# University of Houston-Downtown

**Course Prefix, Number, and Title:** BIOL 1312: Ecology and Environmental Biology

**Credits/Lecture/Lab Hours:** 3/2/2

**Foundational Component Area:** Life and Physical Sciences

**Prerequisites:** Completion or enrollment in ENG 1301
**Co-requisites:** None

**Course Description:** An integrated lecture/laboratory course for non-science majors. This course will include the scientific method and the relationship between science and technology. Major themes will include cells, organization of the human body and functions of organ systems. Issues related to human biology (ie. genetic engineering, human reproduction) will also be discussed. Laboratory activities will be investigative in nature and relate to lecture topics.

**TCCNS Number:** NA

**Demonstration of Core Objectives within the Course:**

| Assigned Core Objective | Learning Outcome Students will be able to: | Instructional strategy or content used to achieve the outcome | Method by which students' mastery of this outcome will be evaluated |
|---|---|---|---|
| Critical Thinking<br><br>Empirical & Quantitative Reasoning | Utilize scientific processes to identify questions pertaining to natural phenomena. | 1) Hypothesis Development and/or Experimental Design<br><br><u>Example Activity</u>:<br>a. Ecology Case: The Effects of Coyote Removal in Texas (class and/or online activity) – Students propose an experiment to test the effects of coyote removal on the remaining animal community, and hypothesize immediate and continued effects of coyote removal. Students analyze example study data, and write a summary about the effects of coyote removal.<br><br>2) Evaluating Sources of Scientific Information<br><br><u>Example Activity</u>:<br>a. Global Warming (class | 1) Students work in teams, or on their own, to develop hypotheses, and/or ways to test them. Mastery of hypothesis development is evaluated based on evidence of reasoning, comprehension, and quality. Experimental design is evaluated based on applicability to the original question(s) and hypothesis/hypotheses, identification of all variables, elimination of potentially confounding variables, and proper use of a control group.<br><u>Additional Methods of Assessment Specific to Example Activity</u>:<br>a. Ecology Case: The Effects of Coyote Removal in Texas (class and/or online activity) – Accuracy and quality of student hypotheses, experimental design components, results |

| | | | |
|---|---|---|---|
| | | and/or online activity) – Students select online articles on global warming from an instructor-provided list, and evaluate the reliability of the information and source itself. | interpretations, and ecological relevance are assessed in responses and a short essay. Students are to summarize the impacts of coyote removal on the remaining community. Students are expected to describe the loss of biodiversity and the difficulty of predicting the consequences of environmental manipulation. This assignment is evaluated using a grading rubric.<br><br>Students evaluate the reliability of scientific information from secondary sources. Students are taught how to identify "red flags," and their ability to critically evaluate the source is assessed. Students collaborate in the evaluation of scientific evidence from multiple perspectives, thus are also evaluated on participation.<br><u>Additional Methods of Assessment Specific to Example Activity</u>:<br>a. Global Warming (class and/or online activity) – Students are to evaluate online articles from an instructor-provided list. Identification of as many "red flags" as possible is extremely important in this activity. Students are evaluated on their ability to recognize "red flags" using a worksheet, and on their overall summary/ explanation of a source's reliability. |
| Critical Thinking<br><br>Empirical & Quantitative Reasoning | Utilize scientific processes to develop hypotheses, collect and analyze data using quantitative and qualitative measures. | 1) Hypothesis Testing<br><br><u>Example Activity</u>:<br>a. Genetic Drift in the Lab (lab activity) – Students will use the random "grabbing" of | 1) Students develop hypotheses and collect and analyze data. Mastery of hypothesis development is evaluated based on evidence of reasoning, comprehension, and |

| | | | |
|---|---|---|---|
| | | different colored beads out of a bag (without peaking), representing different alleles in a population, to investigate how genetic drift alters allele frequencies.<br><br>b. Genetic Drift Analysis (online activity) – Students investigate example scenarios of colored marbles randomly poured or extracted from a container, representing different alleles in a population, to investigate how genetic drift alters allele frequencies, and will explore and describe examples in nature and in human populations. | quality. Students are also evaluated on data collection and analysis techniques.<br><u>Additional Methods of Assessment Specific to Example Activity</u>:<br>a. Genetic Drift in the Lab (lab activity) – Teams collect allele frequency data from "grab" rounds, and organize this information into a graph to display their results. Teams communicate their results in class and on paper. Teams are evaluated on hypothesis development, data analysis, and communication of results.<br><br>b. Genetic Drift Analysis (online activity) – Students analyze frequency data from example scenarios of genetic drift, including population bottleneck and founder effect. Students are required to explain what factors contribute to genetic drift, and to apply what they have learned by proposing hypotheses regarding genetic drift in additional scenarios. Student comprehension of genetic drift and hypothesis development are also assessed based on the quality and completion of these items. |
| Critical Thinking<br><br>Empirical & Quantitative Reasoning<br><br>Communication | Utilize scientific processes to effectively communicate the analysis and results using written, oral and visual communication. | 1) Written, Oral, and Visual Communication<br><br><u>Example Activity</u>:<br>a. Environmental Issues Project (class and/or online activity) – Students select an environmental issue to research and communicate to the class using written, oral, and visual communication. | 1) Students present their work in written, oral, and visual formats, and are evaluated on effective communication using a rubric.<br><br><u>Additional Methods of Assessment Specific to Example Activity</u>:<br>a. Environmental Issues Project (student project) – Students research and present |

| | | | |
|---|---|---|---|
| | | | an environmental issue in detail, and must include (1) background on the topic, (2) evaluation of scientific evidence on the topic, (3) description of ecological/environmental impacts, (4) description of economic impacts, and (5) discussion of current and future focuses. Students communicate in written, oral, and visual platforms, and evaluate peer projects. Two rubrics are used as a guide for the evaluation of these items. |
| Teamwork | Collaborate in the evaluation of the quality of scientific evidence from multiple perspectives toward the goal of reaching a shared objective. | 1) Collaboration in the Evaluation of the Quality of Scientific Evidence in the Laboratory<br><u>Example Activity</u>:<br>a. Morphological Basis of Human Race Classifications (lab activity) – Students assign photographs of people to "race" categories created by students, which may or may not align with present social convention, based upon phenotypic characteristics the students have initially hypothesized to be expected in these "race" categories. Students then evaluate the accuracy of these groupings, when held under biological expectations for "race" (subspecies) groupings.<br><br>2) Collaboration in the Evaluation of the Quality of Scientific Evidence using the Online Discussion Board<br><br><u>Example Activity</u>:<br>a. Discussion Board Communication: Ecology and Evolution Q&A Discussion | 1) Students collaborate in the evaluation of scientific evidence from multiple perspectives, thus are also evaluated on participation.<br><br><u>Additional Methods of Assessment Specific to Example Activity</u>:<br>a. Morphological Basis of Human Race Classifications (lab activity) – Students propose "race" groupings using their own proposed expected physical characteristics (hypothesis development), and evaluate the accuracy of these groupings, when held under biological expectations for "race" (subspecies) groupings. Students communicate their conclusions in the accompanying worksheets from our lab manual, and are evaluated on proper hypothesis development strategy, ability to communicate their findings on paper, and on whether or not the statements in these findings are supported by results within.<br><br>2) Students evaluate |

| | | | |
|---|---|---|---|
| | | (online activity) – Students use/explain scientific reasoning and evidence of the endosymbiotic theory, plant evolution, and tetrapod animal evolution. Students collaborate through the sharing and evaluation of this information. | scientific evidence from multiple perspectives in the online discussion board. Students are to communicate with peers online to lend supporting and/or refuting evidence to peer posts. Student communications are evaluated for accuracy, evidence of critical thought, and the merit of any proposed hypotheses and/or presented information.<br><u>Additional Methods of Assessment Specific to Example Activity</u>:<br>a. Discussion Board Communication: Ecology and Evolution Q&A Discussion (online activity) – Student communications are evaluated for accuracy, evidence of critical thought, and the merit of any proposed hypotheses. Students are required to use/explain scientific reasoning and evidence behind all posts and discussions. |

**Additional Course Outcomes:**

Students will:

- utilize the scientific process to identify questions pertaining to natural phenomena,
- develop hypotheses,
- collect and analyze quantitative and qualitative data,
- collaborate in the evaluation of the quality of scientific evidence from multiple perspectives toward the goal of reaching shared objective, and
- communicate analyses and results using written and oral communication.

After completing this course, students will:

- understand the scientific process and how problems are solved in science,
- understand how science provides explanation of cause and effect relationships in natural phenomena,
- be able to apply scientific reasoning to observations of natural phenomena,
- understand the history and modern application of important concepts in the natural sciences,
- understand how science is perceived by society, how the history of science and our modern world are intertwined, and how science continues to impact society today;
- be able to distinguish arguments that are based on scientific reasoning versus those that are not.

**Course Outline:**

- **Fundamentals of Science and Biology –**
  scientific study of life (chapter 1); cells (chapter 3); basic chemistry (chapter 2.1-2.5)
- **Climate and Biomes –**
  preparatory information on energy (chapter 4.1), photosynthesis (chapter 5.1-5.4), and aerobic cellular respiration (chapter 6.1-6.3); the carbon cycle (chapter 19.7B); global warming (chapter 20.4 and supplemental information); climate and biomes (chapter 19.1-19.3)
- **Introduction to Evolution –**
  preparatory information on basic genetics (chapter 10.1, 10.2, 10.9); forces of evolution (chapters 12, 10.10, 22.7, 18.7); evidence of evolution (chapters 13, 8.7, 28.11)
- **Macroevolution –**
  speciation and extinction (chapter 14); human evolution and "races" (chapters 17.12, 11.5, 7.11, 10.9, 23.6 and supplemental information)
- **The Unity and Diversity of Life –**
  life's origins, prokaryotes, and evolution of the eukaryotic cell (chapter 15.1-15.3); protists and fungi (chapter 15.4-15.5); plants (chapter 16.1-16.5); animals (chapter 17.1-17.11, 17.13)
- **Introduction to Ecology –**
  population ecology (18.1-18.6); communities and ecosystems (chapters 19, 15.6)
- **Biodiversity: threats and preservation –**
  Threats (chapter 20.1-20.5, 20.7 and supplemental information); conservation biology (chapter 20.6 and supplemental information)
- **Topics in Environmental Science –**
  This module covers selected human activities and their environmental impacts. Specific environmental issues are to be explored (e.g., agriculture, water, energy, etc.). Coverage will be from selected textbook topics, *The Habitable Planet* website (http://www.learner.org/courses/envsci/index.html), instructor-provided supplemental information, and student projects on environmental issues. Student projects.

**Grading/Course Content which Demonstrates Student Achievement of Core Objectives:**

| ***Course Grade*** | ***A: 90-100*** | ***B: 80-89*** | ***C: 70-79*** | ***D: 60-69*** | ***F: 0-59*** |
|---|---|---|---|---|---|
| | | | | **Relative** | **Grade** |
| **Module 1 – Fundamentals of Science and Biology** | | | | | **100 pts.** |
| **Module 2 – Climate and Biomes** | | | | | **100 pts.** |
| **Module 3 – Introduction to Evolution** | | | | | **100 pts.** |
| **Module 4 – Macroevolution** | | | | | **100 pts.** |
| **MIDTERM EXAM** | | | | | **100 pts.** |
| **Module 5 – The Unity and Diversity of Life** | | | | | **100 pts.** |
| **Module 6 – Introduction to Ecology** | | | | | **100 pts.** |
| **Module 7 – Biodiversity: threats and preservation*** | | | | | **100 pts.** |
| **Module 8 – Student Projects and Topics in Environmental Science*** | | | | | **100 pts.** |
| **FINAL EXAM** | | | | | **100 pts.** |
| | | | **TOTAL POINTS** | | **1000 pts.** |

*Points in Each Module:* Each module includes 100 points. There is at least one 50 point exam in each module.

**NOTE: Environmental Issues Project*: Students select an environmental issue to explore, describe, and evaluate from a provided list in module 7. In module 8, students post a video presentation on their topic in the classroom discussion board, and receive two separate grades from the project, one based on **content (30 points)**, and another on **oral communication (20 points)**. This module also has a 50 point exam.