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

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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)
SIO 104: PALOBIIOLOGY AND HISTORY OF LIFE

SCHEDULE

<table>
<thead>
<tr>
<th>Date</th>
<th>Lecture</th>
<th>Readings/Activities</th>
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<tr>
<td>2 Oct Th</td>
<td>Lecture 1: Introduction to course; Time, Life, Fossils and Major transitions in the history of life</td>
<td>Reading: <em>The Earth After Us</em> (first couple chapters) Lab: 1: Fossils, preservation and the Geologic Timeline</td>
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<td>7 Oct T</td>
<td>Lecture 2: Geological evidence for the history of life</td>
<td>Demonstration: Time averaging and “better dead than alive” Reading: <em>The Earth After Us</em> (a couple more chapters) Lab 2: Cyanobacteria, stromatolites and algae protists</td>
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<td>9 Oct Th</td>
<td>Lecture 3: Earliest life on earth</td>
<td>Demonstration: Oldest Rocks, Chert and Modern Stromatolite Reading: <em>Life on a young planet</em> Chapts 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)</td>
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<td>14 Oct T</td>
<td>Lecture 4: The “Universal Tree of Life”</td>
<td>Demonstration: Types of fossils &amp; Donut Phylogeny Reading: <em>Life on a young planet</em> Chapts 1-2 Lab 4: Cladistics</td>
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<td>16 Oct Th</td>
<td>Lecture 5: Cyanobacteria, stromatolites, and the rise of oxygen</td>
<td>Demonstration: Examples of oxic and anoxic sediments Reading: <em>Life on a young planet</em> Chapts 6-7 Lab 5: Sponges, archecocyathids, 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)</td>
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<td>23 Oct Th</td>
<td>Lecture 7: Ocean chemistry and Snowball Earth</td>
<td>Reading: <em>Life on a young planet</em> Chapt 12 Demonstration: Glacial sediments, lichens, clay and oxidized soils Lab 7: Beach Walk: how to measure a section; low tide 3:42 pm</td>
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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* Chapts 10-11
Demonstration: Worms in a terrarium, living anemone; baloons
Lab 8: Brachiopods

30 Oct Th  Lecture 9: Origin of Animals and the Cambrian Explosion
Reading: *Life on a young planet* Chapts 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, Chaps 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)