Science 12500: Principles of Life Science: Fall 2019

Course Description:

This course focuses on some of the major characteristics that define and differentiate all living things. We will examine local biodiversity, particularly the different trees and insects that are found in NYC parks and on NYC streets. Evolution will link the major course themes, that so many different kinds of living things exist, and yet that all living things share common ancestry.

Schedule: Tuesdays and Thursdays, 10:00am-11:40am
Room: NAC 5/215
Instructor: Professor Yael Wyner
Office: NAC 5/205c
Email: ywyner@ccny.cuny.edu Do **NOT** email me at my blackboard email (visser). **It does not work**.
Phone: 212-650-5869
Office Hours: By appointment. Generally student prefer to meet after class on Tuesdays and Thursdays.

Policy on Academic Integrity:
Under the CUNY Student Academic Integrity Policy (http://web.cuny.edu/academics/info-central/policies/academic-integrity.pdf) "Academic Dishonesty is prohibited in The City University of New York and is punishable by penalties, including failing grades, suspension, and expulsion, as provided herein." Violations of this policy fall into these areas that include but are not limited to:

- Cheating
- Obtaining Unfair Advantage
- Falsifying of Records and Official Documents
- Plagiarizing

Here are more details on plagiarism from the CUNY academic integrity policy:
Plagiarism is the act of presenting another person's ideas, research or writings as your own.
The following are some examples of plagiarism, but by no means is it an exhaustive list:

- Copying another person's actual words without the use of quotation marks and footnotes attributing the words to their source.
- Presenting another person's ideas or theories in your own words without acknowledging the source.
- Using information that is not common knowledge without acknowledging the source.
- Failing to acknowledge collaborators on homework and laboratory assignments.

Internet plagiarism includes submitting downloaded term papers or parts of term papers, paraphrasing or copying information from the internet without citing the source, and "cutting & pasting" from various sources without proper attribution.

I welcome any questions you may have concerning academic integrity and will do my best to help you understand the standards of academic scholarship. I use CUNY guidelines to sanction any incidents of academic dishonesty in my courses. Any student who violates this policy will FAIL the course.

Reading: The required book for this course is *NYC Trees: A Field Guide for the Metropolitan Area* by Edward Sibley Barnard (2002). Additional readings will be posted on Blackboard. Make sure that you check blackboard for reading assignments.

Blackboard: All students must use CUNY electronic blackboard. It is assumed that you will check blackboard for all assignments and announcements. Blackboard includes a feature that automatically sends announcements via email.

Course Requirements:
Active participation; consistent and timely attendance
Reading of assignments
Timely completion of all required work
Because of the participatory nature of the class, timely attendance is mandatory. You are allowed one absence or three late arrivals (5 minutes late) with no questions asked. Beyond that, I reserve the right to lower your semester grade, if appropriate.

Grading:

1) Assignments: 35%
   I. Green Down Study Protocol (5%): Bring 2 draft copies for class on Tuesday, 9/17; final due Thursday, 9/24.
   II. Green Down Data, Graphs, Data Analysis & Presentation 15%) due Tuesday, 12/10
   III. Natural Selection Write-Up (10%): Post this protocol online by Tuesday, 10/22 @11:59pm; Post comments on protocols of three other groups by the end of the day Wednesday, 1022; Experiment on 11/7 Write up due: 11/14
   IV. Candy Bar Phylogeny (5%): Due 11/21

   All assignments are due at the start of class time, unless otherwise noted. If you are absent from class, you are still responsible for submitting the assignment by the start of class time.

2) Midterm & Final: 55%
   I. Midterm- Thursday, 10/31 (25%)
   II. Final – Tuesday, 12/17 (30%)

3) Participation: 10%
   Active engagement in all aspects of the class including online discussions. Since you need to be present to perform well in this part of the class, make sure you come to class on time and are not absent. Tree census photos posted in the online discussion board count as present for the tree census class.

Class	***Date***	***Topic***	***Due***
1	Tuesday, 8/27	Introduction Close Observation	Biology pg. 154-157
2	Thursday, 8/29	Put a Name on It Characteristics	
3	Tuesday, 9/3	St. Nicholas Park- Support or Reject Your Hypothesis	Tree Guide **Bring in plants to press**
	Thursday, 9/5	**No Class- Monday Schedule**	
4	Tuesday 9/10	Green Down- Planning Your Green Down Study	Introduction to the Scientific Method: http://teacher.nsrl.rochester.edu/phy_labs/AppendixE/AppendixE.html
5	Thursday, 9/12	Preparing Plant Specimens	

		St. Nicholas Park/Street Trees	
6	Tuesday, 9/17	Discussion and Peer Editing of Green Down Protocol Drafts	**Bring in 2 copies of your drafts.**
7	Thursday, 9/19	Flowers (Function and Form) Flower to Fruit	Botany: Flower structure 87-89
8	Tuesday, 9/24	Catkins versus Showy Flowers	**Green Down Protocol Due**
9	Thursday, 9/26	Fruits and seeds Acorns versus Samaras	Botany: Seeds 81-86
	Tuesday, 10/1	**No Classes Today**	
10	Thursday, 10/3	Is the willow oak an oak or a willow? Is the redbud a legume? Is the London plane a maple?	
	Tuesday, 10/8	**No Classes Today**	
11	Thursday, 10/10	Sort the trees - Common ancestors	
12	Tuesday, 10/15 **(no in class meeting)**	Tree Census	**- Photograph 2 tree species from an empty lot.** **- Do not post bushes** **- Identify and post online in the body of the post (not as an attachment)** **- Identify and describe location**
13	Thursday, 10//17	Which Plants Belong Together? What does it mean to be closely related?	
14	Tuesday, 10/22 **(no in class meeting)**	Natural Selection – Plan your study	**Natural Selection Protocol Posted by Tuesday, 10/22 11:59pm** **Comments on protocols of three other groups should be posted by end of the day Wednesday, 10/22**

			Instructor Feedback posted by class time Tuesday, 11/5
15	Thursday, 10/24	Sorting - Common Ancestors and Discussion	
16	Tuesday, 10/29	Angiosperms Versus Gymnosperms	
17	Thursday, 10/31	**Midterm**	
18	Tuesday, 11/5	Evolution/Natural Selection Introduction	Last day to withdraw from class (midterm exams graded)
19	Thursday, 11/7	Mechanisms of Natural Selection – Experiment	
20	Tuesday 11/12	Natural Selection - Mechanism	Evolution: Variation 60-68 Evolution: Natural Selection 73-74
21	Thursday 11/14	Evolution: Common Ancestry	**Natural Selection Write Up Due**
22	Tuesday, 11/19	Candy Bar Phylogeny	Evolution Tree of Life: 125-138
23	Thursday, 11/21	Arthropods Insect Biodiversity Insect Orders	**Candy Bar Phylogeny Write Up Due** Kaufman basic insects: pgs. 7-14
24	Tuesday, 11/26	Insect life cycles Insect Common Ancestry	
	Thursday, 11/28 (Thanksgiving)	**No Class- Thanksgiving**	
25	Tuesday, 12/3	Examination of Arthropod Groups	
26	Thursday, 12/5	Tree-thinking Evolution: Final Exam Review	
27	Tuesday, 12/10	Green Down Presentations	**Green Down Data and Graphs Due**
28	Thursday 12/12 (Last Day of Classes)	Green Down Presentations	
	Tuesday 12/17	**Final Exam**	

Planning Your Green Down Study

In this project, you will ask and answer your own research question about some aspect of leaf fall (green down) in NYC trees. You will design a study that will help you learn about falling leaves of the trees that you see on a daily basis. There are many possible questions to consider. You might have questions about the timing, color, or duration of green down or perhaps you are interested in comparing different species, microclimate, or elevation. These are just some topics to think about when determining your research question and designing your study. Good Luck!

Due Dates:

I. Green Down Study Protocol (5%): Bring 2 draft copies for class on Tuesday, 9/17; final due Thursday, 9/24.
II. Green Down Data and Graphs, Presentation (15%) due Tuesday, 12/10

I. Green Down Protocol Should Include These Parts:

a. Research Question
b. Introduction
c. Hypothesis
d. Study Design
e. List of Steps Taken to Limit Variables (strengths)
f. List of Uncontrolled Variables (weaknesses)

A: Research Question: Today you will determine your research question and begin to design a study that will help you answer this question.

Example Research Question:

Do leaves on the Norway maple change color earlier than leaves on the London plane?

Once you have determined a question. Follow this sequence to design your study:

B: Introduction: Do some research about green down. Why does it happen? What affects it? Contextualize your research question in prior research. It should be relevant to your discussion to show how your information fits with what other people have documented. Make sure to reference your sources and that they are RELIABLE.

C: Hypothesis: You want to make sure that your research question is **testable**. The best way to do that is to transform your research question into a hypothesis, a testable statement (sometimes written as a prediction). If you write a hypothesis and you cannot think of how to test it as written, rewrite it so that it is in a form that helps you test it. Your study should be designed to either support or reject your hypothesis. Again, if a study does not logically follow from your hypothesis statement, you might want to rethink your question or hypothesis, so that you develop a hypothesis that is testable.

Example Hypothesis:

Leaves on the Norway maple change color earlier than leaves on the swamp white oak.

D: Study Design: Describe your study design. Include:

1. Total number and species of trees you will observe
2. Which partner will observe which trees and tree locations
3. Timing of observation schedule

4. Diameter of trees at breast height (DBH)
5. GLOBE protocol (including how to measure color, number of leaves observed, how leaves are marked, etc.)
6. Type of documentation used
7. Blank Data Table

E. List of Steps Taken to Limit Variables (strengths): The most important part of this section is to make sure that your findings are the most robust as they can be, given the limited nature of our class. Describe how you plan to limit variables to make your study more **robust** (e.g. look at equivalent sized Norway maples and London plane trees, i.e. same side of street, same size, same branch position, same health etc.; frequent measurement, sample size)

F. List of Poorly Controlled Variables (weaknesses): You cannot limit all variables. Please describe weaknesses that you were not able to eliminate or reduce.

(Steps A-F are due by **Tuesday, 9/17, 2 copies in class**; final version due in-class **Thursday, 9/24**.)

Protocol Rubric:

Category	**5**	**3**	**1**
Research Question 5%	Clearly Stated and Relevant	Stated, but awkward and not totally relevant	Poorly stated, irrelevant
Introduction 15%	Well researched and relevant.	Researched and Relevant	Poorly researched and irrelevant
Hypothesis 10%	Clearly Stated and Testable	Stated, but not clearly testable	A sentence that is clearly not testable
Study Design 20%	Methods are described in a manner that allows someone unfamiliar with your project can replicate it.	Methods are described in a manner that partially allows someone unfamiliar with your project can replicate it.	Methods are described in a manner that does not in any way allow someone unfamiliar with your project can replicate it.
List of Limited Variables 20%	A complete description of steps taken to limit variables	A partial description of steps taken to limit variables	List of steps taken to limit variables is missing or incoherent.
List of poorly controlled variables - Weaknesses 20%	A complete description of weaknesses that you were unable to address.	A partial description of weaknesses that you were unable to address.	A missing or incoherent description of weaknesses that you were unable to address.
Writing **Part of all sections.**	Well-written. Topic sentence for each paragraph where appropriate. Only one major idea per paragraph. Proper grammar.	Possible to follow, but contains some grammatical errors and paragraphs may not be completely well-defined.	Poorly written, paragraphs do not have topic sentences and contain too many ideas. Poor grammar
Organization & References 10%	Well-organized and easy to follow. References properly cited.	Mostly organized. References mostly properly cited.	Disorganized and hard to follow. References poorly cited.

Green Down Data, Graphs, Data Analysis & Presentation (15%) due Thursday, 12/10:

Data, Graphs & Data Analysis : Hand in a hard copy of graphs, data tables, conclusion, strengths, weaknesses, & further questions on 12/10. This hard copy will be used to more closely evaluate the components of your presentation. (e.g. How does your graph look? Did you properly label axes, title graph, etc.?). Label each section with a subheading.

a. Data Tables:
    a. Name of species
    b. DBH of each tree
    c. Description of each tree location
    d. All observed dates and descriptions
b. Graphs
    a. A bar graph that describes the timing of leaf fall or leaf color change. You can average your data from all four leaves of your tree. Put all your data on one graph. It makes comparison easier (mandatory). Make sure graph is properly titled and labeled.
    b. A pie chart to compare peak leaf colors amongst your trees. If you choose to make a pie chart, please choose colors that match the colors of your leaves (optional).
c. Conclusion: What did you learn from this study? Did you support or reject your hypothesis or do you need more data to make conclusions?
        i. How does your information fit with what other people have documented? You should refer to the information in your introduction.
d. Strengths: What were the strengths of your research? (bulleted list)
e. Weaknesses: What were the weaknesses of your research? (bulleted list)
f. Further Questions: Where would you go from here? (bulleted list)
        i. What new questions can you develop based upon your research?
        ii. How would you test any new hypotheses that you develop? If applicable, think of the weaknesses of your current study and include how you would address them.

Presentations: Make a 10-minute PowerPoint presentation of your study. Use the rubric below for guidance on the elements to include in your presentation.

Presentation due **Thursday, 12/10**

Presentation & Graph, Data Analysis Rubric 15%: All presentations should be well- designed and visually appealing. Make sure to

- Use large font sizes
- Include color photos of your tree leaves
- Follow format below for good organization
- Use bulleted lists
- Do not use full sentences (minimize words)

Category	**5**	**3**	**1**
Research Question, Hypothesis & Observation Sites & description **10%**	Include research question & hypothesis. Description of study site includes location, tree name, tree DBH and any other	Include research question & hypothesis. Description of study site includes location, tree name, tree DBH and any other relevant details (e.g. street	Mostly missing and poorly explained

	relevant details (e.g. street or park). Clear and Concise	or park). Not as clear or concise.	
Data Tables (<u>Hard copy only!</u> Do not include in presentation) 10%	Complete, clear and easy to follow. Include all relevant information like DBH, all data, tree name, tree location.	Mostly complete, clear, and possible to follow. Includes most relevant information.	Incomplete and hard to follow
Graphs & Data Analysis & Conclusion 40%	Complete, Proper scale, Labeling of axes, Appropriate title. Reports appropriately on findings from data. Makes well thought out conclusions from data and connects it to prior research on this topic.	Mostly complete, but missing a few items with some items incorrect. Mostly reports appropriately on findings from data. Makes thought out conclusions from data and connects somewhat to prior research on this topic.	Incomplete and poorly constructed. Missing many components. Reports on inappropriate findings from data. Makes poorly thought out conclusions from data and does not connect to prior research on this topic.
Strengths and Weaknesses **20%**	Well-thought out description of limitations and strengths and how to make study more robust. (Relate back to variables in protocol).	Includes description of limitations and strengths and how to make study more robust. (Relate back to variables in protocol).	Poor discussion of strengths and weaknesses and how to make study more robust. Does not relate back to variables in protocol.
Further Questions 20%	Describes well-thought out questions for further research.	Describes questions for further research.	Describes poorly thought out questions for further research.
Delivery & presentation Quality Embedded in sections above (except data table)	Speaks clearly and with energy. Large font size used. Visually attractive with photos; Well organized; no extra words on slides.	Speaks mostly clearly. Large font size, and includes photos. Too many words per slide.	Unclear in speaking; Font too small; Full sentences on slides.

Natural Selection Assignment:

Part 1: Protocol: With a partner, choose a factor to test that will affect speed of samara fall and design an experiment to test that factor.

Post this protocol online by Tuesday, 10/22 @11:59pm; Post comments on protocols of three other groups by the end of the day Wednesday, 1022; Experiment on 11/7

Make sure you include and organize according to these four sections:

1. Your research question
2. Your hypothesis
3. MATERIALS
4. Research Design (This design should address all of the questions listed in the questions below, but do not organize by answering questions.)

Some things to think about:

1. How will you modify your samaras?
2. How many replicates will you include?
3. Will you do more than 1 trial with each samara?
4. How will you mark your samaras?
5. How will you time your samara fall?
6. How will you record your data?
7. How will you analyze your data?
8. What characteristics are you controlling and what characteristic is your variable?

Part 2: Class 11/7: Implement your Experiment: With partner

1. Modify samaras
2. Collect and record data

Part 3: Experimental Write-up: Do this section on your own.

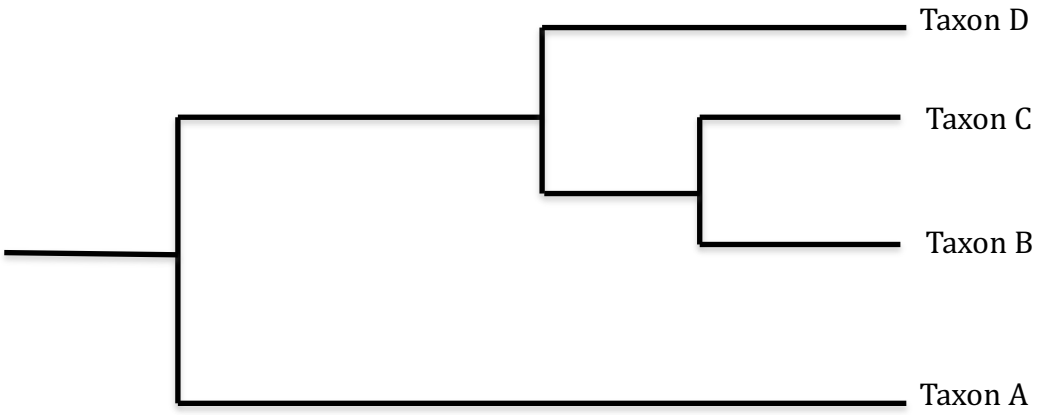
Write up due: 11/14

Items to Include

1. The revised protocol, i.e. parts 1-4 above
2. Data analysis (graph of your data)
3. Conclusions
    a. Interpret your data: Relate this section back to your hypothesis
    b. Describe strengths and weaknesses of your research
    c. What further experiments can you do to make your research design more robust?
    d. Describe two other research questions you have and why they are interesting.

Candy Bar Phylogeny Instructions: Due 11/21

1. In groups examine the four candy bars in your packet.
2. Choose one of them as an outgroup and justify.
3. Determine your characters for developing your evolutionary hypotheses (trees)
4. Create a presence absence matrix for at least 4 phylogenetically informative characters (shared derived characters or synapomorphies), 2 shared primitive characters (pleisiomorphies) and one character that is an apomorphy (unique) for each of the species you have chosen. 4 synamorphies; 2 pleisiomorphies; 4 apomorphies (1/species)
5. Draw the three trees that are possible for your three ingroup taxa. Sample tree (taxon A) stays as outgroup, meaning there are only 3 possible trees.



6. Use the characters you scored for these candy bars to pick the best tree.
7. Answer these questions:
    a. How come your best tree is the best?
    b. Use your characters and best tree to explain why your two most closely related taxa are most closely related.
    c. Why is your outgroup your outgroup?
    d. How does your outgroup help you determine the characters are ancestral and the characters that are derived?