
PHYSIOLOGY OF EXTREME ENVIRONMENTS

Mon, Wed, Fri; 11:00 - 11:50am in ALP 2200



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BioSci III 3622

One-on-one appts:

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BioSci III 3013

How do organisms survive in some of the harshest environments on the planet? What can we learn about ourselves by studying these organisms and environments? We'll tackle these questions and more for high altitude, deep sea, extreme heat, extreme cold and microgravity. Another interesting type of extreme physiology is extreme athletes.

By the end of this course, you will be able to...

- discuss the integration of form and function in physiology.
- propose hypotheses and experiments for investigating physiological adaptations.
- explain how researchers use various tools to test hypotheses in physiology.
- justify why it is important to study non-human models of physiology.

Meeting time

Mon, Wed, Fri; 11:00-11:50am in ALP 220

Required

1) Ashcroft, F. 2000. Life at the extremes. University of California Press.

It's out of print and only available used. Kindle version is \$8. You can find used copies on half.com or Amazon for ~\$10.

(A scanned copy of the 1st chapter will be on the class webpage)

2) Any physiology textbook published within the last 5 years. Here's an online free text: <https://openstax.org/details/anatomy-and-physiology>

3) Bring a WiFi device (laptop, tablet, smart phone) to class. We will be doing regular activities online and using a program called Solstice Client (by Mersive) to connect to the video screens via WiFi. Details on the 1st day of class.

Attendance

You are responsible for attending all classes and getting notes from a classmate if you have to miss a class.

Contacting me

I will be available during posted office hours and by appointment. I enjoy hearing from students and I will be even happier to hear from you if you observe the following guidelines:

- Use a relevant subject line and include E155 so that I know what class you are from.
- Start emails with "Dear Dr. Aguilar-Roca,"

- Assume that I'm too old to understand IM and text-messaging abbreviations.
- Proofread. Auto-corrected renditions of physiological terms are an endless source of amusement, but they hinder efficient communication.

- Sign with the name you prefer to be called.

I try to set aside time every week for one-on-one appointments with students (for everything from help with writing to physiology concepts to life in general). Just put yourself on [my calendar](#).

Personal Conduct

You are expected to conduct yourselves in a manner consistent with [UCI Principles of Community](#)

- *Respect* - We understand that respect is the cornerstone of human interaction.
- *Intellectual curiosity* - We are committed to learning, teaching, creativity and research.
- *Integrity* - We tell the truth and strive to earn the trust of those around us.
- *Commitment* - We always give our best effort.
- *Empathy* - We act with compassion and sensitivity.
- *Appreciation* - We appreciate different opinions and points of view.
- *Fun* - We enjoy our lives to the fullest.

If you observe misconduct, please bring it to the immediate attention of any instructor. You will remain anonymous.



For human SCUBA divers, 40 meters is the recommended maximum depth for recreational divers and 100 meters is the recommended max for technical divers. Why can sperm whales dive to **over 2000 meters**? (To put that in perspective, imagine swimming from Steinhaus to Albertson's and back on a single breath).

Grades: Grades will be based on the following. Points available may change due to unforeseen events

Activity	Notes	Points
Online reading quizzes to help you review and prepare for new material.	10 quizzes; 5 pts each; Drop the lowest score	45
In-class progress checks at the start of each unit. Kind of like midterms, but with a social component.	4 progress checks * 30 pts each	120
In-class participation. In-class activities will include group work, online research, short writing assignments. Five or six of them will be graded.	25 class days * 2 pt per day; Drop the lowest 5 scores	40
Formal writing assignments	5 assignments; 20 pts each	80
Final exam	Cummulative	65
Instructor Evaluation		1
Total Points		351

Note: Our classroom has a lot of new technology in it. Glitches might will happen, but you will never lose points because of a technology issue.

Letter grade equivalents

Scores will be rounded to the nearest tenth of a point and assigned letter grades as follows:

> 96.0% = A+; > 93.0% = A; > 90.0% = A-
 > 86.0% = B+; > 83.0% = B; > 80.0% = B-
 > 76.0% = C+; > 73.0% = C; > 70.0% = C-
 > 66.0% = D+; > 63.0% = D; > 60.0% = D-
 < 60.0% = F

If you earn 89.94%, that will be rounded to 89.9% and it will be a B+. If you earn 89.95%, that will be rounded to 90% and it will be an A-. If the overall class average at the end of the quarter is below 75.0% I will consider using a curve instead of a straight scale.

Incompletes

Students in good standing (having minimally a "C" in the class) who cannot complete the course because of a documented emergency (such as an illness or accident verified with a doctor's note or police report) will be given an Incomplete and will need to make-up the material when the course is offered again. An Incomplete grade is NOT given simply because a student is not doing well in the course.



Adaptation to extreme environments is not just for animals. We'll also look at a couple of examples of plants that have evolved remarkable traits for surviving in some of the harshest environments on Earth.



The pressure in the deep sea is so great that styrofoam cups can be compressed to a fraction of their normal size. How do deep sea animals keep their form at such high pressures?



Academic Honesty

There is zero tolerance for cheating in this class. In the event of cheating, the appropriate campus-wide policies will be followed, including contacting the appropriate deans. Refer to <https://aisc.uci.edu/index> for details. Academic dishonesty or cheating is defined as an intentional act of fraud in which a student seeks to claim credit for the work or efforts of another. This includes assisting other students in acts of dishonesty or coercing students into acts of dishonesty, whether it is on writing, lab work, or exams. If you are not sure if something is cheating or not, ask!

If you observe cheating, please bring it to the immediate attention of any instructor. You will remain anonymous.

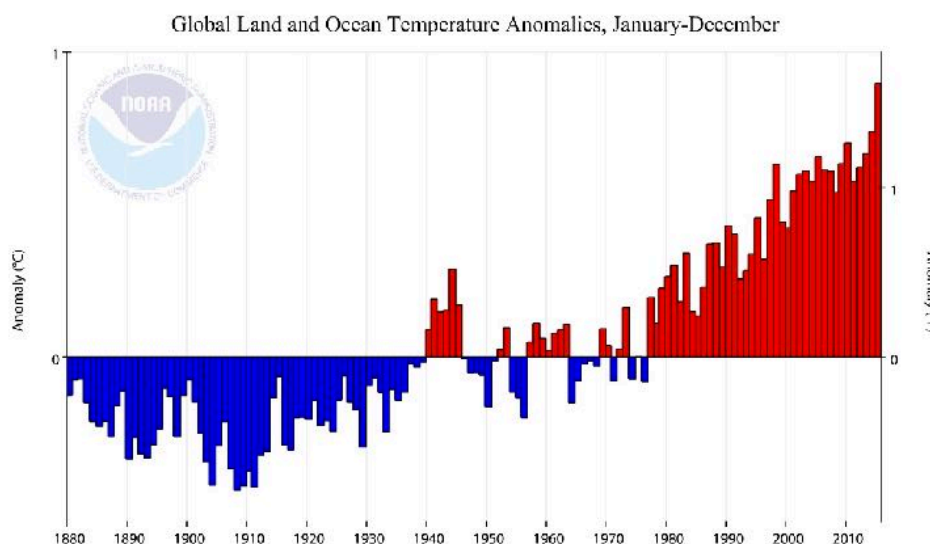
If you're still reading this, send me a picture of your favorite animal (real or fictitious). I'll be impressed!!

Accommodations & Accessibility

I am happy to provide accommodations for students with learning or physical disabilities. Please identify yourself to me during the first week of class so that we may discuss ways that will enhance your learning experience. All such discussions will be fully confidential unless you state otherwise. All requests for alternate exam policies will be coordinated through the UCI Disability Services Center <http://www.disability.uci.edu/>.

Letters of Recommendation

I will consider writing letters for students who earned a B+ or higher AND participated in at least two office hours (at posted times or by appointment). Requests must be made within 6 months of finishing the course.



Studying extreme physiology is relevant to global ecological processes. How are different plants and animals going to respond to climate change? What experiments should we be doing now in order to understand the future? Which environments will be impacted the most?

My Commitment to the Whole Student

Inclusive Classroom: I will uphold UCI's commitment to ensuring equality and valuing diversity. UCI recognizes that our individual differences can deepen our understanding of one another and the world around us, rather than divide us. In this class, people of all ethnicities, genders and gender identities, religions, ages, sexual orientations, disabilities, socioeconomic backgrounds, regions, and nationalities are strongly encouraged to share their rich array of perspectives and experiences. If you have a name and/or set of pronouns that differ from those that appear on the roster, please let me know!

See also [Diversity and Awareness at UCI](#) and [UCI LGBT Resource Center](#)

In an ideal world, science would be objective. However, much of science is subjective and is historically built on a small subset of privileged voices. I acknowledge that it is possible that there may be both overt and covert biases in the material due to the lens with which it was written, even though the material is primarily of a scientific nature. Integrating a diverse set of experiences is important for a more comprehensive understanding of science. Please let me know ways to improve the effectiveness of the course for you personally, or

for other students or student groups. Your suggestions are encouraged and appreciated.

Equal Access for All Students: Janet Napolitano, the UC president, publicly supports all students regardless of immigration status. She has also made a commitment to support and protect students and their families. If you feel that you need any kind of assistance as you are affected by either your immigration status or a loved one (family member, parents, friends, partner) feel free to contact the [UCI DREAM Center](#).

Basic Needs Security: Any student who faces challenges securing sufficient food or housing and believes this may affect their performance in the course is urged to contact the [Dean of Students](#) for support. Other resources available at UCI:

- [Student Outreach and Retention Center \(SOAR\)](#)
 - [SOAR Basic Needs Hub & Food Pantry](#)
- Furthermore, please notify the professor if you are comfortable doing so, so that she can assist with securing resources.

A safe space. [UCI CARE](#) provides free and confidential support services to members of the UCI community impacted by sexual assault, relationship abuse, family violence and/or stalking.

Feeling Extreme Stress?

Over the course of the quarter, you may experience a range of challenges that interfere with your learning and daily activities, such as problems with friend, family, and/or significant other; substance use; concerns about personal adequacy; feeling overwhelmed; or feeling sad or anxious without knowing why. There is nothing wrong with consulting a [professional counselor](#). Some other strategies to consider:



Go for a walk! This is what [exercise does to your brain](#)

Fall 2018

One of the best things you can do is find a study partner. Two heads are better than one!



Give mindful meditation a try. Free intro videos from [UCI](#) and [UCLA](#)

Grab a friend and go play at the [ARC](#) Did you know that you can also get a [relaxing massage](#) at the ARC?

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Schedule

Everyone has slightly different level of background in physiology so we'll start with a crash course in the physiological concepts that we'll encounter the most frequently. We'll use that as the foundation for adding more complexity as we go through the quarter.

The rest of the quarter will consist of 5 units: 1) High Altitude, 2) Extreme Cold, 3) Extreme Heat, 4) High pressure & Microgravity and 5) Student choice. Pre-class online quizzes are designed to help you review relevant physiology and introduce new vocabulary whenever we change topics.

Readings will be posted on the class webpage.

Week	Lesson	Date	Topic	Due on Canvas
0	1	Fri Sept 28	Homeostasis: Why don't we pass out when we stand up?	
1	2	Mon Oct 1	Nervous system: How much control do you have over your body?	Pre-class quiz #1
	3	Wed Oct 3	Respiratory & Cardiovascular systems: The story of how oxygen goes from the air to your tissues.	Pre-class quiz #2
	4	Fri Oct 5	Renal system: Why is drinking sea water lethal?	Pre-class quiz #3
2		Mon Oct 8	Progress check #1	Writing Assignment #1
	5	Wed Oct 10	High Altitude: Why are people flatulent when they arrive at altitude?	Pre-class quiz #4
	6	Fri Oct 12	High Altitude: Medical case study part 1	
3	7	Mon Oct 15	High Altitude: Medical case study part 2	
	8	Wed Oct 17	High Altitude: How are birds able to fly over Mt. Everest?	
		Fri Oct 19	Progress check #2	Writing Assignment #2
4	9	Mon Oct 22	High Pressure: Why do humans get the bends when diving, but diving marine mammals don't? Part 1	Pre-class quiz #5
	10	Wed Oct 24	High Pressure: Why do humans get the bends when diving, but diving marine mammals don't? Part 2	
	11	Fri Oct 26	High Pressure: How do deep sea animals tolerate pressures that would squash a human?	
5	12	Mon Oct 29	High Pressure: If high pressure is dangerous, why does the UCI Med Center have a hyperbaric chamber?	
		Wed Oct 31	Progress check #3	Writing Assignment #3
	13	Fri Nov 2	Extreme cold: Why do some people strip naked before freezing to death?	Pre-class quiz #6
6	14	Mon Nov 5	Extreme cold: Why don't bears lose muscle mass after hibernating for 3 months?	

Week	Lesson	Date	Topic	Due on Canvas
	15	Wed Nov 7	Extreme cold: Antifreeze - it isn't just for your car.	
	16	Fri Nov 9	Extreme cold: If a "cold-blooded" animal is frozen solid, is it dead?	
7		Mon Nov 12	Holiday!	
	17	Wed Nov 14	Extreme heat: What are the hottest places on Earth?	Writing Assignment #4 Pre-class quiz #7
	18	Fri Nov 16	Extreme heat: Is it true that camels store water? Part 1	
8	19	Mon Nov 19	Extreme heat: Is it true that camels store water? Part 2	
	20	Wed Nov 21	Extreme plants - Yes, that's a thing.	Pre-class quiz #8
		Fri Nov 23	Happy Thanksgiving!!	
9	21	Mon Nov 26	Extreme heat: Is it possible to live in boiling hot water?	
		Wed Nov 28	Progress check #4	Writing Assignment #5
	22	Fri Nov 30	Microgravity: What happens to blood flow when there isn't a normal pressure gradient?	Pre-class quiz #9
10	23	Mon Dec 3	Microgravity: What have we learned by taking animals into space?	
	24	Wed Dec 5	Student choice	Pre-class quiz #10
	25	Fri Dec 7	Student choice	
		Fri Dec 14	Final Exam; 8:00 - 10:00am	



This Alaskan wood frog is almost completely frozen (approximately two-thirds of its body water is ice). Is it alive or dead?
