of 14,500, how many of the individuals will be homozygous dominant individuals, and heterozygous individuals.
5. Allele T , for the ability to taste a particular chemical, is dominant over allele t , for the inability to taste it. At a university, out of 400 surveyed students, 64 were found to be nontasters. What is the percentage of heterozygous students? Assume that the population is in equilibrium.
6. In humans, Rh -positive individuals have the Rh antigen on their red blood cells, while Rh -negative individuals do not. Assume that a dominant gene Rh produces the Rh -positive phenotype, and the Rh -negative phenotype produces by its recessive allele rh . In a population that is in Hardy-Weinberg equilibrium, if 160 out of 200 individuals are Rh -positive, what are the frequencies of the Rh allele and the rh allele at this locus?
7. In corn, yellow kernel color is governed by a dominant allele for white color W and, by its recessive allele, w . A random sample of 100 kernels from a population that is in equilibrium reveals that 9 are yellow and 91 are white. What are the frequencies of the yellow and white alleles in this population? What is the percentage of heterozygotes in this population?
8. A rare disease which is due to a recessive allele (a) that is lethal when homozygous (aa), occurs with a frequency of one in a million. How many individuals in a town of 14,000 can be expected to carry this allele?

Lab 3 Comparing DNA sequences

Below are strands of DNA from 4 different species. Base on the DNA sequence, answer the following questions.

I. ACCGGTTAAACATTAGGGACCT TATGGAAAACACGAGCCCGGATTAGGC

II. ACCGGTTTAAACATTAGGCACCT TATGGGAAACTCATGAGCCCGGATTAGGC

III. ACCGGTTGAACATTAGGCACCT TATGGGAAACTCATGAGCCCGGATTAGGG

IV. ATCGGTCGAACATTAGACCT TATGGGAAACTCATGAGCGCGCATTAGGG

1. Which two species are most closely related and why?

2. Which species is more distantly related to the other species and why?

3. What sorts of mutations are found in the DNA of species # 2 when compared to species #3? How will that affect the resulting protein?

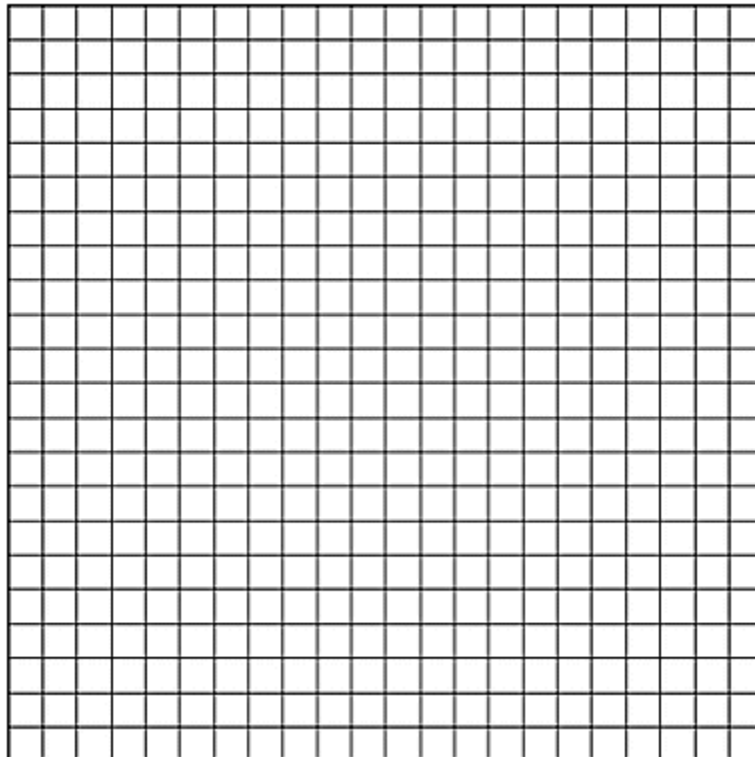
4. What sorts of mutation are found in the DNA of species #3 when compared to the species #4? How will that affect the resulting protein?

Lab 4 Osmosis

A student was working with potato cores and sucrose solutions with varying molarities. The molarities of the solutions were 0, 0.2, 0.4, 0.6, 0.8, and 1.0. The student measured the initial mass of the potato cores and then after 24 hour the student measures the cores again. The student then realizes that the molarities of the beakers were never labeled. Based on the percent change mass of the potato cores determine the molarity of each solution. Also determine the water potential of each solution.

Beaker	Initial Mass	Final Mass	Mass Difference	Percent Change in Mass	Molarity of Solution (M)	Water Potential of Solution
A	8.2	8.8				
B	8.7	8.6				
C	8.8	6.7				
D	7.6	6.6				
E	7.8	9.4				
F	9.1	7				

Graph the percent change in mass versus the molarities of the solutions and determine the molarity where the potatoes were isostonic. _____

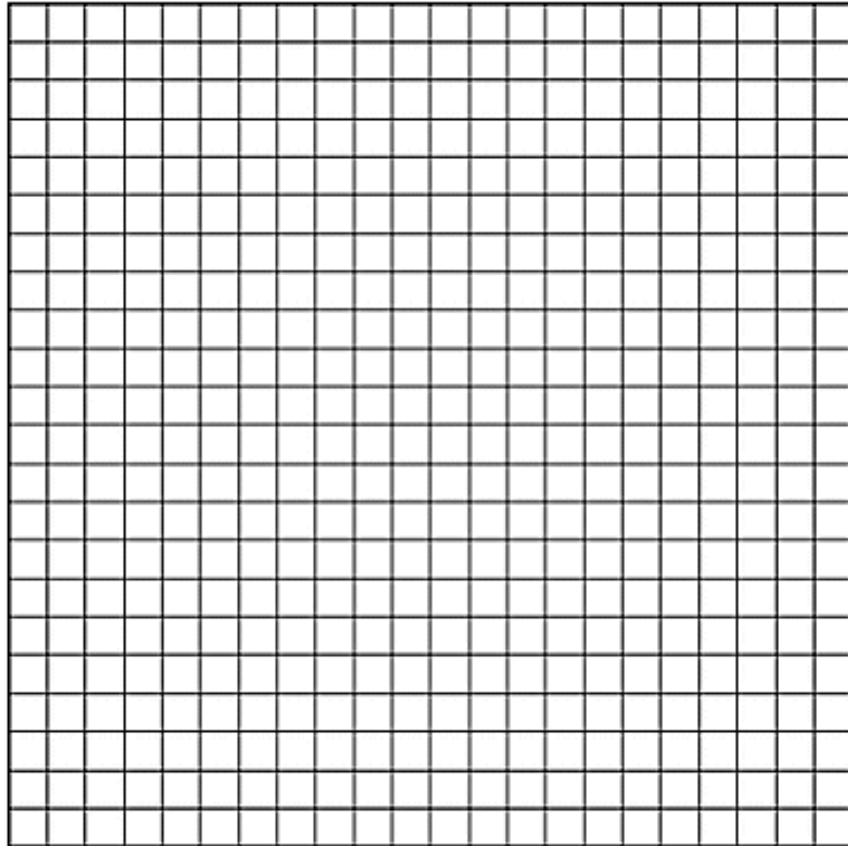


Now determine the water potential of the potatoes

Lab 5 Photosynthesis

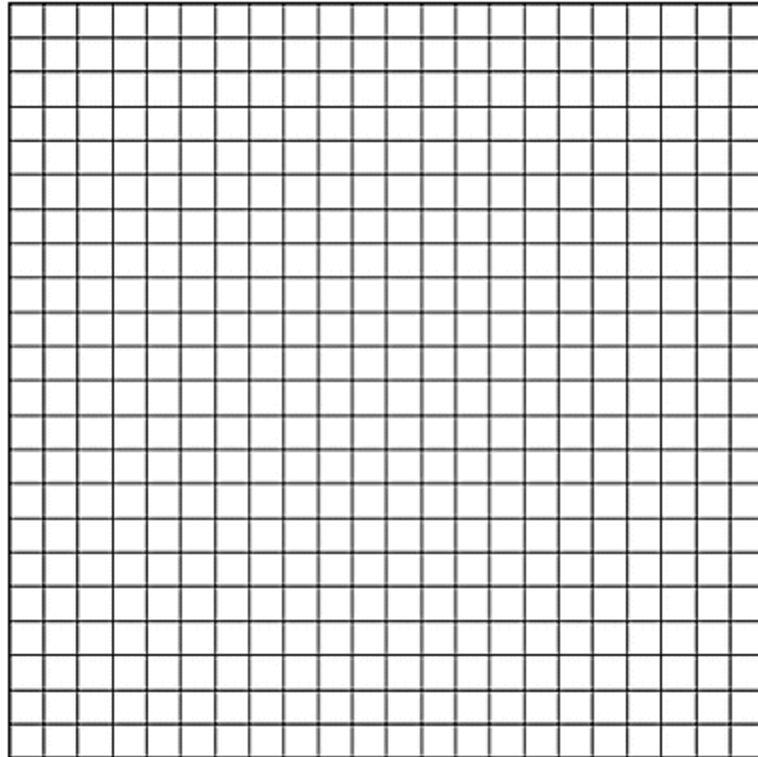
An experiment involved plant tissue disks submerged in a solution of water and sodium bicarbonate. The time it took for the disk to float to the top of the solution was recorded. Graph the data below and determine the median time it took for 5 disc to rise to the top or ET_{50} .

Time	# of floating disks
0	0
1	0
2	0
3	0
4	0
5	0
6	0
7	1
8	1
9	1
10	1
11	4
12	7
13	8
14	9
15	10



This experiment was repeated four times varying the light intensity of the light. The data was recorded below. Determine $1/ET_{50}$. Graph the light intensity versus $1/ET_{50}$.

Light Intensity (FT-C)	ET_{50}	$1/ET_{50}$
100	20	
400	17	
800	13	
1300	7	



Does this relationship seem to be proportional?

Draw in a line if this experiment were repeated under varying light intensities of green light. Justify your how you drew your line.

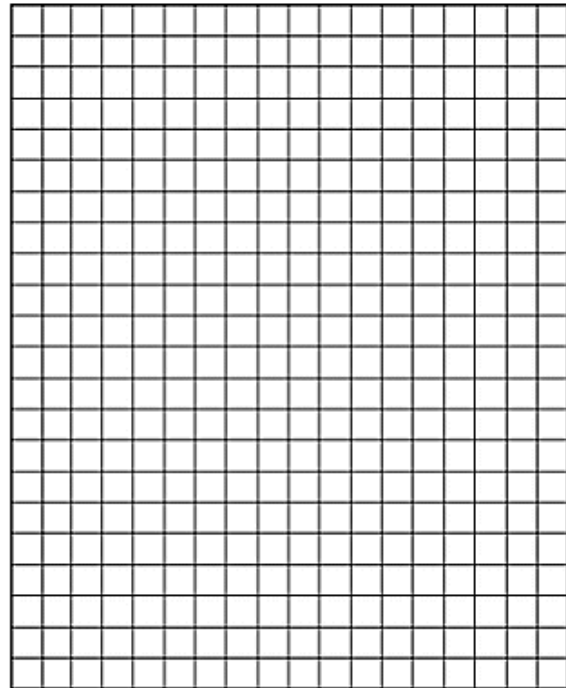
Design an experiment that to investigate another factor of photosynthesis and the protocol you would use and also justify the results you would expect.

Lab 6

Below is data presented from an investigation comparing the oxygen consumption of germinating pea at 25°C versus germinating peas at 10°C. Respirometers with KOH inside were used in measuring the amount of oxygen consumed. In addition there was a control used which was a respirometer that contained only beads and no germinating peas. The data table is only partially completed. Complete the data table and graph the corrected difference versus time.

Trial #1

Temp. (°C)	Time [min]	Beads Alone		Germinating Peas		
		Reading at Time X	Diff.*	Reading at Time X	Diff.*	Corrected Diff.
25	0	0.93		0.91		
	5	0.91		0.84		
	10	0.90		0.77		
	15	0.90	0.03	0.71	0.20	0.17
	20	0.90	0.03	0.64	0.27	0.24
10	0	0.95		0.92		
	5	0.94		0.88		
	10	0.92		0.85		
	15	0.93	0.02	0.83	0.09	0.07
	20	0.93	0.02	0.80	0.12	0.10



1. What is the effect of temperature on the rate of cellular respiration?

2. What is it important to have a respirometer filled with beads?

3. What is the purpose of KOH?

4. Determine the average rate of respiration for germinating peas at 10°C and 25°C.

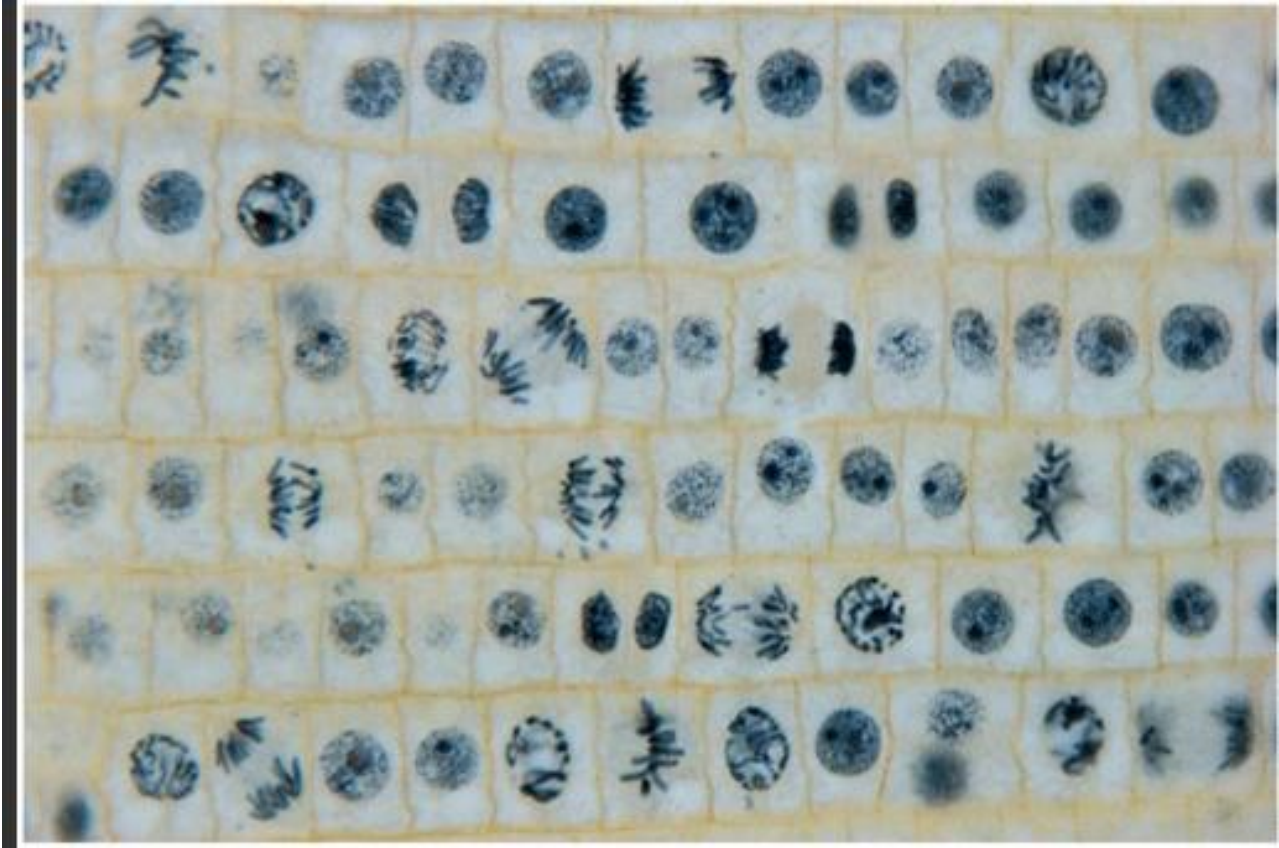
The experiment was repeated four more times and the data is collected below.

Average Rate of O ₂ consumption ml/min							
Trial	Average Rate 25°C	Difference from mean	(Difference from mean) ²	Trial	Average Rate 10°C	Difference from mean	(Difference from mean) ²
1	0.01			1	0.005		
2	0.012			2	0.004		
3	0.014			3	0.006		
4	0.01			4	0.006		
5	0.012			5	0.004		
Mean		Sum		Mean		Sum	
	Standard deviation for 25°C =				Standard deviation for 10°C =		
	t-test value =						

Determine the standard deviation of each set of data and perform statistical with a t-test to determine if the difference between means of the trials are statistically significant different.

Using the means from the two trials determine the value Q₁₀.

Lab 7 Mitosis



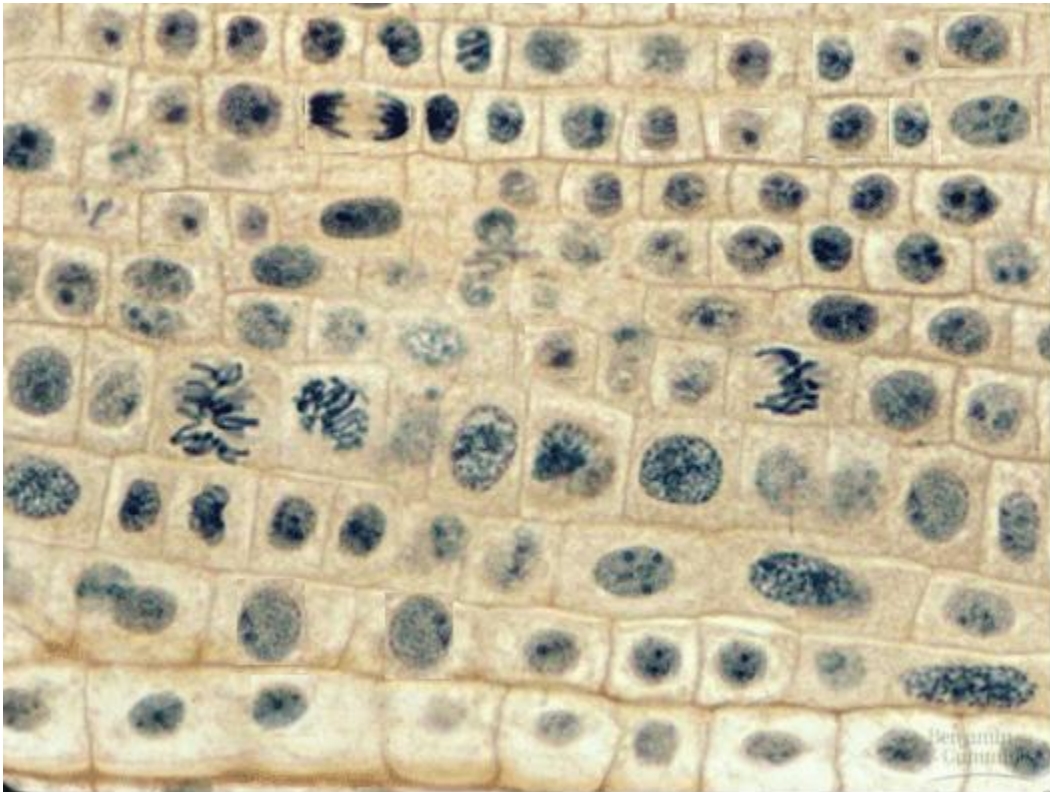
Above is an onion root tip observed under a microscope. In the data table shown below, count the number of cells in each phase of mitosis. Combine prophase and prometaphase.

Phase	Number	Percent spent in each phase
Interphase		
Prophase/prometaphase		
Metaphase		
Anaphase		
Telophase		

Determine the percentage of cells spent in interphase versus mitosis.

If the life cycle of the onion root tip cell is 24 hours, how many minutes will the average cell spend in phase of mitosis?

Phase	Minutes spent in each phase
Interphase	
Prophase/prometaphase	
Metaphase	
Anaphase	
Telophase	



This is a root tip that has been treated with a 1 M concentration of caffeine. Determine the percentage of cell involved in mitosis.

Does it appear that caffeine has an effect on the number of cells involved in mitosis?

Do a Chi-square analysis that determines whether a 1 M concentration of caffeine significantly affects mitosis.

Root tip (Get the Data from Part I		Root tip treated with caffeine	
Phase	Count	Phase	Count
Interphase		Interphase	
Mitosis		Mitosis	
Total Cell Count		Total Cell Count	

Percentage in mitosis untreated =

Percentage in interphase untreated=

	Mitosis	Interphase
Observed		
Expected		
Difference		

Chi square calculation

Is this value significant?

Part III.

The roots of several onion bulbs were removed. Then the remaining severed root mass of onions bulbs were submerged in a beaker of distilled water, and others were submerged in a beaker of water seeped with weeping willow bark. It has been reported that a substance found in the bark of the weeping willow is a root stimulator. The roots were allowed to regenerate for five days. After five days the roots were measured. To determine if there is a substance in the weeping willow bark that is a root stimulator, statistical analysis must be done. Part of the statistical analysis would include a t-test and determination of the standard deviation for each set of data. Determine the standard deviation for each set of data. Perform a t-test to determine if the differences between the two sets of data are significantly different in determining if a substance found in the bark of the weeping willow is a root stimulator.

Root #	Length (mm)	Difference from the mean	(Difference from the mean) ²	Root #	Length (mm)	Difference from the mean	(Difference from the mean) ²
1	7.7			1	12.1		
2	3			2	6.1		
3	2.2			3	5.5		
4	2.2			4	7.1		
5	4.9			5	5.9		
Mean		Sum		Mean		Sum	
	Standard deviation for untreated roots =				Standard deviation for treated roots=		
	t-test value=						

Lab 8

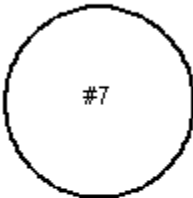
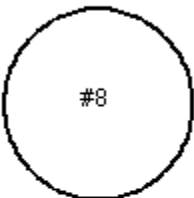
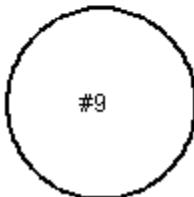
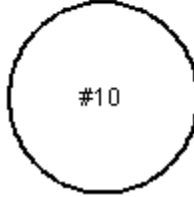
A scientist is using an ampicillin-sensitive strain of bacteria that cannot use lactose because it has a nonfunctional gene in the lac operation. She has two plasmids. One contains a functional copy of the affected gene of the lac operon, and the other contains the gene for ampicillin resistance. Using restriction enzymes and DNA ligase, she forms a recombinant plasmid containing both genes. She then adds a high concentration of the plasmid to a tube of the bacteria in a medium for bacterial growth that contains glucose as the only energy source. This tube (+) and a control tube (-) with similar bacteria but no plasmid are both incubated under the appropriate conditions for growth and plasmid uptake. The scientist then spreads a sample of each bacterial culture (+ and -) on each of the three types of plates indicated below.

	Glucose Medium	Glucose Medium with Amplicin	Glucose Medium with Amplicin and Lactose
Bacterial Strain with added plasmid (+)	#1	#2	#3
Bacterial Strain with no plasmid (-)	#4	#5	#6

1. If no new mutations occur, it would be most reasonable to expect bacterial growth on which of the following plates and be sure to justify your answer

2. Why were restriction enzymes used in this experiment?

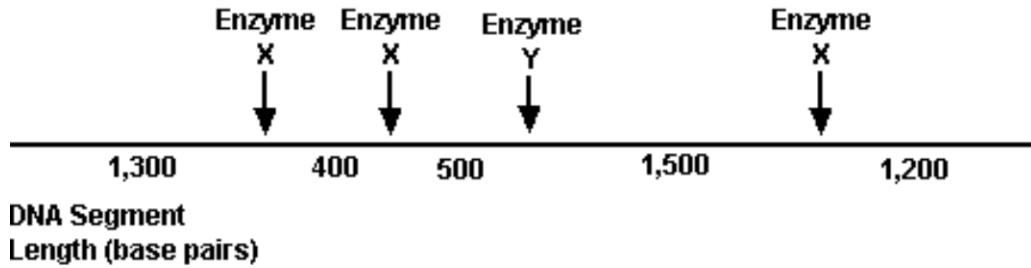
3. If DNA ligase was not used during the preparation of the recombinant plasmid, bacterial growth would most likely have occurred on which plates and justify your answer.

	Lactose Medium	Lactose Medium with Ampicilin
Bacterial Strain with added plasmid (+)		
Bacterial Strain with no plasmid (-)		

4. If another experiment was done with the cultures as shown above, using medium that contained lactose as the only energy source, growth would most likely occur on which of the following plates?

Lab 9

The diagram below shows a segment of DNA with a total length of 4900 base pairs. The arrows indicate reaction sites for two restriction enzymes (enzyme X and enzyme Y).

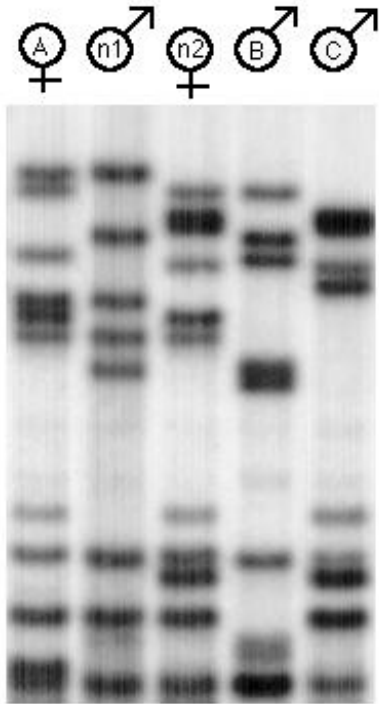


1. Explain how the principles of gel electrophoresis allow for the separation of DNA fragments.

2. Describe result you would expect from the electrophoretic separation of fragment from the following treatment of the DNA segment above. Assume that the digestions occurred under appropriate conditions and went to completion.

- I. DNA digested with only enzyme X
- II. DNA digested with only enzyme Y
- III. DNA digested with enzyme X and Y
- IV. Undigested DNA

3. Explain both of the following. The mechanism of action of restriction enzymes, and the different result you would expect if a mutation occurred at the recognition site for enzyme Y.

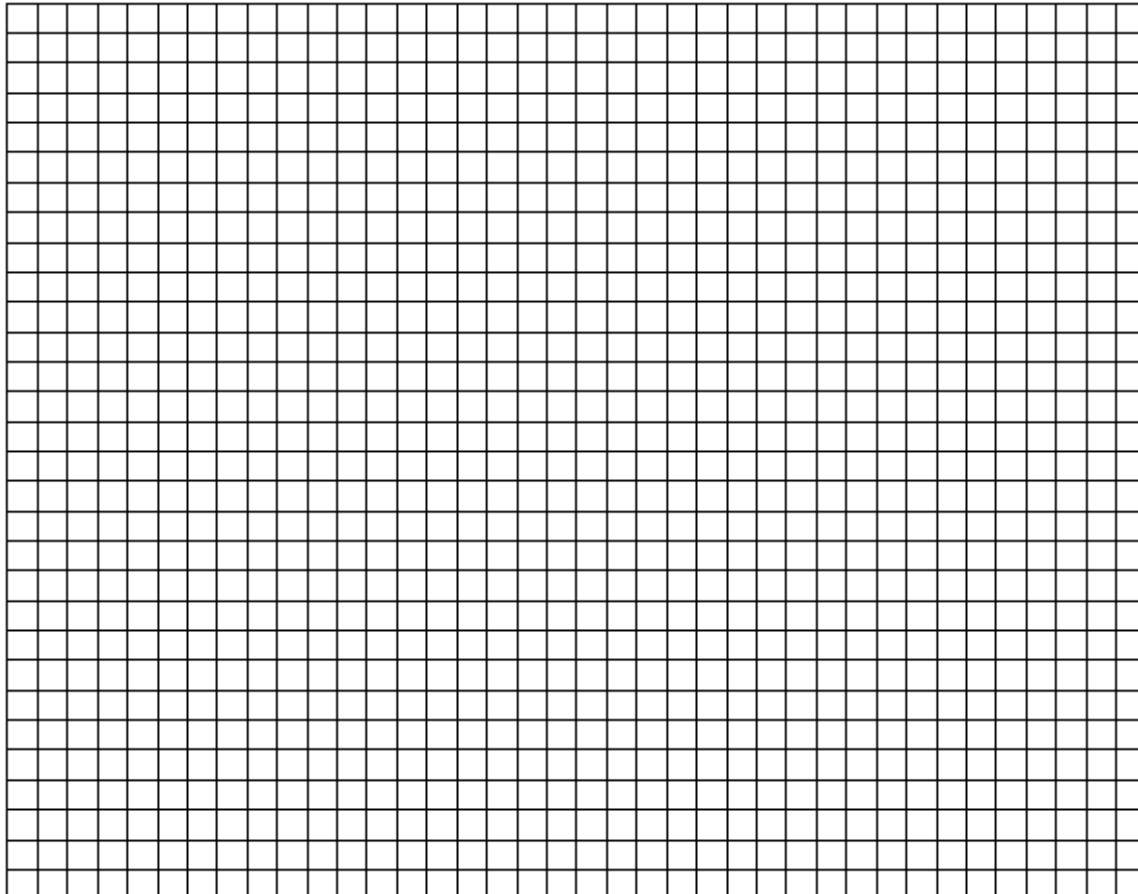


One female and two male adult hawks nested together. All the birds hunted in group and caught prey to feed the three nestlings. The female spend the most itme I the nest, but allowed Male C to help care for the nestlings. Male C would chase male B away. Prove who the parents are and how DNA technology aided in this quest.

Lab 11

		Water Loss mL Time (Minutes)			
Leaf Surface	Treatment	0	10	20	30
0.014	a. Room	0	0.03	0.064	0.092
0.016	b. Light	0	0.067	0.121	0.188
0.021	c. Fan	0	0.095	0.159	0.231
0.015	d. Mist	0	0.019	0.036	0.055

Water Loss mL/M ² Time (Minutes)				
Treatment	0	10	20	30
a. Room				
b. Light				
c. Fan				
D. Mist				



1. Explain the results of the lab in terms of water potential.

2. Why was it important to divide the water loss by the surface area of the leaves?

The experiment was repeated four more times for the untreated plant and the fan, The data is collected below.

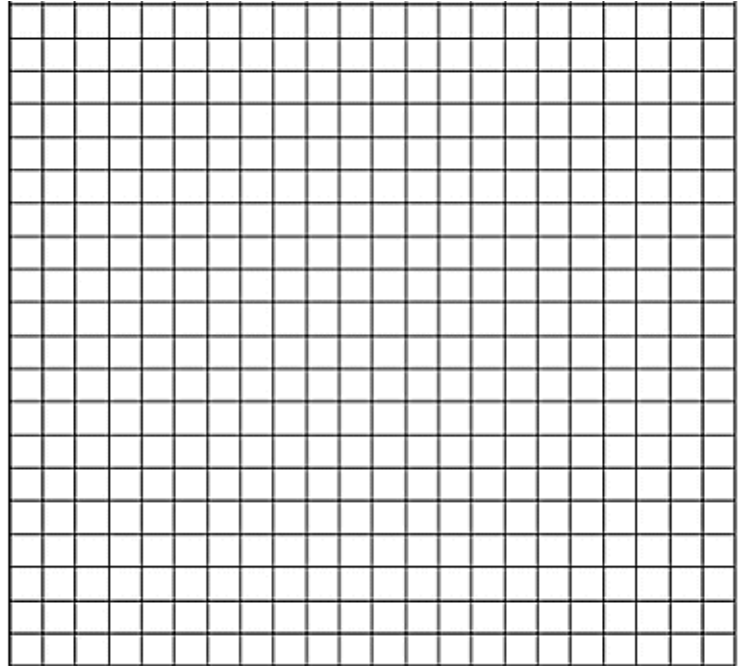
Untreated Plant	Rate of Transpiration mL/M ² /min	Difference from the mean	(Difference from the mean) ²	Fan	Rate of Transpiration mL/M ² /min	Difference from the mean	(Difference from the mean) ²
1	6.5			1	12.1		
2	5.4			2	13.2		
3	3.1			3	12.3		
4	6.8			4	14.1		
5	5.9			5	11.9		
Mean		Sum		Mean		Sum	
	Standard deviation for				Standard deviation for		
	t-test value=						

Determine the standard deviation of each set of data and perform statistical with a t-test to determine if the difference between means of the trials are statistically significant different.

Lab 13 Enzyme Lab

An investigation was determining the amount of oxygen released from the decomposition of hydrogen peroxide with enzyme catalase. This investigation was conducted at two different temperatures. Graph the data presented in the data table.

Time (minutes)	Amount of O ₂ released at 22°C (mL)	Amount of O ₂ released at 10°C (mL)
0	0	0
1	21	8
2	34	14
3	47	20
4	57	28
5	65	35
6	73	41
7	78	52
8	80	60
9	80	65
10	80	67



1. Is the relationship between time and amount of oxygen released proportional? Explain the relationship.

2. During what time frame is the rate of the reaction the fastest? Explain why.

3. What is the effect of a decrease in temperature in this investigation?

4. Determine the rate of the reaction from 0-1 minute.

5. Draw in a line for what the reaction would be if done at 37°C. Justify your prediction.

Trial	Average amount of O ₂ released at 22° (mL)	Difference from the mean	(Difference from the mean) ²	Trial	Average amount of O ₂ released at 15° (mL)	Difference from the mean	(Difference from the mean) ²
1	21			1	8		
2	19			2	7		
3	24			3	10		
4	18			4	11		
5	22			5	9		
Mean		Sum		Mean		Sum	
	Standard deviation				Standard deviation		
	t-test value=						

Determine the standard deviation of each set of data and perform statistical with a t-test to determine if the difference between means of the trials are statistically significant different.

Using the means from the two trials determine the value Q_{10} .