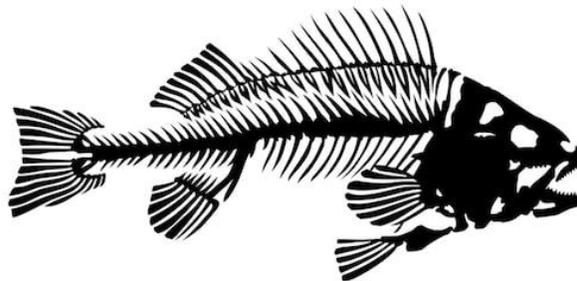


# Biology 3426 – Vertebrate Evolution

## Instructor

Dr. Michele A. Johnson  
Department of Biology  
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Office hours: Monday/Wednesday/Friday  
10:30am-12pm, or by appointment

This course is an evolutionary survey of vertebrates that will focus on major evolutionary innovations and systematic relationships, and major features of the anatomy, physiology, life history, and behavior of vertebrate taxa.

## Course objectives

My Learning Goals for you in this course are as follows:

1. To understand how and why different vertebrate species are related to one another, using the concept of homology.
2. To interpret major evolutionary transitions in vertebrates using phylogenies.
3. To identify structure-function relationships in morphological, behavioral, ecological, and life history traits.
4. To describe the diversity of the major vertebrate groups, including local representatives of each group
5. To address key questions in biology using vertebrates.

In addition, this course is designated as a course that will help you develop skills in Oral and Visual Communication. Upon successful completion of an Oral and Visual Communication (OVC) course, students will have demonstrated the ability to:

1. Identify and use the elements of effective oral and visual communication.
2. Create and deliver effectively structured oral presentations using language correctly and appropriately.
3. Use visual media that are effective, appropriate, and well integrated into the presentation.
4. Analyze and critique oral and visual components of presentations.
5. Respond effectively to questions and comments from audience members.

## Required texts

- *Vertebrate Life* (2013) by Pough, Janis, and Heiser. Pearson, Ninth Edition.
- Additional readings will be available on the course TLEARN site.

## Grading and assessment

Exams – 30%

Two in-class examinations and a final exam (10% each) will assess your knowledge of course content and your ability to think critically about and solve problems related to vertebrate evolution. (Learning Goals 1-5)

“Evolutionary questions” presentations – 24%

Each student will participate in three 30 minute presentations, working in a team of 2-3 students. In each presentation, you will use information from the course textbook and articles from the scientific literature to

address the question posed, and give a PowerPoint (or similar) presentation to the class. (OVC; Learning Goals 1, 2, 3, and 5)

**Texas vertebrate presentations – 6%**

Each student will give two 5 minute PowerPoint presentations on a Texas vertebrate species, during the lab period in which we dissect a representative of that group. (OVC; Learning Goal 4)

**Lab practical – 10%**

A lab practical exam will assess your knowledge of the major morphological structures of vertebrates, their functions, and their evolutionary history. (Learning Goals 1-4)

**Lab quizzes – 10%**

To help you prepare for the lab practical, you will complete ~ 5 lab quizzes. (Learning Goals 1-4)

**Osteology project – 10%**

In the laboratory, each student will prepare a series of osteological specimens. You will then consider one skeletal structure that appears across the collection of specimens from the class, and give an 8-10 minute presentation to the class on the evolution of that structure. You will also contribute to the class display of these specimens, to be housed in one of the display cases in CSI. (OVC, Learning Goals 1 and 3)

**Class participation – 10%**

You are expected to actively participate in all class discussions, and lab and field experiences.

Late work will not be accepted, unless there is a situation for which we have made an arrangement prior to the assignment deadline.

A note on regrades: If you have questions about how points were assigned or need a correction made for a tallying error on an assignment, the assignment must be brought to the professor *within one week* of the date of receipt. No grade adjustments will be made after the one week deadline.

**Class attendance**

Because this course includes class discussions and lectures on material that may not be in your assigned readings, you should plan to attend all class meetings. I expect that you will attend class, and that you will come to class prepared to participate. This includes completing all readings and assignments for this class *prior to class*, asking questions when there is material you do not understand, and focusing your attention on material for this class during all class meetings. Using laptops, cell phones, or any form of social media is a distraction to you and your classmates, and unless otherwise indicated, these are not allowed during class.

If you must miss a class, I expect that you will let me know beforehand. If you must miss class on the day of an exam, you may take a make-up exam **before** the exam date.

**Email and Office Hours**

I am excited to teach you about vertebrate evolution, and I encourage you to ask questions any time there is something you do not understand, or if there is a topic you wish to discuss in more depth than we are able to explore in class. Feel free to email me with any questions about course procedures, assignments, etc., but please ask your content-driven questions in person – either in class, where your fellow students can benefit from your question, or in office hours, where I can better assess your level of understanding and provide a more complete answer to your question. I will do my best to respond to your email messages within one business day.

**Honor Code**

All students are covered by a policy that prohibits dishonesty in academic work. Under the Honor Code, a faculty member will (or a student may) report an alleged violation to the Academic Honor Council. It is the task of the Council to investigate, adjudicate, and assign a punishment within certain guidelines if a violation has been verified.

Further, any materials created by your instructor to enhance or assess your learning in this class (including but not limited to exams, exam keys, problem sets, and lecture slides) are proprietary materials that may not be shared with anyone without prior authorization from Dr. Johnson. **Sharing these documents in any way is a violation of the Honor Code** and infractions will be reported to the Honor Council. The sale or donation of these materials to any organization that, as a business or community service, provides study aids is included in this policy. This includes providing materials to such organizations over the internet.

Students are required to pledge all written work that is submitted for a grade: "On my honor, I have neither given nor received any unauthorized assistance on this work" and their signature. The pledge may be abbreviated "pledged" with a signature.

### Note to students with disabilities

Your success in this class is important to me. If you have a documented disability and will need accommodations in this class, please speak with me early in the semester so I can be prepared to meet your needs. All discussions will remain confidential. If you have not already registered with Student Accessibility Services, contact the office at 999-7411 or [sas@trinity.edu](mailto:sas@trinity.edu). You must be registered with SAS before I can provide accommodations. Students who require exam accommodations will take exams in the Accommodated Testing Center in Halsell 227.

### Schedule of course topics, readings, and assignment due dates

- |              |  |
|--------------|--|
| August 22    | <i>Introduction to the course – why study vertebrates?</i>   |
| August 24    | <i>Best practices for presentations and primary literature</i><br><ul style="list-style-type: none"> <li>• Chapter 12, Making Sense, Northey and Von Aderkas (TLEARN)</li> </ul> |
| August 27    | <i>Tree thinking – phylogeny as a framework</i><br><ul style="list-style-type: none"> <li>• Chapter 1, Vertebrate Life</li> </ul>  |
| August 29    | <i>The geological time scale</i><br><ul style="list-style-type: none"> <li>• Chapters 7, 15, and 19, Vertebrate Life</li> </ul>  |
| August 31    | <i>Vertebrate body systems</i><br><ul style="list-style-type: none"> <li>• Chapter 2, Vertebrate Life</li> </ul>   |
| September 3  | <b>Labor Day</b> , no class  |
| September 5  | <i>Origins of the chordates</i><br><ul style="list-style-type: none"> <li>• Chapter 3, Vertebrate Life</li> </ul>  |
| September 7  | <i>Workshop on biological illustrations</i> , Guest lecture by Professor Jessica Halonen   |
| September 10 | <b>Presentation:</b> <i>How did the vertebrate jaw evolve?</i><br><ul style="list-style-type: none"> <li>• Reading TBA</li> </ul>  |
| September 12 | <i>Challenges of living in water</i><br><ul style="list-style-type: none"> <li>• Chapter 4, Vertebrate Life</li> </ul>   |

- September 14 *Cartilaginous fishes*
- Chapter 5, Vertebrate Life
- September 17 *Bony fishes*
- Chapter 6, Vertebrate Life
- September 19 **Presentation:** *How do fish swim?*
- Reading TBA
- September 21 *Challenges of living on land*
- Chapter 8, Vertebrate Life
- September 24 *Tetrapods*
- Chapter 9, Vertebrate Life
- September 26 **Presentation:** *How did limbs evolve from fins?*
- Reading TBA
- September 28 *Amphibians: reproduction and development*
- Chapter 10, Vertebrate Life
- October 1 *Amphibians: conservation*
- Lips KR. (2018) Witnessing extinction in real time. PLoS Biology 16(2): e2003080. (TLEARN)
- October 3 **Presentation:** *How do frogs jump?*
- Reading TBA
- October 5 **EXAM 1**
- October 8 *Synapsids vs. sauropsids*
- Chapters 11 and 18, Vertebrate Life
- October 10 *Ectotherms vs. endotherms*
- Chapters 14 and 22, Vertebrate Life
- October 12 **Fall Break**, no class
- October 15 *Turtles*
- Chapter 12, Vertebrate Life
- October 17 **Presentation:** *How do sea turtles migrate?*
- Reading TBA
- October 19 *Lizards and tuatara*
- Chapter 13, Vertebrate Life
- October 22 *Snakes*
- Chapter 13, Vertebrate Life

- October 24 **Presentation:** *How do snakes eat?*
- Reading TBA
- October 26 *Crocodiles*
- Chapter 16, Vertebrate Life
- October 29 *Dinosaurs*
- Chapter 16, Vertebrate Life
- October 31 **Presentation:** *How is sex determined in vertebrates?*
- Reading TBA
- November 2 *Birds*
- Chapter 17, Vertebrate Life
- November 5 *Bird flight*
- Chapter 17, Vertebrate Life
- November 6 ***Election Day – PLEASE VOTE!***
- November 7 **Presentation:** *How do birds sing?*
- Reading TBA
- November 9 *Bird eggs*
- Stoddard MC, EH Yong, D Akkaynak, C Sheard, JA Tobias, L Mahadevan. (2017) Avian egg shape: Form, function, and evolution. *Science* 356: 1249-1254. (TLEARN)
- November 12 **EXAM 2**
- November 14 *Mammals*
- Chapter 20, Vertebrate Life
- November 19 *Vertebrates and social media*
- Reading TBA
- November 21-23 **Thanksgiving Break**, no class
- November 26 *Mammals: social behavior*
- Chapter 23, Vertebrate Life
- November 28 **Presentation:** *How did dogs evolve?*
- Reading TBA
- November 30 *Bat flight and echolocation*
- Schnitzler HU, CF Moss, A Denzinger. (2003) From spatial orientation to food acquisition in echolocating bats. *Trends in Ecology & Evolution* 18: 386-394. (TLEARN)

December 3 *Primates*

- Chapter 24, Vertebrate Life

December 5-6 *Reading days*

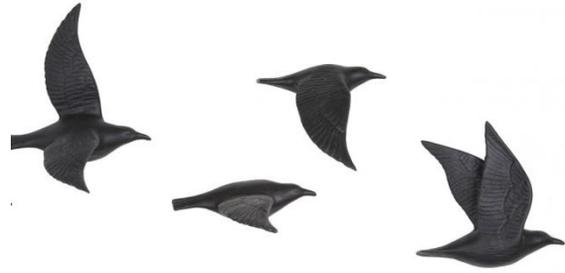
December 7 **FINAL EXAM**, 12:00-3:00pm

*NOTE: This schedule is subject to change as needed. If and when changes occur, announcements will be made in class and on the course TLEARN site.*

# Biology 3426 – Vertebrate Evolution Lab

## Instructor

Dr. Michele A. Johnson  
Department of Biology  
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10:30am-12pm, or by appointment



## Laboratory Co-Instructor

Dale Cochran  
Department of Biology  
Office: CSI 319  
Office phone: 210-999-7248  
Email: [ecochran@trinity.edu](mailto:ecochran@trinity.edu)

## Course objectives

Vertebrate Evolution Lab is designed to provide you with practical exposure to the diversity of vertebrates, both in the lab and the field. Our work in the lab will be informed by the principles of vertebrate evolutionary that we are discussing in the lecture component of this course.

In this lab, my goals for you are:

- To identify major vertebrate organs and components of the musculoskeletal system, and to describe how these structures contribute to the animals' functions
- To trace the evolution of these morphological traits on a phylogeny
- To become proficient with dissection and observation techniques used by vertebrate biologists
- To become familiar with the remarkable diversity of vertebrates in Texas

## Class attendance and expectations

Laboratory attendance is mandatory. There is no way to learn what is covered in lab without being there, and no way to fully make up lab activities outside of class. If you have an unavoidable circumstance that will require you to miss a lab, you must let me know at the beginning of the semester.

As in lecture, I expect you to focus your attention on material for this class during all class meetings. Please turn off your cell phones and anything else that may distract you during class.

In addition, you are expected to behave responsibly in the laboratory and field and to keep your work area clean and safe. You are also expected to complete any preparatory reading or exercises before coming to class.

Although you will work in groups during most laboratory assignments, your work must be your own. I strongly encourage discussion about laboratory activities, but you must complete all lab handouts and other tasks independently.

## Your lab notebook

During lab each week, you will maintain a lab notebook. This should be a bound notebook or

journal, and each page must be dated and initialed in the top corner. By initialing each page, you are pledging that the work on that page is your own work. You may answer prelab questions in the lab notebook, take notes *before or during* lab, and draw and label diagrams. You may not copy text from the lab handouts (or any other source) or trace or recreate diagrams from other sources. (Your diagrams must be based on your *own* observations during lab.) I suggest you keep lab handouts together in a separate folder, but they are not considered part of your lab notebook. If these conditions are met, you will be allowed to use your lab notebook as a resource during lab quizzes and the lab practical.

### Laboratory schedule

The lab portion of our class will primarily focus on anatomy and physiology, through a series of dissection activities in which we will explore the structure and function of morphological traits in the major vertebrate groups. This work will inform a semester-long osteology project in which you consider the evolution of a particular structure across vertebrate taxa. We will also explore vertebrate diversity in the field via your short presentations on Texas vertebrates, and during two field trips.

August 28	1. Basics of human musculoskeletal anatomy. <i>Lab will begin at 1pm in the Bell Center Fitness Room.</i>
September 4	2. Invertebrate relatives of the vertebrates
September 11	3. Dissection of lampreys
September 18	4. Dissection of sharks and bony fishes
September 25	5. Field trip to Palmetto State Park – fish, amphibians, reptiles <i>We will leave campus at 12:45pm and return around 5:30pm.</i>
October 2	6. Dissection of frogs
October 9	7. Examination of reptiles and reptile skeletons
October 16	8. Dissection of pigeons
October 23	9. Dissection of rats
October 30	10. <b>Lab practical</b>
November 6	11. <b>No lab today – GO VOTE!</b> <i>November 9-11: Field trip to Ballew Farm – birds, mammals, fish</i>
November 13	12. Osteology prep
November 20	13. Osteology prep (optional)
November 27	14. Osteology presentations