

INVERTEBRATE PALEONTOLOGY
EAS-E 411 Section 30434, 3 Credit Hours
EAS-E690 Section 30654, 3 Credit Hours
FALL SEMESTER, 2023
Updated: August 21, 2023
Updated: August 30, 2023
Updated: October 12, 2023

Official course description

Structure, classification, habitats, geological history, and significance of the invertebrate phyla. Laboratory study of fossils.

Prerequisites: One course from the General Education Natural and Mathematical Sciences course list.

In this course you will learn about the application of biological principles and the use of invertebrate fossils in the study of Earth's history, the origin of life and the early fossil record, approaches of taxonomy, chemistry of fossils, ecology of ancient life, and the use of fossils to measure geologic time.

Instructor

Dr. Claudia C. Johnson
Geology 5048; claudia@indiana.edu

Objectives of the class

- To increase your basic knowledge of the diversity of life forms that evolved during billions of years of Earth's history
- To gain an appreciation of the theoretical framework for these evolutionary and extinction events.

Through lectures, discussions, assigned readings, exercises and an abundance of invertebrate fossils, you will be exposed to numerous aspects of paleontology. You will complete the course knowing the issues and debates important to the field.

Field Trip

Saturday October 7

Falls of the Ohio State Park

Departure time to be announced

Course materials

Required lecture text: *Introduction to Paleobiology and the Fossil Record, 2nd Edition, 2020*, by David A.T. Harper and Michael J. Benton. Publisher: Wiley & Sons

ISBN13: 9781119272854

Additional materials may be distributed or available on *Canvas*.

Class hours

Tues. and Thurs, 1:15-2:30 pm, Geology 5051

Office hours

After class & by appointment

Course grade distribution – Undergraduate Students

A). This part is an evaluation of your ability to work with fossils - 70% of total grade:

- weekly exercises with fossils - 25%
- field trip exercise at Falls of the Ohio State Park - 20%
- semester fossil project - 25%

B). This part is an evaluation of your ability to apply theory and concepts to fossils
30% of total grade:

- Exam – Part 1, Thursday, Nov. 30, is focused on student learning outcomes a, b, c, d
- Exam – Part 2, Thursday, Dec. 7, is focused on student learning outcome e

Course grade distribution – Graduate Students

Weekly exercises with fossils, field trip, assist undergrads with their semester fossil projects: 33%

Develop and present a lecture to the class - 33%

Research paper - 34%

Final Grade Scale for all Students

A = 90 - 100%; B = 80 - 89%; C = 70 - 79%; D = 60 - 69%; F = 59% or lower. Grades of + and – will be assigned. Semester grades are not curved.

Lecture Development and Presentation Requirement for Graduate Students

The essence of the lecture requirement is for you to present a theme of your choosing that is appropriate for 400-level students with geology, biology, and/or environmental science backgrounds. It is likely students will be hearing the topic for the first time, so basic, fundamental information will need to be presented prior to explaining the complexity.

I'd like your presentation to contain in-lecture questions and a post-lecture exercise with fossils. The in-lecture questions should be designed as thought-based (not specimen-based) and require students to relate the information you present to concepts learned during the semester from my previous lectures. The specimen-based exercise at the end of your lecture should be designed so students apply knowledge of the topic you presented to the specimens in front of them. You will instruct the students and guide them through your exercise and evaluate their work. You will develop a written assignment for students, but through your guidance and oversight of the work there will be no grading after your lecture.

Here's a schedule I propose to you.

- Discuss an outline of your presentation with me by September 19 or 21.
- Three weeks prior to your presentation, discuss with me a first draft of your presentation slides.
- Two weeks prior to your presentation, discuss with me updates on your presentation, and have written for discussion with me the in-class questions and fossil-based exercise.
- One week prior to your presentation, give a practice talk to me with your slides, in-class exercise, and fossil-based exercise.

I can work with you on the in-class questions, the fossil-based exercise, and the fossil specimens that may be good for you to use.

Research Paper for Graduate Students

Investigate a topic that enhances your graduate research project. Develop a hypothesis and discuss with me by October 3 the value of the topic to your graduate research. 20 text pages plus figures & references

Student learning outcomes

Students who pass the course will be able to:

- a) summarize the life history of a fossil from death to discovery
- b) analyze the role of taphonomy in the evolutionary history of a taxonomic group
- c) classify fossils into taxonomic groups and place within a phylogeny
- d) classify fossils using quantitative measures of characters
- e) design a research project using fossils and the scientific method

Keep Reading – Semester Topics and Schedule on the Next Page

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Look at this site to learn more about this history of life from fossils:

Digital Atlas of Ancient Life

Paleontological Research Institution

<https://www.digitalatlasofancientlife.org/>

SELECTED TOPICS TO BE DISCUSSED DURING THE SEMESTER

All pptx. are posted to Canvas

Week 1 Read textbook chapter 1: Paleontology as a science
Lec 1 Overview.pptx
Lec 2 History.pptx
Homework for Thursday: written in Lec 1 Overview.ppt on slide labeled Homework
Aug. 22 Introduction to invertebrate paleontology
Aug. 24 Introduction to macroinvertebrate phyla - specimens

Week 2 Read textbook chapter 4: Paleoecology
Lec 3 & 4 Marine Ecol.pptx
Aug. 29 Marine ecology & paleoecology
Aug. 31 Morphology, ultrastructure and taphonomy of fossil shells - specimens

Week 3 Read textbook chapter 5: Taphonomy and the quality of the fossil record
Sept. 5 Phyla, ecology, and shell ultrastructure exercise
Sept. 7 We will begin the semester fossil project

Week 4 Read textbook chapter 6: Fossil form and function
Lec 5 & 6 Taphonomy & the fossil record.pptx
Sept. 12 Taphonomy and special preservation windows
Sept. 14 Taphonomy and special preservation windows (continued)

Week 5 Read textbook chapter 7: Macroevolution and the tree of life
Sept. 19 Sponges and corals
Sept. 21 Guest Lectuer: Dr. R. Bicknell, visitor to IUPC from the American Museum, NYC

Week 6 Bryozoans and Brachiopods
Sept. 26 Phylum Bryozoa and Phylum Brachiopods specimens and handout
Sept. 28 Semester Fossil Project working session #2

Week 7 Semester Fossil Project – Bryozoans and Brachiopods
Oct. 3 Semester Fossil Project working session #3
Oct. 5 Semester Fossil Project working session #4

Saturday, October 7, Field Trip to Falls of the Ohio State Park

Week 8 Ontogeny, Populations, and Statistical Analyses
Oct. 10 Lec 7 Ontogeny.pptx, specimens and worksheet

Oct. 12 Lec 8 Fossil populations and statistical analyses
Semester Fossil Project working session #5

Week 9 I will be at the GSA Annual Meeting this week
Oct. 17 Semester Fossil Project working session #6
Oct. 19 Semester Fossil Project working session #7

Week 10 The Species Concept; Biostratigraphy, Cephalopoda
Textbook chapter 2: Stratigraphy
Look at textbook figures on cephalopods p. 390-405
Oct. 24 Lec 9 Species.pptx The species concept
Oct. 26 Lec 10 Dating the rock record using fossils.pptx
Phylum Mollusca, Class Cephalopoda & utility for biostratigraphy

Week 11 The origin of life: Read textbook Chapter 9
Origin and expansion of the metazoans: Read textbook Chapter 11
Oct. 31 Lec 11 Origin of life.pptx
Nov. 2 Lec 12 Precambrian explosion of life.pptx

Week 12 Molluscs and Arthropods
Nov. 7 Phylum Mollusca – see relevant pages in Textbook
Nov. 9 Phylum Arthropoda – see relevant pages in Textbook

Week 13 Echinoderms and hemichordates
Nov. 14 Phylum Echinodermata, specimens and handout; see relevant pages in Textbook
Nov. 16 Work on your semester fossil project in the classroom today
Lecture presentation at Colby College

Week 14
Nov. 21 Thanksgiving Break
Nov. 23 Thanksgiving Break

Week 15
Nov. 28 Graduate student presentation
Nov. 30 Exam Part 1: Student learning outcomes a, b, c, d

Week 16
Dec. 5 Review and complete projects
Graduate student presentation
Dec. 7 Exam Part 2: Student learning outcome "e".
Use the scientific method to design a research project for your favorite fossil
Graduate students' research paper is due today
Undergraduates' semester fossil project is due today

Code of Student Rights, Responsibilities, and Conduct

<https://studentcode.iu.edu/>

Academic Integrity: As a student at IU, you are expected to adhere to the standards and policies detailed in the Code of Student Rights, Responsibilities, & Conduct. When you submit a paper with your name on it in this course, you are signifying that the work contained therein is all yours, unless otherwise cited or referenced. Any ideas or materials taken from another source for either written or oral use must be fully acknowledged. If you are unsure about the expectations for completing an assignment or taking a test or exam, be sure to seek clarification beforehand. All suspected violations of the *Code* will be handled according to University policies. Sanctions for academic misconduct may include a failing grade on the assignment, reduction in your final grade, a failing grade in the course, among other possibilities, and must include a report to the Dean of Students.
