IB-113L: Paleobiological Perspectives on Ecology and Evolution

Course format  Two lectures (1 hr 20 min ea)/wk; one 3 hr laboratory/wk (4 units)
Instructor  TBD
GSIs  TBD

Description  What do the fossil and geologic records have to tell us about the nature of ecological and evolutionary processes? What do they teach us that cannot be learnt from the living world alone? In answering these questions, this course provides an introduction to the analysis of key problems in paleobiology, with an emphasis on how evolutionary and ecological processes operate on geologic timescales. Topics include: the evolution of ecosystems; dissecting biodiversity dynamics; determining times of origin and extinction; assessing the absolute completeness of the rock and fossil records; stratigraphy and phylogeny reconstruction; theoretical and functional morphology; major events in the history of life, including Precambrian evolution, the Cambrian explosion, and the mass extinctions.

Labs  Scientific understanding flows from raw data, in our case from the morphologies, ecological associations, environments and ages of fossils. The labs will engage students in these empirical aspects of the fossil record. Each lab will have a formal assignment that will be assessed as part of each student’s final grade.

Reading  There is no text adequate for this course; instead weekly readings (see syllabus) will be made available via bCourses.

Prerequisites  Prior biology experience or permission of instructor. No paleontological or geological background required.

Assessment  % of Final Grade
Weekly lab exercises 20%
Participation in weekly labs 5%
Mid-semester Exam (Th., March 1st) 25%
Lab Exam (Wed, April 25th) 20%
Final Exam (Mon. May 7th, 11:30–2:30) 30%

100%
Syllabus
(the readings will be most useful if read before lecture, the references may be most useful if you at least skim them after lecture)

Jan 16 1) Introduction to the course
Jan 17 No LAB this week
Jan 18 2) Fossils, the fossil record, and its completeness

Jan 23 3) Exceptional preservation; Geological time
Jan 24 LAB 1: Intro to Fossils; Tour of the UCMP Collections
Jan 25 4) Continental drift and plate tectonics

Jan 30 5) An overview of the history of the Earth and life
Jan 31 LAB 2: Fossilization
Feb 1 6) Major transitions: origin of life

Feb 6 7) Time in the rock record
Feb 7 LAB 3: Nature of the Rock Record
Feb 8 8) Major transitions: Cambrian explosion; invasion of land; origins of the modern California biotas

Feb 13 9) How species richness has changed with time
Feb 14 LAB 4: Diversity Dynamics – DNA vs. The Fossil Record
Feb 15 10) Extinction: background vs mass extinctions; the death of the dinosaurs

Feb 20 11) The emergence and evolution of plants (Guest Lecturer: Dr. Duijnste) 
Feb 21 LAB 5: Fossil plants
Feb 22 12) Extinction: the other two greatest mass extinctions and their legacy

Feb 27 13) Diversity dynamics – what drives species richness change?
Feb 28 No LAB this week
March 1 MIDTERM
Reading: None
March 6  14) Systematics and the fossil record (Guest Lecturer: Dr. Finnegan)
March 7  **LAB 6**: Dinosaurs and some of their Relatives
March 8  15) Stratigraphic data, phylogeny reconstruction, and ancestors
   *Reading*: Smith A.B. 1994. Ch. 6 "The construction of evolutionary trees" in:

March 13  16) Punctuated equilibrium and rates of evolution
March 14  **LAB 7**: Dinosaurs in Motion
March 15  17) Macro-evolution (in contrast to micro-evolution)

March 20  18) The evolution of Marine ecosystems
March 21  **LAB 8**: Early life and Sepkoski’s Cambrian and Paleozoic faunas
March 22  19) Diversity change versus disparity change; why is there complexity?

SPRING BREAK

April 3  20) Theoretical morphology and the filling of morphospace
April 4  **LAB 9**: The Paleozoic fauna (continued)
April 5  21) Insights from fossil molecules: stable isotopes and biomarkers

April 10  22) Life in moving fluids; Molecular clocks
April 11  **LAB 10**: Sepkoski’s Modern Fauna
April 12  23) Calibrating time trees; Ancient DNA

April 17  24) The carbon cycle and climate change over geologic timescales
April 18  **LAB 11**: Ecology through time: Evolutionary escalation
April 19  25) The evolution of our humanness

April 24  26) *Homo sapiens* as a geologic force
April 25  **LAB 12**: LAB FINAL EXAM
April 26  27) How has paleontology changed our view of the present?
**Background Texts**

**Text: Principles**

**Texts: Principles and taxonomy of fossil groups**

**Texts: Morphology and taxonomy of fossil groups**

**Text: The evolution of life in the context of our evolving planet**

**Text: Paleoecology (an underdeveloped field; there are no great texts)**

**Concise Syntheses**

**Laggerstätten**

You can even download many of these for free (as entire books), thanks to Berkeley’s subscriptions: [http://www.lib.berkeley.edu/BIOS/ebooks.html](http://www.lib.berkeley.edu/BIOS/ebooks.html)
Academic Expectations

You are among the top students in the world, and will be treated accordingly. Being a student at UC Berkeley is a great privilege, and you have worked hard to get here. But the hard work is not over. Berkeley produces great graduates by consistently challenging its students to become better, and this class will be no different. The concepts covered in lectures are ones that I believe you will be able to understand, but that understanding won’t always come easily. The GSIs and I will work hard to help you understand them, but we also expect you to work hard and to rise to the challenge. If you are having difficulty understanding something in class, please speak out! I guarantee that you will not be the only one who is confused.

The student community at UC Berkeley has adopted the following Honor Code: “As a member of the UC Berkeley community, I act with honesty, integrity, and respect for others.” The hope and expectation is that you will adhere to this code.

Collaboration and Independence: Reviewing lecture and reading materials, and studying for exams can be an enjoyable and enriching thing to do with fellow students. This is recommended. However, exams and assignments are to be completed independently.

Cheating: Anyone caught cheating on a quiz or exam in this course will receive a failing grade in the course and will also be reported to the University Center for Student Conduct. In order to guarantee that you are not suspected of cheating, please keep your eyes on your own materials and do not converse with others during the quizzes and exams.

Plagiarism: To copy text or ideas from another source without appropriate reference is plagiarism and will result in a failing grade for your assignment and usually further disciplinary action. For additional information on plagiarism and how to avoid it, see, for example: http://www.lib.berkeley.edu/instruct/guides/citations.html#Plagiarism, or http://gsi.berkeley.edu/teachingguide/misconduct/prevent-plag.html.

Academic Integrity and Ethics: Cheating on exams and plagiarism are two common examples of dishonest, unethical behavior. Honesty and integrity are of great importance in all facets of life. They help to build a sense of self-confidence, and are key to building trust within relationships, whether personal or professional. There is no tolerance for dishonesty in the academic world, for it undermines what we are dedicated to doing – furthering knowledge for the benefit of humanity. Your experience as a student at UC Berkeley is hopefully fueled by passion for learning and replete with fulfilling activities. Nonetheless, we appreciate that being a student can be stressful. There may be times when there is temptation to engage in some kind of cheating in order to improve a grade or otherwise advance your career. This could be as blatant as having someone else sit for you in an exam, or submitting a written assignment that has been copied from another source. Or it could be as subtle as glancing at a fellow student’s exam when you are unsure of an answer to a question and are looking for some confirmation. One might do any of these things and potentially not get caught. However, if you cheat, no matter how much you may have learned in this class, you will have failed to learn perhaps the most important lesson of all, the value of personal integrity and self-respect.