The Invertebrates (Zoology 413) Spring Semester 2006

Basic course information:

Meeting Time	Lecture: MW 1-1:50 P.M. Lab: MW 2-3:50 P.M.
Meeting Place	Lecture: LS II Room 367; Lab: LS II Room 304
Instructor	Dr. Frank (Andy) Anderson
Office Phone	453-4136
E-mail	feander@siu.edu
Course Website	www.science.siu.edu/zoology/anderson/inverts.html
Office	Life Science 2, Rm. 355B
Office Hours	Mondays and Tuesdays 9-10:30 a.m.
Teaching Assistant	Stephanie Clutts
Textbook	Invertebrates, Second Edition (R. C. Brusca and G. J. Brusca)

Additional course information and suggestions:

Lecture: The lecture portion of the course will constitute 55% of the final overall grade. The lecture grade will be based on two in-class lecture exams (each worth 20% of the final grade) and a final exam (worth 15%).

Lab: The lab portion of the course will constitute 45% of the final overall grade. The lab grade will be based on several criteria. Students will keep a lab notebook (see below) that will be turned in twice during the semester (grades on the lab notebook will be worth 10% of the overall grade). There will also be two lab practical exams (each worth 10%). Some lab sessions will consist of discussions of research papers on invertebrates. Small groups of students will be assigned to lead each discussion, and other students will be expected to participate. Participation in paper discussions will also constitute part of the lab grade (5%). Finally, each student will develop an independent project of their choice, through consultation with Dr. Anderson and the TA (see pg. 6)—the project will be worth 10% of the overall grade.

Bonus points (*new for 2006!*): During the semester, I will provide papers from the scientific literature related to recent lecture/lab topics. You are encouraged to read some or all of these papers, but it is not required. If you decide to read the papers *and* write a short (~1 page) summary of the paper, you will receive **one point** toward your final grade for each summary. Each summary should consist of 1) a review of the central question, methods and findings described in the paper, 2) a paragraph describing something you learned from the paper, or aspects of the paper that you found interesting (or dull) and 3) two questions that you would ask the authors of the paper, if you could. Note: *simply re-writing the abstract will not be enough for bonus points!*

Date	Lecture Topic	Lab
W 1/18	Metazoan Origins and Development	Lab Set-Up, Phylogenetic Principles
M 1/23	Porifera I	Poriferan Diversity
W 1/25	Porifera II, Cnidaria I	Cnidarians
M 1/30	Cnidaria II	Cnidarians and Ctenophores
W 2/1	Cnidaria III, Ctenophora	*Paper Discussion - Hydroids*
M 2/6	Ecdysozoa I: Arthropods; Crustacea*	Arthropod Intro
W 2/8	Ecdysozoa II: Crustacea*	Crustacean Diversity
M 2/13	Ecdysozoa III: Chelicerata*	Crustaceans and Chelicerates
W 2/15	Ecdysozoa IV: Hexapoda*	Chelicerates, Hexapods
M 2/20	Ecdysozoa V: Onychophora, Tardigrada	*Paper Discussion – Spider Behavior*
W 2/22	Ecdysozoa VI: Nematoda, etc.	Hexapods and "Lobopods"
M 2/27	**LECTURE EXAM 1**	Micrometazoan Diversity 1
W 3/1	Spiralia I: Mollusca Intro, Polyplacs	Molluscan Diversity, Gastropods
M 3/6	Spiralia II: Gastropoda	Gastropods and Bivalves
W 3/8	Spiralia III: Bivalvia	**PRACTICAL 1 *(Proposal due)***
	3/13 and 3/15 - SPRING BREAK (NO CLASSES)	
M 3/20	Spiralia IV: Cephalopoda	*Paper Discussion - Torsion*
W 3/22	Spiralia V: Annelida I	Cephalopods
M 3/27	Spiralia VI: Annelida II and Allies	Annelids and Allies 1
W 3/29	Spiralia VII: Echiura, Sipuncula	Annelids and Allies 2
M 4/3	Spiralia VIII: Phoronida, Brachiopoda	"Lophophorates"
W 4/5	Spiralia IX: Bryozoa	"Lophophorates", Project Topics
M 4/10	**LECTURE EXAM 2**	Planarian Experiments 1
W 4/12	Spiralia X: Platyhelminthes	Planarian Experiments 2
M 4/17	Spiralia XI: Platyhelminthes, Nemertea	*Paper Discussion – Polychaete parasites*
W 4/19	Spiralia XII: Micrometazoans	Micrometazoan Diversity 2
M 4/24	Deuterostomia I: Echinodermata I	Echinoderm Diversity
W 4/26	Deuterostomia II: Echinodermata II	Echinoderms and Chordates
M 5/1	Deuterostomia III: Hemichordata	Metazoan Phylogeny and Fossils
W 5/3	Deuterostomia IV: Chordata	**PRACTICAL 2 *(Projects due)***
T 5/9	**FINAL EXAM (12:50 - 2:50 p.m.)**	

* = guest lecturers; Dr. Anderson out of town (CIAC meeting, Tasmania)

The Zoology 413 Lab

The lab will consist primarily of comparative studies of whole preserved specimens and/or slide mounts of histological sections. Dissections of preserved material will be used to study internal anatomy for some taxa. Fossil and living marine, freshwater and terrestrial animals will be available during some labs. A couple of labs will consist of behavioral experiments. The lab will also serve as an opportunity to explore topics in metazoan biology in more detail than is possible during lecture via additional special topic lectures and discussions of scientific publications of research on invertebrate animals. In each discussion, a small team of students will lead the discussion by outlining the research described in the publication, doing some background reading and asking their classmates penetrating questions about the paper.

The primary purpose of the lab is to give you a hands-on introduction to metazoan (multicellular animal) diversity. During the course, you will learn to identify several types of animal. You will have several opportunities to compare modes of feeding, reproduction, and lifestyle across the full range of animal diversity. You should gain a deeper understanding of metazoan evolution and phylogenetic relationships. Finally, you should get a sense of how to conduct research on invertebrates. And you'll be recording all of these things in your lab notebook!

The Lab Notebook

Basic requirements of the notebook: Each student will compile their own laboratory notebook will include line drawings of slides, live and preserved animals, dissections, behavioral observations, etc. The lab notebook must be done with a lead pencil (colored pencils are, at times, acceptable). NO PENS! You may want to use a hard pencil like 2H or 4H, which will smudge less than a regular #2 pencil. Pages must be numbered, and the date the organisms were examined should be placed underneath the page number. Diagrams should be labeled (classification, type, structures, etc.) clearly.

The following information must be on the inside cover of your laboratory notebook:

1. Your name and address(es)
2. Your phone number
3. Any other information that would facilitate its return should it be lost (maybe an e-mail address?)
4. The number of your microscope(s)
5. A table of contents (skip the first two-three pages of the notebook when you make your first entry)

All lab notebooks will be evaluated after each lab practical exam.

What sort of notebook should you use?

I recommend something like an artist's sketchbook. It doesn't have to be fancy and expensive, but it should be a solid, bound book with plain (unlined and unmarked) paper. Something with a sturdy, water-resistant cover is optimal, but may be difficult to find. Do NOT use a binder with notebook paper! It's a recipe for disaster…it doesn't take long before pages start to disappear. Any book made of bound plain paper should be fine.

What makes a good lab notebook?

(the following text is borrowed and modified without permission from a former labmate of Dr. Anderson's…but he borrowed most of it from our Ph.D. advisors, so it's all good)

The production of a useful laboratory notebook is all too rare in many fields of undergraduate study in biology. Too many instructors of zoology laboratories rely on "canned" labs in which the responsibilities of students are restricted to finding anatomical structures of organisms they dissect, filling in blanks in lab books and answering a short set of questions, instead of giving students opportunities to work as scientists–people that look at, actually see, and then ask their specimens questions. One of our primary goals is to give you opportunities to work and think as scientists. In order to encourage that kind of development, we do not rely on "canned" labs, but on our collective curiosities when we do dissections or other laboratory work. We will work to help you transpose your thoughts, ideas, questions, observations, etc., into your own laboratory notebook so that your lab book will become a working tool, and something (we hope) that you can be truly proud of.

A laboratory notebook contains a record of the things you see, do, and think about the topic or specimen at hand.

Now, about drawings…

The goal of making drawings as you work in the laboratory is to produce a record of what you see and do. The information in your lab book should also provide you with a good enough record of your specimens and of what you did that so that if occasion required, you could return to your lab book for review, rather than examining the specimen again.

1) DRAW BIG! FILL the page with your drawing. Nearly all students draw too small, and then have problems adding detail later. The larger the drawing, the more detail you can put in. Work to include detail–even if you don't know what exactly you are drawing. The larger you draw, the harder you will tend to look for detail to include in your drawings. This will, in turn, lead you to asking better and better questions. There is no reason to skimp on paper. It is doubtful that you will fill the notebook.

2) If possible, you should always have a scale for your drawings. You can use either the micrometer scale on your microscope, or a regular ruler.

3) Begin by stating and drawing the obvious, then get more and more specific in your work.

Don't be afraid (if time permits) to include different drawings of a single organism. In fact, the more drawings you make, and the more detailed they will be, the more you will see, and the better you will come to know your specimens.

4) Include plentiful narrative observations with your drawings. Begin by writing the obvious–what do you think of the specimen you have? If it's alive, is it doing anything? What happens when you poke it? This will get you writing, and will get you into the habit of including your thoughts in your lab book. This is an important step in learning to ask questions.

5) Include questions that pop into your mind as you make observations. You may want to highlight these somehow so your eye will be drawn to them later. Start by asking and writing "I wonder why..." questions. These questions could someday be the basis for a senior thesis…or a dissertation!

6) Generally, you should not shade your drawings. Often the shading people try to do obscures detail rather than enhancing it. You should describe the differences in appearance via accompanying text. If you feel that you must shade, then stippling is the appropriate way to shade (some examples of this technique will be made available upon request).

Guidelines for evaluating laboratory notebooks

We will use five criteria for evaluating notebooks. Each category carries equal weight since all of them are necessary if you are to produce a useful record of your work.

1) Completeness - does the lab book contain information on all of the work assigned?

2) Organization - is there a working table of contents? Is the required contact information on or inside the cover of the book? Do all pages bear required information (page number, date, and descriptive title)? Are all entries in the table of contents descriptive enough to allow one to find something in the book, at a glance?

3) Drawings - are drawings in the notebook good working (not necessarily pretty) drawings? Are the drawings large enough to show sufficient detail? Are the structures drawn recognizable? Are there enough drawings, or is there a noticeable lack thereof? Are drawings and parts of drawings properly labeled? Is there a scale?

4) Observations - are observations accurate? Do you make it clear what you know and what you are unsure of (including what you are not sure of is often the most interesting part of lab notebooks–that's one place research questions can come from)? What kinds of things do you see and then try to explain in you observations?

5) Questions - What kinds of questions are posed by the student? Are your questions probing, or just superficial? How many questions are there? The more the better.

The Individual Project

Each student is required to develop a project relating to some aspect of invertebrate biology. There are two types of project that would fulfil this requirement. These are:

1) A research project on some aspect of invertebrate biology. Research projects can be undertaken by individual students or pairs of students, but if a "pair" project is chosen, it should be understood that both members of the pair must participate fully in the research development, data collection, data analysis and writing of the final report. Also, I will expect more from pairs than I expect from individuals.

Some examples of feasible research projects: behavioral experiments with live animals (can you train planarians to run a maze?); assisting with maintenance or development of teaching resources for the class (e.g., the invertebrate aquarium in the lab; see below); a field survey of invertebrates at a particular site, genetic work on various invertebrates in my lab…I often have specific ideas for students that don't have a project in mind–come see me for details.

2) A literature review paper on a topic in invertebrate biology. The paper should be twelve to fifteen pages, double-spaced (not including bibliography), and must include at least ten references *from the scientific literature*. Web sites may be used as references, but they do NOT count toward the required total of ten (and neither does your textbook, although you can cite it if you like).

Some examples of possible paper topics: What was the Cambrian Explosion, and did it really happen? How do vertebrate endoparasites evade the host's immune system? A dissection guide would also make a suitable paper.

A brief (one or two pages) proposal for the project must be turned in at or before the first lab practical. The proposal should include an outline of the project you would like to do, a justification (where you explain why you are interested in the project), examples of reference materials (i.e., books or papers that you plan to cite) and, if it is a research project, a research plan. You will be required to discuss the proposed work with Dr. Anderson. You may find the following books useful when writing your paper:

McMillan, V. 2001. Writing papers in the biological sciences (3rd edition). Bedford/St. Martin's, 207 pgs. ISBN: 0312258577

Pechenik, J. A. 2003. A short guide to writing about biology (4th edition). Pearson Longman, 336 pgs. ISBN: 0321078438

It's all too easy to copy-and-paste your paper together from a few websites, or to buy a paper from a website. As you know, taking someone else's work and passing it off as your own is **plagiarism**. *It should go without saying that you are strongly discouraged from plagiarism, but it doesn't, so I'm saying it: DO NOT download your paper (or large pieces of it) from the web. Why not? There's a reasonable chance that I'll catch you, and that could get uncomfortable for you. This isn't that hard an assignment, and I hope you'll be interested enough in a group of invertebrates that you could spend some time researching it in more detail. If you have questions about what constitutes plagiarism, ask me.*