
Paleontology Lecture and Lab Syllabus
GEOL 4024W/L, Fall 2007

Lecture: T, Th 11:00 AM - 12:15 PM

Lab: T 3-5 PM

Calloway 106

Instructor: Dr. Phil Novack-Gottshall

E-mail: WebCT Mail

Office: Calloway G1-4

Office hours: T 9:30-11, 2-3; W 1-4; R 9:30-11, 2-4
or by appointment

Course description

Paleontology is the scientific study of past life, in the broadest sense. It includes such topics as the origin of life, mass extinctions, evolutionary radiations, exceptional fossil preservation, paleoecology, and key innovations, to name a few. This discipline also allows us to better understand the geological history of earth through the applications of biostratigraphic correlation, reconstruction of depositional environments, taphonomy and preservational biases, paleoclimatology, and isotopic analysis. Paleontology is unique among other geological disciplines because of its dual interface with biology; their reciprocal illumination means that you will use both perspectives to answer important paleontological questions.

Learning objectives

- 1) Identify taxa representing the major lineages of organismal life through study of their anatomy and diversity.
- 2) Observe the skeletal remains of organisms and make successful biological inferences about the soft-bodied organism that produced them.
- 3) Explain the significance of the major transitions in organismal evolution, such as multicellularity, photosynthesis, skeletonization, bilaterality, modularization, mobility, and carnivory.
- 4) List and describe the major events (extinctions, diversifications, and environmental transitions) in the history of life.
- 5) Make successful inferences about the paleoecology and functional morphology of extinct organisms by interpreting their environmental distribution, morphology, taphonomy, and ichnology.
- 6) Make correct stratigraphic designations for strata based on their fossil content.
- 7) Understand and practice the analytical methods of paleontologists, including statistics, simulation models, calculation of evolutionary rates and diversity curves, morphospaces, and phylogenetics.
- 8) Understand critical issues in evolutionary and ecological theory, including competition, evolutionary mechanisms, natural and species selection, extinction, progress, and escalation.
- 9) Practice the skills of reading and writing scientific prose by researching a peculiar aspect of paleontological inquiry in the primary paleontological literature.

Programmatic designation

This course is required for the B.S. in Geology and satisfies elective credit for the B.S. in Physical Geography and the minor in Geology. It counts as WAC credit.

Required textbooks

- 1) Prothero, D.R. 2004. *Bringing Fossils to Life: An Introduction to Paleobiology*. 2nd ed. McGraw-Hill, NYC.
- 2) Lab manual (available at the textbook store).

Supplementary textbooks available in lab

- Boardman, R.S., A.H. Cheetham, and A.J. Rowell, eds. 1987. *Fossil Invertebrates*. Blackwell Scientific, Boston.
- Clarkson, E.N.K. 1998. *Invertebrate Palaeontology and Evolution*. 4th ed. Blackwell, NYC.
- Feldmann, R.M., ed. 1996. *Fossils of Ohio. Ohio Division of Geological Survey Bulletin 70*.
- Moore, R.C., ed. 1953-2006. *Treatise on Invertebrate Paleontology*. Geological Society of America, New York, and University of Kansas, Lawrence.

A note on my office hours

The best science teachers are those who also conduct scientific research. Although I do research throughout each week, I reserve Fridays for uninterrupted research. So I will not be available to meet with you on this day except for exceptional circumstances. You are still welcome to e-mail me with questions and concerns during this time, and I will make every effort to respond in a timely manner. However, an e-mail response cannot be guaranteed until the following work day. On other days, you're welcome to call me on campus (678-839-4061), stop by when the door is open, or e-mail me (pnovackg@westga.edu). **I don't accept phone calls at my home.**

Grading policies

The lecture and lab portions are broken down according to the following lists. Grading follows the typical 10% subdivision. Lecture counts for $\frac{2}{3}$ of your overall grade and lab counts for $\frac{1}{3}$.

| <u>LECTURE:</u> | % | WAC component* |
|---|-------|----------------|
| Exam #1 (Sept. 25) | 20% | I.B |
| Exam #2 (Oct. 25) | 20% | I.B |
| Final Exam (Dec. 11) | 20% | I.B |
| Individual Research Paper (IRP) | 25% | I.B, I.C, II |
| I. Annotated bibliography (Sept. 6) | (5%) | I.C |
| II. Preliminary research summary (Oct. 4) | (5%) | I.C |
| III. Peer review reports (Nov. 6) | (5%) | I.B |
| III. Final research paper (Dec. 4) | (10%) | II |
| Seminar summary (Sept. 11, Nov. 1) | 10% | I.B |
| Participation | 5% | |

* - See key below for WAC designations.

Seminar exercise

We will have two seminar-style class periods this semester where we discuss topical paleontological papers. For each, you will write a one-paragraph summary.

Exams

All exams are take-home. You will have at least one week to work on the exam, and they are due at the start of class on the date above. Exams will require much thinking and writing on your part, including case studies, short answers, and essays. Exams only cover material from lecture, although your readings will prove helpful. **Late exams will be deducted 10% per 24-hour period after the time they are due; do not hand them in late!** The final exam is cumulative and will be due by **Tuesday, Dec. 11 at 11 AM**. It will not be accepted late; after 11 AM it will receive a score of 0%.

The Individual Research Project (IRP)

In order to expose you to the way in which controversial ideas are debated in science, you will research some rather peculiar, paleontological conundrum. In many cases, the answer relies on evidentiary reasoning and inference from incomplete information; they may never be answerable as a provable truth. For this semester-long project, you will choose such a quandary to research. Your grade for this project will be based on four components. The first part, due **Sept. 6** (worth 5%), is an annotated bibliography of relevant literature (at least five primary articles). By **Oct. 4** (worth 5%), you will use this literature to summarize the primary arguments and counterarguments. This part should be at least one typed page in length and include a Works Cited section. For the third part, due **Nov. 6** (and worth 5%), you will bring in 4 copies of a 3-page draft (i.e., in near-finished form) of your final paper to class to be reviewed by your peers; your grade will be based on the quality and extent of feedback you give your peers. The final paper, due by **Dec. 4** (worth 10%), presents your final research paper, including an introduction of your research topic (including relevant background), a critique of arguments and counterarguments (including a conclusion of what arguments you find most convincing), and a proposal of what you feel is necessary in the future to better resolve the question. This final paper should be 4-5 pages in length and cite at least five articles from the primary literature. You will be evaluated on the thoroughness of your research, on the clarity of your summaries of opposing viewpoints, and on your success in explaining the relationship of this small issue to larger paleontological issues.

| LAB: | % | WAC component* |
|---------------------------------------|----------|-----------------------|
| Weekly Lab Assignments (Hand-ins) | 10% | I.B |
| Lab Exercises (Sept. 25, Nov. 6) | 5% | I.B |
| Lab Practical #1 (Oct. 9) | 25% | |
| Lab Practical #2 (Dec. 4) | 25% | |
| Group Research Project | 20% | I.A, I.B, I.C, II |
| I. Bibliography and library (Sept. 4) | (5%) | I.A |
| II. Faunal list (Sept. 18) | (5%) | I.A |
| III. Identifications (Oct. 23) | (5%) | I.A |
| IV. Final research paper (Nov. 30) | (5%) | I.C |
| Field Trip Reports (TBA) | 10% | I.C |
| Participation | 5% | |

* - See key below for WAC designations.

Lab manual and weekly lab exercises

The lab for each week is found in the lab manual available at the textbook store. Read over each lab before coming to lab. Labs require you to study various fossils, paying special attention to anatomy, functional morphology, biology, skeletal chemistry, and geological age. It will often require you to draw specimens; this helps train you to observe important features of fossils. The manual will also require you to describe the anatomy, ponder the functions of important structures, and pose possible ways to test these functions. An example might include: what is the purpose of spines in this clam? The last page in each lab manual is to be handed in after lab and will be graded.

There will also be two additional lab exercises during the semester that will introduce you to several of the analytical methods used by paleontologists: cladistics, morphometrics, diversity, and basic statistical analyses. These exercises may require outside work in the department's computer labs.

Lab practicals

The lab practicals are not cumulative. They will focus on identification of taxa, anatomical features, and preservation. In addition, they will require knowledge (or interpretation) of the ecology, functional morphology, and biology of the fossils. The lab manuals (and especially the hand-in assignments) will be a useful guide for preparing for the practical; I will also provide self-study specimens before the practical.

Group Research Project

In order to understand scientific inquiry, it is best to practice it firsthand. For this semester, you will all become experts in the fossils of the Conasauga Formation, a Cambrian-aged formation in Georgia and Alabama. This is a semester-long project that you will work on as a group. At the end of the semester, you not only will have learned much about how paleontologists do research, but you will teach others (and potentially the world!) about some really special fossils.

Early in the semester, we will collect fossils from this formation in Georgia and bring them back to the lab. During the following weeks, we will process the fossils, create a library of relevant paleontological literature, and compile faunal lists so they can be identified. Using this literature as a guide, pairs of you will then become class "experts" on some group of fossils (such as corals, trilobites, snails, etc.) and identify every fossil. You will then use the West Georgia Digital Imaging, Morphometrics, and Photomacrography Lab (DIMPL) in Callaway G-3 to photograph (or scan) the best specimens. These photographs, along with your written descriptions, summary of their systematics, paleoecology, and taphonomy, general information on the Conasauga Formation, and the bibliography will then be published on the web. We will have some time set aside during labs to work on this project, although you also will be expected to work on your own.

Field trips:

There will be at least two field trips to the Conasauga Formation for this course. The first will be early in the semester to collect fossils for use in lab throughout the semester. We may also take a fieldtrip to the Fernbank Museum and the Georgia Aquarium to observe other marine fossils and living representatives. We will choose the dates for these fieldtrips early in the semester. Field trip reports will be graded.

Attendance and participation

Because this class is relatively small and thrives on discussion, it is critical that you come to, and participate in, every class (and especially every lab). Regular participation will give you full credit; regular indifference will not. Appropriate participation includes attentiveness, participation in class discussions, respectful behavior, and courteousness to your peers.

I will record your attendance throughout the semester. **You can miss up to one lab and two lectures without penalty. You will be penalized one full letter grade from your final class grade for missing each additional lab or lecture, regardless of excuse.** I maintain the right to add pop quizzes or other in-class activities if I feel it would help remind you of your responsibility to attend and participate in class.

Lateness and missed exams/practicals

All late material (including exams, lab assignments, exercises, and research papers) will be deducted 10% per 24-hour period; do not hand them in late! Missed lab practicals can not be made up and will receive 0%. If you expect a scheduling conflict (such as taking two additional exams the same day), please see me in advance so we can make alternative arrangements.

Extra credit

There is no extra credit in this course! Although I want to support you in all your efforts, your success is ultimately your responsibility. Make the most of every assignment, knowing you have limited opportunities to counter grades you later regret.

A note on Writing Across The Curriculum (WAC):

This is a WAC course and can satisfy one of your two required 3000/4000 WAC courses. Because critical thinking, careful reading, and thoughtful writing are essential skills of educated people, this syllabus and its coursework and policies apply equally whether or not you need WAC credit. If you have already fulfilled your WAC requirements, you strongly might consider taking two additional WAC courses to earn a WAC certificate on your transcript; contact the WAC program for details.

The following key explains how the various course activities above fulfill WAC requirements:

Group I (Writing to learn) activities:

I.A – Journal/notebook writing

I.B – Informal writing activities

I.C – Discipline-specific tech. writing

Group II (Writing to communicate) activities:

II – Formal writing assignment

Lecture Schedule

| <i>Date</i> | <i>Topic</i> | <i>Readings*</i> |
|-------------|---|------------------------------|
| Aug. 16 | They're alive! Bringing fossils to life | Peruse Ch. 8 |
| Aug. 21 | Taphonomy: The processes of fossil preservation | Ch. 1 |
| Aug. 23 | Micropaleontology: Advent of oxygen, plastids, and plankton! | Ch. 11 |
| Aug. 28 | Biostratigraphy and the geological timescale | Ch. 10 |
| Aug. 30 | Poriferans, stromatoporoids, & archaeocyathids, oh my! The advent of multicellularity! | Ch. 12 |
| Sept. 4 | Cnidarians: The advent of predation! | Ch. 12 cont. |
| Sept. 6 | Taxonomy, phylogenetics, cladistics, and species concepts (IRP Annotated Bibliography due) | Ch. 3 & 4 |
| Sept. 11 | Seminar Day (Bring summary of Schwimmer & Montante 2007) | <i>WebCT PDF</i> |
| Sept. 13 | <i>Research work day (work on projects)</i> | |
| Sept. 18 | Evolutionary mechanisms: Processes | Ch. 2 & 5 |
| Sept. 20 | ...Evolution continued: Patterns | Ch. 2 & 5 cont. |
| Sept. 25 | Arthropoda I: Life in a suit of armor (EXAM 1 DUE) | Ch. 14 |
| Sept. 27 | Arthropoda II: A Swiss army knife of appendages | Ch. 14 cont. |
| Oct. 2 | Ichnology and trace fossils: What's boring, moving, and feeding? | Ch. 18 |
| Oct. 4 | Bryozoans: Joys of being modular and sessile (IRP Research Summary due) | Ch. 13, 2 nd part |
| Oct. 9 | Paleoecology and depositional environments | Ch. 8 |
| Oct. 11 | <i>NO CLASS – Fall Break (work on projects)</i> | |
| Oct. 16 | Brachiopoda I: More than shells, pedicles, and lophophores? | Ch. 13, 1st part |
| Oct. 18 | Brachiopoda II: The other bi-valved shells | Ch. 13, 1st part |
| Oct. 23 | Mollusca I: The mantle of success | Ch. 15 |
| Oct. 25 | Mollusca II: Uncoiling the cone (EXAM 2 DUE) | Ch. 15 cont. |
| Oct. 30 | <i>NO CLASS – GSA (work on projects)</i> | |
| Nov. 1 | Seminar Day (Bring summary of Raup & Gould 1974) | <i>WebCT PDF</i> |
| Nov. 6 | IRP Peer Review Day (Bring 4 copies of 3-page draft) | |
| Nov. 8 | Case studies in long-term trends | Peruse Ch. 7 |
| Nov. 13 | Radiations and diversity: Waxing poetically | |
| Nov. 15 | Echinodermata I: Introducing the endoskeleton | Ch. 16 |
| Nov. 20 | Echinodermata II: Moving forward, free (living) at last! | Ch. 16 cont. |
| Nov. 22 | <i>NO CLASS – Happy Thanksgiving!</i> | |
| Nov. 27 | Vertebrate paleontology: Are turkeys dinosaur left-overs? | Ch. 17 |
| Nov. 29 | Paleobotany and coevolution | Ch. 19 |
| Dec. 4 | Large-scale trends: Making sense of it all (IRP Research paper due) | Ch. 6 |

* There may also be additional readings throughout the semester.

Lab schedule

| <i>Date</i> | <i>Topic</i> |
|-------------|---|
| Aug. 21 | Taphonomy and modes of fossilization |
| Aug. 28 | Micropaleontology, algae, & stromatolites |
| Sept. 4 | Porifera, Stromatoporoidea, & Archaeocyathida (Conasauga bibliography and library due) |
| Sept. 11 | Conasauga specimen work day (Bring articles to lab) |
| Sept. 18 | Cnidaria (Conasauga faunal list due today) |
| Sept. 25 | Conasauga research and <i>Phylogenetics Exercise (due on Oct. 2)</i> |
| Oct. 2 | Arthropoda |
| Oct. 9 | LAB PRACTICAL I |
| Oct. 16 | Bryozoa |
| Oct. 23 | Brachiopoda (Conasauga IDs and photography/scanning due) |
| Oct. 30 | <i>No lab – GSA (work on projects)</i> |
| Nov. 6 | <i>Quantitative Paleontology Exercise (due on Nov. 13)</i> |
| Nov. 13 | Mollusca I (Monoplacophora, Polyplacophora, Gastropoda, & Cephalopoda) |
| Nov. 20 | Mollusca II (Scaphopoda, Rostroconchia, & Bivalvia) |
| Nov. 27 | Echinodermata (Conasauga final report due Nov. 30) |
| Dec. 4 | LAB PRACTICAL II |