Course Schedule

Date	Lecture/Lab Topic	Reading
1/19/00	Course description, outline & mechanics; Introduction to physiology; **What** is comparative physiology; How do we do physiological research	Syllabus, Intro Sheet "About This Book" "What is Physiology?"
	OXYGEN	
1/21	Respiration: Behavior of gases essential to life in both air and water	Chapter 1 pp. 5-16
	Lab 1 : Recognizing Physiological Phenomena in the Field **1st** Formal **Write-up:** due on or before 2/4/00.	Handouts
1/24	Respiration in air versus water	pp. 16 - 28
1/26	Respiration: Lungs, gills and other biological "breathing" apparatus; Air breathing fish and water-going mammals	pp. 28 - 41
1/28	Respiration: The complexities of avian respiration; Those weird (but efficient) terrestrial arthropods	pp. 41 - 61
	Lab 2 : Human Lung Capacity and Regulation of Respiration 2nd Formal Write-up due on or before 2/11/00.	Handouts
1/31	Blood: Pigments and cells; Oxygen transport in blood	Chapter 2 pp. 65 - 69
2/2	Blood: Dissociation (cont'd) and facilitated diffusion	pp. 69 - 82
2/4	Blood: Carbon dioxide transport in the blood	pp. 82 - 87
	Lab 3: Blood Pigments, Capillary Circulation & Comparative Study of Invertebrate Hearts Biomath Questions: Due Monday 2/7	Handouts
2/7	Circulation: General principles, flow through pipes -- biological and otherwise	Chapter 3 pp. 91 - 93, 106 - 115
2/9	Circulation: Vertebrate versus invertebrate	pp. 93 - 106, 115 - 122
2/11	Circulation: A closer look at its biomechanics	Handout
	Oral Report 1: Journal Article Critique	
	Lab 4: Bradycardia Lab	Handouts
	FOOD and ENERGY	
2/14	Food: Feeding, digesting, general animal nutritional needs	Chapter 4

		pp. 129 - 151
2/16	Food: Specialized nutritional needs; Chemical defenses	pp. 151-163
2/18	EXAM I	
	Lab 5: Investigating the Relationship between Metabolic Rate and Cardiac Output 3'd Formal **Write-up:** due on or before 3/3/00.	Handouts
2/21	N O C L A S S -- President's day	
2/23	Energy metabolism: Metabolic rate, energy storage, oxygen concentration	Chapter 5 pp. 169 - 178
2/25	Energy metabolism: The cost of size	pp. 178 - 200
	Lab 6: Bomb Calorimetry OR Enzyme Kinetics 4th Formal **Write-up:** due on or before 3/10/00.	Handouts
2/28	Energy metabolism: The cost of being active or living at high altitude; Physiological time	pp. 200 -211
3/1	Energy metabolism (catch up day)	
	TEMPERATURE	
3/3	Temperature effects: Terminology; Temperature change; Extreme temperatures	Chapter 6 pp. 217 - 222
	Lab 7: Insect Nutrition (A long-term experiment) 5th Formal **Write-up:** due on or before 5/5/00.	Handouts
3/6	Temperature effects: Tolerating hot and cold	pp. 222 - 232
3/8	Temperature effects: Being specially adapted to hot and cold	pp. 232 - 238
3/10	Temperature regulation: Technicalities of heat transfer; Expensive Living -- Birds and Mammals	Chapter 7 pp. 241 - 253
	Lab 8: Effect of Temperature on Oxygen Consumption Biomath Questions: Due Monday: 3/13	Handouts
3/13	Temperature regulation: Heat balance	pp. 253 - 277
3/15	Temperature regulation: Torpor and hibernation; Poikilothermy	pp. 277 - 293

WATER

3/17	Water and osmotic regulation: Water world and the spineless critters that are adapted to live there	Chapter 8 pp. 301 - 314
	Oral Report 2: Journal Article Critique	
	Lab 9: Osmotic Conformity and Regulation in Brackish Water Invertebrates	Handouts
3/20	Water and osmotic regulation: Aquatic vertebrates; Terra firma and the water balance	pp. 314 - 328
3/22	Water and osmotic regulation: Terrestrial arthropods versus the vertebrates	pp. 328 - 350
3/24	EXAM II	
	Lab 10: Production of Hypotonic Urine and the Active Uptake of Salts	Handouts
	SPRING BREAK	
4/3	Excretion: Relevant parts	Chapter 9 pp. 355 - 360
4/5	Excretion: Invertebrate excretory organs	pp. 360 - 366
4/7	Excretion: The vertebrate kidney; Eliminating nitrogen	pp. 366 - 388
	Lab 11: Vertebrate Kidney Function 6th Formal Write-up: due on or before 4/24/00.	Handouts

MOVEMENT, **INFORMATION,** INTEGRATION

4/10	Movement, muscle, biomechanics: Ways to get around; general principles	Chapter 10 pp. 395 - 405
4/12	Movement, muscle, biomechanics: Muscle function; the role of the skeleton	pp. 405 - 430
4/14	Movement, muscle, biomechanics: Staying afloat or sinking when you want to...	pp. 430 - 458
	Lab 12: Ciliary Movement Biomath Questions: Due Monday 4/17	Handouts
4/17	Control and Integration: Control theory; nerves and nervous systems	Chapter 11 pp. 465 - 471

4/19	Control and integration: Nerve cell function; nerve impulses	pp. 470 - 486
4/21	N O CLASS -- Good Friday	
4/24	Control and integration: The synapse	pp. 486 - 495
4/26	Hormonal control: Vertebrate endocrine systems	Chapter 12 pp. 497 - 519
4/28	Hormonal control: Invertebrate endocrine systems	pp. 519 - 529
	Oral Report 3: Journal Article Critique	
	Lab 13: Resting and Action Potentials	Handouts
5/1	Information and senses: General principles; The chemical senses	Chapter 13 pp. 533 - 540
5/3	Information and senses: Vibration and light	pp. 540 - 555
5/5	Information and senses: "The Body Electric"; Sorting sensory information	pp. 555- 574
	Lab 14: Bioluminescence	

FINAL E X A M : Thursday, May 11 from 10:30 -- 12:30 PM in Henry Hall room 17

Already-Scheduled Service **Learning** Trips:

1/22	Sierra Club: Miconia eradication
2/12	The Nature Conservancy: Fieldwork
2/13	Kai Makana, Jamba Juice: Marine debris study, eviro ethic survey
2/26	The Nature Conservancy: Fieldwork
3/11	The Nature Conservancy: Fieldwork
3/25	The Nature Conservancy: Fieldwork
4/8	The Nature Conservancy: Fieldwork
~4/15	Kai Makana: Marine Debris Clean-Up and Quantification
4/22	The Nature Conservancy: Fieldwork

A Short Written Reflection for the Service Learning portion of the Course (if you participated) is due on May 5.

Biology 442; General and Comparative Physiology

Course Mechanics

Welcome upperclassmen! This is definitely a course for upperclassmen. Why? Because its going to demand that you budget your time well throughout the duration of the semester. Here's why.

There are many "due" dates and "days of reckoning" throughout the semester. You'll have lab reports, oral reports, reflection papers (optional), exams (not optional!). You will also be keeping a lab notebook (graded on a pass/fail basis only). In an effort to make your time-budgeting job manageable I have attempted to spread all of the various due dates around in time as well as making an effort not to have anything due on the day of an exam. One thing that I don't think you should do nor do I think you can get a good grade if you do it (!) is to do that crash and burn and then resurrect-yourself-for-another-such-session thing that some of you make a living at! You know what I mean guys: when you put off studying or doing an assignment and then you make this Herculean effort *right* before the test or the due date.... That thing. Remember how after that Herculean effort (a.k.a. "cramming") you have a few days of down-time when you aren't as productive because you are recovering from that last "Labor"? Well, in this course if you take any "down-time" you are going to miss something and have to cram to accomplish it, hence starting the whole viscous positive feedback loop. (We biologists know about them: the cycles that create shock or contractions during childbirth -- cycles that get bigger and BIGGER, faster and f a s t e r or in you case I fear crazier and **cRa*z*i*e*R!**)

What I suggest you do in order to be successful in this course is ***budget*** your time -- become your own little time-management self-dictator! Do some reading, lab write-up, oral presentation reading or writing, service learning activity (optional) or something else pertaining to the course *each day*. If you go about the course this way, at a steady, constant, moderate effort then you'll be able to keep up with all the deadlines and be ready for the test too.

Good luck. I am here to help you. That means to help you understand the material in the lectures and labs, to facilitate your own discoveries of the principles of physiology, to teach you how to gain access to physiological research papers and other pertinent information, to answer your questions, to help keep you on schedule and aware of all deadlines, to keep you safe in lab and to teach you how to do responsible, kind, physiological research with real organisms.

This course *is Comparative* Animal Physiology. Physiology, as the author of your book states it, "is about animals and how they function in their world". What could be more basic and intriguing! The "comparative" part means we are going to compare the differences and similarities in the ways animals have managed to adapt and survive in the physical world.

Sometimes we'll consider the *different* methods and/or structures that animals have evolved in order to meet a *particular* need they all have (i.e. *different solutions* to a *single* "problem"). In other instances we will consider the unifying principles or similarity in the structural components animals have evolved to meet a particular need they all have (I. e. the *common thread* shared by all solutions to a *single* "problem"). Finally we will consider what sorts of structural/functional solutions particular species hug evolved to cope with the fluctuating or warm physical challenges (i.e. the *variety of solutions* to meet the *variations in the physical world).*

Physiology then is the ultimate biological field for the study of FUNCTION! One may be a molecular physiologist -- sometimes we call them "molecular biologists" or "cell biologists" but if they are studying how molecules or cells *function* they are really physiologists. Or they may be a physiologist on a much larger scale -- wondering how aspects of the whole organism like the knee joint, whale blubber or bird wing works. We call these types of physiologist "biomechanics" or "biophysicists". In this course we will study the general ways animals function at all these levels enabling them to survive and procreate on this "Blue Marble" we call home.

Objectives of the Course

Your objectives for the course should be as follows:

To know *what* animals require in order to survive

To know why animals require the things they do in order to survive

To know the *processes* that are essential to animal survival

To know *how* and *where* the processes essential to animal life occur in the animal body in general

To understand the general function(s) of most animal cells, organs and organs systems

To understand how animals interact with their external environment in order to survive

To understand the challenges that the environment poses to animals

To learn how to use physiological research equipment and conduct physiological experiments

To learn how to write a formal laboratory write-up

To learn how to critique primary scientific literature

To learn how physiology research may be put to use for the betterment of the "Blue Marble" and its inhabitants

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. Keep up with the reading. Schmidt-Nielsen is a wonderful writer. He packs in a lot more information than it feels like he does because his writing style is smooth, logical and entertaining. Lab handouts will be of varying lengths: some will be extremely short other will belong. Pick them up early enough to get through the reading *prior* to labor you will be lost in lab!
5. Schmidt-Nielsen is so function- and principle-oriented that there is not a huge amount of new anatomical terms to get to know. The "payback" is that there are processes to *comprehend.* Make comprehension of concepts your major goal in this course: what needs to be done? and how does a structure/organism get it done!
6. Try to turn everything in/do everything *on time!* getting behind in here, as alluded to above is a bad thing. Budget your time. Make a schedule for yourself? A list? a calendar? *Something !*
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 -- ooohoooohahhhahhh-- during the lab practical! Ask many questions during lab.
8. When you prepare to critique journal articles reread them a few times so that you understand them! I found that when I first started reading the primary literature I understood about 20% more of the article each time I read it. That means I got about 40% on the first go-round but after the second time I read it I understood 60% -- or the *majority* -- of it! (And that's what we are after).

Missing Classes and Labs

My policy on missing classes is this: You can miss a few (<3) lectures 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 a lot *of* $$$ in paying me etc. to teach you who isn't here! Students who miss lots *of* classes *always, I* believe, perform more poorly 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.

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.

Everyone -- don't miss the labs, there are only 14 of them. Missing even one (unexcused) can effect your grade.

On absences in general: Please don't abuse the doctors note = excused absence deal. I love teaching and getting to know you guys, I *LOATHE* the bureaucratic b.s. that people do, fortunately only on rare occasion, try to pull. It wastes our time. Be legit, come to class, learn, enjoy, *think*.

Service Learning Option

If you'd like you may choose to do some hands-on, *meaningful* physiology in the real world through what is called "service learning". Service learning means that you (1) learn physiology (2) in our community, all the while (3) doing some good for man or man and nature. Pretty neat idea huh? Actually its a practical, intelligent, useful, lasting way for you to learn. The emphasis is on learning physiology, the twists are that you do it in the real world and that you can feel good (because you are doing something good for the community) about it.

No one ever asked me what kind *of meaningful* career in biology I planned on doing, they simply asked what sort *of* biological career was I pursuing. While the vast majority *of* careers in biology do provide something good to man and/or man and nature the consideration *of* the *sort of* good or *of* the *particular kind of meaningfulness I* wished to have as part *of* my career was never addressed! As I look back on this I find it a great irony since I derive most of the pleasure from my current career because I believe (hope, imagine, fantasize!?) that I am doing some GOOD, i.e. doing something meaningful, in teaching, mentoring, working with environmental organizations, knowing you. Its also wonderful of course that this occurs within the field of biology because I, like you, find biological knowledge to be an endless source of understanding-of-place, joy, wonder, etc.

I know most of us will naturally and subconsciously consider the potential meaningfulness of careers as you ponder what you'd like to do, but why not make it a conscious, purposeful activity while you're in school. Service learning is aimed in part at doing that: having you realize biology is meaningful and thus setting you up to decide what sort of meaningfulness is most valued by yourself!

I will explain the logistics of service learning to you in class. Basically you may choose to do just TWO service learning trips (usually on Saturdays) in exchange for ONE of the oral journal article critiques. If you do FOUR service learning trips you don't have to do TWO of the three oral journal article critiques. I want everyone to do at least one journal article critique so the maximum number *of* critiques you may "get out *of* doing" through service learning is two.

Your task now is to decide if you want to do service learning instead of journal article critiques. If you answer yes to this question let me know ASAP. I will be polling the class about this in the first and second week of classes.

Journal Article Critiques

If you do not do the Service Learning you will be critiquing three physiology-related research articles of your choosing. You will choose articles from a list of journals that I will give to you. The article you choose must pertain to those aspects of physiology that we have been studying in class. For example, the first critique (2/11/00) must be done on a research article in which the author(s) reports on research pertaining to respiration, blood or circulation - Chapters 1,2 and 3 in the book. If you take the service learning option you will only do one or two of the three journal article critiques and you may choose your critique dates. You will present your critiques orally to the class on the dates indicated on the syllabus. Reports will be no more than 5 minutes in length and you goal will be basically to explain the goals/hypothesis, methods and results of the research you read about. I will do a sample critique prior to the first report day to demonstrate for you what a critique is like.

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. There will be three exams during the course, the third will be given during the final period. None of the exams are cumulative but be aware that the course takes a bottom-up approach: we begin with a very reductionistic view of function and gradually build on it until we find ourselves studying the integration of all functions the last week of class. So in a sense the material in the course builds on itself and thus each exam tests your understanding of compiled information and processes.

Labs

Get ready. Read each lab handout prior to lab Be prepared to take down data, record observations etc. You must be very thorough in this lab. There will be few drawings to make of animals, but you may want to draw the apparatus we employ. If people are not coming to lab prepared I will implement the DREADED Lab Quiz "motivational tool." Don't make me do it! You guys are UPPERclass people now and in having grown in maturity over the duration of the lowerclass people years I know you have now all come to realize the power of a prepared mind!

Formal Lab Write-Ups

There are NO lab practicals!! ! Instead there are 6 formal lab write-ups! All but one of these write-ups are due roughly two weeks after you perform the lab. The 5^{th} write-up is for an experiment that will span many weeks (Insect Nutrition). Its write-up is due on the last day of class. I will be giving you a hand-out explaining the write-up format and style.

Biomath Questions

I have a neat new book that will help you guys get to feel comfortable applying mathematics to biological processes. I've decided to assign three sets of these biomath problems to you during the course. Each will be passed out to you on a Friday in which we are not doing a lab that will be formally written up. The problems will be due the following Monday. They will be graded as completed/not completed.

Grading

You will be receiving two grades for this course: one for the lecture portion and another for the lab portion. Grades for each will be based on the following:

Lecture:

75%	Exams I, II & III
25%	Research Paper Critiques and/or Service Learning Requirements

Lab:

100%	Formal Lab Write-Ups (16.7% each)
Pass/Fail	Notebook*
Completed/Not Completed	Biomath Problems*

*Note: Your performance in these two categories could tip-the-scale one way or the other for your lab grade if your are on the cusp between two grades.

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.