FRIGEOL204 DINOSAURS, EARLY HUMANS, ANCESTORS & EVOLUTION:

THE FOSSIL RECORD OF VANISHED WORLDS OF THE PREHISTORIC PAST

Spring 2023

THE BIG QUESTION:

What Good is the Fossil Record?

INSTRUCTOR

Dr. Thomas R. Holtz, Jr., Principal Lecturer, Department of Geology

Office: CHM 1225B Office Hours: Wed 10:30-11:30 or by Appointment

Contact: ELMS (preferred) or tholtz@umd.edu Phone: 301-405-6965

Teaching Assistants

Edward Williams (Discussion Sections 0101, 0102, 0103)

Office: PHY (Toll Building) 4310 Office Hours: F 10-11 am

Contact: ELMS or ewilli17@umd.edu

Grace Ni (Discussion Sections 0104, 0105, 0106)

Office: PHY (Toll Building) 2330 Office Hours: Th 2:15-3:15 pm

Contact: ELMS or zni@terpmail.umd.edu

Classrooms

Lecture	TWS 0320	9:30-10:45 am	TuTh
0101	ATL 0201	3-3:50 pm	M
0102	ATL 0201	4-4:50 pm	M
0103	ATL 0201	5-5:50 pm	M
0104	ATL 2316	3-3:50 pm	M
0105	ATL 2316	4-4:50 pm	M
0106	ATL 2316	5-5:50 pm	M

Course Organization

2 lectures per week (Tuesday, Thursday), 1 discussion section per week (Monday). **NOTE**: You must attend the particular discussion section for which you are registered.

Lectures lost due to University late openings or cancellations or instructor absence will be made up as Panopto video recordings on the ELMS page. Discussion sections missed due to early closings or cancellations will be handled on a case-by-case basis: expect an announcement on ELMS for these.

Texts

There is no textbook for this course: instead, there are extensive online lecture notes. For some discussion sections, there will be short readings which will be made available on ELMS; these must be read by the discussion day they are listed. There may be some occasions when some extra lecture material will be presented as Panopto videos on ELMS; please watch these by the date announced.

Course Grades

Grade Scale

The numbers given represent the thresholds that must be passed in order to reach that grade (for example, A+ is 97.000... and any number greater). There is no rounding for letter grades; the thresholds must be passed. F is any grade below D-. Thresholds: 97, A+; 93, A; 90, A-; 87, B+; 83, B; 80, B-; 77, C+; 73, C; 70, C-; 67, D+; 63, D; 60, D-; < 60, F.

The Final Grade is the algebraic sum based on the numerical grades.

Grade Components

ITEM	PERCENTAGE
Midterm Exam 1	10%
Midterm Exam 2	10%
Midterm Exam 3	10%
Final Exam	20%
Discussion Participation	15%
Homework	15%
Platform Presentations	10%
Pop-Up Question of the Day	5%
"The Fossil Record in Popular Culture" Project & Presentation	5%

Midterm Exams (10% each): Three online exams on **March 2-4** (covers Weeks I-V), **March 28-30** (covers Weeks V-VIII), and **April 20-22** (covers Weeks IX-XI) respectively. For each of these there will be a section comprised of true/false, matching, multiple choice, and similar type questions, as well as a few short answer questions and an essay. These exams are open note but timed (75 minutes) and are subject to the University's Honor Pledge; you may not seek help from students or other people in doing these. If you encounter a technical problem, please contact ELMS@umd.edu for help (and Dr. Holtz so that he is aware of your situation.

Final Exam (20%): The online final exam during the regularly scheduled exam season. It is cumulative for the entire course, including new material since the third midterm onward. Format is similar to the mid-term exams but will be timed for 120 minutes. The exam will be available **SUNDAY to TUESDAY MAY 13-15**: please plan your end-of-semester travel (if any…) accordingly!! (It that means informing your parents about this now, please do so!).

Discussion Participation (15%): An essential element of education in general (and the I-Series in particular) is discussion, reflection, and clarification of key concepts. That is one of the main functions of the discussion sections. In any given discussion section, there might be a review of the previous week's lectures and readings; a review of homework assignments; the assignment and explanation of new homework projects; interactive participatory activities; student presentations; reviews for forthcoming exams; and actual good old-fashioned discussions

In order to get the complete Participation grade, you must:

- Attend every discussion section (the TA will keep a record of the presence and absence of students in their section)
- Be prepared to (when called upon) discuss the course material (lectures, homework assignments, etc.) in an informed manner
- Be a productive and constructive participant in discussions and in interactive activities
- For those days with presentations, do peer reviews for all presentations (Rubrics and rules for this will be provided later.)
- Be attentive during the session. (NO texting or using social media in section meetings, for instance.)

The TA may (at their own discretion) award up to 2 more percentage points as extra credit for particularly helpful or effective participation in the discussion for students in their section. Students who are present for all discussion sections but are non-participants or are disruptive may be docked up to 2 and 4 percentage points (respectively) at the TA's discretion.

Attendance in Discussion Section: While the expectation is that students attend ***EVERY*** lecture and ***EVERY*** discussion section, it is recognized that occasionally conditions (accident, illness, etc.) arise that prevent such. To recognize that, every student is allowed ***one*** (1) absence in discussion section without penalty, so long as:

- It is not the date of their Platform or Popular Culture Presentation.
- They inform their TA by email (cc:ing Dr. Holtz in the email) beforehand (if at all possible), or certainly by the end of that same day that they will be absent and the reason for that absence.
- When returning to class, students must bring a note identifying the date of and reason for the absence and acknowledging that the information in the note is accurate.
- ***NOTE***: excused absences from Discussion Sections do NOT excuse students from submitting online assignments. These must still be submitted in a timely fashion. If there are extenuating circumstances, please contact the TA and the instructor.

Should these conditions not be met, the students will receive a 0 for the grade for that discussion section meeting. Additionally, if there is more than one absence the student will receive a 0 for the grade each additional discussion section meeting missed.

If there is a medical condition, legal obligation, or other extraordinary circumstance that does require missing ***more than 1*** discussion section meeting—or missing the date of the Platform or Pop Culture Presentation—the student must provide documentation from the appropriate sort of official (health professional; court official; etc.) explaining the absence.

In cases of dispute between student and TA over the Discussion Participation grade Dr. Holtz (as "instructor of record") will be the final arbiter (but be informed he will take the TA's advice very seriously).

Homework (10% total): Throughout the course there will be short homework projects provided on ELMS. The homeworks are submitted as ELMS quizzes. These include short answers (typically true/false, multiple choice, or matching questions) and occasionally this requires an image upload. These projects are intended to allow you to use and interpret the type of data (some of it directly from the peer-reviewed literature) that paleontologists and other scientists employ in understanding the fossil record. Your TA will discuss aspects of the homework in class, and you may discuss the packets with your classmates, but ultimately the answers you turn in ***must be your own.*** If there is even the appearance that you collaborated on homework answers, your homework will be turned over to the Office of Student Conduct for evaluation. The lowest Homework grade is automatically dropped.

Individual Platform Presentations "Notes from the Fossil Record" (10% total): As a term project for the course, you will have an individual presentation about a recent technical research paper in paleontology, which will be presented as an in-Discussion section platform (e.g., PowerPoint) presentation. More details about the logistics of the project, choosing your paper, grading rubric, etc., will be made available later this semester. Your grade will be 50% from your peers' evaluations and 50% from your TA.

Pop-Up Questions of the Day (QotD) (5% total): During each lecture there will be one or more brief question shown on the board. Depending on the particular question, you might submit your answer on your own to ELMS, or after discussing it with a classmate nearby. You will have only a short window in which to answer the question. The format of the question can be true/false, fill-in-the-blank, multiple choice, or more open-ended. In some cases we'll review your submissions as a point of in-lecture discussion.

The **lowest four (4) grades** of your Pop-Up Questions will be automatically dropped. This is how absence from lecture will be handled. In other words, you don't separately ask for an excused absence for these. **NOTE**: facilitating fellow students who are not present in answering these questions remotely is absolutely an Honor Code violation and will result in action taken against you and the student receiving the at-a-distance help. Individual these are low-point assignments, so it is much better to lose a few points than to risk a course grade of "XF" on your University transcript!

"The Fossil Record in Popular Culture" Project & Presentation (5% total): Organisms and aspects of the fossil record are widespread in popular culture: not just movies and TV shows, but games, political cartoons, toys, commercial products, and more. Late in the semester each student will find an example of such (not including the *Jurassic Park/World* franchise!!), which they will evaluate and present in Discussion section. The details of this assignment (both the part turned in on ELMS and the student presentations) will be provided later in the semester.

LATE ITEM POLICY: Late Homework Assignments and will be docked 25% of the total grade if not turned in on time but turned in prior to the next day or docked 50% if turned in the next day. After that point, the grade for that assignment will be a 0. As with most University situations, if there are compelling adverse circumstances, please contact your TA and instructor and they can work with you.

Course Overview

I-Series ("Big Question") Courses

The I-Series courses are designed to address important issues that spark the imagination, demand intellect, inspiration, and innovation, and conclude where possible with real-world implementation. They are intended to fulfill university general education requirements in a creative and contemporary way and to challenge students to apply diverse intellectual traditions to today's big issues.

Learning Outcomes

By the end of the semester, every student should be able to:

- Identify the major techniques used by scientists to date events in the ancient past, the evolutionary relationships of organisms, and the behavior and function of ancient life
- Recognize how scientists test alternative models of evolutionary events and transitions
- Properly identify the various components of a peer-reviewed research paper, its conclusions, and the evidence used to support those conclusions
- Effectively present and document scientific information by means of by means of PowerPoint presentations

Course Themes

This course examines how scientists reconstruct events and life forms of the prehistoric past. Over this semester we will explore several big themes:

- The scale of geologic and evolutionary time
- Biological evolution and the origin, evolution, and diversification (and occasional extinction) of branches of the Tree of Life
- The nature of scientific knowledge, and how diverse lines of evidence are used to reconstruct events of the ancient past
- The role of information from the prehistoric past in understanding climate change and modern biodiversity

Lecture Themes

Each lecture will have one (sometimes more) central question presented towards the beginning, and over the course of the lecture you will see how paleontologists and related scientists answer those questions. It is important that you pay attention to ***HOW*** such questions are answered, and not merely what the answers are.

Note on Content

Science is demonstrably Humanity's most effective way of assessing reality about the natural world. Many of its discoveries contradict deeply held traditional, religious, political, or personal beliefs. In

this particular course, we shall examine what Science has uncovered about the age of the Earth and its inhabitants, the origin and interrelationships of species (including our own), and the reality of climate change (including human contribution to this phenomenon). We will not shy from indicating where the scientific discoveries demonstrate that other beliefs about these aspects of the natural world are in error. If you find it distressing to hear people's beliefs called inaccurate (whether you hold them or not), this may not be the course for you: there are many other courses available at the University which fulfill the same requirement. If, however, you wish to understand not merely what Science has discovered but also HOW it discovered it—regardless of its implications for traditional, religious, political, or personal beliefs—then we encourage your active participation.

EXPECTATIONS & POLICIES

EXPECTATIONS & ATTENDANCE

Attendance in Discussion Section is required: see the grade items for "Discussion Participation" above for details. **NOTE:** Attendance means more than mere presence: it means "paying attention". Please refrain from texting/web-browsing/doing homework/etc. in class.

Attending the lectures is also required. Lecture notes are provided online, but they are not the script of the videos. You can be held responsible for any material presented in lecture in terms in quizzes or exams.

MASK POLICY

The University's policy is that masks will no longer be required while indoors in most situations, including classrooms. However, the University also reminds us that masks are a significant defense against the spread of COVID-19 and other respiratory viruses (including the cold and flu). Therefore, they recommend wearing a KN95 mask while indoors for added protection. So please feel free to mask up if you feel safer, and I STRONGLY encourage masking if the cold or flu is spreading on campus.

COMMUNICATION

Communication in this course will primarily be by means of the ELMS Announcement and Inbox email systems. There is the possibility that due to unusual inclement weather or other unexpected emergencies, the University may close. Please consult the University main webpage (http://www.umd.edu) or call 301-405-7669 (SNOW) to confirm such cancellations. Dr. Holtz will contact students via ELMS in order to inform them concerning how this will affect course organization.

MEMORIZATION

As part of the nature of the course, there will be a lot of memorization (less than a foreign language class, but more than that found in more mathematically-oriented introductory science classes). This will include lots of anatomical, geological, and paleontological terms, as well as evolutionary and temporal relationships. If you have difficulty memorizing, this may not be the class for you. Also, if there are words or concepts with which you are not familiar, feel free to ask Dr. Holtz (in Review Meetings, over email, etc.) for an explanation or clarification.

General Policies

The University has provided a page on Academic policies at http://www.ugst.umd.edu/courserelatedpolicies.html. Each student is responsible for reviewing this page with regards to issues of Academic Integrity; the Code of Student Conduct; Sexual Misconduct; Discrimination; Accessibility; Attendance, Absences, or Missed Assignments; Student Rights Regarding Undergraduate Courses; Official UMD Communication; Mid-Term Grades; Complaints About Course Final Grades; Copyright and Intellectual Property; Final Exams and Course Evaluations; and Campus Resources.

Laptop/Smartphone/Tablet Use

You will need to upload documents to ELMS, take online quizzes, and occasionally watch online lectures this semester, so please make certain that you have access to appropriate hardware, software, and Internet connections. If you are concerned about your ability to connect remotely for this course, please consult the following information about solutions provided by the Division of Information Technology.

Course Experience Survey

CourseExp will be open for students to complete their evaluations during the last two weeks of the semester. Students can access CourseExp through ELMS to complete their evaluations. You will be alerted about these dates and provided more information closer to that time, and students will be alerted via their official University e-mail account.

COURSE SCHEDULE

Week	**Date**	**Topic**	**Question**
I	Jan. 26 Lecture	"Into the Darkness of Prehistory": Our Long Quest for Origins	How did people discover the prehistoric past?
II	Jan. 30	**Discussion:** Introductions; Policy Review; Overview of Syllabus; Icebreakers	
	Jan. 31 Lecture	Clocks in the Rocks: The Geologic Record & Geologic Time	How do rocks form? How do they record past environments? How do we tell geologic time?
	Feb. 2 Lecture	Bones in the Stones & Shells in the Shales: Fossils and Fossilization	What are fossils, and how do they form?
III	Feb. 6	**Discussion:** The Scale of Geologic Time in-class activity; **Homework 1 due**	
	Feb. 7 Lecture	Bringing Fossils to Life: Paleobiology and the Methods of Science	How do we use the fossil record to understand the biology and evolution of extinct organisms?
	Feb. 9 Lecture	"What is It?": Identifying Fossils and the Nature of Species	How do we identify fossils? What are species?
IV	Feb. 13	**Discussion:** What are Scientific Papers, and How Do We Read Them?; **Homework 2 due**	
	Feb. 14 Lecture	Descent with Modification: Evolution by Natural Selection	What is evolution?
	Feb. 16 Lecture	Tempo & Mode: The Fossil Record of Speciation and Evolutionary Transformations	How do new species form?
V	Feb. 20	**Discussion:** Platform Presentations overview; Guide to making PowerPoints; **Homework 3 due**	
	Feb. 21 Lecture	The Tree of Life: Reconstructing the Evolutionary History of Life	How do we reconstruct how species are related to one another? How does the fossil record document the rise of major groups and the origins of new traits?

	Feb. 23 Lecture	Climate Emergencies Past & Present: The PETM and the Anthropocene Contrasted	What do ancient events show about the effects of climate change on the living world?
VI	Feb. 27	**Discussion:** Midterm I Review; **Homework 4 due**	
	Feb. 28 Lecture	Awful Changes: Mass Extinctions	What are extinctions and mass extinctions?
	March 2 Lecture	Death from Above: The Cretaceous/Paleogene Mass Extinction	What caused the Cretaceous/Paleogene mass extinction?
	March 2-4	**Midterm Exam I online**	Covers 1/26-2/21
VII	March 6	**Discussion:** Presentations Part I; **Final Presentation PowerPoints due for all students**	
	March 7 Lecture	Death from Below: The Permo-Triassic Mass Extinction and Mass Extinction Wrap Up	What caused the Permo-Triassic mass extinction?
	March 9 Lecture	First Impressions to Shell Games: The Garden of Ediacara and the Cambrian Explosion	What were the first animals like, and why did animals develop shells?
VIII	March 13	**Discussion:** Presentations Part II; **Homework 5 due**	
	March 14 Lecture	A Tale of Two Dynasties: The Rise and Fall of Trilobites and Ammonoids	How do the histories of trilobites and ammonoids compare?
	March 16 Lecture	"Fearfully Great Lizards": The Rise of the Dinosaurs	How did dinosaurs become so successful?
SPRING BREAK	March 20-24	**SPRING BREAK**	
IX	March 27	**Discussion:** Presentations Part III; Midterm II Review	
	March 28 Lecture	"Behold the Mighty Dinosaur": Gigantism, Ontogeny, and Dinosaur Paleoecology	How did giant size and large clutch size affect dinosaur ecosystems?
	March 28-30	**Midterm Exam II online**	Covers 2/24-3/14

	March 30 Lecture	In the Court of the Tyrant Kings: Paleobiology of the Tyrannosaurs	What can we discover about the locomotion, predation, and ecology of *T. rex* and its kin?
X	April 3	**Discussion:** Presentations Part IV; **Homework 6 due**	
	April 4 Lecture	Feathered Dragons: Dinosaurs and the Origin of Birds	How did birds evolve from (other) dinosaurs, and how did they learn to fly?
	April 6 Lecture	Furry Conquerors: Cenozoic Mammalian Diversification	How did mammals diversify after the K/Pg mass extinction?
XI	April 10	**Discussion:** Fossil Record in Popular Culture project overview; The Grey Literature: the Role of the Blogosphere in Science; **Homework 7 due**	
	April 11 Lecture	Drawing Out Leviathan: The Origins of Whales	What does the fossil record tell us about the origin of whales?
	April 13 Lecture	The Scatterlings of Africa: The Origins of Humanity	Where, and from what, did humans evolve? What were proto-humans like?
XII	April 17	**Discussion:** Fossil Record in Popular Culture presentations I; Midterm III Review; **Fossil Record in Popular Culture PowerPoints due for all students**	
	April 18 Lecture	Last Man Standing: The Rise of *Homo sapiens*	What makes our species unique, and what happened to our closest kin?
	April 20 Lecture	Out of Eden: The Spread of *Homo sapiens*	How did humanity spread around the world?
	April 20-22	**Midterm Exam III online**	Covers 3/16-4/11
XIII	April 24	**Discussion:** Fossil Record in Popular Culture presentations II	
	April 25 Lecture	The Call of Distant Mammoths: The Pleistocene Mass Extinctions	What happened to the Pleistocene megafauna?

	April 27 Lecture	The Sixth Extinction: The Holocene Extinctions & Modern Defaunations	How does the fossil record inform us about the on-going modern extinctions?
XIV	May 1	**Discussion:** Fossil Record in Popular Culture presentations III; **Homework 8 due**	
	May 2 Lecture	Reversing the Tide? Conservation Paleontology, Rewilding & De-Extinction	How can the paleontological perspective be used in service of endangered species and threatened ecosystems?
	May 4 Lecture	The Earth After Us: The Fossil Record of the Anthropocene and Beyond	What will we leave behind in the fossil record?
XV	May 8	**Discussion:** Final Exam Review; **Homework 9 due**	
	May 9 Lecture	Lies, Hoaxes, Profits & Paleoethics	What happens when people use the fossil record for unethical purposes?
	May 11 Lecture	What Good is the Fossil Record? Perspectives of the Prehistoric Past	How do we balance public and private interests in fossil specimens? How do scientists get their information out to the public?
Final Exam Season	May 13-15	**FINAL EXAM online**	