

SPRING 2019

**BIOLOGY OF INVERTEBRATES
SYLLABUS**

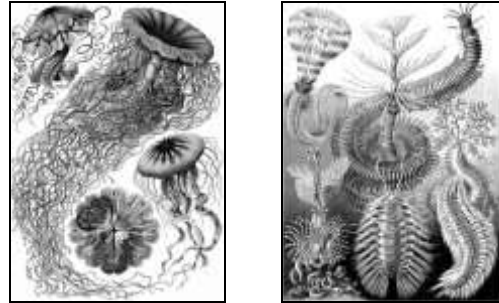
BIOLOGY 241

**Lecture: ISC 136
MWF 10:30-11:20**

**Lab: ISC 105
R 2:30-5:20**

Instructor: Isidro Bosch ISC 260

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Phone: 585-245-5303
Office hrs: M 2:30-3:30 R 10:00-11:30
F 11:30-12:30



Drawings of sea jellies and bristle worms by Ernst Haeckel

Course Description:

This course provides a broad survey of the body plan, physiology, life history, ecology, and evolution of the major animal phyla. Weekly laboratory sessions offer students the opportunity to observe many of the invertebrate organisms studied in lecture. Field surveys of stream invertebrates are scheduled for April.

Books and Supplies:

1. Required Textbook: "Biology of the Invertebrates" by J.A. Pechenik
7th Edition, William C. Brown Publishers, 2015
2. A bound dedicated laboratory notebook (Good drawing pencils are recommended)

Intended Learning Outcomes:

To attain minimum competence in Biology 241 a student must be able to accomplish the following:

- Characterize the evolutionary history of early animal life and 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
- Outline the basic principles and procedures of modern classification and taxonomic methodologies and demonstrate the ability to create, analyze, and interpret evolutionary trees
- Characterize the relationship between form and function and how form and function are influenced by the environment and constrained by evolutionary history
- Describe the patterns of invertebrate development and growth, from gametes to adult, 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 mechanisms that have contributed to these evolutionary changes
- Demonstrate aptitude in interpreting function/phylogeny on the basis of observations of animal form
- Demonstrate progress in effectively observing biological specimens to answer scientific questions
- 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, laboratory exercises, quizzes, species description and a research poster presentation.

Evaluation **:

1. Lecture exams: 3 semester exams, 12%, 16%, and 16% of the final grade and a final exam worth 10%
2. Group Projects (descriptions below)
Poster presentation (10 %), Species Description (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.

Laboratory Syllabus

The Biology 346 laboratory provides an opportunity for students to observe many of the organisms studied in lecture. Students are expected to participate in dissections of fixed or anesthetized animals. Those with legitimate personal conflicts that preclude participation in dissections may be assigned alternative activities. The instructor must be made aware of these conflicts at the beginning to the semester to allow ample time for preparation of alternative activities.

Other activities planned for the laboratory meetings include work on collaborative projects and field trips to observe animals in their natural habitats. Participation in class field trips is expected. Quizzes and exercises will test student knowledge of the organisms studied in the laboratory. Due to the difficulty of setting up laboratories, no make-up labs can be scheduled.

Students are expected to keep a neat, organized, and informative laboratory notebook containing a record of significant concepts and observations. The notebook should include primarily *original* drawings and observations (not copied from books). Original diagrams and notes in the lab notebook can be used as a reference during laboratory quizzes. This is a privilege that may be revoked if students are found to be copying information directly from other sources into their lab notebook. A pre-lab summary of the planned activities should be completed in the lab notebook prior to each lab meeting.

	<u>Date</u>	<u>Topic</u>	<u>Assigned Reading</u>
	Jan. 24	Orientation/Observation	
	31	Phylogenetic Analysis	(Lab Guide #1)
	Feb 7	Protista and Sponges	(Guide #2)
	14	Cnidaria	(Guide #3)
<i>Tentative Laboratory Schedule</i>	21	Embryology	(Guide #4)
	28	Parasitism (Quiz #1: Embryology)	(Guide #5)
	Mar 7	Molluscs I (Quiz #2: Parasitism)	(Guide #6)
	14	Molluscs II (Quiz #3: Molluscs)	
	21	Spring Recess	
	28	Annelid Diversity (Quiz #4: Annelids)	(Guide #7)
	Apr 4	Arthropods I: Crustacea (Quiz #5 Crust)	(Guide #8)
	11	II: Insects (Quiz #6 Insects)	(Guide #9)
	18	Stream Invertebrates Field Trip	
	25	Stream Invertebrates Project	
	May 2	Poster Session	

Group Projects

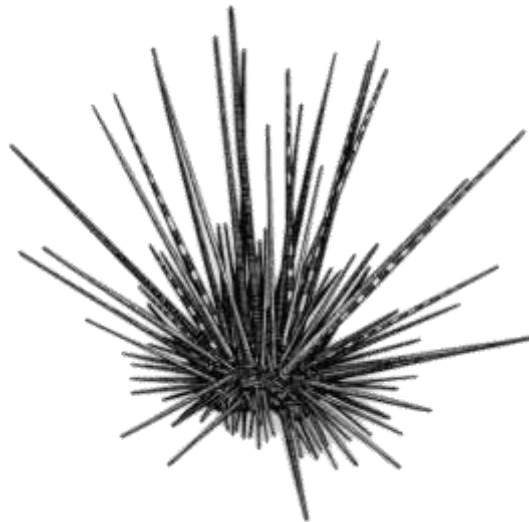
Students must complete two major projects to pass this course. Each project will cultivate particular process skills needed in the study of biology while emphasizing different aspects of animal diversity. All projects will be collaborations. Project groups and topics must be pre-approved by the instructor. Below is a brief initial description of each project. More details are to be provided during the semester.

Project #1: Poster Presentation (10% of total Score, due Thursday May 2)

For this assignment students will explore a question in the areas of phylogeny (taxonomic classification, relationships between different groups), evolution or comparative function and form of invertebrates. The information presented in the poster should be from the peer-reviewed technical scientific literature (journal articles) and must include at least 5 such sources. Internet sources are acceptable only as supplements to the primary literature. The tentative date for the poster presentation is during the lab meeting on April 24. That same day you must **turn in** a 2 page written summary of your presentation, a bibliography, and copies of two key references used. Your grade in this assignment will be determined by the organization, content and effort dedicated to the project. More specific guidelines will be provided later in the semester. Peer-reviews will be incorporated into the final evaluation.

Project #2: Description of Stream Invertebrate Species (5 % of score due Mon May 6)

For this project you will collect and identify (using taxonomic keys) an invertebrate species from local habitats and 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 accuracy of the description and accuracy in the identification of a 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 participate in the identification.



Caribbean long-spined sea urchin.
Phylum Echinodermata
Diadema antillarum

Tentative Lecture Schedule

#	Date	Topic	Readings
			<i>^names in italics are references to articles posted on Canvas</i>
1	Jan 23 W	Course Introduction and Planning	
2	25 F	Animal Diversity	Preface, Ch 1
3	28 M	Protists	Ch 3: 37-42, 58-61
4	30	Classification and Phylogeny	Ch 2: 16-29; Hwk #1 Due 2/4
5-6	Feb 1-4	Evolutionary History of the Metazoa	<i>READ TBD</i>
7	6	Porifera and Placozoa	Ch 4:79-91 Hwk #2 2/6
8	8	Cnidaria: Body Plan; Scyphozoa	Ch 6: 101-110
9-10	M- 11, 13	Hydrozoans/Anthozoans	110-117, 118-127
11	15	Coral Reef Ecology	<i>Muscatine</i>
12	18 M	Exam I (Lec 1-11)	
13	20	Embryogeny and Phylogeny	Ch 2: 7-16
14	22	Ctenophores	Ch 7
15-16	M 25, 27	Flatworms / Challenges of Parasitism	Ch 8:149-156; 157-170
17	Mar 1	Nemertines and Body Cavities	Ch 11
18	4 M	Animal Body Plan Evolution	<i>Nielsen</i>
19	6	Mollusca Body Plan	Ch 12: 215-222
20-21	8-11 M	Molluscan Radiation	224-238; 239-264
22	13	Exam II (Lec 13-21)	
23	15	Light Detection and Vision	<i>Oakley (Hwk #3 Due 3/25)</i>
	18-22	<i>Spring Recess</i>	
24	25 M	Light Detection and Vision	
25-26	27-29	Annelid Body Plan, Diversity	Ch 13 : 295-312; 318-325
27	April 1 M	Arthropods: Introduction	Ch 14: 342-350
28	3	Arthropod: Crustacea	: 374-392
29-30	5 – 8 M	Arthropod: Mandibulates	: 358-373
31-32	10-12	Insects and flight	<i>Averof and Cohen; Hwk #4 Due 4/12</i>
33	15 M	Arthropod Chelicerates	: 352-357
34	17	Nematodes	Ch 16
35	19	Echinoderms Intro	
36	M-22	Exam III (Lec 23 -34)	
37	24	Echinoderms (contd)	Ch 20: 497-509; 509-520
38	26-M 29	Development	Ch 24: 567-580
39-40	May 1-3	Hemichordates and Chordates	Ch 21, 23
41	May 6	Overview/Review for final exam	
42	May 14	Final Exam (Tuesday 8:00-10:30)	



Arrow Worm,
Phylum Chaetognatha