EARTH 101: INVERTEBRATE PALEOBIOLOGY

2015 Course Summary:

Instructor and Contact Info: Matthew Clapham: mclapham@ucsc.edu, EMS A208, 459-1276. I typically will respond to emails within one business day.

Office Hours: Official times are Wednesdays from 1-3 or Thursdays from 10-11. I have an open door policy, so you are welcome to drop by at other times if I am in my office. You can also contact me to schedule a meeting. I am here to support your learning and to help you succeed, so please take advantage!

Lectures: MWF 3:30-4:40, EMS D250

Course Website: At eCommons (http://ecommons.ucsc.edu, log in with your UCSC user name and Gold password). Important handouts and assignments will be posted there and you will also need to log in to submit papers.

Course Goals: By the end of this class, you should be able to:

1) Identify an unfamiliar fossil or at least narrow down its identification.

2) Use fossils to solve geological and environmental problems.

3) Create and test hypotheses about evolutionary pattern and process.

There are two additional "skills" goals:

First, there is a focus on scientific writing. Clear, concise, and accurate written communication is the most important skill for a future career.

Second, you will also learn to critically examine quantitative claims. The class is not about math or statistics but many of the lecture and lab exercises will involve thinking analytically and using data to test hypotheses. A good sense of quantitative intuition (i.e., whether claims are reasonable or not) and skeptical assessment of apparent patterns (are they real or simply random fluctuations?) are valuable tools for a scientist.

Class Structure and Assignments

We will use a "flipped" class structure for this course, rather than the traditional lecture format. In this structure, you will watch a short video (10-15 minutes long) from the YouTube playlist prior to class. You should take notes and try to understand the key concepts, asking for clarification if necessary.

You will then spend the class period working individually or in small groups on hands-on exercises that use fossil specimens or actual data. These exercises will be due at the end of the class period, so make sure you are familiar with the information from the video and come prepared to use it to solve problems. The in-class exercises are designed to challenge you and push you outside of your comfort zone. You may feel confused at times but that is good – a little confusion is an important step in learning! The TA and I will be on hand to guide you through the in-class assignments, so make sure to ask questions and ensure that you understand the material.

The final exam will include the same types of questions that you will do in the in-class work. The exam is intended to evaluate whether you can apply your knowledge to solve problems, not whether you can memorize facts. Because of that goal, you will be allowed to use any hard-copy material (notes, printed material, etc.) for reference during the exam, but no electronic devices (unless needed for disability accommodation).

Disability Accommodation

UC Santa Cruz is committed to creating an academic environment that supports its diverse student body, as am I. If you require accommodations to achieve equal access in this course, please stop by my office with your letter from the Disability Resource Center (DRC), preferably within the first two weeks of the quarter, so we can discuss ways to ensure your full participation in the course. I encourage all students who may benefit from learning more about DRC services to contact DRC by phone at 831-459-2089 or by email at drc@ucsc.edu.

Report and Assignments

Because of the emphasis on writing, you will write three papers. The first is on environmental reconstruction and will use your knowledge of taphonomy (length approximately 6 pages). We will discuss organization, structure, and style of the first report in class on Oct 2. The second paper will be based on data collected on the field trip and will focus on archaeocyath ecology and reef-building (length about 4-6 pages). The third report will cover morphology, evolution, and biogeography using trilobites as example organisms (length about 10 pages).

Report 1 (environmental reconstruction): in-class work Sept 30 and Oct 2, **report due Oct 19**

Report 2 (archaeocyath reefs): field trip October 9-11, **report due Nov 6**

Report 3: (trilobite paper): in-class work Oct 26, 30, Nov 18, 25 (optional), **report due Nov 30**

Late policy: I will deduct 10 percentage points per day – including weekends – for late written reports (with valid exceptions if you contact me before the due date).

In-class work: Most class meetings will include an exercise to be turned in at the end of the period. I encourage you to attend class to maximize your learning, but you can turn in up to three in-class assignments without penalty by the beginning of the next class period in case of illness, personal or family crisis, or any other situation. This offer applies without question, so you do not need to contact me – simply turn in the assignment to me, my mailbox, or your eCommons dropbox folder before the beginning of the next class.

Writing and plagiarism: The scientific method builds upon previous results, but it is extremely important to give credit whenever you are using ideas from other sources and always to rephrase those ideas in your own words. Rewriting and proper citation is important not only because it is ethical, but also because plagiarism hinders you from achieving a deeper understanding of concepts and prevents you from practicing important skills like writing. We will discuss scientific citation in more detail before the second paper. Because academic dishonesty circumvents the learning process, I have a zero-tolerance policy for plagiarism. The penalty for academic dishonesty is, at a minimum, zero on the assignment and may also include a formal filing with your college for particularly egregious cases.

Lecture Grading Scheme

Points will be allocated following this scheme:

In-class work:	40
Environmental reconstruction report:	25
Field trip report:	35
Trilobite report:	50
Final exam:	50
Total:	200

There may be a curve upward but you will be guaranteed the following letter grades if you achieve a given percentage grade:

>90% = A+	>85% = A	>80% = A-
>76% = B+	>73% = B	>70% = B-
>65% = C+	>60% = C	>50% = D

An A grade is given for *excellent mastery* of the course material. To earn an A, students will be able to apply material from the class to solve novel problems and will write clearly, in detail, and with sophisticated interpretations. Grades in the B range indicate *good mastery* of the topics and skills, such as the ability to solve problems similar to previously-encountered questions. Writing that receives a B will contain interpretations supported by the data but may lack detail or nuance. A C grade indicates only *adequate mastery* of the course. This means that a student may only be able to solve some problems or the writing may lack clarity or have limited interpretation without clear support from the data.

Grades for all assignments will be posted to eCommons. Please let me know if you spot any mistakes made during data entry and I will correct the error. Aside from correcting errors from counting of points or data entry, I do not regrade assignments or provide extra credit work because it would not be fair to students who are less outgoing (and who therefore might not ask) or who have other time commitments.

Textbooks: There are no required textbooks and I will not assign specific readings from a text (papers for reading will be provided). However, if you would like a reference, these books are good choices:

> *Benton, M.J. and Harper, D.A.T. (2009). Introduction to Paleobiology and the Fossil Record*. In my view this is the best paleo textbook; it strikes a good balance between coverage of the different taxonomic groups and of analytical topics like diversity and extinction. Copies will be on reserve at the Science and Engineering library.
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> *Foote, M.J. and Miller, A.I. (2007). Principles of Paleontology*. This book is by far the best text on quantitative or analytical aspects of paleobiology, such as morphology, evolution, and extinction. It does not include descriptions of taxonomic groups. The library's copy will also be on reserve at the Science and Engineering library.
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> *Prothero, D.R. (2013). Bringing Fossils to Life: An Introduction to Paleobiology*. I prefer the Benton book, but the library has online access to the third edition and has a paper copy of the second edition (from 2004). The first edition (also at the library, from 1998) is a bit out of date now.

Labs: TA Dan Killam (A201, dekillam@ucsc.edu). Labs will be held most weeks (Tuesday 6-9 PM, Wednesday 8:30-11:30 AM) in D250. Lab exercises will involve a combination of in-class examination of specimens, focusing on important aspects of morphology and classification, and exercises on topics like biogeography and evolution. Lab grades will be separate from lecture grades.

Field Trip: There is a mandatory field trip from Friday October 9 (8 AM) to Sunday October 11. Because you will collect data for a report, field trip attendance is important and is required.

Class Schedule – Fall 2015

Date	Topic	Pre-Lecture Video	Due Dates
Sept 25	Introduction; taphonomy (preservation)		
Sept 28	Taphonomy (transport and time-averaging)	Taphonomy (time-averaging)	
Sept 30	Environmental preferences/reconstruction	Environmental tolerance/marine org	
Oct 2	Environmental reconstruction: report writing	Species composition and diversity	
Oct 5	Functional morphology: suspension-feeding	Morphology of suspension feeders	
Oct 7	Functional morphology: reef-builders	Functional morphology: reefbuilding	
Oct 9	*No lecture (field trip)*		
Oct 9-11	**Required field trip (fossil reefs of Nevada)**		
Oct 12	Reef ecosystems through time	*No video*	
Oct 14	Scientific writing (body of the paper)	*No video (read assigned paper)*	
Oct 16	Scientific writing (title, abstract)	*No video (write abstract/title)*	
Oct 19	Functional morphology: substrate	Substrate adaptations	**Report 1**
Oct 21	Evolution: species concepts/morphometrics	Species concepts and classification	
Oct 23	Evolution: classification and cladistics	Phenetics and cladistics	
Oct 26	Trilobite morphometrics	Landmark morphometrics	
Oct 28	Evolution: ontogeny and heterochrony	Ontogeny and heterochrony	
Oct 30	Trilobite ontogeny and heterochrony	*No video*	
Nov 2	*No lecture (GSA conference)*		
Nov 4	*No lecture (GSA conference)*		
Nov 6	Evolution: pattern and process	Evolutionary pattern and process	**Report 2**
Nov 9	Evolution: evolutionary trends	Evolutionary trends vs random walks	
Nov 11	*No lecture (Veterans Day)*		
Nov 13	Biostratigraphy	Biostratigraphy	
Nov 16	Biogeography	Biogeography	
Nov 18	Biogeography: vicariance and dispersal	Biogeography: vicariance/dispersal	
Nov 20	Trilobite biogeography/biostratigraphy	*No video*	
Nov 23	Diversity: trends, extinction, and origination	Trends/biases + Extinction/origination	
Nov 25	Trilobite paper writing	*No video*	
Nov 27	*No lecture (Thanksgiving)*		
Nov 30	Diversity: spatial and environmental patterns	Diversity: spatial/environ. patterns	**Report 3**
Dec 2	Diversity: guilds and evolutionary faunas	Guilds and evolutionary faunas	
Dec 4	Questions/review	*No video*	
Dec 9	**FINAL EXAM (4-7 PM)**		