

# Syllabus: BISC 445, Fundamentals of Vertebrate Biology

4 units

Spring (Maymester) 2018

Instructor: Dr. Trond Sigurdson, ZHS 256; Email: [sigurdse@usc.edu](mailto:sigurdse@usc.edu)

## Course Description

BISC 445 will cover the biology and evolution of the major vertebrate groups including fish, amphibians, reptiles, birds, and mammals. Emphasis will be on evolution, functional anatomy, and embryology. The course is therefore a great choice for students who are interested in comparative anatomy, biodiversity, or evolution. We will discuss vertebrate evolution in detail, and also describe the methods used to study the relationships of biological taxa.

The diversity of modern vertebrates will be one major area of focus. We will also go through the nomenclature of anatomy with focus on the different germ layers and organ systems (skeletal, muscular, nervous system etc). The evolution of sensory systems will also be covered. Special focus will be put on the skeletal anatomy, as this provides important data both from living species and from the fossil record. The evolution of modern forms will be augmented with the use of fossils.

We will also discuss methods such as Phylogenetic Analyses Using Parsimony, creating phylogenetic trees to work out the interrelationships between animal groups, species, or populations. All the major groups of vertebrates will be described and demonstrated in lab, and a special focus will be put on important stages leading up to the evolution of mammals, and finally modern humans. The methods studied in this course are therefore an excellent fit for students involved in programs focusing on evolutionary biology and human evolution.

**Lectures will not be recorded, but supplementary files will be posted on Blackboard. However, these do not contain all the information needed, so it is very important to come to the lectures, take notes, and participate in class. Although parts of the course will be handled at the USC Dornsife ZHS building (Zumberge Hall of Science), we will spend more than half of our time in various areas of the Natural History Museum of Los Angeles County (including the La Brea Tar Pits). It is therefore very important to pay attention to messages informing you when and where to meet any given day. Our first lesson will be at ZHS.**

**Skills that the students will acquire in this course:**

- Knowledge of vertebrate diversity, including all the major vertebrate groups, as well as chordates in general. This will make use of the extensive collections of skeletons and taxidermy at the NHM.
- Knowledge of the major organ systems and tissues of the vertebrate body.
- A general insight into functional anatomy, and how form follows function, as well as the use of the terms adaptation and exaptation.
- A good overview of vertebrate evolution through geological time. This will require the use of various halls in the NHM collections and general exhibits, and students are expected to recognize key fossil specimens.
- A general familiarity with how the relationships between vertebrate groups are hypothesized and how evidence for these relationships is found.

**Course Dates:** May 14 – June 8, 2018

**Locations:** Morning sessions (9 am): ZHS 469

Afternoon sessions (12:30): Collaboratory Room, Natural History Museum

**Literature:**

Textbook: *Functional Anatomy of the Vertebrates: An Evolutionary Perspective 3<sup>rd</sup> edition*, by Liem, Bemis, Walker, & Grande.

Other readings will be announced in class.

**For updates and important information see:**

<https://blackboard.usc.edu>

**Grading:**

Participation: 20%

Paper presentation: 20%

Quizzes: 20%

Final Exam: 20%

Paper assignment: 20%

## **Schedule of lecture topics**

**The readings should be read BEFORE we meet each day.**

**(Mornings at USC, Afternoons at the NHM):**

### **May 14**

Morning: Introduction to the course; defining vertebrates; phylogenetics and paleontology

Afternoon: Introduction to the Natural History Museum, writing scientific papers

Readings: Skim Textbook chapter 1.

### **May 15**

Morning: Chordates, agnathans, fish

Afternoon: Agnathans and fish collections

Readings: Textbook pp. 48-78.

### **May 16**

Morning: Amphibians, reptiles

Afternoon: Amphibian and reptile collections

Readings: Textbook pp. 79-93.

### **May 17**

Morning: Introduction to birds and bird diversity

Afternoon: Ornithology collections of the NHM presented by Kimball Garrett

Readings: Textbook pp. 94-99. Paper on bird functional morphology.

**May 18**

Morning: Introduction to mammals and mammalian diversity

Afternoon: Mammal collections of the NHM presented by Jim Dines

Readings: Textbook pp. 99-113. Paper on mammalian evolution.

**May 21**

Morning: Evolutionary history of vertebrates; paleontological record

Afternoon: Dinosaur Hall, NHM

Readings: Papers on dinosaurs and evolution of birds

**May 22**

Morning: Evolutionary history of vertebrates cont.

Afternoon: Age of Mammals Hall, NHM

Readings: Papers on the evolution of primates and humans

**May 23**

Morning: Reproduction and embryology

Afternoon: Models and specimens showing embryological stages

Readings: Textbook pp.118-144

**May 24**

Morning: Embryology cont. and organ systems

Afternoon: Models and specimens showing embryological stages and organ systems

Readings: Textbook pp. 144-173

## **May 25**

Morning: Tissues, growth, integument

Afternoon: Writing scientific papers, paper and presentation topic due

Readings: Textbook pp. 184-204; 207-210

## **No lecture Memorial Day May 28**

## **May 29**

Morning: The skeletal system, the skull

Afternoon: Overview of the vertebrate skull

Readings: Textbook pp. 232-266

## **May 30**

Morning: Skeletal system cont.

Afternoon: Vertebrate skeletons

Readings: Textbook pp. 269-312

## **May 31**

Morning: The muscular system

Afternoon: Dissecting fish, frog and rat, bring a draft of your paper

Readings: Textbook pp. 316-345

## **June 1**

Friday June 1 will be spent at the La Brea Tar Pits. A bus will be provided from campus. The paper is also due the same day (Friday June 1), so bring it with you on our trip to the tar pits.

#### **June 4**

Morning: Student presentations. Bring your PP file on a flash drive.

Afternoon: Evolution and structure of the sensory systems, excretion

Readings: Textbook pp. 398-433

#### **June 5**

Morning: The nervous system

Afternoon: The brain and nervous system, models and sheep brain dissections

Readings: Textbook pp. 438-471

#### **June 6**

Morning: Digestion and the endocrine system

Afternoon: Models and dissected specimens of the digestive system of fish and tetrapods

Readings: Textbook pp. 504-527

#### **June 7**

Morning: Respiration and circulatory system

Afternoon: Models of respiratory and circulatory systems

Readings: Textbook pp. 604-629

#### **June 8**

Morning: Final Exam

## Statement on Academic Conduct and Support Systems

### Academic Conduct:

Plagiarism – presenting someone else’s ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in *SCampus* in Part B, Section 11, “Behavior Violating University Standards” <https://policy.usc.edu/scampus-part-b/>. Other forms of academic dishonesty are equally unacceptable. See additional information in *SCampus* and university policies on scientific misconduct, <http://policy.usc.edu/scientific-misconduct>.

### Support Systems:

*Student Counseling Services (SCS) - (213) 740-7711 – 24/7 on call*

Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention.

<https://engemannshc.usc.edu/counseling/>

*National Suicide Prevention Lifeline - 1-800-273-8255*

Provides free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week. <http://www.suicidepreventionlifeline.org>

*Relationship & Sexual Violence Prevention Services (RSVP) - (213) 740-4900 - 24/7 on call*

Free and confidential therapy services, workshops, and training for situations related to gender-based harm. <https://engemannshc.usc.edu/rsvp/>

*Sexual Assault Resource Center*

For more information about how to get help or help a survivor, rights, reporting options, and additional resources, visit the website: <http://sarc.usc.edu/>

*Office of Equity and Diversity (OED)/Title IX compliance – (213) 740-5086*

Works with faculty, staff, visitors, applicants, and students around issues of protected class.

<https://equity.usc.edu/>

*Bias Assessment Response and Support*

Incidents of bias, hate crimes and microaggressions need to be reported allowing for appropriate investigation and response. <https://studentaffairs.usc.edu/bias-assessment-response-support/>

*Student Support & Advocacy – (213) 821-4710*

Assists students and families in resolving complex issues adversely affecting their success as a student EX: personal, financial, and academic. <https://studentaffairs.usc.edu/ssa/>

*Diversity at USC*

Tab for Events, Programs and Training, Task Force (including representatives for each school), Chronology, Participate, Resources for Students. <https://diversity.usc.edu/>