

Upper division course
Taught twice at the University of California, Berkeley

IB 103LF: Invertebrate Zoology

Fall 2019

Course Instructor

Camilla Souto, PhD – csouto@berkeley.edu

Lectures and Discussion: 3h/week and 6h/week, respectively

COURSE DESCRIPTION AND GOALS

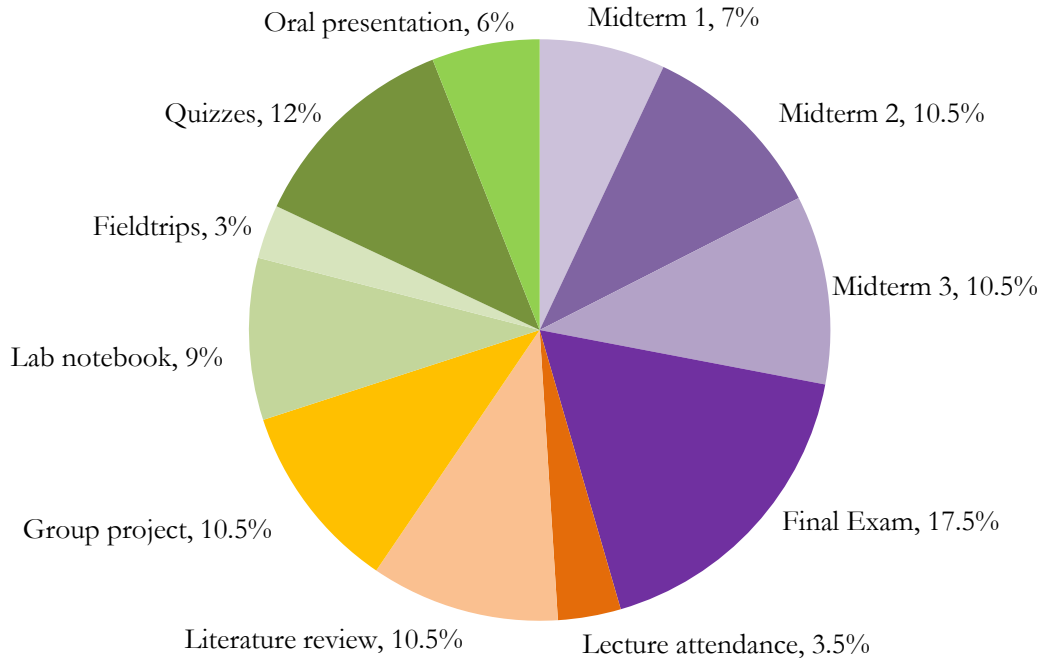
Invertebrate zoology includes the biology of all animal organisms that do not have vertebrae, which means more than 95% of all described species of animals. This 5-credit course includes 3h of lecture and 6h of laboratory per week. Lectures will focus on (1) evolutionary relationships among major taxa, (2) adaptations, biology and natural history of invertebrate phyla, (3) marine invertebrate communities and (4) anthropogenic impacts. Laboratories will be a hands-on opportunity for you to learn about the structure and function of the major invertebrate body plans; and field trips will bring all information together, with living examples.

My primary objective in this course is to present the invertebrate diversity that has evolved on Earth (at least of the ones we are aware of); not in depth, but with an overview and selected highlights. By the end of the course you should be able to (1) identify major invertebrate phyla and the morphological characters that define them; (2) apply basic concepts of zoological classification and interpret phylogenetic trees; (3) discuss current hypotheses for the origin and evolution of major invertebrate groups; (4) explain the main aspects of the natural history of the invertebrate phyla; (5) discuss the impacts that humans are imposing on the environment and conservation strategies. Along with introducing you to the diversity and evolution of animal body plans, my goal is also (6) to develop your written and oral communication skills. I also hope you will teach and learn from one another, especially when studying course materials and completing laboratory exercises.

Upper division course
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ASSIGNMENTS AND GRADING

The final grade will be scaled according to course units: 70% for lecture and 30% for laboratory assignments.



Lecture assignments

Written exams: three midterms and one cumulative final exam. The exam dates are noted on the course syllabus. Each exam will consist of two sections: multiple-choice, labeling and matching questions; and short answers and comprehensive essay questions.

Literature review paper: each student will choose a topic for further study. We will provide a list with suggestions, but you are encouraged to search for topics you are interested in. This paper should be 4–5 pages long (not including references; 12-point font size, line spacing 2.0, margins 1", pdf format, your name on the file name). You should cite **at least** 10 references and **at least** 80% of these should be from peer-reviewed journals. This paper should not just be a review of what has been published, but it should also include your opinion about the issues that have been raised as well as questions that you think could be asked/answered in the shortcoming future. I am here to help; come to my office hours or schedule an individual meeting if needed.

Group project: you will work with some peers to accomplish various goals throughout the semester. Group projects include updating the class on invertebrate news, prepare a new field guide of marine invertebrates in the Bay and preparing an entomological collection to be used by future classes.

Upper division course
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Lab assignments

Lab Notebook: includes lab activities and an aquarium log. The primary goal of the lab sections is to give you hands-on experience observing invertebrates. The lab notebook will consist of detailed, labeled drawings of all organisms and notes on behavior of live organisms made during each lab period. You may have photos in addition to, but not in place of, the drawings. It will also be a log of your fieldtrips and aquarium observations. Lab notebooks will be collected regularly and graded. Grading will be based on the overall quality of the notebook, specifically the care and thoroughness of the drawings and labels, the thought evident in the notes, and the overall accuracy and thoroughness of the lab, fieldtrips and aquarium descriptions. More details will be provided in the first lab section.

You do not need to be an artist to have top-notch notebook. Simple sketches and diagrams are more efficient than artistically rendered illustrations. This notebook will be your most valuable product of the course. Draw what you see, record carefully and in detail, draw big and simple pictures, use the microscope to see details (remember to record the magnification), and talk to your neighbors about what you are seeing. Usually each individual finds a different part of the organism interesting!

The aquarium log will be based on your observation of behavior and interactions among organisms, and also notes on aquarium maintenance (for example, measurements of salinity, pH and temperature, and animal care). We expect you to respect the animals and taking care of them will be your responsibility.

Field trips: there will be four mandatory field trips, three field trips during your regular lab section and a full-day Sunday field trip on **10.Nov.2018**. These field trips are integral parts of the class and attendance is expected. On weeks with fieldtrips you will be notified in advance of appropriate gear to bring. Make sure you dress appropriately! We will carpool to local sites. Fieldtrips will be held in all weather conditions.

Quizzes (Lab practicum): four 20–30 min practical exams with organisms that you have seen in lab. There will be a combination of labeling, matching, fill in the blanks and multiple-choice questions.

Oral presentation: oral presentations will be held during the lab section. The presentation should be done in 12–15 minutes and may use any technology source available in the classroom (e.g. chalkboard, multimedia projector, audio system). You must come to one of my office hours on the week prior to your presentation to show me what you have prepared. Guidance will be provided during the lab section.

COURSE POLICIES

Attendance: this class is very hands-on and your attendance is required. More than two absences to lab sections will be considered as failure unless you present a valid medical reason. I promise to do my very best to help you learn the material in this course. I expect you to come to class punctually, rested, prepared, eager to learn, and to pay attention in class. For the best outcome, this requires us both to stay focused on learning. Please be punctual.

Use of electronic devices: you may bring your laptop computer, but please be respectful to other students by using it only for taking notes or investigating material directly related to the lecture. Fellow students will be distracted if they see you texting, shopping on Amazon, playing games, engaging in social

Upper division course

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media or email, or working on a different class. While you may think *you* can multitask, scientific studies have shown that students engaging in this behavior have reduced comprehension and receive lower scores on tests. Also, you are not only penalizing yourself, but your peers who are in direct view of your behavior also score lower on tests (Sana, F., T. Weston, and N.J. Cepeda. 2013. Laptop multitasking hinders classroom learning for both users and nearby peers. *Computers and Education* 62:24–31).

Grades will be determined by the percentage of the total points received in the course; there are 300 points: A = $\geq 90\%$; B = 80%–89%; C = 70%–79%; D = 60%–69%; F = $< 60\%$. Notice that grading is NOT based on a “curve”, so your grade will be a result of your own merit and you are NOT competing with other students.

Office hours: I encourage you to make use of our office hours. The amount of information introduced in this course makes it easy to get behind. If you even begin to feel overwhelmed, do not hesitate to get help.

Re-grade policy: please feel comfortable to consult me if you believe the grading of your assignments was not fair. You will have **48h** after receiving the exam to request a regrade. Be ready to explain your reasoning.

Make-up exams and late assignments: make-up midterms are given at the discretion of the instructor and will be given only under the following conditions — (1) exceptional circumstances prevent your attendance, for example a sudden hospitalization (subject to verification) or (2) you have contacted me at least one week before the exam is scheduled to begin with a reasonable justification. Make-up examinations may consist of a different format such as an oral examination with me or a few essay questions, and it will be scheduled as soon as possible after the original examination date. The literature review paper should be sent by the deadline. For each late day, 25% will be deducted from your final grade on the paper.

Dissection: dissection is an integral part of this class. We will dissect different invertebrate groups such as clams, worms and crabs. Any concerns should be brought to my attention as soon as possible.

Accommodations: contact me as soon as possible if you need disability-related accommodations in this class or if you are a student athlete and expect to miss any lectures, labs or fieldtrips. If you are a DSP student, give me a Letter of Accommodation from the Disabled Students’ Program office at the beginning of the semester.

Inclusion statement: I embrace human diversity and will not tolerate any kind of prejudice. Please be mindful, respect your peers and help me create a safe learning environment for all.

Academic integrity: academic dishonesty and plagiarism will not be tolerated. Please be honest and produce original work. The internet is a great source of information; however, you will learn nothing by copying and pasting such information on your assignments. You will find that paraphrasing helps you verify your understanding. Please review UC Berkeley’s academic integrity policies at: <http://sa.berkeley.edu/conduct/integrity>.

Upper division course
Taught twice at the University of California, Berkeley

SUPPORTING LITERATURE

Brusca, R.C. & Moore, W. & Shuster, S.M. 2016. **Invertebrates**. 3rd ed. Sunderland, MA: Sinauer Associations.

Maddison, D.R. & Schulz, K-S. 2007. **The tree of life web project**. <http://tolweb.org>.

Pechenik, J.A. 2014. **Biology of the Invertebrates**. 7th ed. McGraw-Hill Higher Education. There is a copy of the textbook on reserve at the Biosciences library (in VLSB).

Ruppert, E.E.; Fox, R.S. & Barnes, R.B. 2004. **Invertebrate Zoology, a functional evolutionary approach**. 7th ed. Belmont, CA: Brooks Cole Thomson.

Primary literature will be posted on bCourses.

TIPS FOR SUCCESS

1. Download the Powerpoint presentation before the lecture and use it to take notes.
2. Go over your notes for clarity soon after the lecture. Ask yourself what point was being made in each part of the lecture. Were there examples to illustrate the point?
3. Be proactive during the lab, engage with the material available and ask the instructor for help as soon as you realize you have a problem with something.
4. Find out what you had wrong on each exam, and why it was wrong. Learn the right answer.
5. Get the memorization out of the way early. Learn the name of the taxa (phyla and class) and relatedness of the organisms discussed in class. Then concentrate on **understanding** the rest of the course material, not just memorizing it.
6. Keep up with the course. Lectures cover a lot of material and once you are behind it will be difficult to recover.
7. Do not wait until the end of the course to start your group project and literature review.

Upper division course

Taught twice at the University of California, Berkeley

WEEK	COURSE SCHEDULE AND CONTENT		
1	Wed, Aug 28 th	What is Invertebrate Zoology about?	
	Fri, Aug 30 th	Protists and the origin and development of the Metazoans	
2	Mon, Sept 2 nd	HOLIDAY	ChsB 1, 5 (187-194, 201-206)
	Wed, Sept 4 th	Protists and the origin and development of the Metazoans	
	Fri, Sept 6 th	Body functioning and the bauplan concept	ChsB 4, 5 (183-187, 197-201)
3	Mon, Sept 9 th	Taxonomy, classification and the Tree of Life	ChsB 2, 28
	Wed, Sept 11 th		
	Fri, Sept 13 th	Porifera and Placozoa	ChB 6
		MIDTERM 1 (2 PM in VLSB 3003; 50 minutes; up to Sept 11th)	
4	Mon, Sept 16 th	Ctenophora and Cnidaria	ChsB 7, 8
	Wed, Sept 18 th	Bilateria/Triploblasts: Xenacoelomorpha, Protostomes (Chaetognatha, Spiralia and Ecdysozoa) and Deuterostomes	ChsB 5 (195-196, 206-209), 9, 11 (420-428)
	Fri, Sept 20 th	Spiralia I: Chaetognatha and Platyhelminthes	ChsB 10, 11 (420-428)
5	Mon, Sept 23 rd	NO CLASS (homework: literature review paper topic)	
	Wed, Sept 25 th	Spiralia II: Some enigmatic spiralian	ChsB 11 (414-420; 428-432), 15
	Fri, Sept 27 th	Spiralia III: Nemertea and Annelida	ChsB 12, 14
6	Mon, Sept 30 th	Spiralia III: Nemertea and Annelida	ChsB 12, 14
	Wed, Oct 2 nd	Spiralia IV: Mollusca	ChB 13
	Fri, Oct 4 th	Spiralia IV: Mollusca	ChB 13
7	Mon, Oct 7 th	Spiralia V: Gnathifera and Lophophorata	ChsB 16, 17
	Wed, Oct 9 th	Recap and beyond: Spiralia Comparative Zoology	
	Fri, Oct 11 th	MIDTERM 2 (50 minutes; Sept 13th–Oct 9th)	
8	Mon, Oct 14 th	Ecdysozoa I: Nematoida and Scalidophora; DECIDE PAPER TOPIC	ChsB 18, 19
	Wed, Oct 16 th	Ecdysozoa II: Panarthropoda – Tardigrada, Onychophora and Arthropoda	ChB 20
	Fri, Oct 18 th	Arthropoda – Myriapoda and Chelicerata	ChB 23, 24
9	Mon, Oct 21 th	Arthropoda – Trilobita and Crustacea	ChB 21
	Wed, Oct 23 rd	Arthropoda – Crustacea	ChB 21, 22
	Fri, Oct 25 th	Arthropoda – Hexapoda	ChB 22

Upper division course

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WEEK	COURSE SCHEDULE AND CONTENT		
10	Mon, Oct 28 th	Arthropoda – Hexapoda	ChB 22
	Wed, Oct 30 th	Recap and beyond: Ecdysozoa Comparative Zoology	
	Fri, Nov 1 st	trIZia	
11	Mon, Nov 4 th	MIDTERM 3 (50 minutes; Oct 14th–Oct 30th)	
	Wed, Nov 6 th	Deuterostomia I: The Echinoderms	ChB 25
	Fri, Nov 8 th	Intertidal community ecology	bcourses
	Sun, Nov 10 th	Fieldtrip to the Fitzgerald Marine Reserve and Montara Beach (LT: 0.4, 3:24 PM), from 10:30 AM – 6 PM	
12	Mon, Nov 11 th	HOLIDAY	
	Wed, Nov 13 th	Deuterostomia II: Hemichordata and Chordata	ChsB 26, 27
	Fri, Nov 15 th	Deuterostomia: Body function	ChsB 25–27
13	Mon, Nov 18 th	Recap and beyond: Metazoa Comparative Zoology	
	Wed, Nov 20 th	Open ocean and larval ecology	bcourses
	Fri, Nov 22 nd	Coral reefs; RESEARCH PAPER DUE	bcourses
14	Mon, Nov 25 th	Metazoan phylogeny: what are the big questions?	
	Wed, Nov 27 th	NO CLASS	
	Fri, Nov 29 th	HOLIDAY	
15	Mon, Dec 2 nd	Climate change and marine pollution	bcourses
	Wed, Dec 4 th	Overfishing of marine invertebrates	bcourses
	Fri, Dec 6 th	trIZia	
	Dec 9–13 th	RRR WEEK	
	Fri, Dec 20 th	FINAL EXAM	
Dec 20th (Fri) 11:30–2:30 pm FINAL EXAM			

* Dates and topics are tentative!

* ChB refer to book chapters in Brusca et al. (2016). If you are using an older edition of the book, make sure you check the corresponding chapters and note that it may be outdated.

Upper division course
 Taught twice at the University of California, Berkeley

LABORATORY SCHEDULE AND CONTENT

Week		LAB themes and activities
1	W/Th (28-29 Aug)	Lab intro, group projects, research topic and animal diversity
2	M/T (2-3 Sept)	NO LAB
	W/Th (4-5 Sept)	Protists; Metazoan bauplan and development
3	M/T (9-10 Sept)	Aquarium tour & set up, making and using identification keys
	W/Th (11-12 Sept)	Phylogeny and Tree-Thinking
4	M/T (16-17 Sept)	Porifera
	W/Th (18-19 Sept)	Field trip: Berkeley Marina (LT: 3.2, 1:24 PM & 2.9, 2:36 PM)
5	M/T (23-24 Sept)	Ctenophora and Cnidaria
	W/Th (25-26 Sept)	Quiz 1; Platyhelminthes and enigmatic spiralian; mud organisms
6	M/T (30Sept-1Oct)	Nemertea and Annelida
	W/Th (2-3 Oct)	Mollusca
7	M/T (7-8 Oct)	Field trip: SF Marina Green (LT: 1.9, 4:10 PM & 1.7, 4:49 PM)
	W/Th (9-10 Oct)	Mollusca, Lophophorata and Gnathifera; trIZia
8	M/T (14-15 Oct)	Quiz 2; Nematoda, Tardigrada, Onychophora
	W/Th (16-17 Oct)	Field trip: Tilden Park (terrestrial and freshwater ecosystems)
9	M/T (21-22 Oct)	Myriapoda, Chelicerata and Trilobita
	W/Th (23-24 Oct)	Crustacea
10	M/T (28-29 Oct)	Hexapoda
	W/Th (30-31 Oct)	Arthropoda
11	M/T (4-5 Nov)	Quiz 3; Essig Museum Tour; Comparative Zoology I
	W/Th (6-7 Nov)	Echinodermata
12	M/T (11-12 Nov)	NO LAB
	W/Th (13-14 Nov)	Echinodermata, Hemichordata and Chordata
13	M/T (18-19 Nov)	Comparative Zoology II; species identification; tips for writing
	W/Th (20-21 Nov)	Sea Urchin, zooplankton; tips for oral presentations
14	M/T (25-26 Nov)	Quiz 4; Student presentations
	W/Th (27-28 Nov)	NO LAB
15	M/T (2-3 Dec)	Student presentations; UCMP Tour
	W/Th (4-5 Dec)	Student presentations; Q&A

* Dates and topics are tentative!