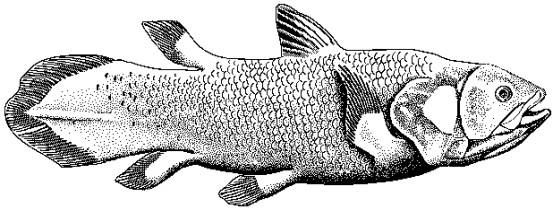

Biology 410
Vertebrate Biology
Syllabus Fall 2018

Long ago God created the world. He created the sun, the moon, and the stars, as well as all the creatures which inhabit the earth. He created all of them out of nothing — not in a single instant of time, but over a vast period of time.

Genesis 1:1 (An interpretive translation by John Sailhamer, 'Genesis Unbound', 1996)

There is grandeur in this view of life, with its several powers, having been originally breathed by the Creator into a few forms or into one; and that, whilst this planet has gone cycling on according to the fixed law of gravity, from so simple a beginning endless forms most beautiful and most wonderful have been, and are being evolved.

Charles Darwin (from 'The Origin of Species', 1859)

It is wrong to hold creation and evolution as mutually exclusive alternatives. I am a creationist and an evolutionist. Evolution is God's…method of Creation.

Theodosius Dobzhansky (one of the founders of modern evolutionary thought), 1973

Catalog Course Description: BIO 410 – Vertebrate Biology (3 units)
Taxonomy, behavior, distribution, and ecology of the vertebrates and a comparative study of their morphologies. Lecture and lab. Prerequisite: BIO 211.

Instructor: Dr. Mike Mooring
Gym Lot, East Trailer #5 – Office hours: Drop in, or make an appointment
Voice: 849-2719; E-mail: mmooring@pointloma.edu

TA: Ezra Dass Email: dassjr@gmail.com

Text: Vertebrate Life 10th edition, by Pough & Janis.; Oxford University Press, 2018.
ISBN: 9781605356075

Labs for Vertebrate Zoology 2nd edition, by Gergus & Schuett, 2000 (reprint).
ISBN: 9781884125782

Equipment: iClicker2 – must be brought to every class meeting

Lecture: Monday-Wednesday-Friday 1:30 - 2:25 PM in Taylor 311

Lab: Wednesday 2:45-6:15 PM in Taylor 311 or field trip

Note: The aquarium and zoo close at 5:00 PM. Therefore, on field trips days we will flip the class and lab by meeting at 1:30 for the field trip and do the classroom session from 5:20-6:15.

Course Learning Outcomes:
Upon completion of the course, you will be able to:

- Explain how vertebrate form is a product of both function and evolutionary history.
- Assess the role of natural selection and evo-devo in the emergence of novel traits and body plans.
- Summarize the principles of the cladistic approach to evolutionary history and relatedness.
- Compare the major groups of vertebrates in terms of structural, physiological, and behavioral traits.
- Become familiar with taxonomic nomenclature and the phylogenetic tree of major vertebrate taxa.
- Research and describe the importance of protecting and conserving vertebrate biodiversity.
- Research, synthesize, and analyze data from the literature for an original research project.

Course Objectives. The goal of this course is to gain an intimate appreciation of God's design for life by analyzing and comparing the anatomy, physiology, ecology, and behavior of the vertebrates. We will examine how structure changes from one vertebrate group to another, and how structural changes are correlated with functional changes. Evolution, the mechanism of historical change and relatedness among groups of organisms, will be considered as God's creative tool. Such historical changes in the structure and function of vertebrates are not random, but reflect adaptations for solving different problems encountered in the environment. A unifying theme will be the role of evolutionary processes and the use of phylogenetic systematics (cladistics) to organize vertebrate diversity and to formulate hypotheses that seek to solve the 'mysteries' of vertebrate evolution. Current conservation efforts to save vertebrate species and retain biodiversity will be an additional theme and personal application.

COURSE DESIGN –

(1) Lecture and Lab: The lecture and lab components will cover most of the same topics, although they will not always be synchronized. Lab partners will complete exercises in phylogenetic systematics, comparative anatomy dissections, examination of mounted specimens, and field trips to the Birch Aquarium and the San Diego Zoo. For the comparative anatomy labs, you will need the Gergus & Schuett lab manual, a dissecting kit with sharp scalpel blades, and clothing that can get dirty.

(2) Textbook Readings and Questions: I have prepared a set of guided questions for each topic reading in the Pough & Janis textbook that is available on Canvas under 'Assignments'. The guided questions are designed to: (1) help you focus on the information that is most relevant to this course, (2) prepare you for iClicker quizzes and midterm exams, and (3) give you the foundational knowledge for the in-class activities.

(3) Exams: The exams will include multiple choice, short answer, and essay questions that will allow you to demonstrate your grasp of whole concepts and ability to synthesize different material. Each exam will count equally; the midterms will be non-comprehensive and the final will be semi-comprehensive. Study guides will specify the material you need to know. I will not cover all the material in lecture, but you should be reading the assigned chapters in the textbook to prepare for exams.

(4) Term paper: You will be required to do your own research and to prepare a final paper and presentation on a conservation topic involving a single species or a taxonomic group of vertebrates.

(5) Canvas: All the class material will be available to you on the course Canvas site. Assignments will be submitted via Canvas 'Assignments' and graded online. The only paper assignments will be activities done in class. Note that Canvas does not support 'Pages', so PLEASE submit Word or PDF files.

(6) iClickers: Class will involve a combination of lecture and small group activities. Classroom quizzes based on readings and assignments will be administered using iClicker2, therefore you should always bring your clicker to class. You should have your own remote so that your participation is recorded. Clickers will be used to assess participation (engagement) and performance (getting the right answer). Total iClicker points will be adjusted to compensate for excused absences. (Note that I have a few loaner clickers.)

(7) Course Attendance Policy: You are required to sign the attendance roster at each class meeting. You are permitted 5 absences without penalty. Every absence in excess of 5 will incur a penalty to be deducted from your attendance participation points and will impact your final grade.

(8) Late Assignments: All assignments should be submitted before the due date and time indicated on Canvas. Late penalties will apply for all assignments submitted after the due date. For labs (15-20 pts) and readings (5 pts), 2 points and 1 point will be deducted for each day late, respectively; no points will be awarded after 10 days under normal circumstances. The intent of late penalties is to encourage you to turn in your work on time, and to be fair to those who do. If you have a legitimate reason for not submitting an assignment on time, please email both the grader and I as soon as possible.

(9) Academic Honesty: The PLNU policy on academic honesty is listed under the institutional policies below. My experience is that many students are not aware that some of their regular practices are considered plagiarism. For example, while you are free to discuss readings and lecture material among yourselves, I expect that you will each do your own work on individual assignments. In this case, teaming up with other students to write joint answers that are then turned in as if they were individual efforts is considered plagiarism. Do not share electronic files of your answers to an assignment with another student; if they subsequently use your answers in their assignment, you are also guilty of plagiarism.

(10) Electronic Etiquette: Recent studies have indicated that we are currently experienced an epidemic of 'digital distraction' caused by multi-tasking – moving quickly between tasks on electronic devices in which only partial attention is given to each task. In the classroom setting, studies reveal that the use of laptops and smartphones for non-course related tasks (checking emails, texts, social media) distracts attention from learning and results in reduced academic performance and lowered grades. The reality is that you cannot fully learn new information or master new concepts when distracted by multi-tasking. Evidence indicates that even classmates who see your screen are distracted and their performance reduced.

To ensure the best learning environment possible, classroom policy is that…

- **All electronic devices are turned off and put out of sight when class is in session.**

This includes laptops because there is evidence that student learning is improved when you have to take notes by hand. Many of these studies are posted on Canvas, along with strategies for managing your use of electronics.

Why am I asking you not to use laptops (and other electronic devices) in class?

Numerous studies have confirmed that classroom laptop use can be an impediment to learning, interfere with your education, and serve as a distraction for your neighbors. Four specific reasons follow, with live links to the articles (more studies are on Canvas Modules):

1. Laptops and other electronic devises enable more than just note-taking, and they introduce numerous distractions (web-surfing, homework for other classes, social media, etc.) for you and your neighbors. You may think that you can multitask, but studies show that you cannot.
   'You'll Never Learn!'

2. As already mentioned, using your laptop in class can be less than neighborly. Your classmates' grades can also suffer due to the distracting pull of the laptop.
   'Laptop Multitasking Hinders Classroom Learning for Both Users and Nearby Peers'

3. Writing is a more effective way of learning material than is typing. With typing, each letter is pretty much the same thing for the brain. Writing, however, uses different muscle groups with each word and encourages the brain to integrate material during the writing process. Typing may be easy and fast, but by making the brain passive, it discourages learning.
   'Attention, Students: Put Your Laptops Away'

4. Using electronic devises in class also impairs long-term retention, with one study suggesting that smartphone use in class can lower one's grade by half a letter grade.
   'The Myth of Multitasking'

Grading Criteria

Assignment	Points*
Exams: 3 non-comprehensive @ 100 pts	300
Textbook reading questions: 21@ 5 pts	105
iClicker quiz points	50
Term paper	100
Classroom activities	50
Attendance participation points	50
Lab assignments: 13@ 20 pts	260
TOTAL	**915**

*points are estimates

Letter	Percent	Letter	Percent
A	90	C	70
A-	88	C-	68
B+	86	D+	66
B	80	D	60
B-	78	D-	58
C+	76	F	<58

PLNU INSTITUTIONAL POLICIES

PLNU Mission: To Teach ~ To Shape ~ To Send
Point Loma Nazarene University exists to provide higher education in a vital Christian community where minds are engaged and challenged, character is modeled and formed, and service becomes an expression of faith. Being of Wesleyan heritage, we aspire to be a learning community where grace is foundational, truth is pursued, and holiness is a way of life.

PLNU Attendance and Participation Policy: Regular and punctual attendance at all classes is considered essential to optimum academic achievement. If the student is absent from more than 10 percent of class meetings, the faculty member can file a written report which may result in de-enrollment. If the absences exceed 20 percent, the student may be de-enrolled without notice until the university drop date or, after that date, receive the appropriate grade for their work and participation. See Academic Policies in the Undergraduate Academic Catalog.

PLNU Academic Honesty Policy: Students should demonstrate academic honesty by doing original work and by giving appropriate credit to the ideas of others. Academic dishonesty is the act of presenting information, ideas, and/or concepts as one's own when in reality they are the results of another person's creativity and effort. A faculty member who believes a situation involving academic dishonesty has been detected may assign a failing grade for that assignment or examination, or, depending on the seriousness of the offense, for the course. Faculty should follow and students may appeal using the procedure in the university Catalog. See Academic Policies for definitions of kinds of academic dishonesty and for further policy information.

PLNU Academic Accommodations Policy: While all students are expected to meet the minimum standards for completion of this course as established by the instructor, students with disabilities may require academic accommodations. At PLNU, these students are requested to file documentation during the first two weeks of the semester with the Academic Support Center (ASC), located in the Bond Academic Center. This policy assists the University in its commitment to full compliance with Section 504 of the Rehabilitation Act and the Americans with Disabilities Act. Section 504 (a) prohibits discrimination against students with special needs and guarantees all qualified students equal access to and benefits of PLNU programs and activities. Once the student files documentation, the ASC will contact the student's instructors and provide written recommendations for reasonable and appropriate accommodations to meet the individual learning needs of the student. The PLNU Disability Resource Center (DRC) can be reached by phone at 619-849-2486 or by e-mail at DRC@pointloma.edu. See Disability Resource Center for additional information. For more details, see the PLNU catalog Accommodations. Students with learning disabilities who may need accommodations should also discuss their needs with the instructor.

PLNU Copyright Policy: Point Loma Nazarene University, as a non-profit educational institution, is entitled by law to use materials protected by the US Copyright Act for classroom education. Any use of those materials outside the class may violate the law.

PLNU Final Examination Policy:
Successful completion of this class requires taking the final examination on its scheduled day. The final examination schedule is posted on this syllabus. No requests for early examinations or alternative days will be approved unless you have 3 final exams scheduled on the same day or another compelling reason.

Vertebrate Biology Class Schedule - Fall 2018

Readings are for Pough et al. 10th edition

DATE	TOPIC	CHAPTER	SECTION	PAGES
Aug 28	Evolution	1	1.2-1.3	5-9
Aug 29	Evo-Devo	1	1.4	11-14
	Duplication of Hox genes	2	2.4	27-28
Aug 31	*Summary of Vertebrate Diversity*	*1*	*1.1*	*1-4*
	Basic Vertebrate Attributes	2	2.1-2.6	19-35
Sept 3	**LABOR DAY**			
Sept 5	Earliest Fish	3	3.1-3.4	41-52
Sept 7	Arrival of Jaws	3	3.5-3.7	52-61
Sept 10	Living in Water	4	4.1-4.2	65-72
Sept 12	Radiation of Cartilaginous Fish	6	6.1-6.2	95-101
	Optional - Extant Sharks and Rays	*7*	*7.1-7.5*	*103-114*
Sept 14	NO CLASS MEETING			
Sept 17-19	Radiation of Bony Fish	8	8.1-8.3	121-130
	Optional - Extant Bony Fish	*9*	*9.1-9.8*	*133-56*
Sept 21	Life on Land: Arrival of Tetrapods	10	10.1-10.4	161-175
Sept 24-26	Amphibians	11	11.1-11.6	181-206
Sept 28	NO CLASS MEETING – *Dr. Mooring in Michigan*			
Oct 1	♦**Exam 1** (Mon)			
Oct 3	World of Turtles	16	16.1-16.6	283-295
Oct 5	Snakes and Lizards	17	17.1-17.10	301-323
Oct 8	Snakes and Lizards (cont'd)			
Oct 10	Ectothermy	15	15.1-15.5	269-279
Oct 12	Crocodylians	18	18.1-18.6	239-337
Oct 15-17	Dinosaurs and Mesozoic Diapsids	19	19.1-19.11	343-366
Oct 19	**FALL BREAK**			
Oct 22	NO CLASS MEETING			
Oct 24	Origin of Flight	21	21.1-21.4	387-394
Oct 26	Avian Specializations	22	22.1-22.12	399-429
Oct 29	♦**Exam 2** (Mon)			
Oct 31	Evolution of Mammals	24	24.1-24.5	451-474
Nov 2	NO CLASS MEETING			
Nov 5	Common Features of Mammals	25	25.1-25.8	481-515
Nov 7	Specializations of Mammals	25	25.1-25.8	481-515
Nov 9	Ecology and Sociality of Mammals	25	25.1-25.8	481-515
Nov 12	Endothermy	20	20.1-20.4	371-383
Nov 14-16	Primate Evolution	26	26.1-26.7	519-549
Nov 19	NO CLASS MEETING			
Nov 21-23	**THANKSGIVING RECESS**			
Nov 26-30	Human Evolution	26	26.1-26.7	519-549
Dec 3-5	Conservation of Vertebrates	Conservation readings from text (page 7)		
Dec 7	NO CLASS MEETING			
Dec 16 (Fri)	♦**Final Exam** (1:30 - 4:00 PM)			

Vertebrate Biology TEXT READING SCHEDULE – 2018

- Readings are for Pough et al. 10th edition. Assignments are due at midnight of the date indicated.

DATE DUE	TOPIC	READING	SECTION	PAGES
Sept 1	Evolution	1	1.2-1.3	5-9
Sept 3	Evo-Devo	1	1.4	11-14
		2	2.4	27-28
Sept 5	Basic Vertebrate Attributes	2	2.1-2.6	19-35
Sept 7	Earliest Fish	3	3.1-3.4	41-52
Sept 10	Arrival of Jaws	4	3.5-3.7	52-61
Sept 14	Radiation of Cartilaginous Fish	5	6.1-6.2	95-101
Sept 21	Radiation of Bony Fish	8	8.1-8.3	121-130
Sept 24	Life on Land: Arrival of Tetrapods	10	10.1-10.4	161-175
Sept 28	Amphibians	11	11.1-11.6	181-206
Oct 1	**Exam 1**			
Oct 5	World of Turtles	16	16.1-16.6	283-295
Oct 10	Snakes and Lizards	17	17.1-17.10	301-323
Oct 15	Crocodylians	18	18.1-18.6	239-337
Oct 19	Dinosaurs and Mesozoic Diapsids	19	19.1-19.11	343-366
Oct 26	Origin of Flight	21	21.1-21.4	387-394
Oct 30	Avian Specializations	22	22.1-22.12	399-429
Oct 29	**Exam 2**			
Nov 2	Evolution of Mammals	24	24.1-24.5	451-474
Nov 7	Common Features of Mammals	25	25.1-25.8	481-515
Nov 9	Specializations of Mammals	25	25.1-25.8	481-515
Nov 12	Ecology and Sociality of Mammals	25	25.1-25.8	481-515
Nov 19	Primate Evolution	26	26.1-26.7	519-549
Dec 3	Human Evolution	26	26.1-26.7	519-549
CONSERVATION READINGS	Declining Shark Populations	7	7.4	114
	Pollution, overfishing, and fish farming	9	9.8	155-156
	Why are amphibians disappearing?	11	11.6	205-206
	Fateful characteristics of turtles	16	16.6	295
	Lepidosaurs and climate change	17	17.10	323
	Crocodylians and the skin trade	18	18.6	337
	Birds and urbanization	22	22.12	428-429
	Mammals and trophy hunting	25	25.8	513-515
	Humans and other vertebrates	26	26.7	547-549

Vertebrate Biology Lab Schedule - Fall 2018

All on-campus labs are WEDNESDAY from 2:45-6:15 pm (field trips are 1:30-5:00). Labs that are starred (*) will involve dissection of preserved specimens; bring dissecting kit and wear appropriate clothing. G&S = Gergus & Schuett lab manual.

On field trip days we will flip our lecture-lab schedule and do the field trip first followed by the lecture class after returning to campus. We will meet at 1:30 for the field trip, return to campus by 5:00, and meet for class at 5:20 in Taylor 311.

DATE	LAB #	ACTIVITY	READING
Aug 29	1	Systematics: phylogenetic & taxonomic analysis	G&S Lab 1
Sept 5	2*	Hemichordata, Urochordata, & Cephalochordata	G&S Lab 2
	3*	Jawless Craniates: Myxinoidea & Petromyzontoidea	G&S Lab 3
Sept 12	4*	Gnathostomata: Chondrichthyes	G&S Lab 4
Sept 19	**NO LAB!**		
Sept 26	5	Field trip to Birch Aquarium	Handout
Oct 3	6*	Osteichthyes: Actinopterygii, Latimeria & Dipnoi	G&S Lab 5
Oct 10	7*	Tetrapoda: Amphibia	G&S Lab 6
Oct 17	8*	Amniota: Reptilia (turtles, snakes, and lizards)	G&S Lab 7 – part 1
Oct 24	9	Field trip to San Diego Zoo: *Amphibians & reptiles*	Handout
Oct 31	10*	Amniota: Reptilia (birds)	G&S Lab 7 – part 2
Nov 7	11	Field trip to San Diego Zoo: *Birds*	Handout
Nov 14	12*	Amniota: Mammalia	G&S Lab 8
Nov 21	**THANKSGIVING RECESSS**		
Nov 28	13	Field trip to San Diego Zoo: *Mammals*	Handout
Dec 5	14	Research Project Presentations	

Cladogram of the Vertebrates