

Principles of Ecology & Evolution

Biology 125

Department: Biology

Course Description:

4 semester hours, 3 hours lecture, 2 hours lab per week. Fundamental principles of biological inquiry, scientific analysis, and concepts in ecological and evolutionary biology.

Text and Materials: Lecture: *Biological Science* (4th Edition), Freeman.

Student Learning Outcomes:

After successful completion of this course student will be able to:

- SLO 1. Demonstrate understanding of the process of science by distinguishing between science and non-science and designing experiments that address testable hypotheses.
- SLO 2. Use quantitative reasoning to interpret evolutionary and ecological data (tables, figures and graphs) from primary research, theoretical models and computer based-simulation experiments.
- SLO 3. Demonstrate understanding of the skills and attitudes necessary for effective teamwork in collaborative learning activities and a semester long project.
- SLO 4. Critically assess the interrelationship of human dimensions and ecology/evolution and communicate resulting conclusions in oral, visual and written formats.
- SLO 5. Understand evolution as the unifying concept in biology.
- SLO 6. Understand the factors that govern interactions between organisms and their environments.

Program Learning Outcomes: Departmental PLOs and associated Student Learning Outcomes.

- PLO 1. The student will demonstrate a good knowledge base in biological concepts (Knowledge). (SLO 1,5-6)
- PLO 2. Clearly articulate scientific information in oral form. (SLO 3-6)
- PLO 3. Clearly articulate scientific information in written form. (SLO 3-6)
- PLO 4. Be able to design, carry out, and analyze experiments to answer biological questions. (SLO 1-2)
- PLO 5. Demonstrate teamwork skills needed to coordinate diverse multidisciplinary teams to solve challenges in the biological world. (SLO 2-4)

General Education Core Curriculum Objectives/Outcomes: Texas State Exemplary Educational Objectives and associated Student Learning Outcome.

- CO 1. **Critical Thinking:** to include creative thinking, innovation, inquiry, and analysis, evaluation and synthesis of information. (SLO 1-6)
- CO 2. **Communication Skills:** to include effective development, interpretation and expression of ideas through written, oral and visual communication. (SLO 3-6)
- CO 3. **Empirical and Quantitative Skills:** to include the manipulation and analysis of numerical data or observable facts resulting in informed conclusions. (SLO 1-2)
- CO 4. **Teamwork:** to include the ability to consider different points of view and to work effectively with others to support a shared purpose or goal. (SLO 2-4)

Course Requirements:

Your final grade in this course is determined by grades from lab based inquiry activities, lecture exams, a group project, daily lecture quizzes, and participation in the course evaluation.

Laboratory Activities: Students will conduct a variety of inquiry activities in the lab section of the course. Each lab meeting will include written and oral instruction on the critical thinking skills developed in that activity and will include written and oral instruction in the empirical and quantitative skills used in that activity. Laboratory activities will include *structured/guided inquiries* in which students work through examples, questions, problems and

case studies. Students will evaluate of primary literature and participate in group discussions. Additionally students will *conduct experiments to test hypotheses* in which they collect data using online databases and field based methods, analyze data using computer software, synthesize data and present conclusions using visual (graphical), written (lab reports), and oral (presentation) communication.

Group Project: As a group, students will conduct a research project and present the results of the project to the class. This is a semester-long project designed to emphasize teamwork and communication skills. Students will be assigned groups in the first week of class and will participate in group and class discussions about characteristics and strategies for effective groupwork. The project itself will be a video, digital media, or formal presentation that will require students to prepare a written script, present the project orally and with computer-generated visual aids (MovieMaker, iMovie, Prezi or Powerpoint). The project will consist of multiple assignments that will be assessed following the Core Curriculum Objectives including a Group Contract (CO2, 4), a Prospectus/Abstract (CO1, 2, 4), an annotated bibliography (CO1, 2, 4), a storyboard/draft (CO 1, 2, 4), a project journal (CO 4), a project reflection (CO 2, 4) and the final project itself (CO 1, 2, 4).

Grading Policy:

The lecture and laboratory portions of your grade are determined by earning 90%, 80%, 70% and 60% of the available points for the associated traditional letter grade.

Attendance Policy:

Attendance is expected for each lecture and lab. Students with poor attendance typically do very poorly in this course. Students with excused absences in lab may make up laboratories by attending other lab sections in the same week as their missed lab. Makeup lecture exams will be limited to one and will be scheduled during dead week unless prior arrangements are made to take the exam prior to the scheduled exam.

Acceptable Student Behavior

Classroom behavior should not interfere with the instructor's ability to conduct the class or the ability of other students to learn from the instructional program (see the Student Conduct Code, policy D-34.1, http://www.sfasu.edu/policies/student_conduct_code.asp). Unacceptable or disruptive behavior will not be tolerated. Students who disrupt the learning environment may be asked to leave class and may be subject to judicial, academic or other penalties. This prohibition applies to all instructional forums, including electronic, classroom, labs, discussion groups, field trips, etc. The instructor shall have full discretion over what behavior is appropriate/inappropriate in the classroom. Students who do not attend class regularly or who perform poorly on class projects/exams may be referred to the Early Alert Program. This program provides students with recommendations for resources or other assistance that is available to help SFA students succeed.

Class etiquette:

Do not be late for class.

Do not leave before the class period is over.

Do not anticipate the end of class and start putting your things away.

Do not talk during class.

Turn your phone off.

Use your computer for class work only.

Stay awake.

Academic Integrity (A-9.1)

Abiding by university policy on academic integrity is a responsibility of all university faculty and students. Faculty members must promote the components of academic integrity in their instruction, and course syllabi are required to provide information about penalties for cheating and plagiarism as well as the appeal process.

Definition of Academic Dishonesty

Academic dishonesty includes both cheating and plagiarism. Cheating includes, but is not limited

to:

- using or attempting to use unauthorized materials to aid in achieving a better grade on a component of a class;
- falsification or invention of any information, including citations, on an assignment; and/or,
- helping or attempting to help another in an act of cheating or plagiarism.

Plagiarism is presenting the words or ideas of another person as if they were your own. Examples of plagiarism include, but are not limited to:

- submitting an assignment as if it were one's own work when, in fact, it is at least partly the work of another;
- submitting a work that has been purchased or otherwise obtained from the Internet or another source; and,
- incorporating the words or ideas of an author into one's paper or presentation without giving the author due credit.

Procedure for Addressing Student Academic Dishonesty

A faculty member who has evidence and/or suspects that academic dishonesty has occurred shall gather all pertinent information, approach the student(s) involved, and initiate the following procedure:

- The faculty member shall review all evidence of cheating or plagiarism and discuss it directly with the student(s) involved. The faculty member shall inform the student(s) of the procedure for addressing academic dishonesty, as well as the appeals process.
- After hearing the student(s)' explanation or defense, the faculty member will determine whether or not academic dishonesty has occurred and will inform the student(s) what action will be taken. Penalties may include reprimand, no credit for the assignment or exam, re-submission of the work, make-up exam, or failure of the course. The faculty member may consult with the academic unit chair/director and dean in making these decisions.
- After a determination of academic dishonesty, the faculty member shall notify the office of the dean of the student's major by submitting a Report of Academic Dishonesty, along with supporting documentation as noted on the form. This report shall be made part of the student's record and shall remain on file with the dean's office for at least four years.
- Upon second or subsequent offenses, the dean of the student's major will determine a course of action, which may include dismissal from the university. The dean may refer the case to the college council for review and recommendations before making this determination.

A student's record of academic dishonesty will not be available to faculty members. The purpose of the record is for the dean to track a pattern of academic dishonesty during a student's academic career at Stephen F. Austin State University.

Students who are found to have demonstrated academic dishonesty and have withdrawn prior to the award of a grade will continue to have the determination of the infraction within their student records.

Student Appeals

A student who wishes to appeal decisions related to academic integrity should follow procedures outlined in Academic Appeals of Students (A-2).

Source: http://www.sfasu.edu/policies/academic_integrity.asp

Withheld Grades Semester Grades Policy (A-54)

At the discretion of the instructor of record and with the approval of the academic chair/director, a grade of WH will be assigned only if the student cannot complete the course work because of unavoidable circumstances. Students must complete the work within one calendar year from the end of the semester in which they receive a WH, or the grade automatically becomes an F. If students register for the same course in future semesters, the WH will automatically become an F and will be counted as a repeated course for the purpose of computing the grade point average.

Source: http://www.sfasu.edu/policies/semester_grds.asp

Students with Disabilities

To obtain disability related accommodations, alternate formats and/or auxiliary aids, students with disabilities must contact the Office of Disability Services (ODS), Human Services Building, and Room 325, 468-3004 / 468-1004 (TDD) as early as possible in the semester. Once verified, ODS will notify the course instructor and outline the accommodation and/or auxiliary aids to be provided. Failure to request services in a timely manner may delay your accommodations. For additional information, go to <http://www.sfasu.edu/disabilityservices/>.

Week	Lecture	Core Objective (Underline indicates instruction)	Instruction
1	Scientific Inquiry: What is Science? Definition of scientific inquiry. Scientific Terms (Fact, Law, Hypothesis, Theory, etc). Scientific Method (forming & testing hypothesis)	<u>1</u> , <u>2</u> , <u>3</u> , <u>4</u>	CO1: Oral instruction in the scientific method focusing on hypothesis formation. CO4: Oral instruction and guided activities in effective groupwork focusing on constructive group behaviors, effective group communication and setting and meeting expectations.
2	Scientific Method continued Experimental design & data analysis Control groups, variables, replication, data collection, basic statistics	<u>1</u> , <u>2</u> , <u>3</u> , <u>4</u>	CO1: Oral instruction on designing controlled experiments. CO3: Oral instruction and activities in data analysis and statistics.
3	Science Immersion Reading & Writing Science Papers Paper evaluation & peer review of writing Intro to Evolution Definition of evolution; evidence for evolution	<u>1</u> , <u>2</u> , <u>3</u> , <u>4</u>	CO1: Oral instruction on evaluation of scientific papers and evidence for evolution. CO2: Oral instruction and review activities in effective writing for scientific audiences.
4	Intro to Heredity Mendelian Genetics	<u>1</u> , <u>2</u> , <u>3</u> , <u>4</u>	CO1: Oral instruction and activities building and interpreting Punnett Squares. CO3: Oral instruction and activities calculating genotypic and phenotypic probabilities.
5	Hardy-Weinberg Equilibrium Definition of Deviations from	<u>1</u> , <u>2</u> , <u>3</u> , <u>4</u>	CO1: Oral instruction on interpretation and analysis of the Hardy-Weinberg Equilibrium. CO3: Oral instruction and activities on calculating Hardy-Weinberg Equilibrium variables.
6	Microevolution I Natural/Sexual Selection	<u>1</u> , <u>2</u> , <u>3</u> , <u>4</u>	CO1: Oral instruction on analysis of natural selection.
7	Microevolution II Genetic drift, migration, mutation	<u>1</u> , <u>2</u> , <u>3</u> , <u>4</u>	CO1: Oral instruction on comparing and contrasting the forces of microevolution. CO3: Oral instruction and activities on calculating population genetic variables related to microevolution.
8	Macroevolution I Species concepts Speciation mechanisms	<u>1</u> , <u>2</u> , <u>3</u> , <u>4</u>	CO1: Oral instruction on differentiating species based on multiple species concepts.
9	Macroevolution II Phylogenies, cladistics, & taxonomy Phylogeography	<u>1</u> , <u>2</u> , <u>3</u> , <u>4</u>	CO1: Oral instruction on classification and understanding relationship among species.
10	Climate & Biomes	<u>1</u> , <u>2</u> , <u>3</u> , <u>4</u>	CO 1: Oral instruction in predicting how climate variables influence major vegetation patterns.
11	Population Ecology I Distribution Life History	<u>1</u> , <u>2</u> , <u>3</u> , <u>4</u>	CO1: Oral instruction in interpreting population pyramids and predicting population growth. CO3: Oral instruction in calculating variable to build life history tables.
12	Population Ecology II Population growth Human population ecology	<u>1</u> , <u>2</u> , <u>3</u> , <u>4</u>	CO3: Oral instruction in calculating population growth rates.
13	Community Ecology Species interactions Competition & Predator-prey (including parasites)	<u>1</u> , <u>2</u> , <u>3</u> , <u>4</u>	CO1: Oral instruction in identifying outcomes of species interactions based on graphical analysis.
14	Community Ecology & Biodiversity E.g., Succession	<u>1</u> , <u>2</u> , <u>3</u> , <u>4</u>	CO1: Oral instruction in compare and contrasting models of succession in biological systems. CO3: Oral instruction in calculating measures of biodiversity.
15	Ecosystem Ecology Nutrient Cycling (including pollution) Climate Change	<u>1</u> , <u>2</u> , <u>3</u> , <u>4</u>	CO1: Oral instruction in evaluating evidence related to climate change. CO3: Oral instruction in calculating movement patterns in nutrient cycles.
16	Final		

Week	Lab Topic	Core Objective (Underline indicates instruction)	Instruction
1	Topic: Scientific method Activity: Guided inquiry on the definition and process of scientific method Group discussion on science vs. non-science	<u>1</u> , <u>2</u> , <u>3</u> , <u>4</u>	CO1- Oral and written instruction on understanding the process of the scientific method. CO4- Oral instruction, activities and discussion of effective group interactions.
2	Topic: Experimental design Activity: Structured inquiry exploring amphibian deformities Individual and group interpretation of data and hypotheses evaluation	<u>1</u> , <u>2</u> , <u>3</u> , <u>4</u>	CO1- Oral and written instruction on experimental design focusing on treatments and control groups. CO3- Oral and written instruction on analysis of graphical data.
3	Topic: Evaluating evidence for evolution Activity: Structured inquiry evaluating scientific claims Group discussion evaluating science from non-science Presentations of scientific criteria and class discussion	<u>1</u> , <u>2</u> , <u>3</u> , <u>4</u>	CO1- Oral and written instruction for exercises evaluating scientific claims. CO2- Oral and written instruction on how to structure and deliver effective informal presentations.
4	Topic: Heredity and disease Activity: Guided inquiry evaluating the role of heredity in probability of disease Small group analysis of various diseases and heredity Presentation of findings to class	<u>1</u> , <u>2</u> , <u>3</u> , <u>4</u>	CO1- Oral and written instruction in interpreting family trees and genetic histories. CO3- Oral and written instruction in calculation of probabilities.
5	Topic: Hardy-Weinberg Equilibrium Activity: Structured inquiry calculating and applying Hardy-Weinberg Equilibrium to natural populations	<u>1</u> , <u>2</u> , <u>3</u> , <u>4</u>	CO1- Oral and written instruction in drawing conclusions from patterns in Hardy Weinberg calculations. CO3- Oral and Written instruction in calculating Hardy-Weinberg Equilibrium.
6	Topic: Process of natural selection Activity: "Natural selection in guppies" Hypothesis testing using EvoBeaker online simulation	<u>1</u> , <u>2</u> , <u>3</u> , <u>4</u>	CO1- Oral and written instruction in hypothesis formation and experimental design. CO2- Written instruction on written communication in a lab report format CO3- Oral and written instruction in data collection, graphical and statistical analysis of data.
7	Topic: Primary literature on evolution Activity: Online Data Interpretation in Evolution activity Small group discussion of primary literature Class discussion of primary literature	<u>1</u> , <u>2</u> , <u>3</u> , <u>4</u>	CO1- Oral instruction on synthesis of multiple types of data. CO3- Oral instruction on data interpretation.
8	Topic: Comparing species concepts Activity: Guided inquiry in application of species concepts Evaluation of data to define species Small group comparison of species concepts	<u>1</u> , <u>2</u> , <u>3</u> , <u>4</u>	CO1- Oral and written instruction on assessing data and drawing conclusions. CO3- Oral and written instruction in evaluation of phenotypic and genetic data.
9	Topic: Building phylogenies Activity:	<u>1</u> , <u>2</u> , <u>3</u> , <u>4</u>	CO1- Oral and written instruction on reading and interpreting phylogenetic

	Structured inquiry on 'Tree Thinking and Building Phylogenies' Group data collection using GenBank, data analysis and synthesis using online phylogenetics programs		trees. CO3- Oral and written instruction in data collection from GenBank online database, data analysis and synthesis using online phylogenetics programs.
10	Topic: Anthropogenic change Activity: Guided inquiry examining Anthromes Hypothesis formation, data collection from online database, data analysis and synthesis	<u>1</u> , <u>2</u> , <u>3</u> , <u>4</u>	CO1- Oral and written instruction in interpreting patterns of change in land use over time and predicting future change in land use. CO2- Oral instruction in effective presentation of graphs (visual communication). CO3- Oral and written instruction in data collection from Anthropocene online database and graphical and statistical analysis in Excel. CO4- Oral instruction in effective group coordination and data sharing.
11	Topic: Life History Activity: Hypothesis testing of variation in life history traits using Animal Diversity Web for data collection, data analysis and synthesis	<u>1</u> , <u>2</u> , <u>3</u> , <u>4</u>	CO1- Oral and written instruction in hypothesis formation, experimental design and data interpretation. CO3- Oral and written instruction in data collection from Quaarvark online database, graphical and statistical analysis in Excel.
12	Topic: Population growth models Activity: Hypothesis testing on density independent and density dependent growth Group data collection, data analysis and synthesis	<u>1</u> , <u>2</u> , <u>3</u> , <u>4</u>	CO1- Oral and written instruction in hypothesis formation and evaluation. CO3- Oral and written instruction in data collection, graphical and statistical analyses of data.
13	Topic: Competition Activity: Hypothesis testing of competition (specific experiment is dependent on semester) Hypothesis formation, experimental design, data collection, data analysis and synthesis	<u>1</u> , <u>2</u> , <u>3</u> , <u>4</u>	CO1- Oral and written instruction in hypothesis formation and experimental design. CO3- Oral and written instruction in data collection, graphical and statistical analysis.
14	Topic: Food webs & Biodiversity Activity: Hypothesis testing of biodiversity and conservation using Animal Diversity Web for data collection, data analysis and synthesis	<u>1</u> , <u>2</u> , <u>3</u> , <u>4</u>	CO1- Oral and written instruction on assessing and interpreting conservation risk. CO3- Oral and written instruction in data collection from Quaarvark online database, graphical and statistical analysis in Excel.
15	Topic: Global Climate Change Activity: Guided inquiry on modeling of climate change Paper discussion of effects of climate change on plants & animals	<u>1</u> , <u>2</u> , <u>3</u> , <u>4</u>	CO1- Oral and written instruction on synthesizing multiple types of evidence. CO3- Oral and written instruction on ecological modeling.