

# Mammal Diversity and Evolution (Fall 2021)

BIOL 345/ANAT 445

Seminar (S): Tuesdays and Thursdays, 2:30-3:45 pm, E429C

Lab (L): Wednesdays, 3:20-6:00 pm, SOM (East Wing), E429C (usually) or E322 (lab reviews)

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Date	Topic and Activity	Textbook Readings, DVDs	Journal Article(s)	Quiz, Deadline, etc.
Aug. 24	S1 (DC): Mammal characteristics and classification	V: Ch. 1, 3-4; DVD 10: Food for thought		
Aug. 25	L1: Mammal skulls and teeth	Elbroch 2006, Ch. 1-2 (on Canvas)		
Aug. 26	S2: Mammal origins, monotremes	V: Ch. 2, 5, 20; DVD 1: A winning design	Krause et al. 2014	
Aug. 31	S3: Afrosoricida, Macroscelidea, Tubulidentata	V: Ch. 7-8; DVD 2: Insect hunters	Lovegrove and Mowoe 2017	
Sept. 1	L2: Phylogenetics	"Tree Thinking" (on Canvas)		Quiz 1: S1-2, L1
Sept. 2	S4: Eulipotyphla	V: Ch. 14	Smith and Angielczyk 2020	
Sept. 7	S5: Cingulata, Pholidota	V: Ch. 10	Mitchell et al. 2016 (& Gaudin and Lyon 2017)	
Sept. 8	L3: Afrosoricida, Macroscelidea, Eulipotyphla			Quiz 2: S3-4, DVD 2
Sept. 9	S6: Pilosa	V: Ch. 10; DVD 8: Life in the trees	Pauli et al. 2014	
Sept. 14	S7: Scandentia, Dermoptera, Primates 1 (Overview, Strepsirrhini)	V: Ch. 11-12	Sefczek et al. 2020	
Sept. 15	L4: Monotremata, Cingulata, Pilosa, Pholidota, Tubulidentata			Quiz 3: S5-6, DVD 8
Sept. 16	S8: Primates 2 (Haplorrhini)	V: Ch. 12; DVD 9: Social climbers	Schwartz et al. 2020	
Sept. 21	S9: Chiroptera 1 (Overview, Yinpterochiroptera)	V: Ch. 15, 22	Amador et al. 2020	
Sept. 22	L5: Scandentia, Dermoptera, Primates, Chiroptera			Quiz 4: S7-8, DVD 9
Sept. 23	S10: Chiroptera 2 (Yangochiroptera)	V: Ch. 15, 22	Hand et al. 2018	
Sept. 28	S11 (TA): South American native "ungulates"	Croft et al. 2020	Gomes Rodrigues et al. 2017 (& Croft et al. 2020)	
Sept. 29	L6: South American native "ungulates"			Quiz 5: S9-10
Sept. 30	S12: Rodentia 1 (Overview, non-hystricomorphs)	V: Ch. 13; DVD 4: Chisellers	Hopkins 2005	
Oct. 5	REVIEW (S3-6)			
Oct. 6	LAB REVIEW (*E322*)			Quiz 6: S11
Oct. 7	REVIEW (S7-10)			Graduate student presentation 1 due
Oct. 12	(No class)			
Oct. 13	MIDTERM EXAM			

Date	Topic and Activity	Textbook Readings, DVDs	Journal Article(s)	Quiz, Deadline, etc.
Oct. 14	S13: Rodentia 2 (Hystricomorpha), Lagomorpha	V: Ch. 13	Rinderknecht and Blanco 2008; Millien 2008	
Oct. 19	(No class: Fall Break)			
Oct. 20	L7: Rodentia, Lagomorpha			Quiz 7: S12-13, DVD 4
Oct. 21	S14: Hyracoidea, Sirenia, Proboscidea	V: Ch. 9; DVD 7: Return to water	Matsui et al. 2017	
Oct. 26	S15: Cetacea	V: Ch. 19, 22	Goldbogen et al. 2019	
Oct. 27	L8: Hyracoidea, Sirenia, Proboscidea, Cetacea			Quiz 8: S14-15, DVD 7
Oct. 28	S16: Perissodactyla	V: Ch. 17; DVD 3: Plant predators	Sandom et al. 2014	
Nov. 2	S17: Artiodactyla	V: Ch. 18	Joly et al. 2019	
Nov. 3	L9: Artiodactyla, Perissodactyla			Quiz 9: S16-17, DVD 3
Nov. 4	S18: Carnivora 1 (Overview, Feliformia)	V: Ch. 16; DVD 5: Meat eaters	Piras et al. 2018	
Nov. 9	S19: Carnivora 2 (Caniformia)	DVD 6: Opportunists	Schubert et al. 2019	
Nov. 10	L10: Carnivora			Quiz 10: S18-19, DVD 5-6
Nov. 11	S20: Marsupialia 1 (Overview, New World marsupials)	V: Ch. 6; DVD 1: A winning design	Ladevèse et al. 2011	
Nov. 13	Cleveland Metroparks Zoo (*optional; 1 pm*)			
Nov. 16	S21: Marsupialia 2 (Old World marsupials)		Price et al. 2017	
Nov. 17	L11: Marsupials			Quiz 11: S20-21, DVD 1
Nov. 18	REVIEW 1			Graduate student presentation 2 due
Nov. 23	(No class)			
Nov. 24	(No class)			
Nov. 25	(No class: Thanksgiving)			
Nov. 30	REVIEW 2			
Dec. 1	LAB REVIEW (*E322*)			
Dec. 2	(No class)			
Dec. 14	FINAL EXAM (12:00-3:00 pm)			

**Office Hours:** by appointment. Contact Dr. Croft directly to arrange a time.

### Required Textbooks and Other Resources

- V: Vaughan, T.A., J.M. Ryan, N.J. Czaplewski. 2014. Mammalogy, 6<sup>th</sup> Ed., Jones and Bartlett Learning (ISBN: 9781284032093; Digital Version ISBN: 9781284038484)
- DVD: The Life of Mammals. 2003. Hosted by David Attenborough. This series will be made available via Google Drive (see link on Canvas).

## Recommended Text

- MacDonald, D.W. 2009. The Princeton Encyclopedia of Mammals. Princeton U. Press. This is out of print, but it is possible to get a used version for < \$50. It has many excellent photographs and diagrams (~ 1,000 pp) and is up-to-date and succinctly written.

## Course Description, Aims, and Learning Objectives

This course focuses on the anatomical and taxonomic diversity of mammals in an evolutionary context. The emphasis is on living (extant) mammals, but extinct mammals are also discussed.

By the end of the course, students will be able to: (1) describe the key anatomical and physiological features of mammals; (2) name and describe all orders and most families of living mammals; (3) identify a mammal skull to order and family; (4) understand how to create and interpret a phylogenetic tree; (5) appreciate major historical patterns in mammal diversity and biogeography as revealed by the fossil record; (6) read and critique a scientific article dealing with mammal evolution.

This course satisfies a laboratory requirement for the Biology major.

**Prerequisite:** BIOL 214 Genes, Evolution and Ecology.

**Recommended preparation:** At least one advanced evolution or anatomy course (e.g., BIOL 223 Vertebrate Biology, BIOL 225 Evolution, or BIOL 346 Human Anatomy).

## Seminars

Most seminars will be led by two undergraduates or one graduate student. At the beginning of the semester, students will submit their top four choices for seminars to lead (i.e., four seminar dates), and an effort will be made to accommodate such preferences. Students who are not leading the seminar on a particular day are also expected to complete the assigned readings and watch the assigned videos beforehand in order to actively participate in the discussions (excluding the first day of class). Each seminar will have the following format:

Overview Presentation (~20 min.). The overview presentation should include many images and relatively little text. Digital versions of the figures in the Vaughan et al. textbook will be made available, but students are encouraged to use additional resources. The presentation should provide a general overview of the group including: diversity and relevant families; evolutionary relationships; fossil record; recognition characteristics (especially external morphology and skull); geographic range; and Ohio representatives (if applicable). It should introduce topics to be addressed in the discussion (below); it does not need to be a thorough treatment. It will be timed and should adhere to the schedule. Slides must be sent to Dr. Croft *by 8 am the day before the presentation* for fact-checking.

Presentation Discussion (~30 min.). This discussion will delve more deeply into topics introduced in the overview presentation. The exact scope will depend on the preferences of the class, but in general, it should focus on form-function relationships including: skeletal anatomy, soft tissue anatomy, diet, size/body mass, locomotion, special adaptations, and ecological niche. Slides from the overview presentation may be revisited, and additional slides, videos, etc. can be used to help facilitate discussion.

Research Article Discussion (~25 min.). One recent research article will be discussed each seminar. All students should come prepared to discuss that day's article. The leader(s) must submit a one-page summary of the research article and a list of questions that will be used to facilitate discussion to Dr. Croft *by 8 am the day before the discussion*.

## Labs

Labs will focus on the osteology of extant mammal groups using a combination of photographs, illustrations, casts, and specimens. Labs will take place on campus and incorporate specimens from Dr. Croft's teaching collection as well as the research collections of the Cleveland Museum of Natural History. (Normally some of the labs would take place at the museum, but due to a major museum renovation, that will not be possible this year.) To prevent damage to specimens, *no touching will be permitted*. You are free to photograph lab specimens for future reference, and you can ask Dr. Croft to reposition a specimen, if necessary. Additionally, an online, photographic [guide to mammal skulls](#) has been developed for this course that will be a useful reference. You might want to consider downloading a magnifying app to your cell phone for viewing small specimens. (Magnifying glasses will also be provided.) Most labs will start with a quiz (see below) and a discussion of the answers. This will be followed by viewing of specimens. The remainder of lab will consist of a student-led discussion of answers to questions designed to highlight craniodental and postcranial features of mammals that are useful for skull identification and/or correlated with mammal ecology. All students are expected to review all questions prior to lab, but each student will be assigned to co-lead discussion of one question (see below).

## Student Assessment and Grading

Seminar Presentations (20% of final grade): All components of seminars (e.g., slides, presentation, research paper summary, discussion) will be graded using the rubric posted on Canvas (Useful References). Pay careful attention to the items listed to maximize your score. Note that materials are due by *8 am the day before class*.

Quizzes (20% of final grade): Most labs will begin with a short quiz (10-15 points, short answer and/or multiple-choice questions, on Canvas) that will cover material from the previous two seminars and associated readings and videos (see schedule above). Each student's lowest quiz score will be dropped from the final grade. Quizzes may be taken in advance (in the case of a planned absence). They may not be taken later without a note from a physician.

Lab Discussion Questions (20% of final grade): For Labs 3-10, each student will submit their answer to one lab discussion question before lab and co-lead discussion of that question during lab. Questions will be posted and assigned by 5 pm on the preceding Friday. You must send your answer to Dr. Croft by *8 am the day of the lab*. The answer must include relevant annotated photographs and/or illustrations. It should also include *the question itself*. An example answer will be posted to Canvas. Each question will be graded as unsatisfactory, satisfactory, or excellent, and the lowest grade will be dropped (i.e., your score will be based on seven labs). The final score for this component will be calculated as  $\%(\text{satisfactory or excellent}) + \#\text{excellent} - 4 * \#\text{late}$ . For example, 1 unsatisfactory, 5 satisfactory, and 2 excellent lab answers with 2 late submissions = 94% (100% + 2% - 8%).

Midterm and Final Exams (15% and 25% of final grade, respectively): These exams will cover class and lab material and have three components: (1) identification of osteological specimens (mainly skulls) to order and family; (2) identification of living mammals to family, plus associated short answer questions (e.g., size, diet, habitat, geographic range, order, etc., of that particular animal); and (3) theoretical exam, mostly short answer questions (e.g., definitions, compare/contrast), basic phylogenetic methods, and some multiple choice questions. The midterm exam will cover material through Sept. 29th (i.e. South American native ungulates but not rodents). The final exam will be comprehensive.

Technology for Exams: Quizzes and exams will be administered via Canvas and require Respondus Lockdown Browser. Before the course begins, you should visit [U]Tech's [page on](#)

[this software](#), download the Getting Started for Students guide, and make sure it works on the device you will use for exams. If you have trouble installing the software, contact [U]Tech.

Final Letter Grades be assigned based on overall class performance, generally as follows: A, 90-100%; B, 80-89%; C, 70-79%; D, 60-69%, F, 59% and below. Class involvement and engagement in seminars and labs will be taken into account in the case of “borderline” letter grades.

### **Additional Requirements for Graduate Students (enrolled in ANAT 445)**

PaleoPlace Presentations: Graduate students will prepare two short (15-20 minute) narrated (recorded) presentations reviewing an ancient terrestrial ecosystem with a particular focus on mammals. For each presentation, the student will be assigned a broad geographic area (e.g., western Europe) and geologic time interval (e.g., Oligocene Epoch) but will have latitude within those constraints to determine the particular fossil site or formation to discuss. The presentation must address: (1) the site’s paleoenvironment (climatic conditions and vegetation structure); (2) the overall mammal community (a brief review of groups present); and (3) the paleobiology of five species recorded at the site (from separate families and representing at least three orders). In support of the presentation, at least 15 references (journal papers or book chapters) must also be uploaded to the Google Drive folder. The first presentation must be uploaded by October 10th and the second must be uploaded by November 21st.

### **Disability Accommodations**

In accordance with federal law, if you have a documented disability, you may be eligible to request accommodations from Disability Resources. In order to be considered for accommodations, you must first register with the Disability Resources office. To register or to get more information on how to begin the process, you can contact their office at 216-368-5230. Please keep in mind that accommodations are not retroactive.

### **How to Succeed in This Course**

- Submit your slides, lab questions, and other materials on time.
- Do the assigned readings and scan the relevant handouts before class. This will facilitate learning by helping you become familiar with the groups and names to be discussed.
- Learn the names and proper spellings of the groups we discuss in class. Taxonomy is how the great diversity of mammals is organized. You cannot learn about mammals without learning names of groups. Make flash cards or download a flash card app for your phone to help you.
- Related to the above, you must capitalize proper names of taxonomic groups (orders, families, genera, etc.). After the first couple weeks of class, points will be deducted for not doing so.
- Learn or review the bones of the skull and skeleton. We will have a lab on this early in the course, but one session will not be enough for you to really learn the details. Sketching bones is a great strategy.
- Learn to love teeth. Few aspects of a mammal’s anatomy are as important as its teeth. They provide information about ancestry (evolutionary relationships) as well as ecology (diet). Learn how to recognize different types of teeth (incisors, canines, etc.) and how to describe them. Practicing sketching and labeling teeth.
- Mammalogy and paleomammalogy are constantly changing fields, and different sources can vary in their information, especially taxonomy. In general, more recent references will be more accurate. When in doubt, ask Dr. Croft or check [the taxonomy web page](#).

- What should you know about each group by the end of this course? Generally speaking:
  - o Taxonomy and Phylogeny: What is the group's name? Where does it fit into the taxonomic hierarchy? How is it related to other groups?
  - o Biogeography: Where do these animals live on the globe?
  - o Ecology: What do these animals eat? How big are they? How do they move and where do they spend their time? In what types of habitats do they live?
  - o Identification: How can you recognize a member of this group, both by its skull and external features? What are its unique or unusual features?
  - o Fossil record: What do fossils tell us about the past diversity, adaptations, range, and evolution of the group?
  - o In general, you should focus on topics mentioned in class and in lab. This may not cover everything you need to know, but it will cover the vast majority of material.
- Check the useful web site links on Canvas for additional resources. [Animal Diversity Web](#) is a particularly good source for mammal information.

### **Academic Integrity**

Any violation of the University's Code of Ethics will not be tolerated. All forms of academic dishonesty including cheating, plagiarism, misrepresentation, and obstruction are violations of academic integrity standards and will result in a minimum penalty of receiving a zero for the assignment, the potential for failing the entire course. Cheating includes copying from another's work, falsifying problem solutions or laboratory reports, or using unauthorized sources, notes or computer programs. Plagiarism includes the presentation, without proper attribution, of another's words or ideas from printed or electronic sources. It is also plagiarism to submit, without the instructor's consent, an assignment in one class previously submitted in another. Misrepresentation includes forgery of official academic documents, the presentation of altered or falsified documents or testimony to a university office or official, taking an exam for another student, or lying about personal circumstances to postpone tests or assignments. Obstruction occurs when a student engages in unreasonable conduct that interferes with another's ability to conduct scholarly activity. Destroying a student's computer file, stealing a student's notebook, and stealing a book on reserve in the library are examples of obstruction.

In addition, the incident will be reported to the Dean of Undergraduate Studies and Academic Review Board for undergraduates or Senior Associate Dean of Graduate Studies, for Graduate Students. The CWRU Statement of Ethics for graduate students can be found [here](#).