Invertebrate Paleontology

Fall 2018 ~ Block 2

"Take the entire 4.5-billion-year history of the earth and scale it down to a single year, with January 1 being the origin of the earth and midnight on December 31 being the present. Until June, the only organisms were single-celled microbes, such as algae, bacteria, and amoebae. The first animal with a head did not appear until October. The first human appears on December 31. We, like all the animals and plants that have ever lived, are recent crashers at the party of life on earth."

— Neil Shubin, Your Inner Fish: A Journey Into the 3.5-Billion-Year History of the Human Body

Instructor:
Prof. Madeline S. Marshall, Norton 102, mmarshall@cornellcollege.edu (Office phone: 319.895.4309)

Class meeting times & location:
9-11 am and 1-3 pm (Monday-Friday) in Norton Geology 108; meeting times within those time blocks may change during the term as in-class learning, labs, and projects fluctuate in relative importance. (Also see **Field Trips**.)

Office Hours:
By appointment (or before/after class). I will respond to emails as promptly as possible, but please plan ahead that I will not generally check or answer emails between 8pm and 8am, or as frequently on the weekends. **If you are confused, struggling, or want to learn more, please do arrange to meet with me — there is not time for you to "wait and see" on the block plan.

Textbook:
Introduction to Paleobiology and the Fossil Record (Benton and Harper, 2009); other relevant readings will be posted on the course Moodle website. You are responsible for all assigned readings and content; please check Moodle daily for readings and assignments.
**You must have a basic set of colored pencils for several exercises in class. You are welcome to share with a friend. Please come prepared to class every day with paper and a writing utensil, as there will be some in-class questions or drawings. Additionally, you will need to print out assignments/labs to complete them; hard copies are required to be turned in.
*I would advise you to read textbook chapters assigned in the syllabus before the class period covering that topic, so that you can have your questions answered then and participate more; it will also serve you well to read the chapters after that class, so it is up to you. The textbook was carefully chosen, and it will clarify and enhance your understanding of the topics discussed in class and provide fodder for discussion.
*You will need to download the free statistical analysis program **R** to your computer (https://www.r-project.org). R Studio is a free accompanying workspace manager that I highly recommend as well, especially if you are not confident working in a stark coding space (https://www.rstudio.com). You will have homework to do during week 1 that requires this software, and you will be recommended to use it for your project analyses. If you have used MiniTab before and are confident and comfortable with that, we can talk about having you use that instead. However, one of the goals of this course is to introduce you to R, which is valuable across subject areas.

Prerequisites:
GEO 130 or BIO 142 and 142; a different introductory geology course will be considered. Sedimentology and Stratigraphy, some knowledge of biology, and some experience with data analysis are highly recommended (if you do not have this background, please be prepared to spend more time reading and put in more time out of class to ensure you are confident with all of the Paleontology material).

Field Trips (REQUIRED):
***If you are unable to attend the field trips, you must drop the class.**
1. We will be taking an afternoon field trip to the **Devonian Fossil Gorge** at the Coralville Dam on Thursday, September 27 (Week 1). We will leave the Commons promptly at 12:15pm, spend the afternoon learning about some local geology and paleontology with the guidance of an Army Corps of Engineers geologist — please be especially respectful of her (and ask any questions you might have about the Corps!), don't wander off, focus on the project at hand, do NOT collect any fossils (it is illegal), and have fun! We will leave to drive back when you are all finished with your investigations, so timing is flexible — we will return by 6pm.
2. We will be taking an overnight trip to **Rockford Quarry** in Rockford, Floyd County, Iowa during Week 2 (dates TBD). You will be working in small groups to devise a research question and sampling scheme beforehand. Once there, you will sample fossils, describe the context (rocks…), and then spend the rest of the block analyzing your collections for a final project and poster presentation (plus a report, with similar content in a different format). We will depart from Cornell at 8am and return to Cornell the following day by 6pm. We will be camping in Rockford, and because it is October, be prepared for the elements — bring warm clothing and rain gear, just in case, and you must wear suitable footwear (boots preferred). You need to be prepared with a sleeping bag (and pad); we will have several shared tents. If you have your own tent, please consult the instructor. We will obtain boxed lunches from Bon Appétit for the first day (or you will bring your own lunch if not on a meal plan), and make sandwiches for our second lunch. We will be cooking in camp for dinner and breakfast — be prepared to take the reins on this! Jobs include prep work, cooking, and clean up. Please advise the instructor of any dietary restrictions during Week 1. Please contact the instructor during the first three days of the block to discuss any other accommodations or concerns. Absolutely NO ALCOHOL, TOBACCO, or any illegal substances. You will be reported to the College and fail the course.

Course Description & Objectives:
In this course you will explore life. Old life. You will be exposed to groups of animals that you have potentially never even heard of (brachiopods, for example), some of which are extinct (like archaeocyathans and rugosans). You will have the unique opportunity to work with the remains of these old, dead organisms. You will also learn some interesting things about the anatomy and ecology of animals that still live today (such as corals, clams, snails, and crabs). You will study the methods used by paleobiologists as they explore the fossil record, and you will learn to view fossils as both tools vital for the interpretation of sedimentary rocks and ancient environments, and exquisite indicators of biological processes and events – such as *evolution* and *extinction*. And fossils are cool and beautiful – they just are. And they are fun to find. You will find hundreds on our field trips.

You will read several papers derived from the primary literature (journals), in addition to a large portion of your textbook. There is much jargon associated with the discipline, and you will need to add a variety of technical / anatomical / morphological terms into your memory. Concepts are important, but so are the highly specific terms that allow us to effectively communicate with each other about the same topic.

Students who take this course will:

1. Gain a basic familiarity with common fossil groups;
2. Learn methods of paleobiological analysis / how to study fossils and ask appropriate questions of the fossil record;
3. Have an opportunity to do paleobiological research (project-based, from sampling to data collection to data analysis and public presentation);
4. Be exposed to the big questions/themes in paleobiological research, e.g., biases, diversification, extinction, evolutionary morphology, paleoecology, etc.;
5. Read and evaluate the primary literature in paleobiology through student-led seminar discussions;
6. Understand that science is a continual process of investigation and interpretation, and that scientific knowledge progresses via the evaluation of competing hypotheses;
7. Hone their skills relating to research, sketching, writing, and the presentation of information, and be able to critically assess the content value of different types of scientific information.

This course supports the Educational Priorities and Outcomes of Cornell College with emphases on knowledge, inquiry, reasoning, ethical behavior, and communication.

What I expect from you:

You should come to class on time, prepared to learn. Be engaged and actively participate in discussions and activities. Ask lots of questions! I am always happy to speak with you about class or other issues. Remember, you should be working a solid 8 hours/day, both for your own learning and to fulfill the requirements for this program to have accreditation — spending at least 150 hours/course; most days we will have ~4 hours in class, including some time for labs, so however you spread out the rest is up to you. Of course, you will likely end up needing to do more (or perhaps less), depending on your own learning pace and style. Read to understand, not to speed through — this means that sometimes you might not finish all of the reading. That happens. I understand. But, be prepared with what you did read.

Evaluation

The assessment tools in this course include two exams, a couple of activities in class, labs for each major fossil group, seminar/discussions, and a final project, in addition to your participation in class discussions and field trip activities.

The exams will be a mix of compare and contrast, short-answer questions, diagrams, and likely some tables. The first exam will be on taphonomy, systematics, and the nature of the fossil record; the second exam will be on the major fossil groups and their characteristics. Depending on which seminar readings happen when, be prepared for those topics to also be included in your exams. Your final project will serve as a higher-order assessment for this course, combining field work, research, synthesis, evaluation, and communication as you create and present your final products.

Grade Breakdown	
Participation (including discussions)	10%
Lab exercises	20%
Exams (midterm and final, 20% each)	40%
Final Research Project	30%

Grading Scale	
95-100 90-94.9	A A-
86-89.9 83-85.9 80-82.9	B+ B B-
76-79.9 73-75.9 70-72.9	C+ C C-
66-69.9 60-65.9	D+ D
59.9 or below	F

Success in the Course

My goals for you upon completing this course are for you to have a solid understanding of the history of life, the diversity of organisms through geologic time, and be able to thoughtfully analyze paleontological data to communicate to the public (or your friends and family). Some useful guidelines for succeeding in this course:

1. Push yourself to become fluent in the foundational material and ask questions to ensure you fully understand concepts in class. (Try explaining a topic to a friend or roommate who is not in the class to make sure you know can clearly articulate your ideas.)
2. This course may present new challenges related to drawing, spatial reasoning, or mathematical concepts, and it is imperative that you leave behind your aversions to those subjects and skills in order to succeed.
3. To that end… Draw, sketch, illustrate, map. You will be more successful if you work on sketching everything — anatomy, time scale, environments, etc. You are highly recommended to practice these skills daily.
4. Revise your writing assignments — a first draft is not the final copy. Proper spelling, grammar, and punctuation are expected.
5. Take advantage of your textbook, readings, classmates, and the instructor as key resources – each will add more depth and another avenue of learning to your experience.
6. The library offers one-on-one tutoring services in geology through the Office of Academic Support and Advising. Contact Brooke Paulsen (bpaulsen) to request a tutor. The sooner, the better!
7. Amy Gullen (agullen) is our Science Reference Librarian, and she is an excellent research- and paper-writing resource.
8. The QRS will be a key resource for you, including both Jessica Johanningmeier (QRS director; jjohanningmeier) and Sami Vetter (our R expert) — reach out to both of them for assistance!

Class Attendance and Participation Policy

You are expected to attend all class meetings and field trips. If you have an unavoidable obligation, you must notify the instructor as soon as possible, and we can discuss how to help you make up and keep pace with the class. While there is a textbook for the course, you will also derive great benefit through the activities and discussions that happen in class. It is your responsibility to know anything I say in class (including changes in the schedule, etc.) and for having any handouts or assignments passed out in class — most important information

will also be on Moodle, but do not rely solely on Moodle! If you do miss a class, you should get notes from a classmate and handouts/ assignments from me the day you return to class. Attendance will factor into your participation grade.

Additionally, you are required to participate. Silently waiting as your classmates answer questions or discuss topics is not acceptable. You don't need to say anything revelatory, but it should be substantive — it's **always possible to find (a) something you learned, (b) something that surprised you, and/or (c) something that confused you or that led to more questions. Finally, do not sleep during class. You will be asked to leave.

Email Etiquette
It's always worth a reminder of acceptable email practices: I will only respond to your emails if they include a descriptive subject line, a salutation (not "hey" or "sup, dude"), proper spelling and grammar, and a signature or closing.
https://www.insidehighered.com/views/2015/04/16/advice-students-so-they-dont-sound-silly-emails-essay

Late Work and Make-Up Policy
Due to the fast-paced nature of the class, policies are necessarily strict. I will **not** accept late assignments for a grade; however, I will look at them for you to ensure you are on the right track. If an assignment is listed in the syllabus (or on Moodle) as due on a certain day, be prepared with it at 9 am, unless it is a topic covered in class that day, in which case it will be expected due by 3 pm. When in doubt, ask! If you require an extension, please see me before the assignment deadline. Please note that group activities in class inherently cannot be made up. Exams can be made up only in exceptional circumstances and/or by prior arrangement with the instructor.

Academic Integrity
All members of the Cornell College community are expected to act with academic integrity; an important aspect of this is respecting the work of others. Students must explicitly acknowledge ideas, claims, observations, or data of others, unless generally known. When a piece of work is submitted for credit, a student is asserting that the submission is her or his own work unless there is a citation of a specific source. If there is no appropriate acknowledgement of sources, whether intended or not, this may constitute a violation of the College's requirement for honesty in academic work and may be treated as a case of academic dishonesty. The procedures regarding how the College deals with cases of academic dishonesty appear in The Catalogue, under the heading "Academic Honesty."

This is different from working with a partner on a lab or field project, which is encouraged. Learning how to communicate your scientific thinking to others is an important skill, and discussing hypotheses with others is an excellent way to further your understanding of a subject. However, that does **not** mean that work product from group collaboration should be anywhere close to identical — you should both come away having learned more from talking to each other, and have new ideas. Make sure that you write up your assignment or report **independently** though, using your own words and conclusions, and always acknowledge your collaborator(s).
Any evidence of plagiarism will result in a zero for that assignment. If it happens more than once, you will be reported to the Dean.

Technology Policy
Cell phones must be off (silent, not vibrate) and put away during all class periods. I do NOT want to hear or see them. If I see your cell phone out during class, you will be asked to leave. Do not take pictures of the chalkboard, slides, or specimens — write or sketch; pictures do nothing to serve your education. When using laptops or tablets for class activities, I expect you to use them responsibly and respectfully. If you are using them for non course-related activities, I will give you a verbal warning. If this behavior continues, I will ask you to leave and your grade will be affected.
*You are highly encouraged to take notes and sketch diagrams by hand during class. This is proven to promote better listening and synthesizing of information, and results in a deeper understanding and longer memory of the material. (https://www.scientificamerican.com/article/a-learning-secret-don-t-take-notes-with-a-laptop/)

Academic Accommodations
Cornell College is committed to providing equal educational opportunities to all students. Students should notify the Coordinator of Academic Support and Advising and their course instructor of any disability-related accommodations within the first three days of the term for which the accommodations are required, due to the fast pace of the block format. For more information on the documentation required to establish the need for accommodations and the process of requesting the accommodations, see http://www.cornellcollege.edu/academic-support-and-advising/disabilities/index.shtml.
*Please do discuss with the instructor if you are a person with CVD (color vision deficiency), so that labs and other course material can be made accessible (and more enjoyable) for you.

Add/Drop/Withdrawal
This course may be added or dropped within the first three days of the block, as per College policy, with the permission of the instructor. A withdrawal may be granted on the 15th day, provided that you have completed all assignments, participated fully in course activities, and attended all class sessions (1 *excused* absence permitted). NOTE: A 15-day drop will not be granted to students who, in my estimation, have not made a good faith effort to learn and/or complete the course material. A health withdrawal (WH) may be obtained if health issues are serious enough to interfere with course completion. To qualify, you must speak with a health professional either on or off campus and receive written documentation.

See Schedule on Moodle (subject to change)