

July 18, 2013

1. College: **Sciences and Mathematics**
2. Department: **Biology**
3. Course status: **new; requires new course approval**
4. Course prefix and number: **BIO 125**
5. Course title: **Principles of Ecology and Evolution**
6. Course catalog 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.**
7. Number of semester credit hours: **4**
8. Estimated total course enrollment per year: **300**
9. Course prerequisites and/or required qualifications for enrolling in the class: **TSI Complete**
10. Course **is not/will not be** available online.
11. Foundational Component Area: **Life and Physical Sciences**
12. Explain why this course fits into this foundation component area: **Principles of Ecology and Evolution focuses on biological thinking, biological skills and theoretical concepts in ecological and evolutionary biology. Lectures will provide instruction in fundamental scientific skills including evaluating scientific ideas and evidence, interpreting data and reading primary literature. Lectures will describe, explain natural phenomena using the processes of microevolution and macroevolution and describe, explain and predict interactions between organisms and their environments at the individual, population, community and ecosystem levels. Laboratories will consist of inquiry-based activities that coordinate with lecture material. In lab, students will explain natural phenomena using the scientific method to generate hypotheses, collect, analyze and evaluate their data. Students will collect data in field experiences, online databases and simulations of large-scale experiments to address concepts in both ecology and evolutionary biology. This course provides an opportunity for students to understand the implications of ecological and evolutionary principles have shaped the physical world and human experience and how the physical world and human experience have shaped the ecology and evolution of the worlds' diverse biota. Note: The subcommittee was concerned about the title of the course, stating "Evolution is sometimes a controversial topic." However, we have not revised the title for the course due to the following: 1) The American Association for the Advancement of Science and the National Science Foundation list Evolution as the first of five Core Concepts vital to scientific literacy in their document "Vision and Change in Undergraduate Biology Education (2011). 2) Evolution is identified as a Unifying Concept and Biological Evolution is identified as a major topic in Life Science by the National Science Education Standards written by the National Research Council (1996). 3) The Biology Department offers a wide variety of core curriculum courses, but none have Evolution as a primary focus.**
13. Core Objectives
 - o Critical Thinking - Instruction: Scientific thinking comprises a significant portion of the content of this course. Students will be instructed in critical thinking skills

through critical readings about the skills they are learning, through lectures, student centered activities and through instructor-led discussions. Activities and Assignments: Students will engage in a number of activities designed to teach critical thinking skills. These include 1) Structured/Guided inquiries. Students will be taught how to evaluate sources, evidence and data in order to draw conclusions about scientific hypotheses. They will learn how to distinguish between competing hypotheses using data-based analysis and evidence (Weeks 1-5, 7-10). 2) Laboratory experiments. In the laboratory, students will regularly engage in all aspect of the scientific method by making observations, formulating hypotheses, collecting data testing these hypotheses, making conclusions and comparing their conclusions with those of other students (Weeks 6, 9-14). These experiments require critical thinking skills in order to justify conclusions and understand how differences in data and analysis may result in different conclusions. Students will be required to expand their understand of their own experiments by incorporating results of other students to build a complete understanding of fundamental concepts. Assessment: Critical thinking skills will be assessed for abilities to evaluate, analyze and draw conclusions in the Week 9 structured inquiry on "Tree Thinking and Building Phylogenies". Critical thinking skills will also be evaluated from the Week 6 laboratory report "Natural Selection in Guppies" based on hypothesis testing activities using a rubric designed to evaluate students' abilities to analyze and synthesize information.

- Communication Skills - Instruction: Students will be given instruction in communication skills through critical readings focusing on the goals and development of written, oral and visual communication skills. Additional instruction in these skills will be provided through lectures, and through instructor-led discussions. Activities and Assignments: In lab, students will develop communication skills in the following types of activities. 1) Structured/Guided inquiries. Students will develop oral and written communication skills by collaborating in small groups to complete question sets, problem sets and case studies (Weeks 2, 3, 4, 5, 8, 9). 2) Group discussion. Students will communicate in small groups and as a class to discuss scientific sources and primary literature (Weeks 3, 7, 15). 3) Lab presentations. Students will give short presentations in small groups to the lab. These will require written, oral, and visual communication skills to prepare (Weeks 3,4) 4) Laboratory reports. Students will develop written and visual communication skills through formal lab reports for experimentally based labs (Weeks 6, 10-13). Students will be required to review literature, describe methods, results and discuss the implications of their results in written reports while incorporating graphical representations of their results. 5) A semester-long project will also contribute to the development of students' communication skills. As a group, students will conduct a research project and present the results of the project to the class. The project will be a video, digital media, or formal presentation that will require students to prepare a written script (written communication), present the project orally (oral communication) and with computer-generated visual aids (MovieMaker, iMovie, Prezi or Powerpoint) (visual communication). Assessment: Assessment of communication skills will be based on the final

project associated with the group project using a rubric that addresses the organization, clarity and correctness of the written script, the quality, relevancy and presentation of images, and the appropriateness and effectiveness of the production of oral presentation. Communication skills will also be assessed in the Week 13 laboratory report on "Competition" using a rubric that addresses the quality of each section of the report (Introduction, Methods, Results, Discussion, Figures).

- Empirical and Quantitative Skills - Instruction: Each lab meeting will include written and oral instruction in the empirical and quantitative skills used in that activity. Students will be provided with handouts guiding them through the steps in each skill relevant to a lab activity. Additionally, mini-lectures by the instructor will provide clarification and examples of each skill used. Activities and Assignments: Empirical and quantitative skills are a major component of each laboratory activity. Students will develop the following empirical and quantitative skills. 1) Data collection. Data will include observations in field settings (Weeks 12, 13) and collection and organization of subsets of data from large online databases such as the Animal Diversity Web, National Climatic Data Center and GenBank, a genetic sequence database maintained by NIH (Weeks 9, 10, 11, 14). 2) Data organization. Students will work with Excel spreadsheets to organize data and create graphical representations of their data (Weeks 4, 6, 10-14). 3) Data analysis. Students will analyze data in a number of ways. They will analyze graphical figures in primary research (Weeks 2, 4, 7 and 15) and also produce graphical representations of their own data (Weeks 6, 8, 9-14). Students will also conduct statistical analysis of data they collect (Weeks 6, 11-14). 4) Mathematical modeling. Students will learn the basics of mathematical modeling and will build and interpret ecological models (Weeks 12, 13, 15). Assessment: Empirical and quantitative skills will be assessed in the Week 6 laboratory activity "Natural Selection in Guppies." This hypothesis testing experiment requires data collection, organization and analysis. Students' abilities will be assessed using a rubric evaluating skills including calculation, analysis, representation and analysis.
- Teamwork - Instruction: Students will be assigned groups in the first week of class and will be instructed in teamwork skills by participating in group and class discussions about characteristics and strategies for effective teamwork. Discussions will include teamwork skills including accountability, individual responsibility, management, and organization. Activities and Assignments: 1) Students will work in teams of 2-3 to complete weekly laboratory exercises involving structured/guided inquiries, data collection and analysis (Weeks 1-15). Teams will coordinate their efforts and will often be required to communicate informally and share results with other teams in their laboratory section. 2) Group Project. Students will complete a semester-long project in teams of 4-5. 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. The project will require leadership by each team member on various tasks, and coordination of tasks to complete the project. In addition to the task of working together, students will complete assignments aimed at

developing teamwork skills including understanding and application of roles, individual responsibility, accountability, management and organization. They will develop a Group Contract at the beginning of the project to assign tasks and outlines expectations for their group. They will also be responsible for a Project Journal tracking group meetings and progress. Finally they will complete a Project Evaluation to reflect on their experience and the teamwork skills they excel at and are challenged by. Assessment: Teamwork will be assessed based on the semester-long group project. At the completion of the project, students will complete peer evaluations for each group member and a self-evaluation. These multiple measures will be combined for an individual grade. Additionally, students will complete a written project evaluation that addresses reflection questions about the process of the project that will supplement the rubric. Questions may include "What did you as a group do well, and what can you have improved on?", "Was the workload evenly distributed among members of your group?" and "What challenges or issues did you have in coordinating as a group?".

Contact person for questions about this submission:

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