

SCI 341: Biological Concepts and Applications

Fall 2015 : Class meetings: T TH 8:45-9:50, SRTC B1-82

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Overview

Biological Concepts and Applications (SCI 341) is designed to provide you with the opportunity to delve into the sources of life and diversity on our planet; DNA, evolution and speciation and to discuss how these topics are relevant in our modern society. In addition to in-class presentations, discussions and activities, you will be conducting individual investigations and inquiry-based projects. The successful completion of these projects will require that you (a) work independently and collaboratively, (b) use the PSU library and associated databases to access scientific articles, (c) collect data (d) organize, analyze and present information and (e) arrive at and defend substantiated (thus persuasive) conclusions.

Course objectives

- 1) Students will understand and apply the basic concepts of biology related to DNA and sources of species diversity.
- 2) Students will find and use primary literature resources and governmental databases to learn about current applications of DNA and genetic studies.
- 3) Students will design, conduct, present and defend a scientific study related to biology.

Expectations

- Be **prepared** for class
 - Arrive on time (absence will result in the loss of participation points)
 - Communicate and collaborate with your classmates on group assignments.
 - Read assigned papers and come to class with assignments completed.
- **Participate** in class activities
 - Be aware that good grammar, clear structure and scientific reasoning will all be incorporated into your grades.
 - For goodness sake, take notes. My notes will not be available to you online or otherwise.
- **Ask Questions!**

Adhere to the code of conduct: <http://www.pdx.edu/dos/codeofconduct>; e.g., no academic dishonesty or negligence; no harassment...

Limit spread of diseases: wash hands (20 sec!); use a tissue to cover your sneeze/cough; get a flu shot; stay at home if sick; go to the doctor as necessary.

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Schedule (SUBJECT TO CHANGE, if you miss a class ask a classmate if there were any changes)

Date	Week	Topic, due dates*	Homework DUE Thursday each week.
9/29	1	Introduction to Course:	
10/1	1	Heritable Variation	Orr (2009) Testing Natural Selection
10/6	2	DNA structure and function	Mindell (2009) Evolution in the everyday world
10/8	2	DNA: Mutation and replication	
10/13	3	DNA: Modern applications	Goetz (2007) 23 and me
10/15	3	Clauson: intro to molecular methods for detecting diversity	Zimmer (2015) Shedding their secrets, Handelsman (2004)
10/20	4	DNA: Modern applications	Kohn (2000) mapping warfarin resistance
10/22	4	Truitt: modern uses of DNA	Weeks (2015) Wolbachia
10/27	5	MIDTERM	
10/29	5	Estimating Diversity	Gould (1996) Tallest tale
11/3	6	Darwin and Evolution	Kettlewell (2009) Darwin's missing evidence
11/5	6	Darwin and Natural Selection	Kingsley (2009) Atoms to traits
11/10	7	Sources of diversity	Vermeij(2002) no lobsters on land.
11/12	7	Phenotypic plasticity	Vermeij (1994) your shelled
11/17	8	Biogeography	
11/19	8	Sources of diversity (tree of life stuff),	Mora (2011)
11/24	9	Consequences of biodiversity loss	
11/26	9	Holiday	
12/1	10	Consequences of biodiversity loss	
12/3	10	Review	
	Finals	FINAL EXAM	

*The topics and schedule of discussions listed in this syllabus may change, changes will be announced in class.

** Assignments are due on the listed day by the start of class. Readings will be assigned daily in class and due at the next class period.

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Week#	Topic	Due beginning of class
1	Lab 1: Making scientific observations	
2	Lab 2: Mendelian Genetics	Lab 1: Scientific observations
3	Lab 3: Variation in traits, Heritability (corn, fastplants)	Lab 2: Mendelian Genetics
4	Variation in traits, Heritability Lab 4: Microbial diversity introduction	
5	Lab 4: Microbial Diversity	Lab 3: Heritability lab
6	Lab 5: Urban Forest Diversity: Field Trip MNP Discuss Team project POA	Lab 4: Microbial Diversity lab
7	Team Diversity Project: Data Collection	Lab 5: Urban Forest Diversity lab Proposal, Hypothesis and Prediction
8	Group project Diversity: Data collection	Bibliography (6) and Introduction
9	Diversity: Data analysis & Summary	
10	Diversity: Presentation	Write-up and presentation.

Class Policies:

- Assignments must be in **on time**. I will not accept unexcused late homework.
- **Quality** is important and is factored into the grade of each assignment
- **Personal Responsibility:** There are many forms of plagiarism, including (See the rant on the last page)
 - Copying word for word without quotation marks and proper citation
 - Closely paraphrasing without proper citation
 - Be especially careful of information obtained from the Internet. In general, for your lab reports **do not cite work from the web**. Follow the information to its source and cite the primary, peer reviewed literature, please see the pitfalls section for further explanation.
 - Strikingly similar work as a classmates', where individual interpretation is expected.
- **Community:** Be considerate of your classmates. Because this class will involve group activities, please come prepared and ready to participate in group and class activities. Arrive to class on time. If you arrive late, you disrupt the class activities and will miss valuable information presented at the beginning of class. **You are responsible for any material, activities and being aware of any changes in assignments that are conducted in class, even if you are not there!**
- Familiarize yourself with the academic code in the University catalog.

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STUDENT EVALUATION & POLICIES

LECTURE (35%):

Attendance & Participation	10%
Midterm	10%
Final	15%

LAB (65%):

Lab 1: Making observations	5%
Lab 2: Mendelian Genetics	5%
Lab 3: Variation in traits/heritability	5%
Lab 4: Microbial diversity in streams	10%
Lab 5: Urban forest diversity	10%
Team Project	
Proposal Hypotheses, Predictions	2%
Bibliography & Introduction	3%
Peer Review	2%
Individual Papers	15%
Team Presentations	5%
Participation	3%

Total 100%

A= 100 to 94%; A-= 92 to 90%; B+= 89 to 87%; B= 86 to 84%; B-=83 to 80%; C+=79 to 77%; C=76 to 74%; C-= 73 to 70%; D= 69 to 60%; F= 59% and below.

Participation & Attendance:

Each day you will be awarded points for: attendance, being prepared for class with any assignments due, participation in discussions and in-class activities. You are responsible for any assignments whether or not you attend class. At the end of the term I will drop your two lowest daily participation scores. Participation is a substantial portion of your grade, please be prepared to attend and be prepared for each class. Missing more than 2 classes will substantially impact your grade.

Exams (midterm/final): The exams will be primarily short-answer; 1 word – 1 paragraph responses will be required to be written legibly and reflect the information that you have learned in class. These will be distributed in the lecture portion of the course.

Labs: You will have several lab projects to complete during this course. Labs meet once per week for 3 hours. To successfully complete each lab, you must come prepared with a pre-lab activity. Please read the lab assignment, conduct the pre-lab activity and come to class ready to collect, analyze and interpret your findings. You should be able to complete your activity during the lab period, but if you are unable to do so, then it will be due at the beginning of the next lab class.

Project: This is a small, team project (no more than 4 people) that will result in a group presentation and individual scientific papers (approx 6 pgs including Abstract, Introduction, Methods, Results, Discussion and References). Your mission will be to go out and observe patterns of diversity in nature. Based on your observations and careful notes, you will identify a testable hypothesis, conduct background research on the topic, design and conduct a scientific study and present your findings. The specific topics of your investigations need to be approved.

D2L

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The class will use D2L to share readings, handouts, asking questions of fellow students. You will also be able to turn in many of your daily assignments to D2L. It will be our primary contact outside of class, so please check it at least every other day. HelpDesk (Smith 018) offers a free tutorial. To access D2L you must have an ODIN account. If you do not have one, please get one as soon as possible. Access to D2L is a privilege. Please do not abuse it as a forum for putting others down or communicating offensive material to the rest of the class. More extensive information on the protocols that we will be following can be found at The Core Rules of Netiquette: <http://www.albion.com/netiquette/corerules.html> Failure to use D2L in a respectful way and to treat all class participants with respect will result in a loss of access to D2L and potentially a failing grade for this course.

- Goetz, T. 2007. 23AndMe Will Decode Your DNA for \$1,000. Welcome to the Age of Genomics. Wired Magazine. Condé Nast
- Gould, S. J. 1993. Eight little piggies : reflections in natural history. Norton, New York.
- Gould, S. J. 1996. This View of Life: The Tallest Tale. Natural history. **105**:18.
- Handelsman, J. 2004 Metagenomics: Application of genomics to uncultured microorganisms. Microbiology and Molecular Biology Reviews. v68 no. 4 669-685
- Kettlewell, H. B. 1959. Darwin's missing evidence. Scientific American **200**:48-53.
- Kingsley, D. M. 2009. From atoms to traits. Scientific American **300**:52-59.
- Kohn, M. H., H.-J. Pelz, and R. K. Wayne. 2000. Natural selection mapping of the warfarin-resistance gene. Proceedings of the National Academy of Sciences **97**:7911-7915.
- Mora, C. Tittensor, D. Adl, S. Simpson, A. Worm, B. 2011. How many species are there on Earth and in the Ocean? PLoS Biology 9(8): e1001127
- Mindell, D. P. 2009. Evolution in the everyday world. Scientific American **300**:82-89.
- Orr, H. A. 2009. Testing natural selection. Scientific American **300**:44-50.
- Vermeij, G. J. 1994. Give Me Your Shelled, Your Clawed. NATURAL HISTORY **103**:32.
- Vermeij, G. J. 2002. FEATURES - WHY ARE THERE NO LOBSTERS ON LAND OR BATS AT SEA? - Succeeding in a new environment involves challenging the incumbents. Natural history.:60.
- Weeks, E. 2015 Wolbachia bacteria can control mosquitoes with fewer chemicals. Entomology Today 23 March 2015
- Zimmer. Carl 2015 Shedding Their Secerts. New York Times (science section) 22 Jan 2015

Optional Text: Biology: Concepts and Applications 9th edition. This text is optional, though I think it is a very good text to use. There are options for purchasing. The full paperback is over \$266, you can get a loose leaf version (in a binder) for \$173.95. There are also rental options and e.book options that are significantly less expensive (<http://www.cengagebrain.com/shop/search/9781285427812>). You may also order by chapter. The chapters that will be relevant are the ones on Genetics and Principles of Evolution (chapters 8-18, 41,44). Finally, there is a version that includes online supplemental material for \$102 (<http://www.cengagebrain.com/shop/isbn/978-1-305-07264-0>) but is only available for one term (includes ebook).

Biological Concepts & Applications

Project RUBRIC

Introduction:

Your assignment is to conduct a scientific study that (1) investigates something about the potential causes or consequences of the distribution or abundance of a population (2) requires a scientific field study in which you will be designing an experiment or survey, collecting data using clearly defined methods. In other words, you must get outside and observe and test biological interactions, conduct background research and a carefully thought out experiment designed to answer a non-trivial question about the natural world around you.

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Purpose: To gain experience researching, designing, conducting and reporting scientific research to answer biological questions/problems that are of interest to you and your group.

Final Product:

- As a group, you will assemble, practice and present a 10 minute talk describing your project to the class.
- A 6-8 pg research project will be individually written in the form of a scientific report. Graphs & results may be written as a group, however, the abstract, introduction, methods, discussion sections should all be written individually.

Research Proposal, Hypothesis & Predictions (2%):

- Your proposal should educate and inform the class on the importance and current state of knowledge on your topic. Consider this a teaching exercise as well as an opportunity to take suggestions from the class as to how to improve your project before you begin. Your proposal should include:
 1. What is your research question?
 - a. Is your research question worth answering? What is its significance or relevance? Try to design non-trivial research studies.
 - b. Can it be realistically answered? Tested in a precise objective verifiable fashion?
 2. Why are you interested in this question? Why should the audience be interested in the question? Give background information (with numbers and citations). What is currently known?
 3. What measurements will you need to make? What tools will you need? How will you design your study (Be explicit about Experimental Units, replication, treatments, location, time)
 4. What are your predictions?
 5. Do you have, or can you acquire the necessary background information and collect data?

Proposal Rubric:

_____/50 Did the proposal address all five points above?

_____/15 Was the proposal well designed with appropriate context, design considerations, implications?

_____/20 Was the proposal effective as a teaching tool?

_____/15 The proposal was presented with confidence in a clear, organized and factually accurate manner

Bibliography and Introduction (3%):

For this section your bibliography should be annotated; that means that in addition to the citation, you also must write a brief description of what information you will be using from this paper, these may be bullet points as well as full sentences, but no quoted material. You need at least **5 citations**, and most (3+) must be from peer-reviewed scientific sources. Your bibliography should be formatted as follows with no extraneous information

Author Last name, first initial (year) Article title, *Journal Title* volume, issue, pgs.

Citations within the text will read (author last name, year). Two authors are joined with an “and” and three or more authors should read as (first author’s last name et al., year). Please note the punctuation in this case.

_____/5 **Bibliography** contains all of above.

_____/15 **Introduction:**

- Clear description of the broad nature of the problem (what issue(s) is (are) the paper addressing?).
- Explanation of why this sort of research is interesting and important
- Scientific background information is provided about this research and to place this work within the body of similar work done by others.
- Includes appropriate definitions and a numeric description of trends and prevalence of previous studies (with citations)

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- Explicit statement of research question.
- Appropriate background information as applied to specific research question
- Prediction: what do you expect to find
- No excessive use of quoted material (should be in own words... with citations)

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Participation: 3%

This will be evaluated based on a private survey conducted midway and at the end of your project. The student will be evaluated based on quality of input to the group, reliability (did he/she show up on time), persistence (did the group member get the job done?) and innovation (did the group member substantially contribute to the intellectual development an execution of the project)

Sci 341 Rubric for Paper: (15%)

_____: Student completed the project in full and clearly understood the assignment (**5 pts**)

_____: Work is clearly typed, in paragraph form, and clearly written without grammatical or spelling errors. (**5 pts**). Paper contains some spelling and grammatical errors, though mostly readable, (3 pts). Project not complete, contains serious grammatical errors, and contains sentence fragments, difficult to read (1 pts).

_____: Project was insightful and carefully executed with clarity in a professional and very scientific manner (**10 pts**). Project was fine, they did a good job (8 pts), Project lacked context, missing interesting analyses, executed adequately, but could have done much more (6 pts). Poor job, unscientific, unsupported, inadequate (2 pts)

_____: All Statements and reasoning were well supported (with academic citations) and properly defined; any references in the text are in the literature cited section and vice versa. (**10pts**) They supported most of their statements, but still had some unsupported statements of fact, (8 pts), background research mostly (>50%) from unscientific sources (6 pts), Statements were unsupported by scientific citations, statements were vague, reasoning was fairly logical (4 pts), no support or context for their work (3pts)

- (**2 pts**) **Title Authorship and affiliation:** Is the title short and descriptive? Authorship should include all who contributed significantly to the intellectual development of the project, but the person writing the paper should be first author.
- (**8 pts**) **Abstract:** Does the abstract cover the entire paper, ideas flow well, introduces the problem, explains methods and results briefly and gives a concise take-home message.

Comments _____

_____/15 **Introduction:**

- Clear description of the broad nature of the problem (what issue(s) is (are) the paper addressing?).
- Explanation of why this sort of research is interesting and important
- Scientific background information is provided about this research and to place this work within the body of similar work done by others.
- Includes appropriate definitions and a numeric description of trends and prevalence of previous studies (with citations)
- Explicit statement of research question.
- Appropriate background information as applied to specific research question
- Prediction: what do you expect to find
- No excessive use of quoted material (should be in own words... with citations)

Contains ALL key ideas above (15 pts), MOST of the key ideas above (12 pts), HALF of the key ideas above (8 pts), NONE of the above (1pt)

Comments _____

_____/10 **Methods:**

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- They are explicit and thorough, so that the reader understands the methods enough to repeat the study.
- Includes relevant information on study location, taxa or other definitions necessary to understand the topic.
- Details should include, size of samples, how sample location was selected, methods of collecting information, resolution of your collections (did you have size, taxa, etc... parameters)
- Clearly relates to individual research question
- Methods are in narrative format and written in past-tense

Contains ALL key ideas above (10 pts), MOST of the key ideas above (7pts), HALF of the key ideas above (5pts), NONE of the above (1pt)

Comments

/15 Results:

- Graphs and tables must be titled with numerically sequenced tags, e.g. Figure 1, Figure 2, with clear and descriptive figure captions,
- Figures are all well labeled; all axes are labeled and legible. Where appropriate (where there is replication), error bars (st.dev) are used
- ALL figures must be referenced within the narrative document -- no figure "orphans"!
- The narrative document in this section DESCRIBES THE PATTERN of what is presented in graphical or tabular form, connects results together and points out trends.
- Results presented clearly without interpretation, though areas of uncertainty should be pointed out.

Comments

/15: Discussion:

- Scientific evaluation and analysis of the results... what do the results mean?
- Related results to the problems introduced in the introduction.
- Results placed in context of a summary of other relevant studies; (with Citations)
- Discussion of the real-world significance of the results... did they corroborate or deviate from the expected patterns? If there is an effect, how strong is it?
- No unsupported claims
- Makes specific, realistic recommendations of further work.
- Makes specific suggestions as to what, if any, action needs to be taken.
- Generalization to the "big picture" without being overly speculative.

Contains ALL key ideas above (15 pts), MOST of the key ideas above (12pts), HALF of the key ideas above (8pts), NONE of the above (1pt)

Comments

/5: References: At the end of the paper, references cited in the text of the report are listed (usually alphabetically) with full and consistent citations (5 pts), Contains extraneous information, such as irrelevant web information (3).

Comments

Your paper should be less than 8 pages. Graphs and figures can be the same for all group members, Narrative sections should all be independently written.

Presentation: 5%

Your presentation should include a slide for each of the above sections of your scientific papers. All members of the group must present some aspect of the study.

PITFALLS: Avoid these common errors (aka. The rant)

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PLAGIARISM IS NOT TOLERATED. Plagiarism comes in many forms; all of which are dishonest, none of which suggest that you understand the material or completed your own work. Any work that is not your own will not count towards your grade (you will receive an F) and in severe or repeated cases will be reported to the University.

- **Always cite (in the text and in your references section) references for any data or statements of fact, or claims that you did not collect or make yourself first-hand.** Always cite references!!! This is extremely important. Making claims that are not your own without appropriate references is dishonest. Making claims with appropriate references is background information and context.
- **Avoid excessive use of quoted material.** While it is important to use background information and to give appropriate credit where it is due, avoid excess quoted material. I want to see the information summarized in your own words... AND cited appropriately (Author, year).
- **If your work is strikingly similar (even if not exactly the same) to the work of someone else... that is still plagiarism!** Your individually written paper must represent your own work, you own reasoning even though many of your projects will be conducted as a group. If you are really stuck, ask to see somebody's paper from outside of your group. You will get the feeling for the flow of a paper without being tempted to make your paper "strikingly similar" (which would be plagiarism).

In general avoid citing internet resources. Be cautious and considerate when using resources from the internet. Look for primary references. If you are in doubt whether the source is reliable or appropriate for an academic paper, please check with the instructor.

Specie = coin or hard money. **Species** = singular and plural form used to describe a single interbreeding population.

Significant figures: Use significant figures to represent the actual accuracy of your measurements. Using excessive decimal points in your results is misleading and inappropriate.

"Data is not reliable due to human error"

While discussion of errors is absolutely necessary in your papers, and all measurements have some levels of uncertainty associated with them (and should be discussed), "Human error" is not an acceptable category of error, nor is it an excuse for lousy or poorly collected data. When discussing errors, state your levels of uncertainty and errors that were basically unavoidable but important or significant when evaluating your results.

"We believe that..." Your beliefs are irrelevant. Convince the reader of your claim using LOGIC and DATA.

Graphs and tables must be discussed in the text and presented in a clear and comprehensible manner!

Provide an informative title. Each Graph or table also requires a very descriptive figure caption. If multiple types of data present, provide a legend. Each Graph should have a title, axes labeled clearly with appropriate units, error measurements where relevant. If you have a graph in your paper, you must also discuss and reference it in your text (and vice versa).

Use graphs and tables to make your point most clearly. They should be used to clarify, not to confuse!