

## BIO 104: Evolution and Society – Spring 2022

Location: McGowan North 143

Hours: Every Second Wednesday 5:45-9:00pm

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Office Hours: By appointment

**Introduction:** “Nothing in biology makes sense except in the light of evolution”, said Theodosius Dobzhansky, one of the most important geneticists of the twentieth century. Evolution is the central unifying principle in the biological sciences and is critical for a proper understanding of the nature and generation of biological diversity. It is also one of the most misunderstood topics in science. Darwin’s development of the theory of evolution by natural selection is a story of great scientific discovery. Traveling around the world on the H.M.S. Beagle transformed Darwin from an insecure young man unsure of his future into an established scientist that would eventually revolutionize the scientific world. The time that Darwin spent on the Galapagos Islands was central to this transformation. Having emerged from the ocean as a product of volcanic activity, the Galapagos are now home to an extraordinary assemblage of animals and plants that highlight the ability of species to adapt to even the harshest conditions.

Evolution and Society is one of two courses that form part of the **Galapagos: Evolution and Society Study Abroad program**. In this course, we will learn about Darwin’s theory of evolution by natural selection, how it was developed including the importance of Darwin’s visit to the Galapagos Islands on the H.M.S. Beagle, what evidence exists to support the theory of evolution, and what it means for society. More broadly, we will learn about the fundamental nature of science. What is science? How do we distinguish science from pseudo-science? How are hypotheses tested? To do so, we will cover the scientific method, learn about the controversy between evolution and intelligent design, and go over case studies in evolution to learn how real scientists go about testing the predictions of evolutionary theory.

**Readings:** The reference book for this course (and the companion Natural History of the Galapagos course, BIO 183) is the Pulitzer Prize winning **The Beak of the Finch** by Jonathan Weiner. It is a beautifully written book that tells the stories of the scientists that study Darwin’s finches on the Galapagos Islands, explaining how they conduct their research and the insights that have come from generations of research on this system. Reading assignments from this book are posted in the course schedule at the back of the syllabus.

We will also have papers to read on some of the topics that we cover. These will be posted as PDFs on D2L. You will be expected to complete the reading assignments by the due dates listed on the course schedule.

## Scientific Inquiry: Science as a Way of Knowing Learning Outcomes

Students will be able to:

- Identify the types of questions that can and cannot be answered by science, and recognize the strengths and limitations of science in answering questions about the natural world.
- Critically evaluate the assumptions that underlie scientific investigations.
- Substantiate the claim that scientific knowledge is durable but can evolve with new evidence and perspectives.
- Connect evidence to the predictions made by theories and hypotheses, and then assess the extent to which the presented evidence supports or refutes a scientific claim.
- Evaluate the role of creativity, curiosity, skepticism, open-mindedness and diligence of individuals in scientific discovery and innovation.
- Recognize the uncertainty inherent in the scientific approach and evaluate scientists' efforts to minimize and understand its effect through experimental design, data collection, data analysis and interpretation.
- Evaluate the role of communication, collaboration, diversity and peer review in promoting scientific progress and the quality of scientific evidence and ideas, and ensuring compliance with ethical standards.
- Determine the extent to which science both influences and is influenced by the societies
- Apply scientific approaches to problem solving and decision-making in their own lives, and evaluate how scientific knowledge informs policies, regulations, and personal decisions.

### Writing Expectations:

Formal writing is essential for communicating ideas and progress in science, mathematics, and computation to experts within the field and to the broader society. Courses within the Scientific Inquiry Domain should include both formal writing (for example lab reports, essays, and written responses to questions) and supplemental elements that are appropriate for the subject of the course such as field journals.

### Course Specific Learning Outcomes:

Upon completing this course, students will be able to:

- Explain Darwin's theory of evolution, its development, and the role that the Galapagos Islands played from its origin to the present.
- Indicate the evidence for the theory of evolution and explain how scientists study it.
- Explain how evolution affects our society, why it matters for critical aspects of our lives including our health, and why it remains controversial in some sectors.

## Course Organization

This course will run as follows:

### Pre-Galapagos Trip (Spring Quarter)

We will meet for an introductory session about the program and five content sessions in the Spring quarter prior to our trip to Ecuador to learn about the development of the theory of evolution by natural selection, the evidence for evolution, the difference between science and pseudo-science, and the implications of evolution for society.

### Ecuador/Galapagos (June 26 – July 10)

During our field component, you will write daily journal entries about their daily activities in mainland Ecuador and on the Galapagos Islands. Some days you will be giving prompts, other days you will write freely on the topics you choose. Journals will be collected after our trip to Ecuador for grading. We will also have formal discussions to reflect on our experiences in the field. Students will be graded on participation and engagement during the field component of the program.

### Post-Galapagos Trip (Autumn Quarter)

We will meet for two sessions post-trip to reflect on the experiences abroad. Students will also give their final project presentations and write a paper highlighting the natural history and evolution of a species of their choice from the Galapagos Islands. These will be individual presentations. The final project paper will be based on the materials covered in the project presentations, but going into more depth, will also be collected.

**Grading Scale:** The following grading scale will be used:

A	-----	93-100
A-	-----	90-92
B+	-----	87-89
B	-----	83-86
B-	-----	80-82
C+	-----	77-79
C	-----	73-76
C-	-----	70-72
D	-----	60-69
F	-----	≤ 59

## Grading and Assignments:

Participation	20%
Pre-Trip Discussion Points for Readings	10%
Pre-Trip Assignments/Evaluations	10%
Pre-Trip Evolution Case Study Presentation	10%
Pre-Trip Case Study Paper	10%
Journal Entries	15%
Post-Trip Final Written Presentation	10%
Post-Trip Final Written Report	15%

**Attendance Policy:** Participation is worth 20% of your grade. Since you must be present to discuss and participate, you are expected to attend every class. Students that are absent will lose participation points for that week. Students that feel sick should not come to class and contact me so that we can make alternate arrangements. Do not be late for class! Students that are late will be considered absent.

**Participation:** The exchange of ideas is critical for fostering an active learning environment so I am counting on you to share your thoughts and participate often. Participation will account for 20% of your final grade. You will be assigned a participation grade every pre-trip session on a 20pt scale. You will also be assigned participation grades during our time in Ecuador and in the post-trip sessions. These participation grades will be averaged for your final Participation grade. You can drop the lowest grade from this category.

**Discussion Points for Readings:** During class, we will discuss the readings assignments from our book and from assigned pdfs. To facilitate the discussion, you will submit three discussion points to use in class. The Discussion Points should be well developed. You should both list the discussion point (including the source and pages in which it is referenced in your readings), AND explain its relevance or why you chose this point to highlight. I expect a paragraph consisting of several sentences for each discussion point. Discussion points should be submitted to D2L prior to the start of class as indicated on the course schedule, and also brought to class for peer review and discussion. The Discussion points will be worth 10% of your final grade. You can drop the lowest grade from this category.

**Pre-Trip Assignments/Evaluations:** We will have assignments to complete throughout the quarter and periodic evaluations. Worksheets will be graded for completeness and effort. To check your answers, we will have peer review sessions and class discussions during which we will discuss the correct answers. It is your responsibility to ensure that you understand what the correct answers are after the peer review sessions. Worksheets should be submitted to the respective Submission folder on D2L on the due date and brought to class in electronic or hard copy versions for discussion/peer review. You can drop the lowest grade from this category.

**Pre-Trip Galapagos Evolution Case Study Presentation:** What is the evidence for evolution and how do scientists gather it? How is a hypothesis tested? Students will prepare a 10 minute presentation on a scientific study conducted on a species from the Galapagos Islands related to biological evolution. You will be expected to draw information from peer-reviewed scientific articles. Original scientific articles are very difficult to read so adequate time to prepare will be crucially important. I expect a high quality presentation. Detailed instructions for preparing the presentations will be posted on D2L.

**Pre-Trip Galapagos Evolution Case Study Paper:** Using the materials from your Galapagos Evolution case-study presentation, you will write a paper on the same topic that will be due at the end of the quarter. The paper should be at least five pages single-spaced and written in your own words (do not use long quotes or multiple short quotes from the paper). The text should be divided into the following sections and include section headers:

-Your name.

-Citation of Paper: Include the authors, year, paper title, journal, volume, pages, and hyperlink to paper (if available).

-Summary: One or two paragraphs concisely summarizing the content of the paper.

-Introduction: Provides background on the topic of study. Should explain in simple, understandable terms.

-Objectives: Concisely summarizes the goal or goals of the paper.

-Methods: Indicates the experiments performed and methods of data analysis in enough detail for them to be clearly understood.

-Results: Presents the major findings of the paper. Can include figures, which do not count towards the page number limits

-Importance/Conclusion: Provides your perspective the importance of the results, indicates problems with the study or directions for improvement, and highlights possible next steps.

-Literature Cited: You should cite at least five other works that you have researched to go beyond what was covered in the original paper. Examples can be papers or internet articles providing a broader explanation of the background for the paper, a source indicating how a particular method used in the study works, similar studies conducted on other organisms, etc. In-text should be cited as follows: "Fish are cool (Aguirre, 2022)" or "Aguirre (2022) says that fish are cool". Citations in the Literature Cited section should follow a format similar to:

Aguirre, W. E., Shervette, V. R., Navarrete, R., Calle, P., & Agorastos, S. (2013). Morphological and genetic divergence of *Hoplias microlepis* (Characiformes: Erythrinidae) in Rivers and artificial impoundments of Western Ecuador. *Copeia*, 2013, 312–323.

The paper will be due on the day of the final exam at the end of the Spring quarter.

**Journal Entries:** During the field portion of the program, students will write daily journal entries about their activities in mainland Ecuador and on the Galapagos Islands. Journal entries should include observations about natural history, ecology, evolution, geology, biogeography, and the species observed. Students will also be given writing prompts about concepts related to the observations made during daily activities. Journals will be collected on a regular basis for grading.

**Post-Trip Final Project Presentation:** Based on the selection of a Galapagos species, students will be responsible for giving a 15 minute PowerPoint presentation to the class. This presentation will include information about the ecological zones that the animal inhabits, the natural food sources of the animal, the unique characteristics (physical and behavioral) and adaptations that the animal exhibits. The talk should also discuss the evolution of the animal, and how it relates both spatially and evolutionarily to other closely related animals. Dates of presentations will be decided prior to Autumn Quarter. The presentations should be deposited in the D2L submission folder one day prior to the actual presentation.

**Post-Trip Final Written Report:** Students will be required to submit a final report on their designated species that will follow a format and rubric as handed out in class. The report should be approximately 10 pages in length, and include the types of information used in the presentation, as well as additional information about the ecological stresses of the island(s) on which the animal is found, as well as the co-evolution that has taken place between the chosen animal and other animals or plants. The report must have standard citations of information used, and will follow the format of a standard research report.

**Academic Integrity:** Academic integrity entails absolute honesty in one's intellectual efforts. The DePaul Student Handbook details the facets and ramifications of academic integrity violations, but you should be especially aware of the policies on cheating and plagiarism. **Cheating** is any action that violates University norms or an instructor's guidelines for the preparation and submission of assignments. Such actions may include using or providing unauthorized assistance or materials on course assignments, or possessing unauthorized materials during an examination. **Plagiarism** involves the representation of another's work as your own, for example: (a) submitting as one's own any material that is copied from published or unpublished sources such as the internet, print, computer files, audio disks, video programs or musical scores without proper acknowledgement that it is someone else's; (b) paraphrasing another's views, opinions or insights without proper acknowledgement or copying of any source in whole or in part with only minor changes in wording or syntax even with acknowledgement; (c) submitting as one's own work a report, examination, paper, computer file, lab report or other assignment which has been prepared by someone else. If you are unsure about what constitutes unauthorized help on an exam or assignment, or what information requires citation and/or attribution, please ask your instructor. Violations may result in the failure of the assignment, failure of the course, and/or additional disciplinary actions. For more information, visit DePaul's Academic Integrity Website:

<https://offices.depaul.edu/academic-affairs/faculty-resources/academic-integrity/Pages/default.aspx>

**Respect for Diversity and Inclusion:** At DePaul, our mission calls us to explore “what must be done” in order to respect the inherent dignity and identity of each human person. We value diversity because it is part of our history, our traditions, and our future. We see diversity as an asset and a strength that adds to the richness of classroom learning. In my course, I strive to include diverse authors, perspectives and teaching pedagogies. I also encourage open dialogue and spaces for students to express their unique identities and perspectives. I am open to having difficult conversations and I will strive to create an inclusive classroom that values all perspectives. If at any time the classroom experience does not live up to this expectation, please feel free to contact me via email or during office hours.

**Writing Center:** I strongly recommend you make use of the Writing Center throughout your time at DePaul. The Writing Center provides free peer tutoring for DePaul students, faculty, staff, and alumni. Writing Center tutors work with writers at all stages of the writing process, from invention to revision, and they are trained to identify recurring issues in your writing as well as address any specific questions or areas that you want to talk about. Visit [www.depaul.edu/writing](http://www.depaul.edu/writing) for more information.

**Students with Disabilities:** Students seeking disability-related accommodations are required to register with DePaul's Center for Students with Disabilities (CSD) enabling you to access accommodations and support services to assist your success. There are two office locations: Loop Campus - Lewis Center #1420 - (312) 362-8002; Lincoln Park Campus - Student Center #370 - (773) 325-1677. Students can also email the office at [csd@depaul.edu](mailto:csd@depaul.edu). Students registered with the Center for Students with Disabilities can contact me privately to discuss how I may assist in facilitating the accommodations you will use in this course.

**University Counseling Services:** DePaul University Counseling Services (UCS) is committed to providing a range of culturally aware and sensitive clinical services to help currently enrolled DePaul students remove barriers to academic and personal success by addressing emotional, psychological, and interpersonal concerns through multiple treatment modalities. Services offered include: group counseling, individual counseling, couples counseling, crisis management, consultation, referrals, and telereach/outreach workshops. To connect with the counseling center, contact their main number at (773) 325-7779 during regular business hours (Monday-Friday, 9am-5pm) to schedule an initial consultation, which is typically scheduled within 1-2 business days of your call.

## Class Schedule

<p>Mar 30 – <b>Session 1: Program Introduction (~ 1 hour)</b></p>
<p>Apr 6 – <b>Session 2: Introduction to Evolution and Society – The making of a theory.</b>            Pre-Class Assignments: Complete Evolution Definitions Worksheet; Watch BioInteractive documentary on The Making of a Theory.            Reading Assignment: Weiner Pages 3-69.  <u>Optional</u> Reading Assignment: Grant &amp; Grant (2003), Boag &amp; Grant (1981).  <i>*Special Topic for Ecuador Trip: Introduction to Ecuador</i></p>
<p>Apr 20 – <b>Session 3: The Scientific Process.</b>            Reading Assignment: Weiner Pages 70-139.            Reading Assignment: Cold Fusion Case Study            In-Class Activities: Worksheet – The Scientific Process: Cold Fusion Case Study  <i>*Special Topic for Ecuador Trip: Safety</i></p>
<p>May 4 – <b>Session 4: Distinguishing science from pseudo-science.</b>            Pre-Class Assignments: Watch Judgement Day: Intelligent Design on Trial Documentary.            Reading Assignment: Weiner Pages 140-212.            Reading Assignment: Defining and identifying pseudoscience: Willingham (2012)            In-Class Activities: Worksheet – Distinguishing science from pseudo-science  <i>*Special Topic for Ecuador Trip: Travel etiquette</i></p>
<p>May 18 – <b>Session 5: Evolution case study presentations.</b>            Reading Assignment: Weiner Pages 213-303.            In-Class Assignment: Worksheet - Peer Review of Presentations.  <i>*Special Topic for Ecuador Trip: History of Ecuador and of humans on the Galapagos Islands</i></p>
<p>Jun 1 – <b>Session 6: Evolution and society</b> – Evolution in education, medicine, conservation, and policy.            Reading assignment: Pew Research Center; Stearns (2012) pages 4305-4313; Stockwell et al. (2003).            In-Class Assignments: Class discussion on the implications of evolution for society.            Worksheet – Evolution and society.  <i>*Special Topic: Trip logistics</i></p>
<p>Jun 8 –Final Pre-trip paper due.</p>

