

Biology 222

Vertebrate Zoology

Instructor:
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Textbooks: *Integrated Principles of Zoology* by C.P. Hickman, Jr., L.S. Roberts, and A. Larson 11th Edition.
(This text was used for Invertebrate Zoology in the fall).

Attendance: You are expected to attend all class and lab meetings. You must notify me in advance of any absence.

Quizzes: Approximately every week; will cover all previous material and assigned reading for that date. Some quizzes may be take home (i.e. homework). No make-up on quizzes!

Presentation: A 10 minute PowerPoint presentation on a vertebrate of your choice.

Exams: Two mid-term tests and a final; make-up by **prior** arrangement or legitimate excuse such as your own death or illness. All quizzes/tests are comprehensive. There will also be a test on identification/scientific names.

Papers: You will be required to write a short paper comparing two vertebrates.

Field Experiences: You may complete field experiences for bonus points.

Grading:

	Scale:
Presentation†	- 50 pts
Paper†	- 150 pts
Quizzes	- 100 pts
1st Mid-term	- 100 pts
2nd Mid-term	- 100 pts
Final	- 150 pts
Scientific names	- 50 pts
	<hr/> 700 pts

Your final grade will be determined as follows:

A+	97%	B+	87%	C+	77%	D+	67%	F	< 60%
A	93%	B	83%	C	73%	D	63%		
A-	90%	B-	80%	C-	70%	D-	60%		

† Failure to complete this assignment will result in a grade of "F"

General Statement

Think of Biology 222 - Vertebrate Zoology - as the second half of a year- long course in Zoology, although completion of Invertebrate Zoology is not a prerequisite. It should be recognized that invertebrates comprise 95% of all the animal species - that leaves 5% for the vertebrates. Why do we spend so much time on such a small group? The answer lies in the fact that we are vertebrates and have a natural interest in other organisms like us. Also, vertebrates tend to be larger and more intelligent than invertebrates, and thus they are more likely to be seen, and more likely to be doing something interesting. Finally, other vertebrates comprise a large portion of our diets.

The vertebrates as a group are recognized by the presence of a backbone. Traditionally, scientists and laymen alike have recognized several main types of vertebrates - fish, amphibians, reptiles, birds, and mammals. New understanding of the evolutionary relationships of these groups is changing the picture today, however, and your textbook uses this new understanding.

Since there are far fewer vertebrates than invertebrates, we will be able to spend more time this semester on the mechanisms of evolution and on such processes as body temperature regulation and development, and less time on pure taxonomy. Since our department does not currently offer courses in evolution or development, this may be your most in-depth look at these areas.

With biological knowledge doubling every 4 years, simply managing the information explosion becomes a critical skill. You will gain experience with this in several ways. First, you will write papers for which you will have to do significant research. Second, you will use a suite of computer programs to learn evolutionary relationships and scientific names.

Goals, Methods, and Criteria

Goal 1. Each student will be familiar with the taxonomy of the vertebrates.

Methods to achieve this goal:

1. Individual use of digital images for self-study.
2. Use of computerized "hypertext" programs and name quizzes.
3. Lectures/slide presentations on each group.
4. Reading the textbook.
5. Field experiences.

Evaluation/criteria for success:

- A. Each student will receive a passing grade on quizzes and lectures.
- B. Each student will pass the name/ID test at the end of the semester.

Goal 2. Each student will learn the basics of reproduction, development, homeostasis, circulation, gas exchange, evolution, development and ecology as they apply to vertebrates. Finally, each student will know the characteristics associated with major groups.

Methods to achieve this goal:

1. Assigned readings from the text.
2. Occasional assigned readings from other sources.
3. Small group/class discussions.
4. Lectures by the instructor.
5. Field experiences.

Evaluation/criteria for success:

- A. Each student will pass objective tests and quizzes on the assigned material.

Goal 3. Each student will learn how to gather zoological information from our library, and how to assemble that information into a well-written report.

Methods to achieve this goal:

1. Selection of an vertebrate taxon by each student; this will be paired with a taxon selected by the instructor.
2. Location of at least 20 references in our library (or from full-text internet sources); 10 of which are peer-reviewed papers in refereed journals.
3. Completion of a 15-20 page (typed, double-spaced) research paper on the biology of the selected taxa.
4. Revision of the paper after review by the instructor.
5. Presentation on one taxon to the class.

Evaluation/criteria for success:

- A. Completion of a satisfactory paper. Details on evaluation are included with the paper assignment.
- B. An informative and well-delivered presentation.

Goal 4. The class will be fun.

Methods to achieve this goal:

1. An atmosphere of academic respect and cooperation.

Field Experiences

You cannot learn everything in biology in the classroom. This is particularly true of vertebrates. To understand them, you must observe them in their natural habitats. Since the laboratory is not required for this class, I have tried to provide some alternates, in the form of field experiences that you can participate in for bonus points. I will give you up to 20 points for completing them. Students who are physically disabled can make separate arrangements. Students enrolled in the lab are also eligible for these bonus points.

Valid field experiences include participating in the Marietta Natural History Society nature walks held in the morning and evening later in the semester, attending MNHS programs, by attending weekend hikes led by a member of the biology department, or by pre-arranged substitutes. A MNHS program counts 5 points, a morning nature walk is worth 10 points, and an evening walk is worth 5 points. A weekend hike will be worth from 5-20 points depending on length and other factors.

The Paper

Two consistent themes emerge whenever college teachers and employers mingle. Employers are consistently looking for students who can write well, and who can work in groups. This assignment is meant to give you practice at the former, as well as another important skill - acquiring and interpreting information

The first step in writing the paper is for you to choose a taxon to research. This taxon will be paired with a taxon identified by the instructor. The paper that you will write as part of this project will compare and contrast the two taxa overall, and should cover at least **three** of the following categories:

1. morphology, anatomy and physiology
2. behavior
3. ecology
4. conservation and relationships with humans

You should research the species thoroughly, consulting sources beyond your textbook and small guidebooks. I expect to see evidence of significant library work, including **recent** references from the **primary sources** (scientific journals). There need to be at least 20 valid scientific references (primary, secondary or tertiary works produced for a scholarly audience). Ten of the references need to be from primary sources. Pay particular

attention to how you organize and arrange topics and the transitions between topics - be sure to have a logical development of your paper. Your paper should be illustrated with appropriate drawings, photographs, maps, tables, etc. as you see necessary. I prefer original illustrations to those photocopied or downloaded from your sources. Of course the paper will be typed, with no grammatical or spelling errors. Keep the **text** of the paper between 15-20 pages. Cite all references in the text following the style of the *Ohio Journal of Science* (Harvard system).

Primary Sources and Citing References

I make a big deal out of insisting on proper reference citation and the use of primary sources. Since scientific writing differs from the experiences you may have had in English classes; let me clarify these two points.

Every idea you get from another source must acknowledge that source in the text where the idea is stated. This is known as citation, and failure to do so is plagiarism. The general rule is that any information that is not general knowledge (that is, anything you found in an article, book etc.) must have the reference cited. For instance, the fact that a mayfly is an insect is general knowledge, the fact that the mayfly *Stenacron interpunctatum* prefers slow currents is not, and must be cited. If you do original experiments or make original observations, you do not need to cite these, but you must also include a methods section so that others may try to reproduce your results. Note that original *conclusions* that *you* draw based on information presented need not be cited. For instance, if Jones reported in 1985 that a species of ant is dependent on a certain plant, and Smith reported in 1986 that the plant is going extinct, then you could conclude that the ant is also going extinct - but even here you would have to cite Jones and Smith as evidence for your conclusion. Similarly, if Thompson says that there are 315 species of bees in Borneo, and you write, "there are over 300 species of bees in Borneo", or "there's bunches of bees in Borneo", you must acknowledge Thompson, even though you didn't quote her exactly. If you hadn't gotten the idea from her, you wouldn't have had a clue as to how many bees there were (short of counting them, then your paper would be a primary source). If in doubt - cite the source!

Consider the following paragraph from a paper I wrote:

"Little ecological information on *E. needhami* has been published. Ecological studies concerning the diet of organisms may give clues to the function of their mouthparts. According to Cummins et al. (1984) the *Ephemerella* belong to the collector-gatherer and scraper functional feeding groups (FFGs). Hawkins (1985) described a western species, *E. infrequens*, as a diatom scraper, detritus shredder, and collector-gatherer. Sweeney & Vannote (1981) studied 6 species of ephemerellids, 2 of which belong to the genus *Ephemerella*; all of the ephemerellids in their study fed on diatoms and detritus. Other Ephemeridae have usually been considered to be collector-gatherers (Cummins et al., 1984)."

The first sentence has no citations; it is a fact derived from my study of the literature. The next sentence is transitional and introduces no new information, just an obvious truism. The remaining sentences summarize the results of other worker's studies, and I gave them each credit for what they discovered. Note that each citation is accomplished by stating the author(s) name(s) and the date of the paper in such a way that it is clearly associated with the idea being discussed. Often, the name is part of the sentence, and only the date is enclosed in parentheses; however, it is also proper simply to put both the name and the date in parentheses, as is done in the last sentence. The abbreviation "et al." is used when more than two authors wrote a paper.

This form of citation is very common (but not universal), and I want you to use it. Read through several articles in *The Ohio Journal of Science* to get a feel for the general style of scientific writing, as well as how to handle references. We will make one small modification of that system: PLEASE INCLUDE THE PAGE NUMBER(S) WHERE YOU FOUND THE INFORMATION YOU ARE CITING.

The next most common mistake I encounter (after failing to cite a reference at all) is what I call "lumping". This occurs when all of the information you use in a paragraph comes from the same source, and you try to reference that source simply by putting it at the end of the paragraph. That is *not* acceptable. You must acknowledge a source within the sentence (or clause) in which you use it. If that means that each sentence in your paragraph ends with (Brown, 1986, p. 54), so be it. If that monotony bothers you (and it should), you *can avoid it by finding more sources to cite*, or citing the one source in different ways: Brown (1986 pp. 54-58), according to Brown (1986 p. 1017), Brown (1986 p. 56, 59, 314) also found, and so on. The reason for this is simple - in a scientific

paper, any information that is not cited directly is assumed to have been generated by the author(s). A single citation at the end of a paragraph makes it unclear as to which ideas came from the author, and which were taken from another source.

A note on quotes: In the humanities, frequently the exact wording of the ideas of the author under consideration is critical to the reader's understanding of the points being made in the paper. In this context, it is necessary to use exact quotes (with citations!). In the sciences, we are supposed to be "objective". This means writing methods sections in the passive voice to avoid the use of the pronoun "I", which distracts the reader from the work that was done and focuses attention on the scientist who performed it. Quotes also take emphasis away from the results and put emphasis on personalities. Unless the exact wording of the author you are citing is critical to the concept you are reviewing, paraphrase the author(s) and cite appropriately. Note that changing one or two words is not enough to paraphrase correctly - it must be a substantial revision, or again, you will be guilty of plagiarism. One way to avoid inadvertently quoting an author exactly is to paraphrase as you make notes, and then paraphrase your notes as you write your paper.

At the end of the paper, you must have a section listing all the papers you have cited. Again, follow the format in the *Ohio Journal of Science*. Do yourself a favor, and find an article now (preferably one dealing with your topic), and photocopy it, so that you can use it as a guide to solving different style problems. Note that journal articles are handled differently than books in the Literature Cited section. Pay attention to where the periods and commas go, but don't get too paranoid about these - be consistent.

O.K. - I know what you're thinking - where do I find these references - in *our* library? First of all, our library is an excellent source, and nothing to be ashamed of. What it lacks in size it makes up for in ease of use. The following tips will help you get started:

Avoid the encyclopedias - you're not in high school.

Go to the online catalog, and look up your subject.

Go to the stacks - find the book.

Look at the books around it (they're organized by subject)

Examine your textbook. Note the selected references at the end of each chapter.

Examine books in the Biology Reading Room (Bartlett 105) and in the lab.

Examine their bibliographies.

From the sources above, note which journal names keep popping up.

Find those journals in the library.

Examine recent issues for articles of interest.

Examine their bibliographies.

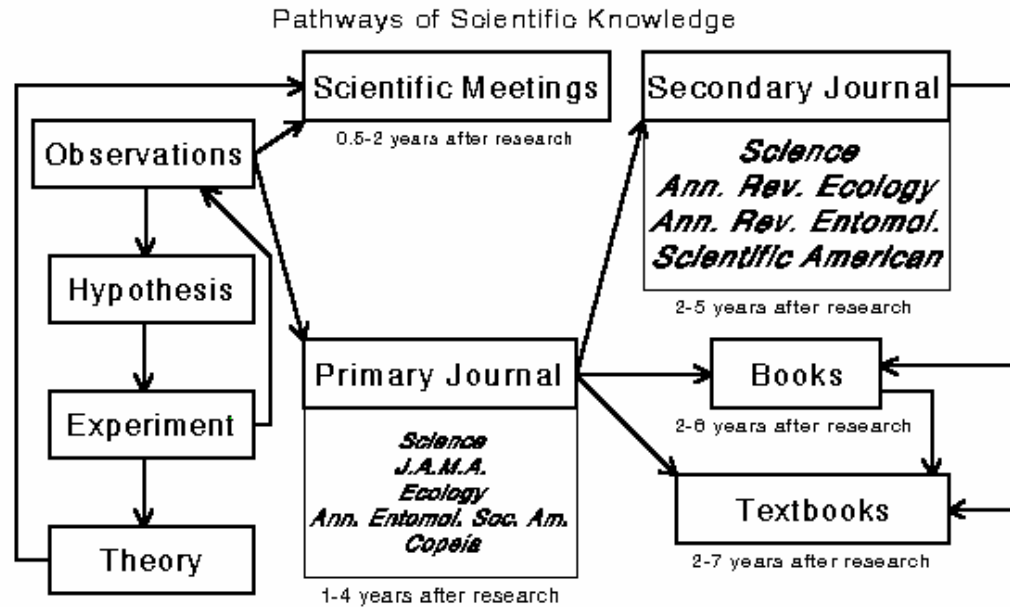
Do a search:

Through [Biological Abstracts and Biosis Previews](#) or [Google](#)

By computer ProQuest Direct, Alta Vista, Yahoo, etc. Don't ignore the references the Biology department has put online for you (see our home page: <http://www.marietta.edu/~biol/index.html> and go to the information resources link - <http://www.marietta.edu/~biol/library/info.html>).

In this class, I do not require that you use interlibrary loans, although you are free to do so if you wish. I will not accept the excuse "I'm waiting for an interlibrary loan." on this project. Concentrate on finding the references in our library. If you can't find enough, perhaps you need to choose a different topic.

Finally, what is a primary source, and what's all the fuss about? A primary source is one written by the person who has uncovered new knowledge - who has made a new observation or conducted an experiment (and thus didn't have to cite it when writing it up). As you can see from the diagram below, a primary journal contains the most recent, up-to-date *written* information. The stuff in books and textbooks may be up to ten years old, and may have been superseded by subsequent studies. Also, the material in most primary journals is subject to peer review - that is, review by other scientists for scientific (as opposed to editorial) accuracy.



Note: A textbook published in 1990 will at best contain research done in 1988.
Scientific knowledge in biology is doubling every 4 years!

The problem with primary sources is that they are written by specialists, for specialists, and appear in many different journals, some of which are hard to come by. Secondary journals help with this problem by consolidating information on a given topic. Such articles are usually written by experts in a field, but often are written for non-specialists or even lay people; most all are carefully referenced. The price is timeliness. Books consolidate matters even further. Many conform to strict citation of sources, but some do not, making it difficult to backtrack to original papers. Textbooks are in the same boat. While you may find useful information in non-technical sources (*Time* magazine, *U.S.A. Today*, etc.), these rarely cite their sources and are thus scientific hearsay - inadmissible in court, so to speak. The same for encyclopedias, comic books, the little books that come with insecticides, and so on - yes, even your trusty invertebrate or vertebrate zoology class notes.

If it's not clear already, let me be specific. You must have at least 20 sources, and these 20 sources may not include any non-scientific sources. You may cite these, but you must have at least 20 other valid references. At least 10 references must be from the primary literature. To help keep you on track, a bibliography will be due before the paper is due. While the bibliography will not be graded, if it does not have 20 relevant references (including 10 primary sources) then your paper's grade will be reduced by 10%.

Presentations

	Organism	Student
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		

Paper Assignments

	Taxon	Taxon	Student
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			

At each stage, your paper will be graded. When you submit the final draft, you must also turn in the marked copy of your earlier draft so that I can check to be sure that you have made corrections. Failure to do so will result in a grade penalty. Illustrations from one draft can be "recycled" in the final draft; they need not be redone. The standards will increase with the final draft. Only the final grade will be recorded.

The following table may help you understand the criteria I use in grading:

	A	B	C	D	F
Length	as assigned	as assigned	as assigned	somewhat short or long	too short or long
Spelling	few mistakes	some mistakes	some mistakes	many mistakes	atrocshus
References	as assigned	as assigned	as assigned	deficient	few
Organization	excellent	good	adequate	poor	non-existent
Grammar	few, minor errors	minor errors	few major errors	several major errors	many major errors
Coverage of topics	excellent	good - some items not covered in depth	adequate - all items covered	obvious weak areas	whole sections skipped
Appearance	neat, crisp	neat	neat	scraggly, unstapled	dog-eared, torn, unstapled
Readability	Flows	reads well	choppy in spots	hard to follow	places unreadable in
Reference citation	diligent	some missed	some missed	many missing or lumped	plagiarism
Paraphrasing source	Well - paraphrased	Not too far from the original quote	Quotes (with quotation marks)	Misquotes (with quotation marks)	Quotes (withOUT quotation marks)

In grading a paper, I take all of the above into account, although I weigh some more than others. For instance, I will not give a paper an "A" if it contains major grammatical errors or doesn't meet assigned standards such as number of references or page length.

Also, failure to include the page numbers in your citations will result in a significant grade reduction.

Tentative Schedule

	Date	Day	Topic	Reading	Lab
1	Jan. 14	T	Introduction	Handout	
1	Jan. 16	Th	Computer Use	Chapter 6	Introduction
2	Jan. 21	T	Evolution - the basics	Chapter 6	Computer Help Session Week
2	Jan. 23	Th	"	"	Fish I
3	Jan. 28	T	Evolution - the basics	Chapter 6	Library Help Session Week
3	Jan. 30	Th	Body Plans	Chapter 9	Fish II
4	Feb. 4	T	Classification	Chapter 10	
4	Feb. 6	Th	"		Amphibians
5	Feb. 11	T	Review - Bibliography Due		
5	Feb. 13	Th	Exam 1		Reptiles
6	Feb. 18	T	Chordates	Chapter 25	
6	Feb. 20	Th	Fishes	Chapter 26	Birds
7	Feb. 25	T	Fishes	Chapter 26	
7	Feb. 27	Th	Amphibians	Chapter 27	Mammals
8	March 4	T	""	Chapter 27	
8	March 6	Th			Bones
9	March 11	T	Spring Break		
9	March 13	Th	Spring Break		
10	March 18	T	Reptiles	Chapter 28	
10	March 20	Th	Reptiles - Papers Due!!	Chapter 28	Leith Run/ Kroger
11	March 25	T	Birds	Chapter 29	Presentations start
11	March 27	Th	Birds	Chapter 29	Baker's Run
12	April 1	T	Mammals	Chapter 30	
12	April 3	Th	Exam 2		Archer's Fork (long)
13	April 8	T	Reproduction	Chapter 7	
13	April 10	Th	Development	Chapter 8	Veto Lake
14	April 15	T	Homeostasis - Osmosis	Chapter 32	
14	April 17	Th	Excretion / Circulation	Chapter 33	Indigo Hill
15	April 22	T	Gas Exchange	Chapter 33	
15	April 24	Th	Digestion/Nutrition	Chapter 34	Wilds? - (long)

Final: Wednesday, April 30, 3:00 to 5:30 PM

Lab Practical: Tuesday, April 29; 3:00 to 5:30 PM

Note: Lab practical may be held earlier, weather permitting.

Taxa To Be Covered

Phylum Chordata

Subphylum Urochordata

Subphylum Cephalochordata

Subphylum Vertebrata

Superclass Agnatha

Class Myxini

Class Cephalaspidomorphi

"Class" Ostracodermi

Superclass Gnathostomata

Class Chondrichthyes

Subclass Elasmobranchii

Subclass Holocephali

"Class" Placodermi

Osteichthyes

Class Actinopterygii

Subclass Chondrostei

Subclass Neopterygii

Class Sarcopterygii

Class Amphibia

Order Gymnophiona

Order Caudata

Order Anura

"Class" Reptilia

Subclass Anapsida

Order Testudines

Subclass Diapsida

Superorder Lepidosauria

Order Squamata

Suborder Lacertilia

Suborder Amphisbaenia

Suborder Serpentes

Order Sphenodonta

Order Ichthyosauria

Superorder Sauropterygia

Order Plesiosauria

Superorder Archosauria

Order Thecodontia

Order Crocodilia

Order Pterosauria

Order Saurischia

Suborder Sauropodomorpha

Suborder Theropoda

Birds

Order Ornithischia

Subclass Synapsida

Order Pelycosauria

Order Therapsida

Mammals

Class Aves

Class Mammalia

Subclass Prototheria

Infraclass Ornithodelphia

Order Monotremata

Subclass Theria

Infraclass Metatheria

Order Marsupialia

Infraclass Eutheria

Order Xenarthra

Order Pholidota

Order Macroscelidea

Order Lagomorpha

Order Rodentia

Order Insectivora

Order Dermoptera

Order Chiroptera

Order Primates

Order Carnivora

Order Pinnipedia

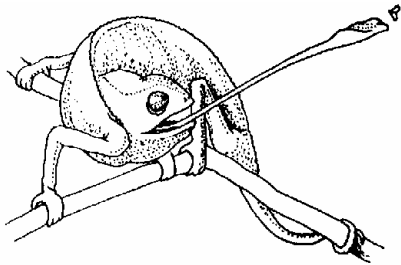
Order Sirenia

Order Proboscidea

Order Perissodactyla

Order Artiodactyla

Order Cetacea



Biology 222 Vertebrate Zoology Lab Syllabus



Textbooks: *Integrated Principles of Zoology* by C.P. Hickman, Jr., L.S. Roberts, and A. Larson

In addition, you must obtain a field guide (to fish, birds, mammals, or reptiles and amphibians)

Lab Fee: A lab fee of \$10 will be charged to offset costs of field trips and supplies.

Attendance: You are expected to attend all lab meetings. You must notify me in advance of any absence. Unexcused absences will cost you 10 pts; excused absences will cost you 5 points and may be made up by field experiences at a 0.5 to 1 point ratio.

Exams: One practical (final); make-up by **prior** arrangement or legitimate excuse such as your own death or illness.

Field Experiences: You may complete field experiences for up to 10 bonus points. A single field experience cannot count for both lab and class, and if you have an excused absence from lab, any field experiences will only count 1/2 until the deficit is made up.

Grading:

	Scale:
Animal Care	- 200 pts
Life List	- 200 pts
Practical	- 100 pts

500 pts

Your final grade will be determined as follows:

A+	97%	B+	87%	C+	77%	B	67%	F	< 60%
A	93%	B	83%	C	73%	D	63%		
A-	90%	B-	80%	C-	70%	D-	60%		

Animal Care: You will be assigned an animal or group of animals to care for in the department. You will be responsible for feeding, cleaning the enclosure, and providing interpretive displays for the animals. You will write a 4-6 page paper describing your experience and what you learned about the animals. This assignment is due in lab the last week of classes.

Life List: A list of all native Ohio or West Virginia vertebrate species seen on field trips or sanctioned field experiences. Each student must keep their own list; each listing must include the date, time, location and species names. Each species must be initialed by the leader of the group. Each species seen is worth 2 points; field signs are worth 1 point.

For each point over 200 points that the class member with the least number of points has on her or his list, I will reduce the number of specimens on the practical and award automatic points for those specimens. This bonus will extend up to 1/2 of the practical.

Animal Care List

Area	Student Responsible
Greenhouse	
Display Tank	
Room 101 and Office	
Room 103	
Zoology Lab	
Animal Room	