Biology 2011: Ecological and Evolutionary Systems - Spring 2020
Point Loma Nazarene University

The earth is the Lord's and everything in it. Psalms 24:1

Instructor: Dr. April Cordero (x2328)
e-mail: AprilCordero@pointloma.edu

Time and place: Monday, Wednesday, Friday, 1:30 pm – 2:35 pm, Latter Hall 1 (basement level)
Lab: Rohr Science 40 (basement level by the greenhouse)
Thursdays: 8:00 – 11:00 am, 1:30 – 4:30 pm, or 5:30 – 8:30pm

Text: Brooker et al., *Principles of Biology* 2nd ed. (ISBN 9780073532271)

Supplemental: (A) Additional Book – *Origins*, by Haarsma & Haarsma (ISBN 978-1592555734)

(B) iClicker**2** (the one with the screen) – Everyone must have their own iClicker2 and it must be registered with the first 6 digits of your ID number. They are available in the bookstore or online at http://www.iclicker.com/Products/iclicker2/

Office hours: Thursday 11:00-12:00noon OR open door – come by anytime, but you can also make an appointment. My office is on the 1st floor of Rohr Science (room 140).

PLNU Mission: To Teach ~ To Shape ~ To Send

Point Loma Nazarene University exists to provide higher education in a vital Christian community where minds are engaged and challenged, character is modeled and formed, and service becomes an expression of faith. Being of Wesleyan heritage, we aspire to be a learning community where grace is foundational, truth is pursued, and holiness is a way of life.

Course Description:

An introduction to the principles of ecology, evolutionary biology, & sustainability.
Co-requisite: Bio 2011L: This Ecological and Evolutionary Systems laboratory is a co-requisite for Bio 2011. Students enrolled in Bio 2011 must also be enrolled in Bio 2011L, and vice versa. If Bio 2011 is dropped, Bio 2011L must also be dropped. Your grade for Bio 2011 and Bio 2011L will be calculated together and the same grade applied to both.
Offered every semester. Letter graded. Lecture is 3 units and lab is 1 unit. Bio2011 meets the General Education Life Science requirement with lab.

Course objectives:

This course provides an introduction to two major areas of study in biology: evolution and ecology. Evolution is the unifying theme for all of biology; it encompasses all subdisciplines, from development to medicine to conservation biology. Ecology, on the other hand, helps us to understand and sustain the delicate balance between the living and nonliving world.

The introduction to the study of evolutionary processes will include the basic mechanisms for evolution, the theory of natural selection, the basis of heredity and variation, population structure and genetics, and mechanisms of speciation. Along with these topics we will explore the ways that questions about evolution are answered, and how some Christians reconcile their faith with their acceptance of evolution.

The introduction to the study of ecological systems will include an examination of both biotic (living) and abiotic (non-living) elements of the environment that influence the distribution and abundance of organisms. Population, community, and ecosystem level ecology are addressed, especially in light of man's influence on

nature and nature's influence on man. We will then discuss how we can apply ecological principles to improve conservation of species and consider our responsibility to care for God's creation through sustainability.

My hope is that you develop an appreciation for the complexity and beauty of living systems, and develop awe and respect for the Creator through study of His creation.

Student Outcomes:

Students completing Bio 2011 and Bio 2011L will be able to:

- assess the status of modern evidence for the theory of biological evolution as an explanation for the diversity, commonalities, and ancestry of living organisms.
- articulate the relationship between scientific understandings of evolution and Christian concepts of creation.
- describe how interactions between organisms and their environment influence populations, communities, and ecosystems.
- articulate and defend a position on environmental stewardship drawing on both biological and world views
- design and conduct an independent investigation applying the processes and tools of scientific inquiry (both hypothesis testing and discovery science) to test biological hypotheses.
- prepare and analyze graphs drawing valid scientific conclusions.

Evaluation and grading:

Your grade for this course will be based on five distinct evaluation tools: exams, online quizzes, homework assignments, laboratory experience, and special projects. Each is described in detail below.

1. Online and RAT Quizzes (10%). Quizzes will cover both the content and the reading material. One goal of the quizzes is to hold students accountable for the assigned reading and online lectures. Some of the quizzes will be available on Canvas (online), others will be in class. You will be given fair notice and have an adequate window in which to complete the quiz. If taking the quiz online, no quizzes will be accepted after the time window has expired (so don't ask for an exception). For online quizzes, you will generally have about 20 minutes to complete the quiz, during which time you may not have discussions with other students, but you may use your textbook and notes. To avoid disruption of internet connections, E-quizzes *must* be taken in a computer lab on campus; if you take the quizzes anywhere else, you do so *at your own risk*.
2. Outside reading/discussions/assignments/problem sets (15%). There will be several different assignments that relate to the course material. All assignments will be listed on Canvas and you will be given fair notice as to when they are due.
3. Three examinations (10% each) and a Final (20%). Students are expected to take the exams on the days scheduled unless they have a written excuse cleared by Dr. Maskiewicz no later than the Friday preceding the exam. If there is an approved conflict you will be expected to take the exam prior to the scheduled time. Missing an exam due to illness will require medical verification. Unexcused misses will result in a zero grade. You will have **two weeks** from the time exams are handed back to discuss possible corrections, after which the **grade becomes permanent.** Exams will cover all material assigned, including assigned chapters from *Origins*. In addition to the material that will be covered in lecture, each exam will include questions from material assigned but not discussed directly in class. This is intended to begin developing the skills necessary for independent learning.

4. Laboratory Grade (20%). You are required to attend all lab sessions. Attendance, participation, and lab assignments will determine your lab grade for the semester. A lab report will be used to assess *General Education Learning Outcome 1d. Critical Thinking*: Students will be able to examine, critique, and synthesize information in order to arrive at reasoned conclusions.
5. Special Projects (5%). There will be a reflection project assigned during the semester related to the intersect between faith and science (details to come later). You will also complete a service learning project during the semester (more information on this later).

Grade Percentage breakdown

3 exams (10% each) and Final (20%)	50%
Online & RAT quizzes	10%
Reading/discussions/assignment /projects	15%
Laboratory experience	20%
Special Projects	5%
TOTAL	100%

Percentage range	Letter grade earned*
90-100%	A
80-89%	B
70-79%	C
60-69%	D
≤ 59%	F

*Notes about grades:

1. Plusses and minuses (*e.g.*, B+/A-) will be determined at the instructor's discretion. A major factor in this decision will be class participation and attitude.
2. First-semester Freshmen earning an F will be offered the opportunity to retake one 5 unit course once, with the new grade completely replacing the F.

iClickers. I am requiring iClickers and will have questions throughout the course that you must answer with your iClicker. *Everyone must have their own iClicker and it must be registered with the first 6 digits of your ID number.* iClicker2 is available in the bookstore or online (http://www.iclicker.com/Products/iclicker2/).

Course Credit Hour Information

In the interest of providing sufficient time to accomplish the stated Course Learning Outcomes, Bio2011 with Bio2011L meets the PLNU credit hour policy for a 4 unit class delivered over 15 weeks. Specific details about how the class meets the credit hour requirement can be provided upon request.

Compensating for Holidays in the Spring

There are several holidays during the spring semester. This means that we lose 65 minutes of class time for each of these holidays. In order to ensure that we complete enough hours for you to receive course credit, you will be assigned online work for two of those holidays. In other words, you may be asked to watch an online lecture, read a portion of the text, and complete an online quiz for each of the holidays. This material will not be covered during our face-to-face sessions but you will be held accountable for learning the material. In short, you will have assignments to complete during those holidays that will each take approximately 65 minutes plus homework time.

EXAMS

Final Exam Policy: Successful completion of this class requires taking the final examination on its scheduled day. Your Final Exam is scheduled for: **Friday, 5/8/20, 1:30-4:00pm**
No requests for early examinations or alternative days will be approved.

Students are expected to take the mid-semester exams on the days scheduled unless they have an *excuse cleared by the instructor no later than the class preceding the exam*. If there is an approved conflict you will be expected to take the exam **prior to** the scheduled time. If something unexpected happens, we will make appropriate arrangements at that time. Un-excused misses will result in a zero grade. Makeup exams may not be the same as the original and will generally be more difficult in nature.

You will have **two weeks** from the time exams are handed back to discuss possible corrections, after which the **grade becomes permanent.**

PLNU COPYRIGHT POLICY

Point Loma Nazarene University, as a non-profit educational institution, is entitled by law to use materials protected by the US Copyright Act for classroom education. Any use of those materials outside the class may violate the law.

PLNU ACADEMIC HONESTY POLICY

Students should demonstrate academic honesty by doing original work and by giving appropriate credit to the ideas of others. Academic dishonesty is the act of presenting information, ideas, and/or concepts as one's own when in reality they are the results of another person's creativity and effort. A faculty member who believes a situation involving academic dishonesty has been detected may assign a failing grade for that assignment or examination, or, depending on the seriousness of the offense, for the course. Faculty should follow and students may appeal using the procedure in the university Catalog.

See Academic Policies for definitions of kinds of academic dishonesty and for further policy information.

PLNU ACADEMIC ACCOMMODATIONS POLICY

While all students are expected to meet the minimum standards for completion of this course as established by the instructor, students with disabilities may require academic adjustments, modifications or auxiliary aids/services. At Point Loma Nazarene University (PLNU), these students are requested to register with the Disability Resource Center (DRC), located in the Bond Academic Center (or 619-849-2486). The DRC's policies and procedures for assisting such students in the development of an appropriate academic adjustment plan (AP) allows PLNU to comply with Section 504 of the Rehabilitation Act and the Americans with Disabilities Act. Section 504 (a) prohibits discrimination against students with special needs and guarantees all qualified students equal access to and benefits of PLNU programs and activities. After the student files the required documentation, the DRC, in conjunction with the student, will develop an AP to meet that student's specific learning needs. The DRC will thereafter email the student's AP to all faculty who teach courses in which the student is enrolled each semester. The AP must be implemented in all such courses.

If students do not wish to avail themselves of some or all of the elements of their AP in a particular course, it is the responsibility of those students to notify their professor in that course. PLNU highly recommends that DRC students speak with their professors during the first two weeks of each semester about the applicability of their AP in that particular course and/or if they do not desire to take advantage of some or all of the elements of their AP in that course.

PLNU ATTENDANCE AND PARTICIPATION POLICY

Regular and punctual attendance at all classes is considered essential to optimum academic achievement. If the student is absent from more than 10 percent of class meetings, the faculty member can file a written report which may result in de-enrollment. If the absences exceed 20 percent, the student may be de-enrolled without notice until the university drop date or, after that date, receive the appropriate grade for their work and participation. See Academic Policies in the Undergraduate Academic Catalog.

Because lab sessions are 3 hours, missing a lab counts as 2 absences. A total of four *unexcused* absences will be permissible. More than four absences will result in forfeiture of one percentage point per absence from your final grade unless documentation of a valid excuse is provided (see below). Three weeks of absences (9 lectures or 3 labs) will result in de-enrollment from the course, according to University policy. Missed assignments cannot be made up without prior instructor approval or documentation of a legitimate

excuse. There are no allowed or excused absences except when absences are necessitated by certain university-sponsored activities and are approved in writing by the Provost.

STUDENT CONDUCT

Dishonest behavior will be dealt with firmly by the Academic Provost. Cheating is inconsistent with the Christian lifestyle and the tenets upon which PLNU is based. Just as it is not tolerated in society, it will not be tolerated in this class. Academic dishonesty is the act of presenting information, ideas, and/or concepts as one's own when in reality they are the results of another person's creativity and effort. Violations of academic honesty include cheating, plagiarism, falsification, aiding academic dishonesty, and malicious interference. If you are found to be involved in a situation involving academic dishonesty I will assign a failing grade for (a) that particular assignment or examination, and/or (b) the course.

Although you may discuss readings and lecture material among yourselves, I expect that you will each do your own work. Each assignment (in its entirety) must be written in your own words, and no electronic files should be exchanged. Another form of plagiarizing would be to copy and paste answers from a reading which involves using someone else's words as if they were your own. Much of the learning process involves articulating the answer in your own words, and bypassing this step will almost guarantee an inadequate understanding of the material. It is also plagiarism if you use old homework, lab reports, exams, etc. (from previous Bio2011 courses or students) to get ideas for how to complete current homework, labs, and exams. Lastly, recycling a paper written for another class for your assignment(s) is also considered plagiarizing.

Group work and cooperation. In an effort to create the best learning environment possible, all students will be assigned to work in a group – whether in the lab or lecture. You may be surprised how much you can learn from one another, especially from people who you may not have chosen to work with. You are expected to show respect to your classmates and instructors by listening when others are speaking, refraining from discussing non-related issues during class, and not belittling the opinions of others, even when you disagree. Behavior intended to embarrass or ridicule others will not be tolerated and will have serious consequences. Likewise, gossip has no place in the Christian classroom.

PLNU CANVAS SUPPORT

If you have questions about the content you find in my Canvas course or need clarification on assignment instructions please let me know. If you are unsure how to use any given feature in Canvas you will find the Canvas Guides to be a very helpful resource. If you cannot access something in my Canvas course or it appears that some part of the course is not working properly, please contact the Office of Instructional Technology for support at oit@pointloma.edu. Include specific information in the request (course ID, section, assignment or module name, etc.) to expedite the troubleshooting process. Screenshots are super helpful!

Important Dates:

Last day to add the course…….1/24/20
Last day to drop the course……3/27/20
Tentative exam dates
Exam 1…….. 2/3/20
Exam 2…….. 3/5/20
Exam 3…….. 4/23/20
Final…… Friday, 5/8/20, 1:30-4:00pm
Holidays……...1/20/20, 3/9-3/13, 4/9-4/13

****Topic Schedule and Lab Schedule on next pages.**

Topic Schedule

Weeks	Topic**	Notes
1	What are ecosystems and how do they function? How do organisms obtain and use energy they need to live and grow?	• Dialogue assignment • Surveys
2	How do matter and energy move through ecosystems? What happens when an aquatic ecosystem is overloaded with nutrients?	Rachel Carson reading
3	What happens when humans interfere with an ecosystem: remove species, destroy habitat, etc.? What is biodiversity and how do we preserve it?	Start *Origins* book Ch 2-6
4	What is biological evolution? Are creation & evolution compatible? What is natural selection?	**1st exam** *Origins*: Ch 7-8
5	How does natural selection explain phenomena? How does evolution occur? (What are the mechanisms of evolution?)	*Origins*: Ch 9 & 11
6	How do new species arise? How do scientists depict evolutionary relationships? How does geography influence how organisms evolve?	
7	What factors contribute to changes in gene frequencies within populations?	
8	Why did sex evolve?	**2nd Exam**
	Spring Break	
9	What are life history traits? How does the physical and ecological environment affect organisms?	
10	What types of interspecies relationships occur in ecosystems? How do species interactions promote coevolution?	
11	How old is the Earth? How do we conceptualize long periods of time? What is radiometric dating?	Lottia Posters Due **4/1/20**
12	What is radiometric dating? Where did whales come from? What about human evolution?	Easter break Thurs & Fri
13	How does human industrialization affect ecosystems? What impacts how the human demographics change?	Easter break Monday
14	What is the evidence for Global Climate change?	**3rd exam**
15	How does GCC affect biological systems?	
	Finals week	**Final is Friday 5/8/20**

**This topic schedule is subject to change, and likely will change.

Biology 2011L: Ecological and Evolutionary Systems Lab - Spring 2019
Point Loma Nazarene University

Week	Topic	Lab Title	Learning Objective	Goals
1	Ecosystem functioning	EcoSphere	Analyze data to create a model that explains the functioning of a simplistic ecosystem (EcoSphere). Articulate the roles producers, consumers, and decomposers play in cycling matter and transferring energy.	To understand biologically mediated processes including energy flow, matter cycling, respiration, photosynthesis, decomposition, and the interrelationships among these.
2	Biodiversity and field data collection	Canyon Lab	Collect field data using a handheld GPS; survey *Acacia melanoxylon* in a local canyon; record and analyze class data.	To gain exposure to field data collection using a GPS; try out and modify a collection method; experience the challenges of collecting data in the field.
3	Biodiversity and Reserve design	Biodiversity & Hiruna	Analyze a group of prospective sites for inclusion in a biodiversity protection reserve and determine the sites that provide the most efficient reserve system. Calculate a Shannon Biodiversity index for each of the prospective sites as part of the analysis.	To learn ways to measure biodiversity (genetic, species, and ecosystem diversity); to apply the criteria (10) used to protect biodiversity when designing marine reserves; to discuss the advantages and disadvantages of clustered vs. scattered sites in marine reserves; and to apply what is learned to a real-life suburban canyon development project.
4	Natural Selection & Adaptation	Evodots	Simulate and then articulate variation, inheritance, and selection as central components of evolution (change in allele freq in a pop over time). Predict how a pop would evolve without selection, and without inheritance. Design a simulated experiment to test a hypothesis.	To explore the mechanisms of evolution; to see the effects of removing one of these mechanisms on a population over time; and to apply these mechanisms to explain changes in Threespine stickleback populations.
5	Population growth	Population growth	Identify similarities & differences between exponential & logistic population growth; explain how carrying capacity & biotic potential affect population growth; determine a habitat's carrying capacity using a logistic population growth curve.	Simulate simple models of density independent and density dependent population growth and interactions.
6	Phylogenies	Phylogenetic Trees	Construct by hand a morphological phylogenetic tree using published data; construct by hand another tree using a shortcut method; draw conclusions from a published tree.	Learn to read and construct a phylogenetic tree. This lab is one of a two lab sequence: in your subsequent Genetics course you use the same published data but create molecular phylogenies with computer programs.

7	Hardy Weinberg and Population Genetics	PopCycle	Track alleles and genotypes across the entire life cycle of a population using a simulator; predict the characteristics of the next generation in whole populations.	Explore the five assumptions of the Hardy-Weinberg principle through a simulator and in a real-world application.
8	Exam 2			
9	Excel data analysis; Asking and answering a scientific Q	*Lottia gigantean* Lab 1 of 2	Analyze a very large authentic data set (Lottia gigantea in So. Cal) to draw conclusions about changes in the abundance over time in various sites.	Lab 1 of 2: Become competent at using Excel with large data sets; create graphs and drawing non-intuitive conclusions from data. In lab 1, students answer the instructor's question about abundance change in three different sites (highly populated to no human interference)?
10	Excel data analysis; Asking and answering a scientific Q	*Lottia gigantean* Lab 2 of 2	Analyze a very large authentic data set (Lottia gigantea in So. Cal) to draw conclusions about changes in the size over time in various sites. Calculate t-tests.	Lab 2 of 2: Students analyze a large data set to answer their own question about the mollusc populations; learn to bin data, conduct t-tests, and present findings on posters.
11	Human Evolution	Hominid Skulls Lab 1 of 2	Use calipers to collect data; identify the appropriate cranial and dental features required for the measurements and descriptions; recognize the sequence pattern in which several hominin skull features appeared over time.	Lab 1 of 2: Describe and measure cranial casts from modern humans and fossil "hominins" (erect and bipedal forms evolutionarily separated from apes), a contemporary chimpanzee, and a human and chimp fetal skulls.
12	Human Evolution	Hominid Skulls Lab 2 of 2	Recognize the sequence pattern in which several hominin skull features appeared over time; summarize and graph measurement data of the cranial specimens; construct and justify a phylogenetic classification of the specimens.	Lab 2 of 2: Upon completion of measurements, compare cranial casts from modern humans and fossil "hominins" (erect and bipedal forms evolutionarily separated from apes) and a contemporary chimpanzees.
13	Exam #3			
14	Easter Break			
15	Global Climate change	RMBL Data: Warming Meadow	Query disparate data sets on the effects of climate change on biological organisms; frame a question from limited data; analyze the data; construct an argument from data.	Examine the Rocky Mountain Boulder Laboratory data on how climate change affects biological organisms including marmots, robins, forbs, shrubs, and soil carbon.