

IB 103/103L – INVERTEBRATE ZOOLOGY
LECTURE SCHEDULE AND SYLLABUS
SPRING 2008

LECTURE: Tuesdays & Thursdays, 9:30 a.m.-11:00 a.m., 130 Wheeler

WEBSITE: bspace.berkeley.edu

FACULTY INSTRUCTORS:

Prof. Sheila Patek
5054 VLSB, 3-9159
patek@berkeley.edu
Office Hours:
Th 11 a.m.-12 p.m.
Th 1-2 p.m.
5054 VLSB

Prof. David Lindberg
5110 VLSB, 2-3926
drl@berkeley.edu
Office Hours:
Fri 9 a.m. - 12 p.m.
5110 VLSB

GRADUATE STUDENT INSTRUCTORS:

Joey Pakes
pakes@berkeley.edu
Lab Section 1:
M,W 1-4 p.m. 3019 VLSB
Office Hours:
M,W 4-5 p.m. 3019 VLSB

Erin Meyer
emeyer@berkeley.edu
Lab Section 2:
Tu,Th 1-4 p.m. 3019 VLSB
Office Hours:
Tu, Th 4-5 p.m. 3019 VLSB

DATE	DAY	TOPIC	Lecturer	READING
Jan. 22	Tues	Assembling the Tree of Life: Metazoa minus the vertebrates	Patek	Ch. 1,3
24	Thurs	Phylogeny & history of life on Earth	Lindberg	Ch. 2,24
29	Tues	Porifera & others	Lindberg	Porifera: Ch. 6,7
31	Thurs	Constructional units, coevolution, and convergence	Patek	Cnidaria & Ctenophora: Ch. 8,9
Feb. 5	Tues	Metazoa & Acoelomorpha	Lindberg	PrimLit
7	Thurs	Ecdysozoa, Lophotrochozoa & Deuterostomia	Lindberg	PrimLit
12	Thurs	Body walls and migrating cells: when do layers matter?	Patek	Platyhelminthes: Ch. 10
14	Tues	Worrisome worms: what flexible life cycles can do for you and do to you	Patek	Platyhelminthes & Nemertea: Ch. 10,11
19	Tues	Segments, coeloms and skeletons: where annelids fit in	Patek	Annelida: Ch. 13
21	Thurs	Worms, more worms: from the deep to under your feet	Patek	Annelida & Lophotrochozoa: Ch. 13,14
26	Tues	Exam #1 (including lectures from 1/22- 2/21)		
28	Thurs	Arthropoda & Ecdysozoa revisited	Lindberg	PrimLit
Mar. 4	Tues	The power of the Bauplan concept	Patek	Arthropoda, Onychophora and others: Ch. 15,18
6	Thurs	Opposable thumbs: the key innovation concept	Patek	Crustacea: Ch. 16
11	Tues	Dead arthropods: Burgess Shale fauna	Lindberg	PrimLit
13	Thurs	I want to be a biologist	Patek	Crustacea: Ch. 16
18	Tues	Good stories: adaptations and adaptive story telling	Patek	Hexapoda: Ch. 17
20	Thurs	Arthropod evolution and phylogeny: putting it together	Patek	Cheliceriformes: Ch. 19
24-28		Spring Break		

Apr. 1	Tues	When Bauplans go awry	Patek	Blastocoelomates and others: Ch. 12
3	Thurs	Lophotrochozoa	Lindberg	PrimLit
8	Tues	Exam #2 (including lectures from 2/28-4/3)		
10	Thurs	FIELD TRIP TO LOCAL MUDFLAT; Mollusca I LECTURE DURING LAB PERIODS	Lindberg	Mollusca: Ch. 20
15	Tues	Mollusca II	Lindberg	Mollusca: Ch. 20
17	Thurs	Mollusca III	Lindberg	Mollusca: Ch. 20
22	Tues	Colonies, coordination and conflict: putting the lopho in the Lophotrochozoa	Patek	Lophophorates: Ch. 21
24	Thurs	Metazoan developmental patterns	Lindberg	Ch. 4
29	Tues	Deuterostomia	Lindberg	PrimLit
May 1	Thurs	Starry synapomorphies and puzzling plesiomorphies: the well-defined and poorly allied echinoderms	Patek	Echinodermata: Ch. 22
6	Tues	Hemi- and calci-chordates	Lindberg	Hemi- & Calci-Chordata: Ch. 23
8	Thurs	Chordata	Lindberg	Chordata: Ch. 23
19	Mon	FINAL EXAM (includes all material) 8-11 am		

Course goals: Our primary goal is to provide a fundamental understanding about the evolution and diversity of invertebrates, with a special emphasis on marine invertebrates. Through lectures and laboratories, the basic biology and evolutionary history of the major invertebrate phyla will be explored. We will draw on approaches ranging from morphology and ecology to behavior and phylogeny to understand diversity of invertebrate forms.

Textbook: R. C. Brusca and G. J. Brusca. 2003. *Invertebrates*, 2nd Edition, Sinauer Press. The assigned readings for each lecture are noted on the syllabus. The textbook functions most effectively as a reference rich with details about invertebrate biology. You may also find Ruppert et al.'s *Invertebrate Zoology* useful (on reserve in the Biosciences library), in addition to the many other invertebrate textbooks housed in the Biosciences library.

Exams and grading: The grade for the lecture portion of IB 103 is based on two midterms and one final exam. The exam dates are noted on the course syllabus. Each exam will consist of two sections: (1) short answers, definitions, labeling, and fill-ins; (2) 3-4 short-essay questions. We will distribute a list of 9-10 questions approximately one week before each exam and then choose 3-4 of these questions to be used on the actual exam. ***The exams will draw on information from the lectures, readings, laboratory exercises, and field trips.*** The first and second midterms are worth 30% and the final exam is worth 40% of the total grade.

Acknowledgements: Many thanks to Rick Grosberg, Seth Tyler and Terri Williams for their inspiring invertebrate courses which have influenced the design and development of this course and laboratory.

**IB 103/103L – INVERTEBRATE ZOOLOGY
LABORATORY AND FIELD TRIP SCHEDULE
SPRING 2008**

LABORATORIES:

SECTION 1: Mondays & Wednesdays, 1-4 p.m., 3019 VLSB

SECTION 2: Tuesdays & Thursdays, 1-4 p.m., 3019 VLSB

WEBSITE: ospace.berkeley.edu

FACULTY INSTRUCTORS:

Prof. Sheila Patek
5054 VLSB, 3-9159
patek@berkeley.edu
Office Hours:
Th 11 a.m.-12 p.m.
Th 1-2 p.m.
5054 VLSB

Prof. David Lindberg
5110 VLSB, 2-3926
drl@berkeley.edu
Office Hours:
Fri 9 a.m. - 12 p.m.
5110 VLSB

GRADUATE STUDENT INSTRUCTORS:

Joey Pakes
pakes@berkeley.edu
Lab Section 1:
M,W 1-4 p.m. 3019 VLSB
Office Hours:
M,W 4-5 p.m. 3019 VLSB

Erin Meyer
emeyer@berkeley.edu
Lab Section 2:
Tu,Th 1-4 p.m. 3019 VLSB
Office Hours:
Tu, Th 4-5 p.m. 3019 VLSB

This laboratory will focus on living invertebrates from local environments. In some lab periods, the class will make short journeys to study and collect organisms in their natural habitats. Upon return to the lab, these organisms will be observed and sometimes dissected in order to examine the internal anatomy. In addition, there will be lab classes focused on specialization projects, research discussions, and Linnean Society meetings (described below).

Grading: The laboratory grade will be based on four components:

- Active learning during laboratory and field excursions (10%).
- Quality of notebook (30%).
- Extinction symposium presentation (10%).
- Paper discussion leadership, Linnean Society meeting participation/preparation (10%).
- Specialization project – proposal, peer review, research, short paper, and presentation (40%).

Supplies: There are several essential supplies necessary for the laboratory exercises and field trips.

- 1) Notebook – this can be bound or loose-leaf, lined or un-lined. This will be your closest companion during all of the laboratories.
- 2) Clothes for exploring the intertidal. Old tennis shoes are the minimum. If you like staying dry, hip waders or tall rubber boots would be great.
- 3) Raincoat and warm clothes. It may be cold and rainy during our field trips.

The Notebook: The primary goal of the laboratory is to give you hands-on experience observing living invertebrates. The notebook will be a log of your field expeditions, observations of natural habitats and location/identification of species, and, most importantly, a collection of drawings, notes and questions about these fascinating organisms.

You need not be an artist to have a top-notch notebook. Simple sketches and diagrams are often more effective than artistically rendered illustrations. Draw, examine, label, make notes, and ask questions. This notebook will be your most valuable product of the course.

Notebook suggestions:

- Draw what you see – do not simply copy what is in the textbook. Use the texts and references in the classroom to help you identify the structures and *accurately* report your personal observations of the organisms.
- Record carefully and in detail. Note the key features of the organisms, observe their behavior, question the function of peculiar structures, and ask about similarities and differences with other related organisms.
- Draw BIG, simple pictures. It is much easier to add labels and write notes when the drawings are large. And, it is easier to draw a series of simple pictures of different parts of an organism than it is to draw the whole thing in one image.
- Use the microscope! Some features are macroscopically visible, but many others will be visible with the microscope. Remember to record the magnification used and draw scalebars.
- Talk to your neighbors about what you're seeing. Usually each individual finds a different part of the organism interesting – you will probably find yourself saying, "I didn't notice that!"

The notebooks will be collected regularly and graded. Grading will be based on the overall quality of the notebooks, specifically the care and thoroughness of the drawings and labels, the thought evident in the questions and notes, and the overall accuracy and thoroughness of the lab or field expedition descriptions.

Field trips: When possible, field trips are scheduled within your lab time slot. We will carpool to local sites (30-45 minutes). If you are a passenger in a carpool you are encourage to help (\$) fellow students who drive with gas and bridge tolls. Appropriate clothing, release forms, carpooling arrangements, etc. will be discussed in lecture and in your lab sections.

WE WILL LEAVE PROMPTLY FOR ALL FIELD TRIPS. LATE STUDENTS WILL BE LEFT BEHIND AND WILL RECEIVE NO CREDIT FOR THE LAB. WE WILL GO IN ALL WEATHER CONDITIONS – RAIN OR SHINE.

Discussion sessions (DS): Discussion sessions will focus on special topics in invertebrate biology. Generally several primary literature papers or a review paper will be assigned in preparation for the lab activity. Come prepared to discuss these papers - what you liked *and* what you didn't like about them, questions that came to mind, comments, etc. Typically these discussion sessions will also include a lab activity, campus field trip, or guest speaker.

Specialization projects: One major focus of the laboratory is the opportunity to choose an invertebrate species for more in-depth study. Most students find a few species that especially capture their interest – this is your opportunity to learn more about a particularly interesting creature and to become a “specialist” in one particular taxonomic group and ecological role.

The specialization project is an independent research project which can be conducted during several laboratory sessions. This year, we will focus on the fouling community and choose organisms and questions that can be addressed in this ecological group. To help guide your research and focus your questions, we will provide a list of taxa and suggested questions. The first step is to visit this fouling community (our first field trip). Then, several weeks later, you will write a brief proposal and give a “chalk talk” about your plan to the lab. Following these three minute informal talks (only using a piece of chalk, or, a whiteboard marker...), the class will perform a peer-review on the proposals. This lab period will be a valuable opportunity to evaluate the strengths and weaknesses of your proposed project given the insights of your lab colleagues.

With this feedback in hand, and your revised proposal, you will then have a second opportunity to visit your fouling community field site followed by a lab in which you collect preliminary data for your study. Finally, in the last weeks of the course, you will go back to this community one last time, and devote three lab periods to collecting and analyzing your data.

The culmination of the research project will be a short presentation to the lab and an accompanying double-spaced, 5-page paper. The presentations will follow a conference-style format. The paper will consist of a brief introduction to the organism (including its phylogenetic and taxonomic positions), the methods used during the study, results (including at least one figure or table), and discussion.

Linnean Society meetings: During a laboratory session prior to each exam, we will hold Linnean Society meetings. At the start of the laboratory, you will form small teams and will be assigned a particular taxonomic group for your area of expertise. Your job is to become collective experts on this group such that you can answer specific questions about the organisms. Once the teams are prepared, a moderator will address specific questions about these organisms, based on information from the laboratories, textbook and lectures. Each team answers the questions and compares the response to the other teams. These group meetings are particularly effective for identifying important information about the organisms and to review for the upcoming exam.

DATE	LABORATORY TOPIC/ACTIVITY	DEADLINES and NOTES
M, Tu Jan. 21, 22	Holiday (Mon.), No lab (Tues.)	
W, Th 23,24	Introduction; Building phylogenies and understanding keys	
M, Tu 28,29	Field trip: Fouling community	
W, Th 30,31	Fouling community organisms	
M, Tu Feb. 4,5	Discussion session: Extinctions! – UCMF tour; Design your own extinction	
W, Th 6,7	Extinction Symposium	
M, Tu 11,12	Focus on morphology: Cnidaria, Ctenophora, Porifera	Specialization project proposal due uploaded at bSpace by noon on February 11
W, Th 13,14	Specialization project proposal presentations and peer review	Download your panel's proposals from bSpace before lab period
M, Tu 18,19	Focus on morphology: Platyhelminthes, Nemertea, Annelida	
W, Th 20,21	Linnean Meeting	
M, Tu 25,26	Discussion session: Invertebrate conservation and management, Essig tour	Exam #1 on Feb. 26 (including lectures and labs from 1/22- 2/21)
W, Th 27,28	Field trip: Fouling community	
M, Tu Mar. 3,4	Fouling community organisms: Specialization project preliminary data collection and setup during lab	
W, Th 5,6	Introduction to invertebrate paleontology	
M, Tu 10,11	Focus on morphology: Arthropoda, Onychophora	
W, Th 12,13	Discussion session: Revolutions in invertebrate biology – Invertebrate Genomics	
M, Tu 17,18	Field trip: Marina Green	
W, Th 19,20	Marina Green organisms	
	Spring Break	

M, Tu	31, Apr. 1	Discussion session: Invertebrates and human health	
W, Th	2,3	Linnean meeting	
M, Tu	7,8	Discussion session: Build an invasive species	Exam #2 on Apr. 8 (including lectures and labs from 2/28-4/3)
W, Th	9,10	Mollusca I lecture (field trip during lecture period on April 10)	
M, Tu	14,15	Mudflat organisms	
W, Th	16,17	Focus on morphology: Mollusca, Echinodermata, Lophophorates	
M, Tu	21,22	Field trip: Fouling community	
W, Th	23,24	Specialization project	Required outline/optional draft of specialization project paper due to your GSI by 9:30 am on Monday, April 28
M, Tu	28,29	Specialization project	
W, Th	30, May 1	Specialization project	
M, Tu	5,6	Specialization project presentations	
W, Th	7,8	Linnean Meeting	Specialization project paper due to your GSI by 5 pm on Thurs., May 11
Mon	19	FINAL EXAM (includes all lab and lecture material)	