SPRING 2021

BIOLOGY OF INVERTEBRATES SYLLABUS

BIOLOGY 346

Lecture: ISC 136 MWF 12:30-1:20 Lab: ISC 105 Thursday 2:30-5:20

Instructor: Isidro Bosch ISC 260 e-mail contact: <u>bosch@geneseo.edu</u> Phone: 585-245-5303 Office hrs: T 1:00-2:15 :W 1:30-3, T 1-2:15 PM Th 9:30-10:30 AM



Drawings of medusas, octopi and arachnids by Ernst Haeckel

Course Description:

This course offers students an opportunity to study the great diversity of animal phyla and to investigate how different groups are designed to function as integrated units that we refer to as a 'body plan". As you learn about the body plans of the most diverse among the nearly 36 animal phyla, we will also study their evolution, the position that individual lineages hold in the tree of life (that is, their phylogeny), and aspects of their physiology, development and ecology. This is not a traditional zoology course- taxonomic names and anatomical nomenclature are not the fundamental learning outcomes. Instead, taxonomic names and nomenclature will serve as the basic language you will need to understand broader aspects of biology, such as diversity, form-function relationships, evolutionary history, regulation of development and more.

The laboratory portion of this course offers an opportunity to observe first-hand many of the animals studied in lecture, thus providing context to abstract lecture concepts. Lab activities provide a moderately-structured learning experience that encourage investigative observation and independent-learning rather than following specific protocols. A limited number of dissections will be used to understand details of internal anatomy of selected groups. There are two major assignments associated with the laboratory portion of the course. One is a poster presentation on a current topic and the other is a taxonomic identification and description of an aquatic species collected from a local stream habitat. Field outings for collection stream invertebrates are scheduled for the last week of April.

I greatly value the opportunity to have our in-person class meetings. We will use this time to build on materials covered in the textbook and video lectures. The COVID-19 pandemic presents challenges to in-person learning, but by working together we can make this a safe experience. It is essential that we follow some basic practices (masking, distancing as much as possible) to help keep everyone safe. Although these practices may seem inconvenient, they reflect current public health guidance that helps minimize the spread of corona virus. Please incorporate these essential health and safety measures into your normal routine, consider the ways that your actions may affect the health and wellbeing of those around you, and try to approach this semester with a spirit of empathy and compassion.

Our Health and Wellbeing in a Stressful Time

Your health and wellbeing are foundational to your ability to learn, and if you find that you are feeling unwell (physically or mentally) and it is impacting your ability to complete your coursework, please communicate any concerns and any issues you might be facing to someone who can help,

including your instructor and lab teaching assistant. We need to help one another to successfully overcome this crisis. If there's anything I can do to promote your wellbeing and your success then, as much as possible, I will help. The <u>Dean of Students</u> (585-245-5706) can assist and provide direction to appropriate campus resources. The college also has collected resources in a <u>Coping</u> with COVID webpage. (https://www.geneseo.edu/health/copingwithcovid).

In a similar way, I will occasionally ask for some patience and flexibility on your part. The pandemic is affecting faculty as well as students and creating demands that would not be present in an ordinary semester. If will respond fairly quickly to email, but if I take some time to grade an assignment, if I am a bit late posting lecture slides, please be patient (and feel free to send me a 'nudge'; I will not be offended). You will never suffer any disadvantage in the course because of delays on my part. I know it may seem like a tired phrase, but we are all in this together and I am ready to work with you to make your introduction to the biology of invertebrates a fruitful and enjoyable learning experience.

Books and Supplies:

1. Required Textbook: "Biology of the Invertebrates" by J.A. Pechenik 7th Edition, William C. Brown Publishers, 2015. Used hard cover, paperback international editions and even an ebook are available for the 7th edition at a lower cost. All of these alternatives are acceptable for use. This book will serve as a useful reference for course content, and we will use it to provide background for class discussions.

2. A bound dedicated laboratory notebook . This lab book should hold a record of your observations in the laboratory. Lab quizzes are "open lab notebook". At the end of the semester your lab notebook will be collected for grading.

Intended Learning Outcomes:

To demonstrate minimum competence a student must be able to accomplish the following:

- Characterize the evolutionary history of early animal life; evaluate conflicting hypotheses about the timing of major historical events and the processes that contributed to them
- Categorize the range of diversity and functional attributes of animal body plans and identify key characters that define the body plans of major phyla
- Summarize the phylogeny of the major animal groups (e.g. phyla, classes) and critically analyze evidence that contributes to our understanding of these relationships
- Create, analyze, and interpret evolutionary trees
- Describe the patterns of animal development from gametes to juvenile, identifying key attributes of different evolutionary lineages
- Explain the role that developmental modifications have played in shaping the evolution of animal body plans and identify key developmental mechanisms that contributed to these evolutionary changes
- Demonstrate aptitude in interpreting function/phylogeny on the basis of observations of animal form
- Maintain an organized and practical written record of activities and observations in the laboratory
- Demonstrate progress in ability to analyze and communicate biological information at a level appropriate for this course

Success in meeting the intended learning outcomes will be evaluated through lecture exams, discussions, and laboratory activities, quizzes and assignments.

Evaluation**:

- 1. Lecture exams: 3 semester exams, Feb 21, Mar 28, Apr 25, worth 12%, 16%, and 16% of the final grade and a fourth exam during finals week on May 16 worth 10%.
- 2. Group Projects (descriptions below) Poster presentation on May 12 (10 %), Species Description on May 9 (5 %)
- 3. Contributions to class and laboratory activities/discussions (5 %)
- 4. Laboratory quizzes (12%) and laboratory notebook (5%)
- 5. Homework assignments (9% three assignments)

**Make-up exams or assignments may be scheduled at the discretion of the instructor when legitimate written medical or personal justification is provided. There are no provisions for making up laboratory activities. Field outings postponed due to weather may be rescheduled outside of the regular lab period.

The grading scale will follow the standard Geneseo distribution with some minor deviations. There will be no curve, and no set letter grade allotment.

Total Score	Grade
93-100 %	А
89 - 92	A-
86 - 88	B+
82 - 85	В
79 - 81	B-
76 - 78	C+
71 - 77	С
66 - 70	C-
61 - 65	D
< 61	E

Laboratory Syllabus:

In the laboratory portion of the class, you will still be able to observe first-hand many of the organisms you will learn about in lecture. You are asked to participate in 3 dissections, two of fixed animals (squids and crayfish) and one of an anesthetized earth worm. If you have legitimate personal conflicts that preclude participation in dissections let your instructor know and may be assigned alternative activities. Please alert me to these conflicts at the start of the semester to allow ample time for preparation of other activities. Due to the difficulty of setting up laboratories, no make-up labs can be scheduled.

One of your primary responsibilities in lab will be to keep a laboratory notebook. Your lab book will serve as your record of significant concepts and observations from the laboratory. It should include primarily original drawings and observations (not copied from books). You will be able to use your lab notes as reference during laboratory quizzes. This is a privilege that may be revoked if students are found to be copying information from other sources into the notebook. A pre-lab summary of the planned activities should be written prior to each lab meeting.

You are asked to participate in two collaborative projects. The projects are intended to cultivate particular process skills needed in the study of biology while emphasizing different aspects of animal diversity. Below is a brief description of each project. More details are to be provided during the semester.

Project 1: Description of Stream Invertebrate Species (5 % of score due Mon May 9th)

For this project you are asked to collect and identify (using taxonomic keys) an invertebrate species from local aquatic habitats and to submit a formal written description of the species of no more than 5 pages. Examples of successful species descriptions from previous years and a grading rubric for the assignment will be provided. The report will be graded on overall organization, the analysis of key characters and a description of what other information is available on your species. To complete the project each group must submit a representative specimen preserved in 70% ethanol and stored in a vial labeled with the taxonomic order and species name, date, and the name of at least one student who participated in the identification.

You are asked to explore an integrative question in the areas of phylogeny (taxonomic classification, relationships between different groups), evolution, or comparative function and form of invertebrates. Your sources for this research project must include a minimum of five peer-reviewed technical scientific papers (journal articles). Other sources (*e.g.*, web sites) are acceptable only as supplements to the primary literature. The tentative date for the poster presentation is during the last lab meeting on Thursday, May 12th. On that same day you should turn in a 2 page summary of your presentation with an annotated bibliography.

Date	Topic for Laboratory	Pre-Lab Read
Jan 27	Introduction/Assignments	#1 Guide
Feb 3	Phylogeny Exercise	#2 Guide
10	Protista and Sponges	#3 Guide
17	Cnidaria	#4 Guide
24	Fertilization & Embryology	#5 Guide
Mar 3	Flatworms and Parasitism	#6 Guide, Quiz 1 Embryology
10	Molluscs I: Clams & Squid	#7 Guide, Quiz 2 Parasitism
17	Spring Break	
24	Molluscs II: Snails	#8 Guide, Quiz 3 Snails
31	Annelid Diversity	#9 Guide, Quiz 4 Annelids
Apr 7	Aquatic Arthropods	#10 Guide, Quiz 5 Crustaceans
14	Land Arthropods; Insects	#11 Guide, Quiz 6 Insects
21	NO LAB; GREAT Day	
28	Stream Invert Collection	Field Trip
May 5	Species I.D.	(Due on Monday, May 9 th)
12	Poster Session	

Laboratory Schedule

<u>Project 2</u>: Poster Presentation (10% of total Score, due in Wed. May 12, which is designated as a Thursday on the schedule)

Tentative Lecture/Lab and Reading Schedule for Bio 346 Spring 2022

Part I

Lec # Date		Торіс	Readings (Ch are from Textbook)
Week 1 Jan-	26		
1 Ja	an 26 W	Course Overview	Preface: About this Book
2	28 F	Animal Diversity	Ch 1: 1-2; 4-6
Week 2 Jan-	31		
3	31 M	Classification and Phylogeny	Ch 2: 18-24; <i>Hwk #1 Due 2/7</i>
4 Fe	b 2 W	Evolutionary History	Read Sokol (2018)
5	4 F	Evolutionary History	Discussion 1: Evolution of Multicellularity
Week 3 Feb	7		
6	7 M	Protists and Multicellularity	Ch 3: 36-43 <i>Hwk #1 due</i>
7	9 W	Porifera	Ch 4:77-91
8	11 F	Porifera and Placozoa	Discussion 2: <u>Carnivorous Sponges</u>
Week 4 Feb	14		
9	14 M	Cnidaria Body Plan, Scyphozoa	Ch 6: 99-102, 102-108
	16 W	Diversity Summit- No classes	
10	18 F	Cnidaria Hydrozoa, Anthozoa	Ch 6: 109-114, 117-126
Week 5 Feb 21			
11	21 M	Exam I (Lec 1-10)	

Part II

Week 5	5 Feb 21 C	Continued			
	12 23	3 W	Embryology and Phylogeny	Ch 2: 9-17	
	13 25	5 F	Embryology and Phylogeny	Discussion 3: Proto and deuterostomes	
Week (6 Feb 28				
	14 28	Μ	Comb Jellies (Ph. Ctenophora)	Ch 7: 135-144; Hwk #2 Due 2/7	
	15 Mar 2	2 W	Flatworms, Parasites	Ch 8:147-148; 156-168	
	16 4	F	Free Living Flatworms	Discussion 4: Tree of Life (Cannon 2016)	
Week 7	7 Mar 7				
	17 7 I	М	Flatworms and Phylogeny	Ch 8 149-155	
	18 9	W	Mollusca, Cephalopods	Ch 12:215-218, 255-264	
	19 11	F	Article Discussion 4: Cephalopod	ds Hwk #3 Due Wed, 3/23	
Week 8 March 14-18 Spring Break NO Class					
Week 9 March 21 (Welcome back!)					
/	20 21	I M	Bivalves, Gastropods	Ch 12: 224-250	
	21 23	3 W	Evolution of Eyes	Hwk #3 Due	
-	22 25	5 F	Evolution of Eyes, Exam Review		

Week 10

23 28 M Exam II (Lec 12-22)

Part III

Lec # Da	ite	Topic	Readings
Week 10 co	ont	٠	
24	Mar 30 W	Annelid Body Plan, Diversity	Ch 13 : 295-304; 318-325
25	Apr 1 F	Annelid Oligochetes	Discussion 5: <u>Blood Sucking Creature</u>
Week 11 A	pril 4		
26	4 M	Ecdysozoa and Arthropods	Ch 14:341-348
27	6 W	Arthropod: Crustacea	:373-390
28	8 F	Arthropods: Hexapods	:359-364
Week 12 A	pril 11		
29	11 M	Insect Development	Ch 14:367-371
30	13 W	Evolution of Flight	:364-367
31	15 F	Flight cont	Discussion 6: Evolution of Wings
Week 13 A	pril 18		
32	18 M	Chelicerates	Ch 14 : 351-358
33	20 W	Nematodes	Ch 16: 431-445
34	22 F	Exam III Review	Discussion 7: Programmed Cell death
Week 14 A	pril 25		
35	25 M	Exam III (Lec 25 -35)	
Part IV			
Week 14 co	ont		
36	27 W	Deuterostomes and Echinoderr	ns Ch 20: 497-500
37	29 F	Echinoderm Lecture	Ch 20: 500-509; 509-520
Week 15			
38	May 2 M	Evolution of Development	Ch 24: 567-577
39	- 4 W	Hemichordates	Ch 21: 529-535
40	6 F	Chordate Characters	Ch 23: 539-545

Week 16

41	9 M	Chordate Evolution	Ch 23: 548-560
42	11 W	Chordate Evolution, Wrap Up	

Final Exam (Monday May 16th 12:30-1:20) (Lec 37 -43 + final in-class essay)



Discussion 8: Evolution of the CNS