Weekend Core Biology
CORC 1321
at Brooklyn College

Lab Investigations

Investigations :

The lab exercises for the Weekend Core 3.21 course are a series of computer bio-simulations (developed by Professor J. Blamire @ Brooklyn College) that recreate specific laboratory experiments and are designed to complement the lecture material.

The Biology Computer room (2233N) is designated to the Weekend Core sections for your use. An instructor will be present during your assigned lab hours to offer assistance. The investigations can also always be accessed at any time from any internet connection. Computer access on the BC Campus is available at the Campus Library or Library Café.

Assignments :

Each assignment (or investigation) is due the following lab period and should be handed in to your instructor. You can check the schedule of labs listed on the website.

Late assignments are not accepted and you must complete your own work.

These investigations require data charts and graphs to be submitted to your instructor. Feel free to submit your own based on the examples given in the directions or notes, or you may use the tables and graphs provided here.

Investigation #1 - The Scientific Method

Text : *Essential Biology (??? Edition).* Campbell and Reece. pp. 13-18.

Web : Science at a Distance - Brother Gregory - Scientist
http://www.brooklyn.cuny.edu/bc/ahp/SCI/Science1/Sci1.HP.html

Assignment:

Read the material presented and visit all links.

What Scientists Do All Day?

There are <u>two</u> experiments in which you become the researcher. Your job is to try to find out if:

A. Sore feet can predict the weather.

- Record and turn in 10 observations by clicking on 'Sore Feet' 10 times and then 'See Results'
- State your conclusion: Can sore feet predict rain?

B. Atmospheric conditions can predict the weather

- Record and turn in 10 observations each by clicking on the 'Environment' button 10 times, then 'See Results' using these conditions: (1) *high pressure & hot temperature* (2) *low pressure & cool temperature*
- State your conclusions.
    - Can atmospheric conditions predict the weather with greater accuracy than sore feet?
    - Which conditions predict rain most often?

Investigations are due the next scheduled lab period.

Late investigations will NOT be accepted!

Investigation #2 - Genetics (Patterns of Inheritance)

Text : *Essential Biology (??? Edition)* . Campbell and Reece. pp. 144-148.

Web : Science at a Distance - Brother Gregory Investigates
http://www.brooklyn.cuny.edu/bc/ahp/MGInv/MGI.Q3.html

Background

Brother Gregory wants you to investigate the patterns of inheritance seen in his pea hybrids as the traits are inherited through two generations (called the F1 and F2 generations).

If he is right, and the form of a trait is controlled by a 'transmission element', an offspring receives one 'element' from its male parent and a second 'element' from its female parent.

Once in the body of the offspring, these 'elements' direct the development of the traits they control. It should be possible to determine what 'elements' each offspring inherits by the numbers, and ratios, of the offspring showing those traits.

Following a 'pattern of inheritance' requires:

- two parent plants that are 'pure breeding',
- performing a genetic cross using these plants to produce the F1 hybrids,
- recording the form(s) of the trait seen in the F1 generation of plants,
- using some of these F1 plants as parents in a second series of genetic crosses to produce the F2 hybrids,
- counting the number of times a version of a trait occurs in the F2 hybrids,
- calculating the ratios of plants showing one form to those plants showing the alternate form of a trait.

Think about this question as you do your investigation:

What different patterns of inheritance can be seen during genetic crosses, and how can these patterns be interpreted?

Assignment

First Genetic Cross - to produce F1 hybrids

- Select "pure breeding tall plant" from the Special Peas menu.
  This will become "TRAIT ONE" of Parent One (or Parent Two).

- Select "short plants" from the Traits menu.
  Click on "TRAIT ONE" of the other Parent.

You should now have two parent plants. You know that the 'tall' plant is 'pure breeding', but what do you know about the 'short' plant? Is it 'pure breeding'? How would you know? (Hint: haven't you checked this already?).

- Carry out the genetic cross by clicking on the "Collect Peas" box, collecting the seeds and then clicking on the "Plant Peas" button.
  The new peas will grow and number and type of offspring will appear in the boxes underneath.

- Write down, and record your results in the data table given to you

- Repeat this type genetic cross experiment five times, and then use the other 'special pea' that is 'pure breeding for the purple flowered plant'. The other parent in this cross should hold the 'white flowers' trait.

This is now the data for the 'pattern of inheritance' seen as Mendel's transmission elements are passed from the original parent plants into the first generation of hybrids, the F1 hybrids.

First Genetic Cross - to produce F1 hybrids

Cross 1a data: *"pure breeding tall plant*" and *"short plants"*

cross #	total Fl offspring	# tall plants	# short plants	ratio of tall : short plants
1				
2				
3				
4				

Questions based on your data:

1. What should the experimental ratios be for each cross?
   Hint: Figure out the genetic make-up of your plants with a Punnett Square.

2. Do the experiment ratios match your actual ratios? YES NO

3. If 'NO, explain why there may be a discrepancy.

Cross 1b data: *'pure breeding for the purple flowered plant'* and *'white flowers'*

cross #	total Fl offspring	# purple flowers	# white flowers	ratio of purple : white flowers
1				
2				
3				
4				

Questions based on your data:

1. What should the experimental ratios be for each cross?
   Hint: Figure out the genetic make-up of your plants with a Punnett Square.

2. Do the experiment ratios match your actual ratios? YES NO

2. If 'NO, explain why there may be a discrepancy.

Second Genetic Cross - to produce F2 hybrids

One of the F1 hybrid plants (produced in the first round of genetic crosses) must be one of the parents in the second round of genetic crosses.

To do this,

- click on the 'special pea' called "an F1 seed from a tall/short cross" and this version of the trait will become one of the parents.

You can now cross this F1 hybrid plant with three other types of plant:

1. another F1 hybrid plant from a tall/short cross. To do this click again on that 'special seed'. Both parents should now be these F1 hybrids.

2. a 'tall plant' selected from the Traits menu.

3. a 'short plant' selected from the Traits menu.

Repeat these genetic cross at least 4 times each. Record all the results on the tables provided at the end.

Second Genetic Cross - to produce F2 hybrids

Cross 1 data: *F1 seed from a tall/short cross* and *F1 seed from a tall/short cross*

cross #	total F2 offspring	# tall plants	# short plants	ratio of tall : short plants
1				
2				
3				
4				

Cross 2 data: *F1 seed from a tall/short cross* and *a tall plant seed*

cross #	total F2 offspring	# tall plants	# shorts plants	ratio of tall : short plants
1				
2				
3				
4				

Cross 3 data: *F1 seed from a tall/short cross* and *short plant seed*

cross #	total F2 offspring	# tall plants	# short plants	ratio of tall : short plants
1				
2				
3				
4				

<u>Questions based on your data</u>: (use extra paper if necessary!)

1. What should the experimental ratios be for <u>each of the three crosses above</u>? Hint: Figure out the genetic make-up of your plants with a Punnett Square.

2. Do the experiment ratios match your actual ratios? YES NO

3. If 'NO, explain why there may be a discrepancy.

Calculation of ratios - The Raw Data

Brother Gregory was able to make sense of his raw data because of the way he interpreted the relationship between the sets of numbers.

In one of his famous experiments, he obtained the following results for a cross of two F1 plants to give the F2 offspring:

Total F2 offspring = 1064

Length of Stem = 787 tall, 277 short

What does this raw data mean?

1. Percentages: Mendel calculated the percent of his F2 plants that were tall,

   e.g.

   percent tall = 787/1064 x 100 = 73.96%

2. Ratios: Mendel calculated the ratio of tall/short plants, e.g.

   Ratio (tall/short) = 787/277 = 2.84 : 1

When interpreted this way, the variation in the raw numbers seen from one experiment to the next, suddenly vanishes! In the F2 generation, the percentage of tall plants (and the percentage of short plants) becomes constant (or almost so), and the ratio of one version of the trait to the other version also becomes almost constant!!

Investigation #3 - Classification

Text : *Essential Biology (??? Edition)* . Campbell and Reece. pp. 286-291.

Web : Mendel and the Species Problem
http://www.brooklyn.cuny.edu/bc/ahp/AVC/Inv/One/VCB.Inv.One.html

Assignment:

Under "Investigation Number One" go on to
"2) Here is your first research assignments from Brother Gregor"

Brother Gregory's First Research Assignment: Sorting into Groups

Submit your investigation following the directions given and using the data presented in the --> First Experiment <--

Use only one folio for your investigation.

You should put into your report:

- A classification scheme (taxonomy) showing the groups (taxa) that you have created.
- The rationale for the adopted scheme.
- A list of all the organisms seen in the Folios, showing in which group each organism should be placed.
- Your scheme should be organized similar to a flow-chart (refer to your lab notes).

Your report should include answers to these five assignment questions as well:

1. What is a taxonomy?
2. Give two examples of current taxonomies used in biological science.
3. Why do scientists classify organisms into groups?
4. What is a good example of a modern classification criterion?
5. What is a species?

Investigations are due the next scheduled lab period.

Late investigations will NOT be accepted!

Investigation #4 - Patterns of Evolution

Text : *Essential Biology (??? edition)* . Campbell and Reece. pp. 286-291.

Web : Mendel and Darwin's Problem
http://www.brooklyn.cuny.edu/bc/ahp/AVC/Inv/Two/VCB.Inv.Two.html

Assignment:

Under "Investigation Number Two" go on to
"2) Here is your second research assignment from Brother Gregor"

Brother Gregory's Second Research Assignment: Phylogenies

Create and submit a portfolio following the directions given and using the data presented in **one** of the following sets:

← Set-B →, ← Set-C →, ← Set-D →, ←Set-E →.

You should put into your portfolio:

- A chart containing the following (given on the following page):
    1. determine the age of the rock (gives a time line to work with)
    2. give each species a scientific binomial name
    3. make some notes about the creatures (size, shape)
    4. numbers of each type of organism
- A phylogeny for the creatures seen in the set you have chosen.

Your report should include answers to these five assignment questions as well:

1. What is a phylogeny? Your answer should include an explanation of anagenesis and cladogenesis.
2. Give two examples of trends or patterns seen in various phylogenies. What type of events are being see?
3. Why do scientists study phylogenies? What can we learn from them?
4. Other than the examples in this exercise, give two other examples of well studied phylogenies.
5. What role does adaptation and variation play in determining the patterns of evolution?

Investigations are due the next scheduled lab period.

Late investigations will not be accepted!

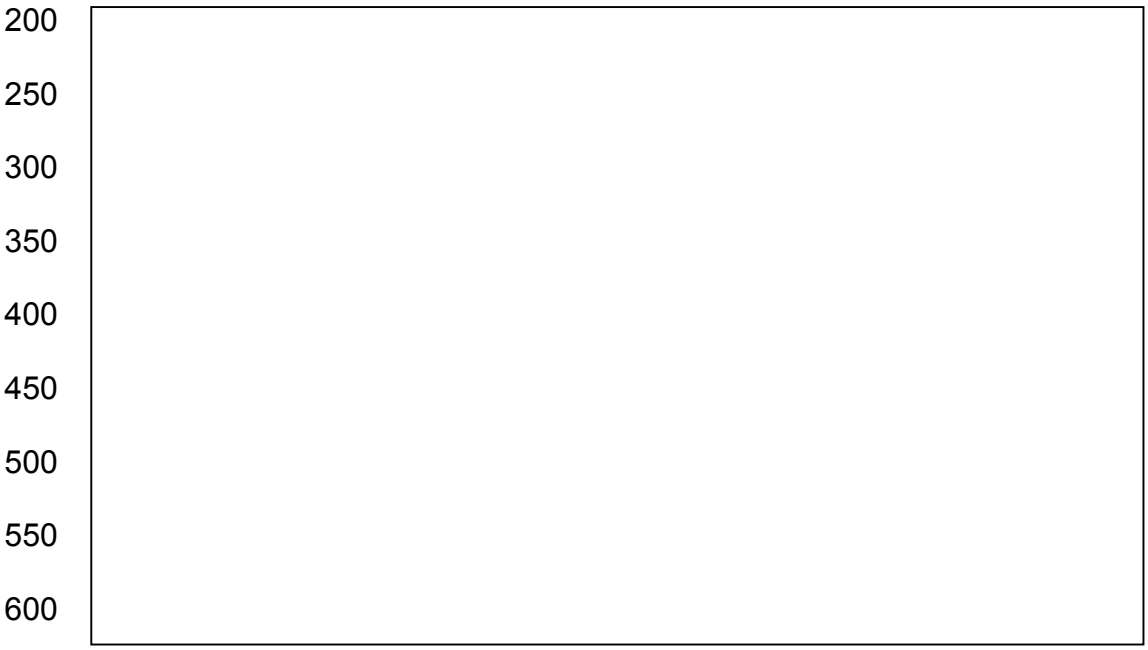
Brother Gregory's Second Research Assignment: Phylogenies

Determine the phylogenies of the creatures within each set of tiles:

Note: You may have to extend your chart if you have more than 2 organisms (fossils)

layer	height (cm)	tile age (my)	time line (mya)	organism (1)	size (units)	#	organism (2)	size (units)	#
6									
5									
4									
3									
2									
1									

Phylogeny



Time (mya)

Investigation #5 - Ecological Niche

Text : *Essential Biology (3rd Edition)* . Campbell and Reece. pp. 408-409.

Web : Brother Gregory Investigates (Ecological Niche)
http://www.brooklyn.cuny.edu/bc/ahp/CellBio/Growth/MGecol.html

---

Assignment:

Read all material and follow directions in the investigation.

In this investigation you will determine the best growth conditions for four different microbes by growing them under a variety of conditions of temperature and pH to find out the upper and lower limits for each species.

These values for these variables will define the "ecological niche" for each microbe.

Submit your results using the tables and graphs provided.

This investigation has only one assignment question:

1. Do your results prove or disprove Gause's Principle? Why?

Investigations are due the next scheduled lab period.

Late investigations will not be accepted!!

Investigation #5 - Ecological Niche (data)

Effects of Temperature - **Results Table**

Organism: ____________________

T (°C)	generations per minute	log value of generations per
0		
5		
10		
15		
20		
25		
30		
35		
40		
45		
50		
55		
60		
65		
70		
75		
80		
85		
90		

Organism: ____________________

T (°C)	generations per minute	log value of generations per
0		
5		
10		
15		
20		
25		
30		
35		
40		
45		
50		
55		
60		
65		
70		
75		
80		
85		
90		

Organism: ____________________

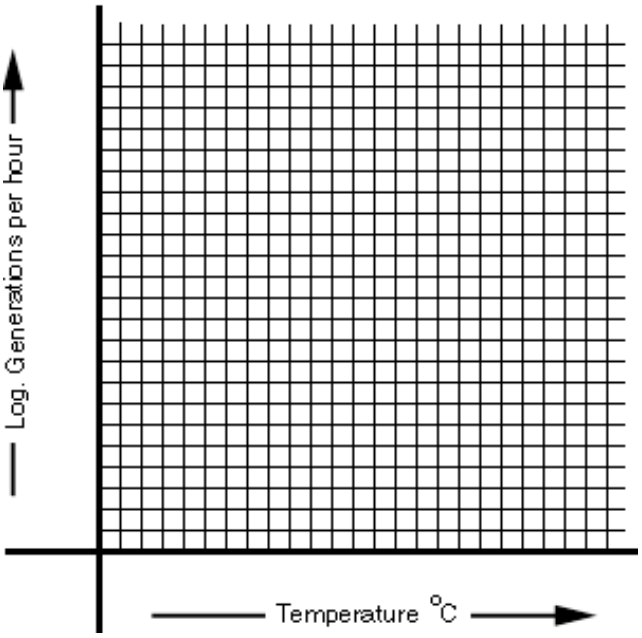
T (°C)	generations per minute	log value of generations per
0		
5		
10		
15		
20		
25		
30		
35		
40		
45		
50		
55		
60		
65		
70		
75		
80		
85		
90		

Organism: ____________________

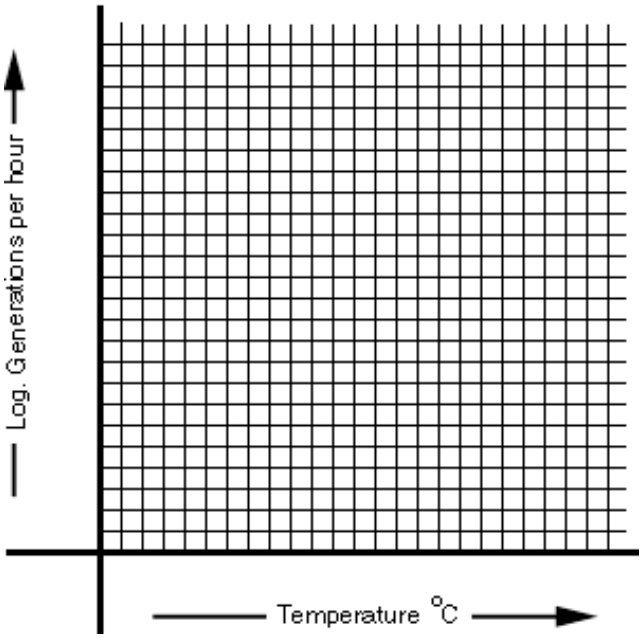
T (°C)	generations per minute	log value of generations per
0		
5		
10		
15		
20		
25		
30		
35		
40		
45		
50		
55		
60		
65		
70		
75		
80		
85		
90		

Effects of Temperature - **Results Graph**

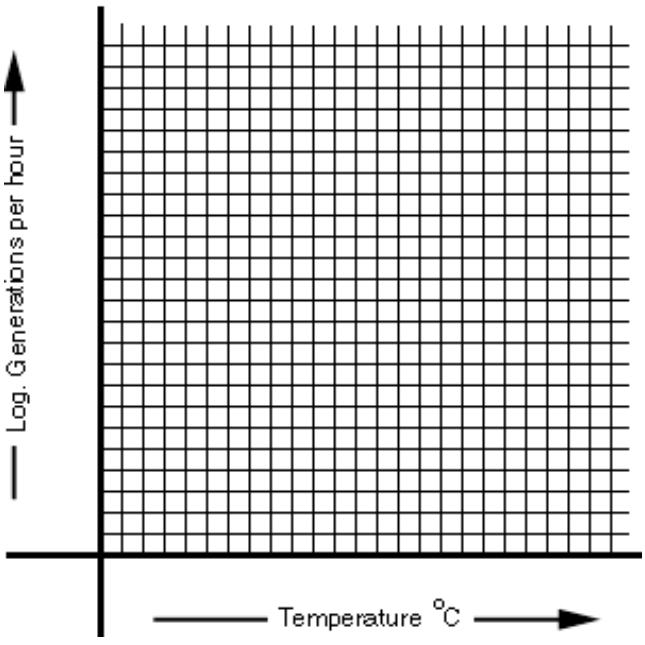
Organism: _____



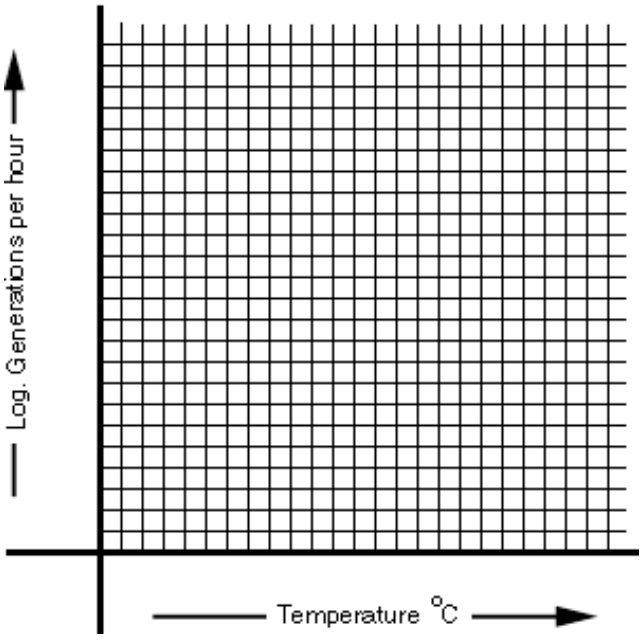
Organism: _____



Organism: _____



Organism: _____



Investigation #5 - Ecological Niche (data)

Effects of pH - **Results Tables**

Organism: ____________________

pH	generations per minute	log value of generations per
1.0		
1.5		
2.0		
2.5		
3.0		
3.5		
4.0		
4.5		
5.0		
5.5		
6.0		
6.5		
7.0		
7.5		
8.0		
8.5		
9.0		
9.5		
10.0		

Organism: ____________________

pH	generations per minute	log value of generations per
1.0		
1.5		
2.0		
2.5		
3.0		
3.5		
4.0		
4.5		
5.0		
5.5		
6.0		
6.5		
7.0		
7.5		
8.0		
8.5		
9.0		
9.5		
10.0		

Organism: ____________________

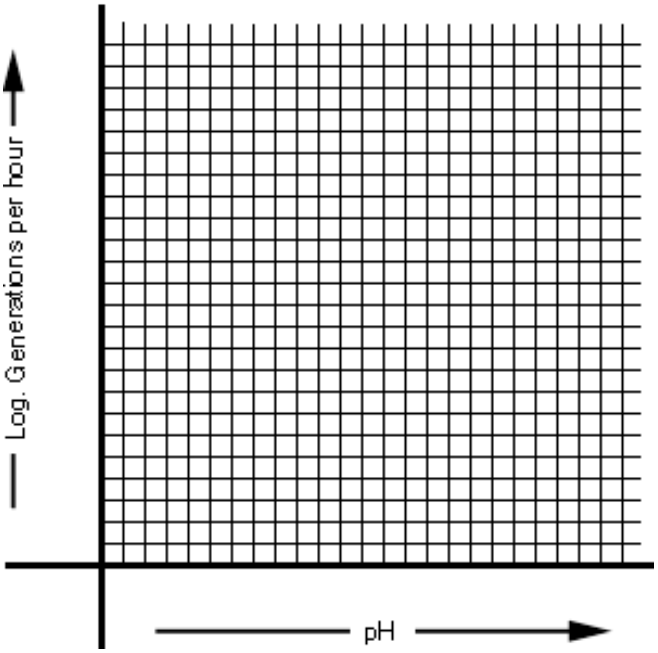
pH	generations per minute	log value of generations per
1.0		
1.5		
2.0		
2.5		
3.0		
3.5		
4.0		
4.5		
5.0		
5.5		
6.0		
6.5		
7.0		
7.5		
8.0		
8.5		
9.0		
9.5		
10.0		

Organism: ____________________

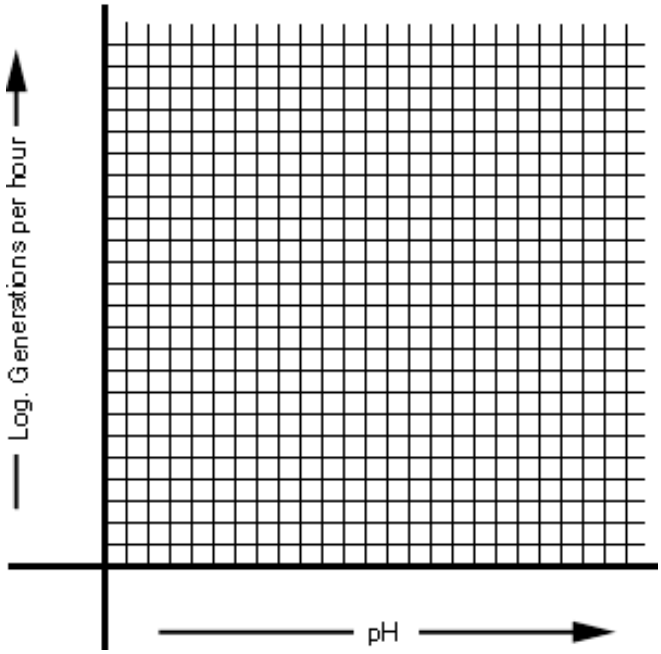
pH	generations per minute	log value of generations per
1.0		
1.5		
2.0		
2.5		
3.0		
3.5		
4.0		
4.5		
5.0		
5.5		
6.0		
6.5		
7.0		
7.5		
8.0		
8.5		
9.0		
9.5		
10.0		

Effects of pH - **Results Graphs**

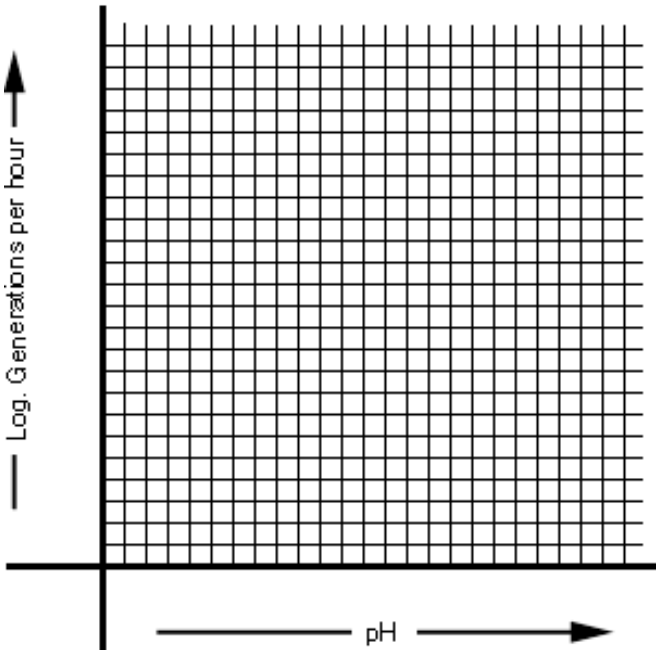
Organism: _____



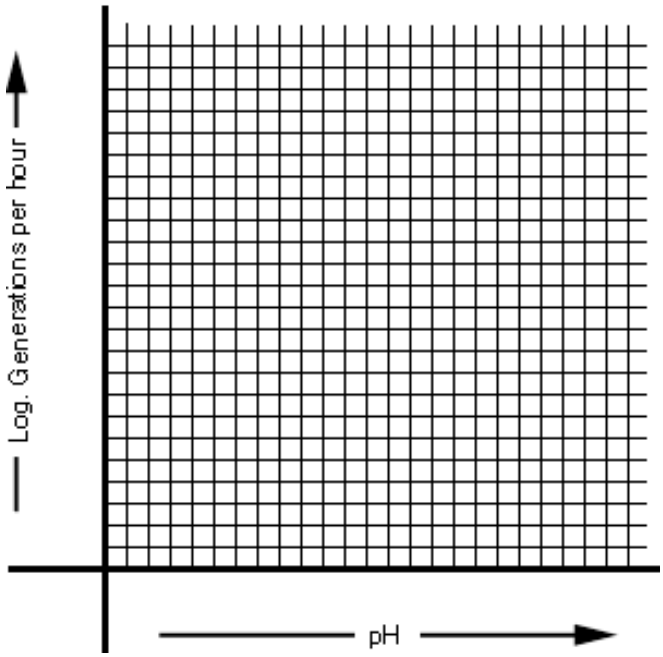
Organism: _____



Organism: _____



Organism: _____



Investigation #5 - Ecological Niche (final results)

Ecological Niche - **Results**

organism	pH range (low to high)	temperature range (low to high)