Bio 351: Comparative Anatomy of the Vertebrates
Dr. Gail Grabowsky Kaaialii
office hours: MWF 9:30 - 11:00; TTh 1:00 - 4:00

Biology 351: Comparative Anatomy of the Vertebrates
Syllabus

We must give up a conventional notion of human dominion, but we learn to cherish particulars, of which we are but one, and to revel in complete ranges, to which we contribute one precious point -- a good swap I would argue, of stale (and false) comfort for broader understanding. It is, indeed, a wonderful life within the full house of our planet's history of organic diversity.

Stephen Gould, Full *House*

The Ancestry of Vertebrates

Gill-slits, Tongue-bars, Synapticulae,
Endostyle and Notochord: all these you will agree
Mark the Protochordate from the fishes in the sea,
And tell alike for them and us our lowly pedigree.

Thyroid, Thymus, Subnotochordal Rod:
These we share with Lamphreys, the Dogfish, and the Cod, --
Relics of the food-trap that served our early meals,
And the Tongue-bars that multiplied the primal water-wheels.

Walter Garstang c.a. 1922

The history of vertebrate life... is a story of major evolutionary transformations over millions of years, of long periods of little or no change, and of disastrous worldwide extinctions and great evolutionary radiations. And, of course, the story includes our own evolutionary history, which can be traced from our early ancestors among ancient jawless fish.

Leonard Radinsky, *The Evolution of Vertebrate* Design

Date	Lecture/Lab Topic	Reading
1/12/99	Course Description & Mechanics; Introduction to Comparative Vertebrate Anatomy: History, Evolution & Morphology, Basic Concepts and Unifying Principles	Chapter 1
1/13	LAB 1: Hypothesizing Relatedness: Methods in Phylogenetics Hands on experience with cladistic classification using real & fictitious organisms	Handouts
1/14	Unifying Principles (continued), Phylogenetic Hypotheses, Paleontological Contributions, Being a Comparative Anatomist	Handout
1/19	Chordate Basics: General Phylogeny, Major Characteristics	Chapter 2
1/20	LAB 2: The Protochordates and the Agnathan Vertebrates	Lab Book Chapters 2 & 3
1/21	Protochordate Diversity; Chordate Origins	
1/26	Vertebrates: Origins, Classification & Major Characteristics	Chapter 3

1/27	LAB 3: Survey of Vertebrate Diversity in a Phylogenetic Framework	Lab Book Chapter 1 Handouts
1/28	Vertebrate Diversity	
2/2	Vertebrate Life Histories: Embryology, the Coelom and Maturation, Ontogeny versus Phylogeny	Chapter 5
2/3	LAB 4: The Basic Vertebrate Body Plan	Handouts
2/4	The Integument: Ancient Fishes, Chondrichthians and Modern Fishes	Chapter 6
2/9	The Integument: Amphibians, Reptiles and Birds, Mammals; Specialized Structures of the Integument	
2/10	LAB 5: Comparative Anatomy of the Integument	Lab Book Chapter 4
2/11	EXAM I	
2/16	The Skeletal System: The Skull The Chondrocranium, Splanchnocranium and Dermatocranium	Chapter 7
2/17	LAB 6: The Comparative Anatomy of the Skull	Lab Book Chapter 5 pp. 39 - 41, 66 - 79
2/18	The Skeletal System: The Skull (continued) Evolutionary Transformation and Functional Morphology	
2/23	The Skeletal System: The Axial Skeleton Components and Their Evolutionary Transformation	Chapter 8
2/24	LAB 7: The Comparative Anatomy of Teeth and the Axial Skeleton	Lab Book Chapter 5 pp. 42 - 53, 82 - 86
2/25	The Skeletal System: The Axial Skeleton (continued) Evolutionary Transformation and Functional Morphology	
3/2	The Skeletal System: The Appendicular Skeleton Components and Their Origins	Chapter 9
313	LAB 8: The Comparative Anatomy of the Appendicular Skeleton	Lab Book Chapter 5 pp. 53 - 66
3/4	The Skeletal System: The Appendicular Skeleton (continued) Evolutionary Transformation and Functional Morphology	
3/9	The Muscular System: Organization, Embryonic Origins	Chapter 10
3/10	LAB PRACTCAL I	
3/11	The Muscular System: Evolutionary Transformation	

3/16	The Respiratory System: Components, Functional **Morphology**	Chapter 11
3/17	LAB 9: The Comparative Anatomy of the Muscular System: Part I Shark and Necturus	Lab Book Chapter 6 pp. 87 -103
3/18	The Respiratory System: Evolutionary Transformation	
	SPRING RECESS	
3/30	The Cardiovascular System: Components, Single versus Double Circulation	Chapter 12
3/31	LAB 10: The Comparative Anatomy of the Muscular System: Part II Mink	Handouts
4/1	The Cardiovascular System: Comparative Anatomy of the Heart, Fetal Circulation in Placental Mammals	
4/6	EXAM II	
4/7	LAB 11: The Comparative Anatomy of the Cardiovascular System	Lab Book Chapter 8 pp. 136 -147, Handout
4/8	The Digestive System: Components and Their Evolutionary Transformation	Chapter 13
4/13	The Urogenital System: Urinary System Components and Their Evolutionary Transformation	Chapter 14
4/14	LAB 12: The Comparative Anatomy of the Urogenital System	Lab Book Chapter 9
4/15	The Urogenital System: Reproductive System Male/Female Components and Their Evolutionary Transformation	
4/20	The Endocrine System: Components and Their Evolutionary Transformation	Chapter 15
4/21	LAB 13: The Comparative Anatomy of the Nervous System	Lab Book Chapter 10
4/22	The Nervous System: Peripheral Nervous System Components	Chapter 16
4/27	The Nervous System: Central Nervous System Components and Their Evolutionary Transformation	
4/28	LAB PRACTICAL II	
4/29	The Sensory Organs: Components and Their Evolutionary Transformation	Chapter 17

FINAL EXAM: Monday, May 3rd from 8:00 - 10:00 am.

Biology 351: Comparative Anatomy of the Vertebrates

Course Mechanics

This course consists of 28 lecture periods and 13 laboratories. There will be two hour exams plus a final exam and two lab practicals. You will also keep a lab notebook which you will turn in at each of the lab practicals. I will explain the nature of the tests, labs and lab notebook and grading policy for each in this introduction as well as immediately prior to each throughout the course. You will be earning separate grades in this course: one for your performance in the labs and the other from the lecture portion of the course.

I am NOT the worlds toughest grader, BUT, I do expect you to rise to challenge of this course -- and enjoy yourself doing so. By this I mean that there will be a lot of material: Comparative Anatomy, as the name implies, entails the comparison of the ***structure*** and ***function*** of all of the parts that compose all of the critters we call the "Vertebrates"! You'll have to know anatomical terms and understand physiological/physical processes, you'll have to become familiar with all of the major groups of chordates and vertebrates and finally, you'll have to learn how, from a morphological perspective, certain vertebrate groups gave rise to other groups and how, throughout this process, anatomical parts were transformed ***structurally and functionally!!! Whew! Sound like a lot?*** Well IT IS!

My aim is not to make the material "easy". My job is to make the material ***interesting*** (which it is already) and ***understandable*** (which it may not be at this point!). I reward you for your efforts to learn this complex, voluminous and interesting stuff by NOT being a "bear" when it comes to grading. In other words, your efforts will ***be rewarded !*** But, like a bear sleeping by the side of the river full of salmon -- little effort will reap little rewards. So -- lets go fishing for knowledge!

Please ask questions AT ANY TIME DURING LECTURE! You do not have to raise your hand as I may be writing on the board at the time your question comes to mind, so just "holler" out any question. I prefer the class to feel like a seminar in which you may ask any relevant question or make a comment at any time during lecture/lab. We all learn from each others thoughts and experiences.

The only dumb question is the one in which you ask yourself if you should ask your question!!!

Objectives of the course

Your objectives for the course should be as follows:

1. To learn how evolutionary processes may bring about the transformation of form and function.
2. To learn the major groups within Phylum Chordata and the characteristics that define each of the groups.
3. To learn the subdivisions within Subphylum Vertebrata and the characteristics that define each of them.
4. To learn the patterns of relatedness, or phylogenetic hypotheses, for all of the vertebrate groups we consider.
5. To learn the anatomical terms for the structures discussed in each group we consider.
6. To learn the mechanism of function of many of the structures discussed in each of the groups we consider.
7. To learn how the form and/or function of each of the structures discussed was transformed over evolutionary time within subphylum Vertebrata, and to be able to apply the terms ho o o 14@-logy-and/or o o to such structures.
8. To construct an overall understanding of the general functional and morphological trends within Subphylum Vertebrata.

I am here to help facilitate all of this wonderful understanding which you do not have now but will, I am hopeful, acquire in just four short months if I have it my way! I am here to teach, answer questions, guide, lead, follow (where your wondrous minds take me), assist, stimulate, motivate, ameliorate (your stress) and initiate a greater, deeper, fuller understanding of the world around you. I will do all I reasonably can. I hope you enjoy the course. This one can really answer a lot of your questions regarding why you are "designed" the way you are if you engage yourself. (That means it can really help you get into med school. . .) Tally ho!

On Missing Classes and Labs

My policy on missing *lecture* classes is this: You can miss a few (<3) and *perhaps if* you're great at understanding *someone else's* notes *and you* have a *natural knack for understanding science and you* have kept up with *all of* the reading, then, perhaps, missing those few classes won't hurt your grade or the greater benefits you will reap from the course *that* much.... Its your call; its your grade, your benefit, your life.... Missing a lot (>3) classes is, in my opinion, truly foolhardy since it means you, your family or Chaminade has wasted $$$ in paying me to teach a you who isn't here! Students who miss lots *of* classes *always, I* believe, perform less well than they are capable *of* had they not missed so many classes, not to mention that they just plain miss out on something soooooo cool: knowledge, dialogue, information, WISDOM! So, come to class! Don't let those other stresses take you from our ranks. Budget that time. Prioritize wisely.

My policy on missing *labs is* this: don't. There are no "free" missed labs. I *f you* miss a lab and don't have a legitimate excuse you receive a zero for that lab.

If you are sick, experiencing some genuinely stressful situation (death in the family, abuse, pregnancy, etc.) let me know and we'll see what we can do about it. If you bring me evidence of your illness - in the form of some document signed by your doctor -- then your absence is excused. Otherwise it is unexcused.

Athletes -- *if you* have to miss for a game or travel let me know prior to your absence.

Pace of the Class

This class will proceed at a rapid pace. There will be new terms to learn, understand and apply *each lecture so* try keep up with it. Come prepared to suck up that new information like our close relatives the ascidians do every day. (You'll know what an ascidian is soon enough!)

Helpful Hints

1. Buy a pen with more than one color ink or bring a number *of* different colored pens. You'll need these to help you distinguish what's what on your drawings.
2. Study with a friend. Biology is a science. Pieces *of* information fit together to create one (fairly) logical reality. Studying out loud with a friend can help you realize what does and does not make logical sense to you. *If* it doesn't make sense then you are probably misunderstanding something and should see Dr. Grabowsky Kaaialii so that she can help de-mystify whatever it is that is confusing you.
3. Take thorough notes. Write down whatever you can. If it gets written on the board it should get written in your notes.
4. Memorize those new anatomical terms. They may seem cumbersome at first but they have specific meanings and are very useful.
5. Keep up with the reading. Comparative Anatomy *really, really* builds on itself, if you keep up with the reading all should fall into place as we proceed. All labs MUST be read prior to the lab. There may be frequent lab quizzes at the beginning of each lab based on the reading for the lab!...
6. Turn in your laboratory notebook *on time.* Keep it neat. Answer all questions in the lab notebook. Draw. Label. The more you include in the notebook the better. I cannot give credit for what I cannot see!
7. Take the labs seriously. Dissect carefully. Don't rush. Don't skim. Don't leave before you are done - it will come back to haunt you -- ooohooohahhhahhh-- during the lab practical! Ask many questions during lab.

Exams

Exams will be given during the lecture period. *If you* miss the exam you will receive a zero for it unless you have a signed excuse (see above). *If you* have a good, excuse then an alternative time for you to take the exam can be arranged. No test scores will be dropped. Tests will be graded on a curve. Exams will contain a variety *of* types *of* questions including: multiple choice, true or false, matching, fill-in, short answer, essays and diagramming. Each exam will be preceded by a review sheet and possibly a review session (depending on *if you would* like a review session or not). The final is cumulative and counts for a bit more than Exams I and II.

Lab Practicals

Lab practicals are a CENTRAL part *of* Comparative Anatomy. You'll be tested on the things covered in lab BIGTIME! You'll be learning to name and identify structures in a variety *of* organisms. You'll be

expected to know the function of most structures you know the name of. You'll be expected to **know** what each structure in a particular vertebrate is **homologous/analogous** or **homoplasous** with in other vertebrates. (These terms will make sense shortly!) You'll be expected to understand the embryonic origin of each structure we study. (Yes, it is a lot! I empathize but hey I *didn't invent the whole complex beautiful mess that is EVOLUTION!)*

Grading

The semester grades for the lecture and lab portion will be based upon the following:

Lecture:	
60% (30% each)	Exams 1 & II
40%	Final Exam
Lab:	
60%	Lab Practicals
30%	Notebook
10%	Lab Quizzes

The Only Thing that is Constant is Change Clause: The instructor, despite her best efforts to anticipate the *best* course for the course and stay on that course, reserves the right to **tinker** with, change, deviate from, or omit an aspect of the syllabus at any time. Biology is a four-dimensional process and so is this course: both "unfold" in **time**. I will notify you of any mutations as soon as I become aware of them!

Bio 352: Developmental Biology
Dr. Gail Grabowsky Kaaialii

Properties & Components of the Successful Laboratory Notebook

1. The successful notebook is neat enough that you can read it tens years from now when you pull it out to study from to teach a biology class yourself

2. The successful notebook is full of drawings and diagrams with ***explanations*** *of* ***WHAT you*** *have drawn!* Note the quality of the drawing (i.e. beautiful drawings) is pretty much irrelevant; it need only be an adequate representation of what you saw.

3. The drawings in the successful notebook all contain a scale bar so that you can determine the actual size of the structure drawn. Dr. Gail will review the mechanics of drawing the scale bar.

4. The successful notebook always includes a Table of Contents with page numbers and headings for each of the labs.

5. Each lab write-up in the successful notebook starts out with the Title of the Lab!

6. The title is typically followed by a short description of the purpose of the lab.

7. If the instructor includes any additional instructions/directions separate from those described in the lab book/handouts these instructions should be included in the write-up.

8. Any notes taken during the lab period should be included in the lab notebook (unless the notes are extra "lecture notes" -- these can be included in the lecture notebook.

9. All observations made during a lab should be recorded in the lab notebook.

10. Record all data in the lab notebook.

11. Discuss any conclusions, integrative ideas, questions for further study, in the lab notebook.

12. Answer all questions from the lab in the lab notebook.

13. Finally the successful lab notebook has an element of your own style and creativity and may, of course include elements not discussed in numbers 1 - 12.