

Dinosaurs - EARTH 2401 – Course Outline for Winter 2021

Instructor: Michael Ryan, MichaelJ.Ryan@carleton.ca

Due to Covid restrictions, I do not have an on-campus office.

Teaching Assistants: TBA

The course will be delivered asynchronously (pre-recorded) using cuLearn. There will be two 80-minute lectures uploaded and released each week at the beginning of their scheduled time slots. Additional non-examination material may be uploaded as support material for each lecture.

It is important that you have access to cuLearn. If you have difficulties connecting, please solve these issues with the university.

Lectures: Monday 10:05 am – 11:25 pm; Wednesday 10:05 am – 11:25pm.

Office hours: Mondays and Wednesdays 1:00 pm to 2:00 pm. Office hours will be conducted via Zoom. A Zoom link (invitation) for each office hour will be posted with each lecture and will be open to anyone accessing the meeting through that link. If you require a one-on-one session, please e-mail me to arrange a meeting.

Questions about the course or the lecture material should be emailed to MichaelJ.Ryan@carleton.ca. E-mailed questions will be responded to within 24 hours. Note that e-mails will only be responded to between 9:00 am to 5:00 pm, Monday to Friday.

Grade Breakdown:

Midterm 1: 30%, 80 minutes

Midterm 2: 35%, 80 minutes

Final Exam: 35%, 2 hours TBA

Note that midterm 2 and the final exam are *non-cumulative*. The exams will be taken on-line through cuLearn.

A valid excuse for missing the midterm is for medical reasons or death in the family, and must be documented with a medical certificate (see also the section Academic Accommodation). Other excuses are not valid. In such circumstances there will be no make-up midterm. The grade weighting corresponding to the test that was missed will be added to the grade weighting of the next midterm or final exam, as appropriate (i.e., missing the first midterm will make the second midterm count for 65% of your total grade; missing the second midterm will make the final exam count for 70% of your total grade). The make-up exam date will be scheduled for only those who have presented a medical certificate. The final will have a make-up exam with the university rules attached. You will not be allowed to write a make-up exam on a date before the main exam. Due to the size of this class, examinations will consist of multiple choice, true/false, labeling, or choose the correct term or phrase questions.

Course objectives

1. Identify the major events in the evolution of dinosaurs. (Remembering and Understanding)
2. Explain the importance of fossils for paleoenvironmental interpretations. (Remembering)
3. Explain the position of dinosaurs in the evolutionary history of life and their development throughout the Mesozoic Era, including extinction theories. (Remembering, Analyzing and Understanding)
4. Distinguish dinosaurs according to the characters of fossil remains. (Remembering and Understanding)
5. Analyze dinosaur intraspecific and interspecific behaviour through time. (Remembering and Understanding)
6. Analyze dinosaur palaeobiology for each major group. (Remembering and Understanding)
7. Describe the non-dinosaur flora and fauna of the Mesozoic. (Remembering and Understanding).
8. Explain the importance of dinosaurs in culture and as a tool for educating about science. (Understanding)

Learning outcomes

By the end of this course, students will be able to:

1. Recall the anatomy of dinosaurs.
2. Describe and evaluate patterns of relationships between major dinosaur groups.
3. Describe key evolutionary events in the origin and radiation of dinosaurs.
4. Describe the inferred biology and behaviour of dinosaurs.

Suggested reading:

D.E. Fastovsky and D.B. Weishampel, 2016. *Dinosaurs, A Concise Natural History*. Cambridge University Press (ISBN 978-1316501153). This book can be ordered online. It is recommended, but not mandatory. An earlier edition (2009 or 2012) is also useful, if you can find one.

Lecture topics and dates

The lecture order is derived from, but diverges from the textbook, and some lectures are not covered in the textbook. The relevant chapters for each lecture (where appropriate) are listed after each lecture, although only portions of the chapter may be covered (chapter numbers follow the 2016 edition of the textbook).

The asynchronous (pre-recorded) nature of the lecture delivery allows the student to pause and return to the lecture at their leisure. For this reason, most lectures will be broken down into modules covering a subset of the main lecture topic. Please note that each lecture should be viewed and understood before proceeding to the next lecture. Many of the modules will be delivered by a guest lecturer who is a leading expert in their field. I will post a written summary of the most important points from each guest lecture within 24 hours after the lecture has been released; however, this is not a replacement for you taking your own notes from each lecture.

Lecture Outlines:

Note that lecture topics are subject to change, with some sub-sections being deleted or moved to another lecture slot for time considerations.

Lecture 1 (Jan 11): Introduction & Objectives: Course Introduction and Overview; Review of Geological time; Review of plate tectonics; What is a dinosaur? (Chapter 2)

Lecture 2: (Jan 13): Fossils and fossilization: What is a fossil? How do fossils form? How do we know the age of a fossil (Law of Superposition; radiometric dates; fossil correlations) (Chapter 1)

Lecture 3 (Jan 18): Evolution and Phylogenetics: Review of evolution; What is a species? Phylogenetic systematics; Cladograms and how they are constructed. (Chapter 3)

Lecture 4 (Jan 20): Anatomy and Relationships: Vertebrate anatomy; Overview of Dinosauria and the key features of each major group.

Lecture 5 (Jan 25): Life Before The Dinosaurs: Origin of life; Burgess Shale; Origin and diversification of fish; Spotlight on *Dunkleosteus*; From the water to the land (evolution of tetrapods); Spotlight on *Tiktaalik*; Early reptiles from Joggins, NS; Spotlight on *Dimetrodon*. (Chapter 4)

Lecture 6 (Jan 27): The Mesozoic Era: Triassic and the origin of dinosaurs; Jurassic (rise of the sauropods); Early Cretaceous; Spotlight on *Utahraptor*; Late Cretaceous.

Lecture 7 (Feb 1): Theropoda 1: The first dinosaurs; Spotlight *Eoraptor*; Transitions – omnivory to herbivory & bipedality to quadrupedality; Spotlight *Coelophysis*; Tetanurae - *Carnotaurus*/southern hemisphere & *Allosaurus*/northern hemisphere. (Chapters 6 & 7)

Lecture 8 (Feb 3): Theropoda 2: Introduction to Coelosauria; Tyrannosauridae; Spotlight *T.rex* feeding mechanics; Spotlight on tyrannosaurid ontogeny (*Nanotyrannus* vs. *T.rex*); Ornithomimids. (Chapter 7)

FEB 8 (Monday), 10:05 – 11.25 AM MIDTERM LECTURE #1 (covering lectures 1 - 8 only); 80 minutes; 30%

Lecture 9 (Feb 10): Maniraptoria & the Origin of Birds: Maniraptoria; Oviraptoria & *Anzu*; *Archaeopteryx*; Feathers, wings and the origin of flight. (Chapter 8)

Feb 15, STATUTORY HOLIDAY; SPRING BREAK FEB 16 – 19, UNIVERSITY CLOSED, NO LECTURES

Lecture 10 (Feb 22): Sauropodomorpha: Origin of sauropods; Evolution of large body size; Star Wars & sauropods – finding the Krayt Dragon in Tunisia. (Chapter 9)

Lecture 11 (Feb 24): Thyreophora: Thyreophora origins; Ankylosaurs and *Zuul*; Stegosaurs. (Chapter 10)

Lecture 12 (March 1): Marginocephalia: Pachycephalosauria; basal ceratopsians; Spotlight on *Aquilops*; Ceratopsidae; Frills and ornamentation; Spotlight on *Torosaurus* and *Triceratops*. (Chapter 11)

Lecture 13 (March 3): Ornithopoda: Basal ornithopods; Hadrosauridae; Spotlight on *Parasaurolophus*. (Chapter 12)

Lecture 14 (March 8): Dinosaur Biology: Endothermy vs. ectothermy; Dinosaur life spans (palaeohistology); Soft tissue preservation; Biomechanics (spotlighting *Yi*); How to make a dinosaur from a chicken. (Chapter 13)

Lecture 15 (March 10): Dinosaur Behaviour: How do we infer behaviour? Parental care; Tyrannosaurid herding; Growth in *T. rex*; How to make a fossil trackway; Spotlight on Alaskan trackways. (Chapter 6)

MARCH 15 (Monday, 10:05 – 11:25 AM, MIDTERM LECTURE #2 (covering lectures 9 - 15 only), 80 minutes; 35%

Lecture 16 (March 17): In The Shadow of The Dinosaurs: Mesozoic plants (spotlight on Dinosaur Provincial Park); Cretaceous fish; Pterosaurs; Marine reptiles; Spotlight on marine reptiles from Svelblard; Mesozoic mammals. (Chapter 14 for plants)

Lecture 17 (March 22): Palaeoecology & Taphonomy: Cretaceous palaeoecology; Taphonomy; Reconstructing fossil communities from microsites. (Chapter 14)

Lecture 18 (March 24): Exploration and Discovery: Early history of palaeontology; Spotlight on Mary Anning; Spotlight on Roy Chapman Andrews; Field palaeontology; Fossil preparation; How to assemble a dinosaur for museum exhibition. (Chapter 15)

Lecture 19 (March 29): Dinosaurs of Canada: Overview of Canadian dinosaur localities; the Southern Alberta Dinosaur Project; Dinosaurs of Saskatchewan.

Lecture 20 (March 31): Dinosaurs Around The World: Dinosaur paleobiogeography in the Mesozoic - who was where when; South America (*Argentinosaurus* and *Giganotosaurus*); Dinosaurs of Africa; Dinosaurs of Europe (spotlight on Portugal); Dinosaurs of Japan.

Lecture 21 (April 5): The Rise & Fall & Rise of the Dinosaurs: Dinosaurs at the end of the Cretaceous (Hell Creek Formation); What Killed the dinosaurs (Chicxulub asteroid impact vs. Deccan traps)? How did dinosaurs survive the K-Pg extinction (birds!)? (Chapter 16)

Lecture 22 (April 7): Dinosaurs & Culture: Writer and artist Stephen Bissette on the evolution of dinosaurs in (pop) culture; CGI SFX artist Andreas Feix builds dinosaurs for *Jurassic Park*.

Lecture 23 (April 12): Communicating Science through Dinosaurs: National Geographic & Scientific American science writer Riley Black on using Dinosaurs for Public Education; Ashley Hall (Museum of the Rockies) on Dinos & SciComm; Danielle Dufault (Royal Ontario Museum) on The Art of Scientific Illustration. Writer and artist Mark Schultz on using dinosaurs to highlight climate change & environmental awareness.

Lecture 24 (April 14): Final Exam Review

FINAL EXAM: TBA, (covering lectures 16 -23 only), 2 hours; 35%

Requests for Academic Accommodation

You may need special arrangements to meet your academic obligations during the term. For an accommodation request, the processes are as follows:

Pregnancy obligation

Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details, visit the Equity Services website: carleton.ca/equity/wp-content/uploads/Student-Guide-to-Academic-Accommodation.pdf

Religious obligation

Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details, visit the Equity Services website: carleton.ca/equity/wp-content/uploads/Student-Guide-to-Academic-Accommodation.pdf

Academic Accommodations for Students with Disabilities

If you have a documented disability requiring academic accommodations in this course, please contact the Paul Menton Centre for Students with Disabilities (PMC) at 613-520-6608 or pmc@carleton.ca for a formal evaluation or contact your PMC coordinator to send your instructor your Letter of Accommodation at the beginning of the term. You must also contact the PMC no later than two weeks before the first in-class scheduled test or exam requiring accommodation (if applicable). After requesting accommodation from PMC, meet with your instructor as soon as possible to ensure accommodation arrangements are made.
carleton.ca/pmc

Survivors of Sexual Violence

As a community, Carleton University is committed to maintaining a positive learning, working and living environment where sexual violence will not be tolerated, and its survivors are supported through academic accommodations as per Carleton's Sexual Violence Policy. For more information about the services available at the university and to obtain information about sexual violence and/or support, visit: carleton.ca/sexual-violence-support

Accommodation for Student Activities

Carleton University recognizes the substantial benefits, both to the individual student and for the university, that result from a student participating in activities beyond the classroom experience.

Reasonable accommodation must be provided to students who compete or perform at the national or international level. Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. <https://carleton.ca/senate/wp-content/uploads/Accommodation-for-Student-Activities-1.pdf>

For more information on academic accommodation, please contact the departmental administrator or visit: students.carleton.ca/course-outline

Academic Integrity

The University demands, unequivocally, academic integrity from all of its members, including students. Misconduct in scholarly activity will not be tolerated. The integrity of a student's academic work is critical to enabling student success. Students who violate the principles of academic integrity undermine the quality of their education and the value of a Carleton University degree.

Plagiarism and other forms of misconduct will not be tolerated. It is the student's responsibility to read and understand the university's Academic Integrity Policy which can be downloaded from here: <https://carleton.ca/registrar/wp-content/uploads/Academic-Integrity-Policy.pdf>