

## **BIOL 356/356L - Comparative Biomechanics – Spring 2020**

**Lecture: Tuesday and Thursday, 12:15PM-1:30PM, RITA 279**

**Lab: Monday, 12:00PM-3:00PM, RITA 279 unless specified otherwise**

Instructor: Andrew Clark, Ph.D.  
Office location: RITA 123  
Office hours: By appointment  
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Mailbox: Biology Department Office, RITA 245-255

### **Prerequisites; Co-requisites:**

BIOL 111/111L, BIOL 112/112L, BIOL 221; BIOL 305, MATH 250, PHYS 101/101L or 111/111L

### **Textbook:**

Required: *Comparative Biomechanics: Life's Physical World 2<sup>nd</sup> Edition*. By Vogel

Recommended: *Nature's Machines*. By Alexander.

**Course Description:** Comparative biomechanics is an interdisciplinary field involving the study of organismal structure and function using Newtonian physics to model and understand structure-function relationships, how structure-function relationships regulate animal behaviors, and more broadly, how these relationships connect with organismal ecology, evolution and diversity. The laboratory component of Comparative Biomechanics provides hands-on experience using various techniques and equipment for measuring organismal size and shape, recording and analyzing animal locomotor behaviors, measuring the properties of biological materials, generating 3D models and rapid prototyping. Finally, you will gain experience communicating scientific results in post-lab assignments, lab reports, and oral presentations. Comparative biomechanics was introduced in the Fall 2011 semester, and is the product of collaborative efforts from three Biology department faculty members who actively conduct biomechanics research: Dr. Eric McElroy, Dr. Jason Vance, and myself.

### **Assessment:**

<b>Assignments</b>	<b>Points</b>
Exam 1	100
Exam 2	100
Exam 3	100
Lab Report	100
Post-lab assignments	50
Problem-sets	50
Presentation	50
Participation	50
<b>TOTAL</b>	<b>600</b>

### **Honor system and academic integrity:**

Academic dishonesty is unacceptable. Dishonesty includes, but is not limited to: cheating on an exam; stealing exam questions; substituting one person for another at an exam; falsifying data; destroying, tampering with, or stealing a computer program or file; and plagiarizing (using as one's own the ideas and writings of another). If you are caught cheating you will be reported to the Chair of the Biology department and receive a grade of 0 points for the paper, project, or exam in which the dishonesty was observed by the instructor. Additionally, you may also receive an F for the course and may receive additional disciplinary action.

Be familiar with the College of Charleston's Honor System: <http://studentaffairs.cofc.edu/honor-system/>

**Special needs:**

The College will make reasonable accommodations for persons with documented disabilities. Students should apply for services at the Center for Disability Services/SNAP located on the first floor of the Lightsey Center, Suite 104. Students approved for accommodations are responsible for notifying me as soon as possible and for contacting me one week before accommodation is needed.

For more information about disability services, please see <http://disabilityservices.cofc.edu>.

**Attendance:**

Attendance is mandatory and will be recorded at the beginning of lecture and lab. All students are expected to arrive on time. If you have a legitimate conflict with a lab or lecture, you must inform me as soon as possible and provide an official excuse within five days of the date of your absence. **An absence memo alone will not exempt you from the following penalties.** An unexcused absence from a lab will result in a zero for that week's post-lab assignment and 5% deducted from your final grade. An unexcused absence from a lecture without prior consent will result in a 1% deducted from your final grade. **NOTE – family reunions and vacations are inexcusable reasons for absences.**

**Late Assignments:**

Assignment grades will be reduced by 10% for each calendar day late. No assignment will be accepted after ten days late (this timeline includes weekend days and holidays). Unless specified otherwise, I will not accept electronic copies of late assignments. Hard copies of late assignments are to be turned into my mailbox, however if the Biology Department office is closed (e.g. after 5 PM on M-F or during the weekend), simply slide your late assignment under my office door. Once dropped off, inform me by email of the assignment's location plus the date and time of the drop-off. You have 24 hours to email me this information after dropping off your late assignment. Failure to contact me and provide me with all of the required information within 24 hours will result in a zero for that assignment.

**Exams:**

There will be three in-class exams administered this semester. Each exam will be closed book and worth 100 points. Exams will consist of a mixture of problem sets, multiple choice, and short answer questions, and will cover material presented in lecture, unless specified otherwise.

**Laboratories:**

The lab will begin during the second week of classes (Monday, January 13). The locations for lab exercises include the designated lab space for this semester (RITA 279), the research laboratories of Dr. Clark (RITA 289), and locations off-campus; please see the syllabus and check for announcements on OAKS. Students are expected to arrive to lab on time and participation is mandatory (see assessment).

**Lab Report:**

There will be one lab report assigned this semester pertaining to your group's independent project. It will be worth 100 points and will be prepared in a format characteristic to research articles in the profession. Detailed guidelines about writing the lab report will be provided. Students must prepare lab reports **individually**. The lab report will be graded as your final exam in lieu of a traditional final exam. The report is due by 5:00 PM EST on Friday, April 24.

**Presentation:**

Students will deliver oral presentations on their independent research at the end of the Spring 2020 semester, scheduled on April 20. Each group presentation is expected to last 15 minutes followed by 5 minutes of Q&A. Your instructor will provide you with detailed guidelines about this assignment and tips for delivering effective, professionally styled oral presentations. All students of the presenting groups must contribute equally to the preparation and delivery of the presentation. Students in the audience are expected to ask questions and engage presenters during the Q&As. Details will be available in the guidelines.

**Post-lab and problem set assignments:**

You will be required to complete two problem sets and five post-lab assignments this semester. Each post-lab assignment will be worth 10 points, and will require you to analyze and interpret data sets gathered in relevant labs. Each problem-set will be worth 25 points, and will require you to employ skill sets (mathematics, physics, computer software, etc.) to address questions in biomechanics.

## **Student Conduct**

1. There is to be no talking during the instruction portion of the lecture or lab. If you have a question, please raise your hand prior to asking the question. While answering a student's question, please remain quiet so that the student and other class members can hear the reply.
2. Remember you are attending the lecture and lab to learn and apply the material/principles covered in the lecture, not to text-message, surf the internet, read newspapers/magazine, sleep, or distract the instructor or the other students.
3. Please turn off all cellular phones before entering the lecture and lab. Computers will be provided to perform the laboratory exercises. Personal tablets and laptops may be used during lab for the research, data analysis and write-up of the experiments and research projects. If you choose to use these devices for non-course-related material, you will be excused and considered absent for that session.
4. No College of Charleston employee or student should be subject to unwelcome verbal or physical conduct. It is expected that students, faculty and staff will treat one another with respect. Individuals who violate this policy are subject to termination and/or expulsion from the College and the possibility of civil and criminal prosecution.

## **Food & Housing Resources:**

Many CofC students report experiencing food and housing insecurity. If you are facing challenges in securing food (such as not being able to afford groceries or get sufficient food to eat every day) and housing (such as lacking a safe and stable place to live), please contact the Dean of Students for support (<http://studentaffairs.cofc.edu/about/salt.php>). Also, you can go to <http://studentaffairs.cofc.edu/student-food-housing-insecurity/index.php> to learn about food and housing assistance that is available to you. In addition, there are several resources on and off campus to help. You can visit the Cougar Pantry in the Stern Center (2nd floor), a student-run food pantry that provides dry-goods and hygiene products at no charge to any student in need. Please also consider reaching out to Professor ABC if you are comfortable in doing so.

**See next two pages for tentative lab and lecture schedules**

**Tentative Lab Schedule:**

<b>Week</b>	<b>Date</b>	<b>Topic</b>	<b>Location</b>	<b>Assignments</b>
1	Jan 6	<b>NO LAB</b>		
2	Jan 13	<b>Intro:</b> collecting and managing data, and presenting results	RITA 279	Post-Lab 1 assigned
3	Jan 20	<b>NO LAB</b>		
4	Jan 27	<b>Intro:</b> materials and structures	RITA 279	
5	Feb 3	<b>Intro:</b> materials and structures	RITA 279	Post-Lab 2 assigned
6	Feb 10	<b>Intro:</b> 3D modeling & rapid prototyping (3D printing)	RITA 279	Post-Lab 3 assigned
7	Feb 17	<b>Intro:</b> to 3D modeling & rapid prototyping (3D printing)	RITA 279	Post-Lab 4 assigned
8	Feb 24	<b>*Field trip:</b> SC Aquarium CT scanning facility	TBA	
9	Mar 2	<b>Intro:</b> videography & motion analysis 1	RITA 279	
10	Mar 9	<b>Intro:</b> videography & motion analysis 2	RITA 279	Post-Lab 5 assigned
11	Mar 16	<b>NO LAB (Spring Break)</b>		
12	Mar 23	<b>Semi-Independent projects:</b> Proposal & experimental plan	RITA 279	
13	Mar 30	<b>Independent projects:</b> Data collection & analysis	RITA 279	
14	Apr 6	<b>Independent projects:</b> Data collection & analysis	RITA 279	
15	Apr 13	<b>Independent projects:</b> Preparing oral presentation	RITA 279	Lab Report Assigned (due date on page 2)
16	Apr 20	<b>Oral presentations</b>	RITA 279	

\*Collecting data in the field will be a "backup" lab if SC Aquarium field trip gets cancelled.

**Tentative Lecture Schedule:**

<b>Week</b>	<b>Date</b>	<b>Topic</b>	<b>Assignments</b>
1	Jan 9	Introduction	
2	Jan 14 Jan 16	Units and states of matter Scaling	
3	Jan 21 Jan 23	Biological materials Biological materials	
4	Jan 28 Jan 30	Viscoelasticity Viscoelasticity	Problem set 1 assigned
5	Feb 4 Feb 6	Biological structures Biological structures & Review	
6	Feb 11 Feb 13	<b>Exam 1</b> Skeletal muscles	
7	Feb 18 Feb 20	Skeletal muscles Terrestrial locomotion	Problem set 1 due
8	Feb 25 Feb 27	Terrestrial locomotion Introduction to fluids	
9	Mar 3 Mar 5	Aquatic locomotion Aerial locomotion	Problem set 2 assigned
10	Mar 10 Mar 12	Review: muscles and locomotion <b>Exam 2</b>	
11	Mar 17 Mar 19	<b>Spring Break (no lectures)</b>	
12	Mar 24 Mar 26	Feeding: suction and filtration Feeding: biting with jaws	
13	Mar 31 Apr 2	Feeding: biting without jaws Hydrostatics	Problem set 2 due
14	Apr 7 Apr 9	Biomimetics and bioinspiration Contemporary research	
15	Apr 14 Apr 16	Review: Feeding <b>Exam 3</b>	