BIOE 136: Environmental Physiology
Summer 2022| Coastal Biology Building 110| Dr. Kelley Voss

Instructor	OFFICE	STUDENT HOURS	EMAIL
Dr. Kelley Voss	CBB 170/Courtyard	Tuesdays 1:00-2:00 PM, or Zoom – weekdays between 9:00 and 5:00, by appointment	kmvoss@ucsc.edu

Course Description

This course will explore how an organism's physiology interacts with its environment, including molecular to whole organism level processes. How do animals thrive in the most diverse regions of Earth? What is the difference between physiological plasticity and adaptation, and what does an animal's capacity for adaptation mean for its ability to survive or thrive in a rapidly changing climate? Using a variety of case studies, we will explore the amazing physiological tricks and strategies that organisms have evolved to live in the diverse environments of our planet.

PREREQUISITES:

BIO 20A, BIOE 20B, 20C

REQUIRED MATERIALS:

Bringing a laptop or tablet will be helpful to most actively participate in group work. You will be provided PDFs of class slides, but you are free to take notes however works best for you. If you do not have access to a portable computer and you would like to borrow one, please speak with me. **I will provide all of the content materials I require for you to succeed in this course (readings, papers, videos, lecture slides) on Canvas.** You may consult *Environmental Physiology of Animals* by Willmer, Stone, and Johnson from Blackwell Science for additional understanding. Please see me if you would like to borrow a copy. I will not require you to print out your own materials. Some worksheets will be provided in class.

Course Learning Outcomes

This course will focus on adaptation to the environment with respect to the following topics. After completing this course students should be able to

1) Explain the main biophysical forces that marine, freshwater, and terrestrial organisms contend with
2) Explain the difference between acclimation, adaptation, and physiological plasticity, and give examples of how each are related to an organism's environment
3) Describe the relationship between form and function, and how we can connect these to an organism's interactions with the environment
4) Explain the mechanisms that organisms have evolved to thermoregulate and exchange respiratory gases in a variety of environments
5) Explain major anthropogenic threats to animals in the environments that we explore
6) Predict what physiological and life history traits make some animals more vulnerable to anthropogenic threats than others

In this course we will also focus on practicing several important scientific skills. After completing this course, students should be able to

7) Read and thoughtfully discuss a scientific paper thoroughly enough to identify the claim, evidence and reasoning laid out by the authors
8) Translate the main findings of a scientific paper into a form that a layperson can understand in both written and oral form

9) Read and identify the most important aspect of a wide variety of graphs
10) Work collaboratively with a team of peers to successfully complete a group project

LEARNING ASSESSMENTS:

Reflections will help orient you to the topic of the day as part of your participation. You will complete these before each class session starts. *They are due at the beginning of class*, and cannot be made up.

Case studies are real-world examples of environmental physiology in action! There are two parts to these: The pre-reading assignments that will be *due at the beginning of class the day we will discuss the paper*, and count as homework. The in-class worksheets, *due at the end of class*, will count toward your overall participation.

Four weekly quizzes are how I will assess your learning in lieu of midterms and a final. These will start at the end of Week 2, and will cover material from the previous 2 sessions (Note: Quiz 1 will cover the first three sessions). These will be two-stage tests: We will end Thursday sessions with a two-part quiz: a 30-minute group portion, then you will complete a 30-minute individual portion. Students requiring extended testing time will have more time after Thursday session to complete the quiz.

The group project will be your chance to explore the impacts on the physiology of an organism due to an anthropogenic environmental change with like-minded classmates. You will each summarize a scientific paper, and then collaborate on a mini literature review, a blog post, and a final presentation to communicate your understanding of your chosen topic.

ASSIGNMENT SUBMISSION LOGISTICS:

Unless otherwise specified, assignments are due **ON CANVAS** by 11:59 PM on Sunday night: please check the syllabus for exceptions. After a due date passes, assignments will remain open for a grace period of 1 week. **Assignments turned in during this grace period will be docked 10% for each day that it is late (therefore, the lowest score is 40%). Items turned in 1 week or later after the due date will receive no credit.** This course will move quickly, and it will be important to keep up with these assignments. **IMPORTANT: Note that due dates may change depending on the pace of the class. You are responsible for reading emails and in-class announcements to know when this happens.**

TIME SPENT ON THIS CLASS:

This 5 unit course is composed of 2 weekly lecture periods of 3 hours and 30 minutes each: 7 hours total. A 5-unit course usually requires about 15 hours of your time… in a 10-week quarter. This means you should expect to spend about 30 hours a week either in class or doing work for the class in this 5-week session. In the 23 hours outside of class, you are expected to engage with new course material and practice questions, and work on your reflections, case study pre-reading, homework assignments, and group work, and study for the weekly quizzes.

GETTING HELP WITH THIS COURSE:

Students are enthusiastically encouraged to attend the ***student hours*** of your instructor. These are times I have specifically set aside for students to get to know you better and support you how I can. I prefer to have one-on-one or small group conversations with my students in this time-- I would rather save general material reviews in class for everyone's benefit. You are welcome to come with specific material or project questions, or to just come talk about biology, research, grad school, or really anything else that's on your mind! If you have a private question/issue to discuss, please contact me ahead of time to make an appointment to ensure your privacy.
Also remember that your peers are a great resource! I encourage you to exchange contact information, form study groups, or use the discussion forum in Canvas to post questions and receive feedback.

Week	Date	Topics	Reading	Group Work/ *Due Dates*	Individual Assignments
Week 1	June 21	Topic 1: What is environmental physiology? Adaptation vs. Acclimation vs. Phenotypic plasticity Topic 2: Conforming & Regulating; Molecular Mechanisms of Adaptation		Create group, choose topics Paper annotation activity	Pre-class survey Reflection 1
	June 23	Topic 1: Size and Scale: Allometry **CASE STUDY**: Human influence on the evolution of flightlessness in insects	Foster et al. 2021	*Summary of journal article due June 26*	Reflection 2 Case Study Pre-reading Due in class
Week 2	June 28	Topic 1&2: Physiological responses to temperature		How-to: Mini Literature Review (MLR); Collaborate	Reflection 3
	June 30	Topic 1: Physiological Responses to Temperature **CASE STUDY**: Review Paper - Overwintering adaptations in wood frogs **Quiz 1 (Sessions 1-3)**	Costanzo 2018	*Mini-Lit Review Draft Due July 3*	Reflection 4 Case Study Pre-reading Due in class
Week 3	July 5	Topic 1&2: Respiration in Air and Water		MLR Peer Review	Reflection 5
	July 7	Topic 1: Circulation and Gas Exchange **CASE STUDY**: The heart of the Antarctic icefish as paradigm of cold adaptation **Quiz 2 (Sessions 4 and 5)**	Tota et al. 1997	*Final Mini-Lit Review Due July 10*	Reflection 6 Case Study Pre-reading Due in class
Week 4	July 12	Topic 1&2: Oxygen and Metabolism, Focus On Hypoxia		How-tos: Blog post, speed talks/posters	Reflection 7
	July 14	Hypoxia cont'd **CASE STUDY**: Human adaptations to hypoxia **Quiz 3 (Sessions 6 and 7)**	Beall et al., 2007	*Draft of Website Blog Due July 17*	Reflection 8 Case Study Pre-reading Due in class
Week 5	July 19	Activity and Energy Budgets Summary activity		(Material review)	Reflection 9
	July 21	Guest lecture: Dr. Pauline Blaimont **Final Project Presentations** **Quiz 4 (Sessions 8 and 9)**		*Final draft of Website Blog, Final project file* ***Due July 21 by 11:59 PM***	Reflection 10

**** Dates and topics are subject to change based on pace of course****

COURSE ORGANIZATION & EXPECTATIONS:

My expectations of students in this upper division course are that you come to class prepared, engaged, and curious. We will also do a lot of team learning in this course. I expect students to fully participate in their team project, treat teammates with respect, and ask for help as needed. **If you have a problem that you anticipate will affect your success in this class, please let me know as soon as possible so we can work out a plan to keep you on track.**

In this course, we will spend the first session of the week diving deeply into important physiology topics that are especially relevant in the context of environmental physiology (energy, oxygen, temperature, etc.) and making progress on the group project. The second session will include both a general discussion and a detailed case study that showcases some of the amazing strategies that animals have evolved to survive and thrive in all of the diverse environments on Earth. This will be the general flow of class time and weekly due dates:

Tuesday
Reflection due!
Topic 1
Group work activity
Topic 2
Free group work time
Dr. Voss' student hour

Thursday
Reflection due!
Case Study Pre-reading due!
Topic 1
Material Review
Case Study
Group Quiz
Individual Quiz

Sunday
Group assignments due

A NOTE ABOUT ACTIVE LEARNING:

I value your participation in this class. As we know, group activities are more enjoyable when everyone contributes! In class, we will facilitate your learning by incorporating opportunities for you to actively engage with the material. *Scientific data shows that people learn more effectively when they take an active role in their learning even in class!*

Active learning strategies include: drawing and labeling diagrams, standing at a whiteboard and walking someone else through a concept, asking "what if" questions in which you challenge your understanding of material by asking what would happen if I perturb the system in a particular way (thought questions in class are examples), asking experimental design questions and challenging yourself to understand how an experiment answers a particular question, asking new scientific questions, making up sample quizzes for yourself and exchanging them with a friend, teaching the material to your peers, friends, family, or pet!

Passive learning strategies include: reading book or lecture notes, watching video recordings, making flash cards, making vocabulary lists, rewriting your notes in different color inks. These are all good, but are NOT good enough on their own to help you keep an A in this course.

TRANSFER STUDENTS:

Welcome to UCSC! As a former community college transfer student myself, I am thrilled to have you here. Transfer students have a unique experience, and in addition to the regular course work, I understand you may have other challenges associated with starting off at UCSC as a new student in upper-division courses. Please don't hesitate to reach out to the me for help. I want you to be successful, and look forward to your unique perspectives and contributions to our learning community.

DRC STUDENTS:

Welcome! Please introduce yourself on the first day. The new Accommodate site has not worked well for me in the Spring quarter, and I want to be sure to give you the resources you need.

A few notes:

1) Testing will be coordinated through PBSCI testing and will take place at the CBB building.

2) We are going have four two-stage quizzes which involve a group portion and an individual portion of the quiz. I am open to coordinating this however you feel comfortable. If you would prefer all solo time, everyone will be given that opportunity. If you want to participate in the group time, we will all be starting with the group portion and extend the individual portion after the regular class time based on your accommodations.

3) We are going to be doing a group project that involves lots of communication and collaborating on written documents. If this is challenging for you, I am confident we can work out a solution to almost any need - just reach out to chat with me.

I am here to support your learning! Please let me know if you have any questions.

ACADEMIC INTEGRITY:

Academic integrity means conducting yourself in a way that is consistent with the academic code of conduct of UCSC. More importantly, it means conducting yourself in such a way that you are engaging in the course and with the other members of our community with respect for learning. As in life, taking short cuts may lead to short term gains but almost certainly will lead to long term problems. Cheating on assignments or copying assignments means you will not really learn the material and end up being unprepared going forward. Most people do not come to college to just get by – rather – we come to college to deeply learn and improve ourselves intellectually. Of course, in doing so we also improve our chances of securing a well-paying job that we are passionate about.

Uploading course materials that Dr. Dunkin and I have created onto websites without our permission is also seen as against the academic integrity policy of the university. It will not help future Environmental Phys students succeed in this course. More importantly, online websites that put these copyrighted materials behind a paywall are contributing to the inequity in student access to resources. Thank you for holding yourselves to high standards!

GRADES:

Grades will be calculated as follows:

Weekly Quizzes (4)	**40%**
Group Project Assignments	**30%**
Case Study Pre-reading and In-Class Assignments	**20%**
Participation (Reflections, misc. in-class worksheets)	**10%**

% in Course	Grade	**A+ are only given for truly exceptional work. An A+ and an A count the same for GPA points.**
94-100	A	
90-93	A-	
88-89	B+	
84-87	B	
80-83	B-	
78-79	C+	
70-77	C	
68-69	D+	
63-67	D	
60-62	D-	
</=59	F	