

Biology 220 ORGANISM DIVERSITY

Fall 2009

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Office hours: T, W 9:30-11 AM, F 2- 3 PM
also by appointment

Lecture: MWF 11:50 AM-1:05 PM, Dow 226

Lab: Dow 319 and field
Tues 8:00-11:30 AM; 12:30-4:00 PM
Thur 12:30-4:00 PM

Course materials: <https://moodle.kzoo.edu>



“There is grandeur in this view of life ... from so simple a beginning endless forms most beautiful and most wonderful have been, and are being, evolved.”

Charles Darwin, *Origin of Species*, 1859

“... to the degree that we come to understand other organisms, we will place a greater value on them, and on ourselves.”

Edward O. Wilson, *Biophilia*, 1984

COURSE TEXTS:

- 1) *Biology* (7th ed.), Campbell and Reece, 2004
- 2) *A Photographic Atlas for the Biology Laboratory* (6th ed.), Van De Graaff and Crawley, 2009
- 3) *A Short Guide to Writing About Biology*, 6th ed., Pechenik, 2007
- 4) Additional outside reading, as assigned
- 5) 2” thick binder (for organizing laboratory manual and Photographic Atlas)

COURSE DESCRIPTION

An introduction to the diversity of organisms, including their sampling, identification, classification, evolution and conservation. Diversity will be explored from the organismal to the biome level and will incorporate hands-on investigations in laboratory and field settings.

COURSE GOALS

- Enhance awareness of and appreciation for biological diversity, both locally and globally
- Acquire “face-name” recognition of the major groups (phyla) of life
- Appreciate the interplay between organism and environment (biotic and abiotic) and how this interplay influences biological diversity on micro- and macroevolutionary scales
- Gain exposure to and proficiency in practices related to the study of biological diversity, such as:
 - sampling, identification and classification of organisms
 - analysis and interpretation of biological data (e.g. phylogenies, diversity indices, trait correlations or measurements)
 - effective communication of ideas and scientific findings

By the end of this course, students will be able to discuss the following in an informed manner:

- **The scope of biodiversity** How many species are there? How do we know? What is the importance of biological diversity? How is biodiversity distributed on earth, regionally and globally? What factors threaten biodiversity?
- **The origin and diversification of life** When did life first appear? What were the earliest life forms like? What major innovations led to novel forms of life? What are the major branches on the tree of life? What factors promote macro- and microevolutionary changes in life forms? Has diversity within groups changed over time (is it increasing, decreasing, or not changing?)
- **Phylogenetics and systematics** How is the diversity of life named and classified? What are the evolutionary relationships between different forms of life? How are these relationships determined? How has our view of the tree-of-life changed over time? What key characteristics do we use to identify and classify various organisms?
- **Community diversity, ecosystems and biomes** What roles do organisms play in maintaining community diversity and ecosystem stability? What is known about the biological diversity within various biomes?
- **Biodiversity, conservation and human affairs** How do humans use and impact biological diversity? Is the biodiversity crisis real? What are some strategies for conserving and restoring biodiversity? Do humans have an innate affinity to associate with other life forms? If so, does this mean we possess a conservation ethic? To what extent are humans dependent on other organisms to sustain humanity?

COURSE PERFORMANCE EVALUATION	Value
Exams	
Exam 1	175
Exam 2	175
Final Exam (cumulative - conceptual material)	220
Practical Exam (lab material including specimen IDs and characteristics)	120
Assignments	
Lab worksheets (5 @ 10 pts ea)	50
Lab review quizzes (4 @ 25-35 pts ea)	110
Biodiversity sampling lab report	75
Bioindicators lab report	75
TOTAL	1000

APPROXIMATE GRADING SCALE

A 90-100% B 80-90% C 70-80% D 60-70% F below 60%
 plus/minus breakpoints: e.g. B+ = 87-90 B = 83-87 B- = 80-83

COURSE STRUCTURE

ATTENDANCE AND LEARNING TIPS

You are expected to attend all lectures and are required to attend all labs. Come prepared to learn and participate. Skim the assigned text pages *before* lecture or lab, take notes during class, and supplement these notes with a more thorough reading of the text following class. Using this strategy you will quickly recognize areas that require greater clarification, and you will be well prepared for reviewing material as an exam date approaches.

LECTURES

The lecture portion of the course is designed to introduce you to concepts, ideas and studies of organismal diversity. In addition to the traditional lecture-style presentations of material, lectures will include class discussions, videos, short student presentations and interactive problem solving sessions.

LABS

Labs are conducted in both laboratory and field settings. Field labs involve observing, collecting and recording organism diversity. Please **dress appropriately for field trips**. This means **wear sturdy shoes, long pants and dress in layers**. Remember: you can always take something off if you are too warm, but you can't put on what you don't have with you if you get cold or wet.

Classroom labs involve examining preserved and live specimens of organisms to enhance your recognition and classification of the diversity of life.

EXAMS

There will be **two midterm exams, one final lecture exam (cumulative)** and **one final lab practical exam (cumulative)**. Because lecture and lab are complementary, there are times when you will be expected to integrate information covered in both portions of the course on exams. Consult the course schedule for specific exam dates. Review sheets outlining key concepts, terms, etc. to be covered on the lab quizzes and exams are provided in the lab manual. Lecture exam review sheets will be posted to Moodle in advance of the exam.

ASSIGNMENTS AND GRADING POLICY

Details for each assignment will be provided separate from the syllabus. Assignments are due at the beginning of class/lab on the specified date, unless otherwise noted. Lab worksheets must be handed in on the specified date or receive a grade of zero. **Late assignments and lab reports will lose 10% per day** (including weekends) from the assigned value of the report. Reports more than 5 days overdue will not be accepted and will receive a grade of zero. Late assignments are to be delivered to Dr. Fraser's office (Dow 314) with the date and time indicated on the front.

DISABILITIES, ALLERGIES AND OTHER SPECIAL NEEDS

Anyone with a documented disability should contact the professor during the first week of class to discuss further arrangements. Please notify your professor of any allergies you may have, especially as related to classroom and field laboratories.

HONOR SYSTEM

This course operates under the Kalamazoo College Honor System, a statement of values and responsibilities central to our education. Group discussion of material is encouraged (except during a test), but written work is to be completed individually or in groups, as specified, with proper citation of all sources of ideas or other information that is not your own. You are responsible for learning how to cite appropriately works other than your own. Use *A Short Guide to Writing About Biology* for guidelines on how to cite sources. NOTE: The use of electronic devices or headphones is not permitted during exams. Cell phone use is not permitted during lecture or lab

COURSE SCHEDULE

NOTE: schedule is subject to revision. Check Moodle for the most recent schedule.

WEEK	DATE	Lecture Topic (MWF 11:50-1:05, Dow 226)	Relevant reading (C&R) (check Moodle for updates and additions)	Lab Topic (Dow 319)
1 Sept 21-25	M	Course introduction Plant overview	Ch 1: 12-15, Ch 25: 495-500 (grouping species, Linnaean classification scheme; cladistics) Ch 26: 530-531 (phylogeny of life forms) Ch 29: 578-579 (Plant phylogeny) Ch 13: 242 (life cycles; alternation of generations)	LAB 1: Trees and Seed Dispersal <u>Lab 1 WS</u> due at end of lab
	W	Plant diversity and evolution (seedless plants)	Ch 28: 567-568 (green algae/land plant relationship) Ch 29: 573-588 (origin, defining traits, colonization of land, bryophytes, pteridophytes) Ch 35: 717,719 (vascular tissues)	
	F	Plant diversity and evolution (seed plants)	Ch 30: 591-606 (gymnosperms, angiosperms; reduction of gametophyte generation)	
2 Sept 28 – Oct 2	M	Pollination	video: "Flowering"	LAB 2: Plant Diversity <u>Lab 2 WS</u> due at end of lab
	W	Plant reproduction and biotechnology	Ch 38: 771-786 (plant reproduction – pollination and seed production, biotechnology) <u>sign up for Lab 1 QUIZ</u> to be written between 9-4 on Wednesday	
	F	Coevolution and diversification of angiosperms	Ch 30: 602-604 (coevolution with animals) Ch 39: 812-813 (herbivore defense) Ch 53: 1163-1165 (herbivory, mutualism) additional reading to be provided	
3 Oct 5-9	M	Patterns of diversity – factors influencing diversity	Ch 53: 1160-1162; 1171-1178; (habitat heterogeneity and niche partitioning; disturbance; area); 1165-1166 (species diversity - community measure) Ch 50: 1087-1090 (energy availability)	LAB 3: Testing Hypotheses about Diversity, part 1 (field lab - Arboretum)
	W	Plant diversity wrap-up and review	<u>sign up for Lab 2 QUIZ</u> to be written between 9-4 on Wednesday	
	F	EXAM I	Plant diversity and evolution (does not include patterns of diversity material)	
4 Oct 12-16	M	Animal origins and overview	Ch 32: 626-636 (fossil record, uniting characteristics, phylogenies, body plans) Ch 33: 642-643 (sponges)	LAB 4: Testing Hypotheses about Diversity, part 2 (in lab, sample sorting) Scientific writing overview
	W	Invertebrate diversity, challenges of life	Ch 33: 638-667 (invertebrate diversity - overviews of phyla) Ch 40: 820-822 (common challenges of life) Ch 41: 853-855 (digestion, absorption, elimination) Ch 42: 867-871; 884-888 (circulation and gas exchange)	
	F	Scientific writing (NO CLASS – Fraser away)	see Pechenik and handouts	

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5 Oct 19-23	M	Cambrian explosion – causes and consequences	Ch 26: 526; Ch 32: 628-629 (Cambrian explosion and some explanations) Ch 21: 421-429; 431-433 (pattern formation, <i>Hox</i> genes) Ch 47: 1003-1008 (animal development) Ch 24: 482-486 (macroevolution and development)	LAB 5: Animal Diversity <u>Lab 5 WS</u> due at end of lab Diversity hypothesis lab report due in lab
	W			
	F	Invasion of land – challenges, solutions	Ch 26: 527 (colonization of land by plants, fungi, animals) Ch 33: 656-665 (arthropods) Ch 34: 671-700 (vertebrates and other chordates)	
6 Oct 26-30	M	Animal diversity - land vs. sea comparison	Ch 53: 1166-67 (food webs) Ch 54: 1186-1191 (factors limiting production in ecosystems) additional reading to be provided	LAB 6: Organisms as Bioindicators (field lab - Asylum Lake)
	W	Animal diversity wrap-up and review	<u>sign up for Lab 5 QUIZ</u> to be written between 9-4 on Wednesday	
	F	EXAM II	Patterns of diversity through Animal diversity	
7 Nov 2-6	M	Fungal diversity	Ch 31: 608-624 (fungus phylogeny, characteristics, life cycle, phyla) additional reading to be provided Ch 37: 766-767 (mycorrhizae)	LAB 7: Fungal Diversity <u>Lab 7 WS</u> due at end of lab
	W			
	F	Phylogenetic tests of diversity	additional reading to be provided	
8 Nov 9-13	M	Phylogenetic tests of diversity	Bioindicators lab report due in class	LAB 8: Protist Diversity <u>Lab 8 WS</u> due at end of lab
	W	Prokaryotes and Protists	<u>sign up for Lab 7 QUIZ</u> to be written between 9-4 on Wednesday	
	F		Ch 25: 507 (universal tree of life) Ch 26: 519-526 (history of life) Ch 27: 534-547 (prokaryotes) Ch 28: 549-571 (protists)	
9 Nov 16-20	M	Biodiversity and conservation biology	Ch 24: 473-476 Ch 26: 518-520 (extinctions) Ch 52: 1152-1156 (human popn growth) Ch 53: 1178-1180 (species richness-area relationship; community structure) Ch 55: 1209-1214, 1220-1229 (biodiversity crisis; conservation strategies) additional reading to be provided	9: Lab Practical Exam (covers Labs 1, 2, 5, 7, 8)
	W			
	F			
10 Nov 23-27	M	Catch up and wrap up		LAB 10: NO LAB (Thanksgiving holiday)
	W	Review session		
	F	THANKSGIVING HOLIDAY		
11 Dec 3	R	Final Exam (comprehensive) Thur, 8-11 AM		

* lab quizzes will be written Wednesdays on your own time (~15 min). A signup sheet with start times between 9 AM and 3:30 PM will be posted on Monday of the quiz week.

COURSE ASSIGNMENTS & DUE DATES

NOTE: grade apportionment and due dates are subject to revision. Check Moodle for the most recent version

Below is a schedule of exam and assignment dates, and the point value assigned to each

Exams	Date	Points
Exam 1	Fri, Week 3	175
Exam 2	Fri, Week 6	175
Final lecture exam	Thur, Exam Week, 8-11 AM	220
Final lab practical exam	in lab, Week 9	120
TOTAL		690
Assignments	Date due	Points
Lab 1 worksheet (trees and seeds)	end of lab, Week 1	10
Lab 2 worksheet (plant diversity)	end of lab, Week 2	10
Lab 5 worksheet (animal diversity)	end of lab, Week 5	10
Lab 7 worksheet (fungal diversity)	end of lab, Week 7	10
Lab 8 worksheet (protist diversity)	end of lab, Week 8	10
Review quiz – Lab 1 (plants)	*Wednesday, Week 2	25
Review quiz – Lab 2 (trees and seeds)	*Wednesday, Week 3	25
Review quiz – Lab 5 (animals)	*Wednesday, Week 6	35
Review quiz – Lab 7 (fungi)	*Wednesday, Week 8	25
Diversity hypothesis lab report	in lab, Week 5	75
Bioindicators lab report	in class, Monday Week 8	75
TOTAL		310

* lab quizzes will be written Wednesdays on your own time (~15 min). A signup sheet with start times between 9 AM and 3:30 PM will be posted on Monday of the quiz week.