

SIO 104: PALEOBIOLOGY AND HISTORY OF LIFE SYLLABUS Fall 2014

Lectures TTh 12:30-13:50 Vaughan Hall 100
Laboratories TTh 14:00-15:55 Hubbs Hall 3300

Richard Norris, Professor
300C Ritter Hall
858-822-1868
rnorris@ucsd.edu
Office Hours Wednesday, 16:00-17:00 or by appointment

Elizabeth Sibert, Teaching Assistant
esibert@ucsd.edu
Office Hours: TBA; Ritter Hall 154

Samantha Trumbo, Teaching Assistant
strumbo@ucsd.edu

Josh Reeves, Administrator Earth Sciences
188 Galbraith Hall
858 534 8157
jreeves@ucsd.edu

Course Description and Organization

The course introduces basic biological and environmental patterns and processes that have shaped the history of life. The laboratories introduce the diversity of the fossil record as well as basic biostratigraphy, taxonomy, and systematics. There will be one overnight week-end field trip to the Mojave Preserve that stresses Precambrian-Cambrian fossils and Cenozoic vertebrate fossils and another half-day trip to Anza Borrego that stresses Cenozoic shallow marine fossils and the formation of the Gulf of California. There are three required texts: *Life on a Young Planet: The First Three Billion Years of Evolution on Earth* by Andrew Knoll, that is closely linked to the lectures for the first half of the course, *Paleontology: a brief history of life* by Ian Tattersall, that addresses mainly issues in the last half of the class, and *The Earth After us: what legacy will humans leave in the rocks?* By Jan Zalasiewicz that is not only a fun read, but also addresses fundamental themes about how fossils are preserved, the nature of trace fossils and body fossils, and the paleoenvironmental indicators of ecosystems. Additional readings for the lectures and the weekly essays will be available electronically on "TED". [<https://ted.ucsd.edu/>]

Course Requirements and Grading

Lecture Midterm Exam 20%
Lab 40%
Essays on weekly readings/lectures 10%
Final Exam 30% (Friday, December 14, 11:30 am-2:30 pm)

SIO 104: PALO BIOLOGY AND HISTORY OF LIFE SCHEDULE

- 2 Oct Th Lecture 1: Introduction to course; Time, Life, Fossils and Major transitions in the history of life
Reading: *The Earth After Us* (first couple chapters)
Lab: 1: Fossils, preservation and the Geologic Timeline
- 7 Oct T Lecture 2: Geological evidence for the history of life
Demonstration: Time averaging and “better dead than alive”
Reading: *The Earth After Us* (a couple more chapters)
Lab 2: Cyanobacteria, stromatolites and algae protists
- 9 Oct Th Lecture 3: Earliest life on earth
Demonstration: Oldest Rocks, Chert and Modern Stromatolite
Reading: *Life on a young planet* Chapt 1-5 (but particularly 3-5)
Lab 3: Protists
Essay: Summarize this week’s lectures in 250 words and again in 48 words (due 14 Oct)
- 14 Oct T Lecture 4: The “Universal Tree of Life”
Demonstration: Types of fossils & Donut Phylogeny
Reading: *Life on a young planet* Chapt 1-2
Lab 4: Cladistics
- 16 Oct Th Lecture 5: Cyanobacteria, stromatolites, and the rise of oxygen
Demonstration: Examples of oxic and anoxic sediments
Reading: *Life on a young planet* Chapt 6-7
Lab 5: Sponges, archeocyathids, and cnidarians
Essay: Why don’t the more metabolically-efficient forms of life drive less efficient organisms extinct? For example, why do we still have lithotrophs, iron-reducers and methanotrophs around in the face of hyper-efficient heterotrophs? (250 words, max); then give a two sentence summary of your essay (points for being concise) (due 21 Oct)
- 21 Oct T Lecture 6: Origin and Diversification of Eukaryotes
Demonstration: How organelles get multiple sets of membranes
Reading: *Life on a young planet* Chapt 8-9
Lab 6: Arthropods
- 23 Oct Th Lecture 7: Ocean chemistry and Snowball Earth
Reading: *Life on a young planet* Chapt 12
Demonstration: Glacial sediments, lichens, clay and oxidized soils
Lab 7: Beach Walk: how to measure a section; low tide 3:42 pm

Essay: Briefly (1 page max—could be less!) Why, in terms of ocean chemistry, weathering and O₂, is the early Proterozoic such a watershed moment in Earth history while the mid Proterozoic is seemingly such a dull time? Finish with a one sentence summary of your article. (due 28 Oct)

28 Oct T

Lecture 8: Origin of Animals and Body Plans
Reading: *Life on a young planet* Chaps 10-11
Demonstration: Worms in a terrarium, living anemone; balloons
Lab 8: Brachiopods

30 Oct Th

Lecture 9: Origin of Animals and the Cambrian Explosion
Reading: *Life on a young planet* Chaps 11 & 13
Demonstration: Ediacaran fossils
Lab 9: Mollusks I
Essay: Summarize (in 6 sentences or less) the controversy between molecular and fossil evidence for the origin of metazoans (due 4 Nov)

1-2 NOVEMBER

OVERNIGHT FIELD TRIP (Saturday & Sunday)
Mojave National Preserve: Cambrian-Precambrian Boundary and Miocene fossil mammals

4 Nov T

Lecture 10: Pelagic Ecosystem Evolution
Demonstration: Chalk, Paleozoic limestone, and siliceous ooze
Lab 10: Mollusks II

6 Nov Th

Lecture 11: Pelagic Ecosystems II-Marine vertebrates
Demonstration: Convergence of reef builders
Lab: **MIDTERM LAB EXAM**

11 Nov T

VETERANS DAY HOLIDAY

13 Nov Th

Lecture: **MIDTERM LECTURE EXAM**
Lab 11: Anza Borrego Fossils and Rocks

16 Nov SUNDAY

DAY FIELD TRIP (Sunday)
Anza Borrego proto-Gulf of California invertebrates

18 Nov T

Lecture 12: Benthic Ecosystems
Reading: *Paleontology: a brief history of Life*, Chapt 5
Demonstration: incumbency
Lab 12: Bryozoans

20 Nov Th

Lecture 13: Extinctions
Demonstration Coin-flips & the Signor-Lipps effect

Reading: *Schulte et al 2010 and Discussion/Reply*
Lab 13: Echinoderms and protochordates

25 Nov T Lecture 14: Evolution of Forests and Animals
Demonstration: Early plants—lichens, horsetails and cycads
Reading: *Paleontology: a brief history of Life*, Chapt 5
Lab 14: Plants
Essay: In what ways does the formation of the first forests affect life in the oceans? (due 2 Dec)

27 Nov Th THANKSGIVING HOLIDAY

2 Dec T Lecture 15: Evolution of Dinosaurs and Mammals
Reading: *Paleontology: a brief history of Life*, Chapt 6-7
Lab 15: Vertebrate skull morphology

4 Dec Th Lecture 16: Radiations
Demonstration: Sabertooths and how they work
Lab 16: Biostratigraphy
Essay: (One page, max) Would we know if there had been a civilization like ours on Earth before us? What would be the best evidence for such a civilization? (due 9 Dec)

9 Dec T Lecture 17: Speciation and Mammal Diversification
Reading: *Paleontology: a brief history of Life*, Chapt 8-10
Norris and Hull: 2011: The temporal dimension of speciation
Lab 17: The Works—Lab review

11 Dec Th Lecture 18: Human evolution and our Legacy
Demonstration: Thought experiment: what would our time look like in 10 my?
Reading: *The Earth After Us* (if you have not finished it)
Lab: **LABORATORY FINAL EXAM**

19 DECEMBER (FRIDAY) FINAL EXAM (11:30AM-2:30PM)