

SIO 104: PALEOBIOLOGY AND HISTORY OF LIFE

SYLLABUS Fall 2015

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

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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)

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elizabethsibert 9/5/2014 7:14 PM

Comment [1]: General Comment: I made the essays due the next class after they were assigned. If you want to extend them to a week out, please do so. I forgot to change them when I did the initial date shifts, sorry!

SCHEDULE

- 24 Sept. 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 and Fossil Preservation
- 29 Sept 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: Beach Walk: How to measure a section and Geologic Time
- 1 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: Cyanobacteria, stromatolites and algae protists
Essay: Summarize this week’s lectures (2 & 3) in 250 words and again in 48 words (due 6 Oct)
- 6 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
- 8 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: Protists
Essay: Summarize the biological and geological evidence for when the Earth first became oxygenated. Was the “Great Oxygenation” an event or a long span of time? (250 words, max—I will count!); then give a two sentence summary of your essay (points for being concise) (due 13 Oct)
- 13 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: Sponges, archeocyathids, and cnidarians
- 15 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: Bryozoans
- 20 Oct T Lecture 8: Origin of Animals and Body Plans
Reading: *Life on a young planet* Chapt 10-11
Demonstration: Fun with balloons...and Ediacaran Fossils
Lab 8: Brachiopods
Essay: Briefly (1 page max—could be less! Points for being concise.) Is the “Cambrian Explosion”, really an explosion? Briefly summarize the

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Comment [2]: Made this more intensive last year, still didn't do well, need to work on better demos and interactive activities for this

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Comment [3]: Elizabeth at GSA

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Comment [4]: Elizabeth at GSA

biological and environmental evidence that tells how long the fuse burned and how rapidly animal diversification unfolded. Finish with a one sentence summary of your article. (due 27Oct)

22 Oct Th

Lecture 9: Pelagic Ecosystem Evolution
Demonstration: Chalk, Paleozoic limestone, and siliceous ooze
Reading: *Life on a young planet* Chaps 11 & 13
Lab 9: Arthropods

27 Oct T

Lecture 10: Pelagic Ecosystems II-Marine vertebrates
Demonstration: Mososaurs and delphinids
Lab 10: Mollusks I

29 Oct Th

Lecture 11: Benthic Ecosystems
Reading: *Paleontology: a brief history of Life*, Chapt 5
Demonstration: incumbency
Lab: **MIDTERM LAB EXAM (covers labs 1-8)**

31 Oct-1 Nov

Mojave National Preserve: Cambrian-Precambrian Boundary and Miocene fossil mammals

3 Nov T

Lecture 12: Extinctions
Demonstration Coin-flips & the Signor-Lipps effect
Reading: *Schulte et al 2010 and Discussion/Reply*
Lab 11: Mollusks II

5 Nov Th

Lecture: **MIDTERM LECTURE EXAM**
Lab 12: Anza Borrego Fossils and Rocks

10 Nov T

Lecture 12: Evolution of Forests and Animals
Demonstration: Early plants—lichens, horsetails and cycads
Reading: *Paleontology: a brief history of Life*, Chapt 5
Lab 13: Plants
Essay: Compare the molecular and fossil evidence for the diversification of land plants with the molecular and fossil evidence for the diversification of animals. Think here about the big picture—how do these two radiations compare in similarities and differences? (1 page max—could be less! Points for being concise.) (due Nov 17)

12 Nov Th

Lecture 13: Evolution of Dinosaurs and Mammals
Reading: *Paleontology: a brief history of Life*, Chapt 6-7
Lab 14: Vertebrate skull morphology

15 Nov SUNDAY

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

17 Nov T

Lecture 14: Radiations
Demonstration: Sabertooths and how they work
Lab 15: Deuterostomes: Echinoderms and protochordates

elizabethsibert 9/11/2015 12:08 PM

Comment [5]: I like this one before the

- 19 Nov Th Lecture 15: Speciation and Mammal Diversification
Reading: *Paleontology: a brief history of Life*, Chaps 8-10
Norris and Hull: 2011: The temporal dimension of speciation
Lab 16: Biostratigraphy and Climate Proxies
- 24 Nov T Lecture 16: The Late Neogene World
Lab 17: The Works—Lab review
Essay: (One page, max) Research a Summer Internship you might like to apply for and write a statement describing why they should select you, instead of somebody else. (1 page max—could be less!) Alternatively, write your personal statement (you will need one for most internships) describing your background and career goals. (due 1 Dec)
- 26 Nov Th THANKSGIVING HOLIDAY**
- 1 Dec T Lecture 17: Human evolution
LABORATORY FINAL EXAM (cumulative)
- 3 Dec Th Lecture 18: 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 18: **Fascinating Fossils Day**
- 11 DECEMBER (FRIDAY) FINAL EXAM (11:30AM-2:30PM)**

SIO 104: Paleobiology and the History of Life Laboratory

Location: Hubbs 3300

Time: Every Tuesday and Thursday following Lecture (2-3:50pm)

Professor: Dr. Richard Norris, morris@ucsd.edu

Teaching Assistants

Elizabeth Sibert - esibert@ucsd.edu

Office: Vaughan Hall 430

Office Hours: 2-3 PM MONDAY

10:30-11:30 PM THURSDAY

Michelle Zill – mzill@ucsd.edu

Office: Vaughan Hall 1XX

Office Hours:

NOTE: Office hours are held in Ritter Hall 154. Additional times by appointment

Grading

The laboratory portion of SIO 104 is worth 40% of your final grade. This includes completion of all laboratory exercises and field trips (65%), two practical laboratory quizzes (midterm - 10% and final - 15%), and participation (10%).

Attendance

Attendance is mandatory at all laboratories*. Missed labs must be cleared with us ahead of time (email is fine, but please let us know). Please be on time for labs – we will be keeping attendance. Not arriving on time will affect your participation grade. You will be allowed a maximum of two make up labs during the quarter*.

Laboratory Exercises

Laboratory exercises are designed to be completed during the 2 hour lab session. You are welcome to turn them in when you finish. **Labs are due at the beginning of the following lab session.** Late labs will have a penalty, but we will accept them, so it is always better to hand them in than not.

Field Trips

Field trips are an integral part of the course, and are mandatory*. They are also incredibly fun, and we highly recommend doing your best to be there. If you have a known conflict with any of the trip dates, please let us know as soon as possible, so we can determine the appropriate make-up work for you. You will hand in 1) your field trip guidebook and notes, and 2) a write-up with the results of each field trip, which will be assigned at the time of the trip. **Field trip assignments are due the Thursday after the field trip** (see schedule on next page).

Office Hours

Office hours will be held in Ritter Hall 154 – go to the basement of Ritter Hall, and walk south (towards Vaughan 100). 154 is the double doors on the left of the hall. You can use this time to make up missed labs, finish labs, ask us questions, or review the specimens at your leisure. If you cannot make the assigned times, please feel free to set up an alternate time with one of us.

A note about lab safety

We share the teaching lab space with biology classes that use toxic chemicals and biological agents. This means that no food or drink can be consumed in lab.

SIO 104 Laboratory Schedule

24 Sept Th	<u>Lab 1</u> : Fossils and preservation	
29 Sept T	<u>Lab 2</u> : Beach Walk: how to measure a section and Geologic Time	elizabethsibert 9/11/2015 12:24 PM Comment [6]: We'd do geologic time first, then beach walk second, for optimal tidal efficiency and because the beach walk is something that students can come back if they don't finish, but geologic time isn't really...
1 Oct Th	<u>Lab 3</u> : Cyanobacteria, stromatolites and algae protists	
6 Oct T	<u>Lab 4</u> : Cladistics	elizabethsibert 9/11/2015 12:24 PM Comment [7]: Should stay as "lab 4", to go with "lecture 4, tree of life"
8 Oct Th	<u>Lab 5</u> : Protists	
13 Oct T	<u>Lab 6</u> : Sponges, archeocyathids, and cnidarians	
15 Oct Th	<u>Lab 7</u> : Bryozoans	elizabethsibert 9/11/2015 12:24 PM Comment [8]: October 14 th is "National Fossil Day"
20 Oct T	<u>Lab 8</u> : Brachiopods	
22 Oct Th	<u>Lab 9</u> : Arthropods	elizabethsibert 9/11/2015 12:24 PM Comment [9]: I like this one before the
24-25 Oct	OVERNIGHT FIELD TRIP (Saturday & Sunday) Mojave National Preserve: Cambrian-Precambrian Boundary and Miocene fossil mammals	elizabethsibert 9/11/2015 12:24 PM Comment [10]: Need new dates!
27 Oct T	<u>Lab 10</u> : Mollusks I	elizabethsibert 9/11/2015 12:24 PM Comment [11]: Thursday before lecture midterm, during "week 5"
29 Oct Th	MIDTERM LAB QUIZ (covers labs 1-8)	elizabethsibert 9/11/2015 12:24 PM Comment [12]: This lab should be the class before the day trip. This was conveniently the afternoon after the lecture midterm, which worked really well.
3 Nov T	<u>Lab 11</u> : Mollusks II	elizabethsibert 9/11/2015 12:24 PM Comment [13]: New date!
5 Nov Th	<u>Lab 12</u> : Anza Borrego Fossils and Rocks	elizabethsibert 9/11/2015 12:24 PM Comment [14]: Should stay with "evolution of forests" or "invasion of land" lecture
16 Nov SUNDAY	DAY FIELD TRIP (Sunday) Anza Borrego proto-Gulf of California invertebrates	elizabethsibert 9/11/2015 12:24 PM Comment [15]: This is a nice relatively light lab that goes well with the "right before Thanksgiving".
10 Nov T	<u>Lab 13</u> : : Plants	
12 Nov Th	<u>Lab 14</u> : Vertebrate skull morphology	
17 Nov T	<u>Lab 15</u> Deuterostomes: Echinoderms and protochordates	
19 Nov Th	<u>Lab 16</u> : Biostratigraphy and Climate Proxies	
24 Nov T	<u>Lab 17</u> : The Works—Lab review	
26 Nov Th	<i>THANKSGIVING BREAK</i>	
1 Dec T	LABORATORY FINAL QUIZ (cumulative)	
3 Dec Th	Lab 18: Fascinating Fossils Day	elizabethsibert 9/11/2015 12:24 PM Comment [16]: Maybe...

