

University of Southern California – Department of Biological Sciences
HBIO-408L* –Biomechanics (4 Units) Fall 2019
<http://hbio408biomechanics.usc.edu/lab/lab.html>

Instructors: Jill McNitt-Gray, Ph.D. mcnitt@usc.edu

Lecture: SOSB2 M/W 2:00 – 3:20 P.M; Comprehensive Final

Office Hours: MON / WED, 3:20-4:20 PM (Bring lab notebook to office hour meetings).

Laboratory: 3 hours/week

2:00 – 4:50 T	PED B15
5:00 – 7:50 T	PED B15
5:00-7:50 W	PED B15
2:00 – 4:50 Th	PED B15
5:00 – 7:50 Th	PED B15

***Course includes project-based capstone experience**

Kinematic and kinetic analysis of human motion; emphasis on performance enhancement and injury prevention. Concepts from high school algebra (word problems and solving for an unknown) and the use of sine, cosine, and tangent concepts from trigonometry. Calculus is not required. **Prerequisite:** [EXSC 301L](#) and 1 from ([MATH 108](#) or [MATH 125](#)) and 1 from ([PHYS 135a](#) or [PHYS 151](#))

Required Texts and Supplies:

1. Web-Based Lecture Notes
2. Selected Literature Readings available through PubMed@usc through USC Library
3. Electronic Storage Device (back up and store homework, labs, and project content)

I. Objectives:

1. Develop critical thinking and analytical skills to solve meaningful problems; use Newton's Laws to understand cause-effect relationships governing human movement.
2. Improve oral, written, electronic information and communication skills.
3. Gain hands-on experience analyzing motion and quantifying and interpreting biomechanical information in scientific, ethical, social, and environment related contexts.

II. Grading Procedures:

1. Exam 1 - 20%
2. Exam 2 - 20%
3. Comprehensive Final - 25%
4. Lab - 20%
5. Project - 15%

Lab Grading:

1. Pre/Post Lab Reports, Demonstrations, - 50%

2. Weekly Lab Quizzes - 25%

3. Practical - 25%

Grading Scale: >90%=A, > 80%=B, >70%=C, >65%=D, otherwise =F

III. Laboratory Component

Undergraduate Lab Director: Emi Embler, Ph.D.

Email: eembler@usc.edu

Teaching Assistant: Kimberly Popp popp@usc.edu

Office hours: PED B9 Tues 12-2 (bring lab notebook to office hour meetings)

IV. Expectations

1. Come prepared for class and labs (lecture pop quizzes).
2. Sincere Personal Investment in independent discovery and lab activities.
3. USC conduct code (you must do your own work!) - Refer to **SCampus** Academic Integrity Section.
4. Excused absences require written notification *one week in advance*.
5. Honor due dates in lab and lecture (**anything turned in after due date = zero points**).
6. Email and class participation.

VI. Project Overview and Grading

Project: Identify significant problem (compare/contrast), generate a meaningful hypothesis, design and conduct a biomechanical experiment to test hypothesis (limitation of analysis: two 2D planar movements).

Project Grade:

1. Background/Significance (10%) *Problem? known/unknown in peer reviewed literature?*
2. Kinematics (angle-angle) (25%) *kinematic context for muscle force generation*
3. Kinetics (whole body: imp/mom (25%); joint kinetics (25%) *cause/effect at joint & CM levels*
4. Presentation and hand-in materials (15%); *all comparisons specific to research question*
 - a) 3 related scientific journal articles (.pdf emailed to TA prior to presentation)
 - b) hand written Free Body Diagrams and associated calculations (show all work)
 - c) Paper copy of presentation (must be able to read all text on all figures)
 - d) Peer evaluation (emailed to TA prior to presentation)

Statement on Academic Conduct and Support Systems

Academic Conduct:

Plagiarism – presenting someone else’s ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in SCampus in Part B, Section 11, “Behavior Violating University Standards” policy.usc.edu/scampus-part-b. Other forms of academic dishonesty are equally unacceptable. See additional information in SCampus and university policies on scientific misconduct, policy.usc.edu/scientific-misconduct.

Support Systems:

Student Health Counseling Services - (213) 740-7711 – 24/7 on call engemannshc.usc.edu/counseling

Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention.

National Suicide Prevention Lifeline - 1 (800) 273-8255 – 24/7 on call suicidepreventionlifeline.org

Free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week.

Relationship and Sexual Violence Prevention Services (RSVP) - (213) 740-4900 – 24/7 on call engemannshc.usc.edu/rsvp

Free and confidential therapy services, workshops, and training for situations related to gender-based harm.

Office of Equity and Diversity (OED) | Title IX - (213) 740-5086 equity.usc.edu, titleix.usc.edu

Information about how to get help or help a survivor of harassment or discrimination, rights of protected classes, reporting options, and additional resources for students, faculty, staff, visitors, and applicants. The university prohibits discrimination or harassment based on the following protected characteristics: race, color, national origin, ancestry, religion, sex, gender, gender identity, gender expression, sexual orientation, age, physical disability, medical condition, mental disability, marital status, pregnancy, veteran status, genetic information, and any other characteristic which may be specified in applicable laws and governmental regulations.

Bias Assessment Response and Support - (213) 740-2421 studentaffairs.usc.edu/bias-assessment-response-support

Avenue to report incidents of bias, hate crimes, and microaggressions for appropriate investigation and response.

The Office of Disability Services and Programs - (213) 740-0776 dsp.usc.edu

Support and accommodations for students with disabilities. Services include assistance in providing readers/notetakers/interpreters, special accommodations for test taking needs, assistance with architectural barriers, assistive technology, and support for individual needs.

USC Support and Advocacy - (213) 821-4710 studentaffairs.usc.edu/ssa

Assists students and families in resolving complex personal, financial, and academic issues adversely affecting their success as a student.

Diversity at USC - (213) 740-2101 diversity.usc.edu

Information on events, programs and training, the Provost's Diversity and Inclusion Council, Diversity Liaisons for each academic school, chronology, participation, and various resources for students.

USC Emergency - UPC: (213) 740-4321, HSC: (323) 442-1000 – 24/7 on call dps.usc.edu, emergency.usc.edu

Emergency assistance and avenue to report a crime. Latest updates regarding safety, including ways in which instruction will be continued if an officially declared emergency makes travel to campus infeasible.

USC Department of Public Safety - UPC: (213) 740-6000, HSC: (323) 442-120 – 24/7 on call dps.usc.edu

Non-emergency assistance or information.

USC Kortschak Center for Learning and Creativity

The mission of the Kortschak Center for Learning and Creativity (KCLC) is to apply and engage in research and training to serve individuals with diverse learning needs and to empower students to reach their full academic and creative potential.

KCLC offers outreach, programming, and individual coaching services to USC undergraduates and departments to promote a campus-wide understanding of learning differences and their potential to facilitate creativity and academic excellence.

The KCLC is located in Student Union 311 and can be reached by email at kortschakcenter@usc.edu or at (213) 740-7884. For more information, visit the Website at kortschakcenter.usc.edu.

Disability Services and Programs

Disability Services and Programs (DSP) provides support and accommodations for students with disabilities. We serve undergraduate, graduate and professional students, as well as on-ground and on-line students in all credit-granting programs of study. DSP engages in an interactive review process to determine appropriate accommodations for each student, factoring in the student's request, the nature of the student's disability, functional limitations of the disability, the supporting documentation, and the fundamental requirements of courses, programs of study, and the University. DSP is part of the Division of Student Affairs, and while we are a separate department from other support, advocacy and counseling departments, we work closely with these and other resources on campus to best support student needs.

Please contact DSP by visiting in GFS 120, calling (213) 740-0776, emailing ability@usc.edu or reviewing our Website for more information (dsp.usc.edu).

STATEMENT FOR STUDENTS WITH DISABILITIES

Any student requesting academic accommodations based on a disability is required to register with Disability Services and Programs (DSP) each semester. A letter of verification for approved accommodations can be obtained from DSP. Please be sure the letter is delivered to me (or to TA) as early in the semester as possible. DSP is located in STU 301 and is open 8:30 a.m.–5:00 p.m., Monday through Friday. **Website for DSP** and contact information: (213) 740-0776 (Phone), (213) 740-6948 (TDD only), (213) 740-8216 (FAX) **ability@usc.edu**.

STATEMENT ON ACADEMIC INTEGRITY

USC seeks to maintain an optimal learning environment. General principles of academic honesty include the concept of respect for the intellectual property of others, the expectation that individual work will be submitted unless otherwise allowed by an instructor, and the obligations both to protect one's own academic work from misuse by others as well as to avoid using another's work as one's own. All students are expected to understand and abide by these principles. **SCampus**, the Student Guidebook, contains the University Student Conduct Code (see University Governance, Section 11.00), while the recommended sanctions are located in Appendix A.

EMERGENCY PREPAREDNESS/COURSE CONTINUITY IN A CRISIS

In case of a declared emergency if travel to campus is not feasible, USC executive leadership will announce an electronic way for instructors to teach students in their residence halls or homes using a combination of Blackboard, teleconferencing, and other technologies. See the university's site on [**Campus Safety and Emergency Preparedness**](#).

Week of*	*Syllabus may be modified as needed	
	Monday	Wednesday
1 8/25	Motion analysis: events/phases	Independent Field Study: Mechanical objectives
2 9/2	Labor Day	Mechanical Objectives FBD
3 9/9	Kinematic Context Multijoint control	Linear Impulse, Change in momentum
4 9/16	Angular Impulse, FBD	Projectile motion
5 9/23	Review	EXAM 1
6 9/30	Integration of Concepts, FBD	Project Planning
7 10/7	Joint level FBD	Muscle contribution to Joint Kinetics
8 10/14	Joint Level Kinetics	Applications in Rehab engineering
9 10/21	Applications in Sports Science	Newton's Laws of Motion, FBD
10 10/28	Multijoint Kinetics	Multijoint kinetics
11 11/4	Clinical Applications	Project analysis
12 11/11	Review	EXAM 2
13 11/18	Project discussion	Translation into practice
14 11/25	Natural History	Thanksgiving 11/28
15 12/2	Applications	Review for Final Exam FINAL: Friday 12/13 2-4pm

Lab Exercises	Project Progression*: Understanding Cause-Effect <i>Integrate knowledge each week</i>
Introduction/ computer skills, FBD	Microsoft Excel, Kinovea (PC), Tracker (Mac) * develop tool proficiency
Linear kinematics & TBCM (video clips)	** Clarify real world problems & critical questions that are meaningful to you!!
Angular kinematics	** Finalize movements of interest and begin extensive research on topic- what? how?
Linear impulse & momentum	** Critically read literature, pilot, develop hypotheses and experimental design - why?
Angular impulse & momentum	** Methods, variables to test hypothesis Thought experiments? If .. then? So what?
LAB PRACTICAL	** Practice the experiment, movements need to be performed in a realistic context
Total body kinetics	** Collection plan, movement analysis plan, time table, responsibilities, milestones
PROJECT COLLECTION	REVIEW QUANTITATIVE SKILLS MAP out Project Time line within group
Joint kinetics	** Title, significance, expected results from compare and contrast analysis
Project: kinematics	** Analyze multijoint control using joint and segment kinematics
Project: impulse/ momentum	** Analyze net impulse/change in momentum relationships (lin or ang)
Project: joint kinetics	** Analyze upper extremity or lower extremity joint kinetics
Project: interpretation PRESENT TO LAB TA	** Compare results to the literature, data makes sense? What makes quantities big and small? Cause-effect? Significance?
Final report .ppt/prezi	** Assimilate results, communicate results
ORAL PROJECT PRESENTATIONS-	** 10 min, 5 min questions, hand written FBD/ joint kinetics turned in before, literature .pdf emailed

