* Syllabus may be adjusted as needed

HBIO 408L Biomechanics

Units: 4 (integrated lecture and lab)

Fall 2023

Instructor: Dr. Jill McNitt-Gray
Office: PED B9
Office Hours: M&W 3-3:30, 4:50-5:30PM
Contact Info: mcnitt@usc.edu

Teaching Assistant: Dr. Shannon Cross
Office: PED B9
Office Hours: use online appointment tools
Contact Info: sjcross@usc.edu

Teaching Assistant: Dr. Laura Held
Office: PED B9
Office Hours: use online appointment tools
Contact Info: held@usc.edu

IT Help: Dornsife Technology Services
University of Southern California
835 Bloom Walk, SHS 260
Los Angeles, CA 90089

E: ts@dornsife.usc.edu
P: 213-740-2775
F: 213-740-5534

COVID-19 Resource Center: The COVID-19 pandemic is constantly evolving and USC community members need critical information to better protect themselves and others as well as their work and living areas.
https://ehs.usc.edu/welcome/covid-19-resource-center/

* Syllabus may be adjusted as needed

Course Description

Kinematic and kinetic analysis of human motion. Emphasis on performance enhancement and injury prevention. Geared for junior and senior undergraduate students. 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.

Prerequisites: MATH 108 and PHYS 135A or higher

Learning Objectives

1. Discuss the interplay and relative influence of biology and social context on dimensions of human diversity and health.
2. Apply cross-disciplinary scientific principles to explain how humans function, adapt and evolve.
3. Analyze and synthesize discipline-related content specific to real world problems and utilize the scientific method, basic scientific principles and methodologies concepts to clarify what is known, unknown or need further study.
4. Independently and collaboratively apply scientific knowledge as well as analytical and experimental skills to produce integrative original work.
5. Describe the structure/function of muscles, bones, joints and tissues of the human body.
6. Formulate testable hypotheses, design and conduct experiments, present interpretations of results and articulate reasoned conclusions to solve real-world and conceptual problems.
7. Safely and properly use scientific equipment, databases, Newton's Laws, and other mathematical and computational tools to advance working knowledge of cause-effect relationships governing human movement.
8. Use relevant sources of scientific evidence to construct a well-supported, logical argument, explain it to others using oral, written, and multimedia forms of communication in real world contexts.

University of Southern California – Department of Biological Sciences
HBIO-408L* – Biomechanics (4 Units) Fall 2023

Instructor: Jill McNitt-Gray, Ph.D. mcnitt@usc.edu
Lecture: MON, WED, 3:30-4:50 PM, SOS B46
Office Hours: Outside M, W 3-3:30, 4:50-5:30 PM
(be prepared to share work done during office hours), Fall Recess: Thursday - Friday, October 12-13, 2023
Laboratory: 3 hours/week **Content builds weekly through integrated lecture & lab experiences, Comprehensive Final Exam**
Course includes project-based capstone experience that progressively builds each week *with active participation in lab
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:** 1 from (MATH 108 or MATH 125) and 1 from (PHYS 135a or PHYS 151)

Required Texts and Supplies:

1. Web-Based Content (Blackboard and Google Drive)
2. Selected Literature Readings available through PubMed@usc through USC Library
3. Electronic Storage Device (back up and store homework, labs, and project content)
4. Weekly review of course content, course announcements, and syllabus updates on Blackboard
5. Personal Calculator for use during assessments.

Learn-by-Doing Objectives

- Develop critical thinking and analytical skills to solve meaningful problems; use Newton's Laws to understand cause-effect relationships governing human movement.
- Improve oral, written, electronic information and communication skills.
- Gain hands-on experience analyzing motion and quantifying and interpreting biomechanical information in scientific, ethical, social, and environment related contexts.
- Develop self-refection and evaluation approaches to systematically check the accuracy of data and quality of your own work

II. Grading Procedures:

- Assessment 1 - 20%
- Assessment 2 - 20%
- Comprehensive Assessment - 25%
- Lab experiential Learning - 20%
- Project - 15%

Lab Experiential Learning Activities

- Pre/During/Post Lab: Assignments, Reports, Demonstrations, Community of Practice Posts, Literature Review, Active participation in data collection, demonstrated analysis processes, Communication and Data Visualization etc. 50%
- Lab Assessments (prelab): 25%, Practicals: 25%, Assignment submission timeline as stated on Blackboard

Rubric for Evaluation Mastery of Course Content:

Check +: demonstrates full understanding and can apply to novel situations
Check: demonstrates solid understanding
Check -: demonstrates emerging understanding

Couse Grading Scale: >90% A range, > 80% B range, >70% C range, >65% D range, otherwise F, +/- given

III. Laboratory Component

Human Biology Instructional Laboratory Manager
Anh-Khoi Nguyen agnguyen@usc.edu

Teaching Assistants: Dr. Laura Held, Dr. Shannon Cross
Office hours: sign up on google doc

IV. Expectations

1. Come prepared for class and labs (lecture pop quizzes, review of blackboard course content, discussion board, updates etc.)
2. Sincere Personal Investment in independent discovery, lab activities, and **checking your own work**.
3. USC conduct code (you must do *your own original 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 (HBIO 408 as subject line), class participation including participation in lab and on blackboard discussion board

VI. Weekly Learning Experiences, Project Overview and Grading

Weekly Learning Experiences:

- Prepare and organize your approach and timeline informed by course content and links to resources provided through blackboard,
- Integrate information and resources provide through blackboard as well as independent investigation
- Check your own work at each step of the learning process

- Submit assessments through blackboard using timelines provided by laboratory instructors
- Incorporate weekly review of content mastery and work products and communicate what you are learning through self-reflection

Project*: Identify significant problem (compare/contrast tasks), generate a meaningful hypothesis, design and conduct a biomechanical experiment to test hypothesis (limitation of analysis: compare and contrast 2D planar movements). Slides for oral presentation of capstone learning experience are generated weekly, shared, and refined as project progresses.

Slide deck needs to include:

1. **Project Title:** (Who: task & team),
2. **Research questions of interest** (What & Why: literature, personal motivation),
3. **Movement Analysis**: Compare and contrast mechanical objectives at whole body level using task filmstrips, events and phases
4. **Cause-Effect** Compare tasks during interval of interest (Use net imp/change in momentum relationships to advance knowledge),
5. **Mechanical Demand** at an instant (Use joint kinetics to determine what contributes to increases/decreases in demand x limb,
6. **Kinematic Context for Muscle Force Generation**: link joint kinetics to multijoint control (Angle-Angle diagrams) and interpret in relation to muscle-tendon-unit mechanics- Force, length, rate of change in length relationships in one and two joint muscles
7. **Interpretation and implications of results** *for improved performance physical preparation,* and *skill acquisition*

***Requires weekly reflection by team mates to** check the quality of their own work and that of others, provide timely and relevant near-peer mentoring, as well as constructive feedback throughout the process

Project Grade will include the following components:

1. Background/Significance/Research Questions (10%) *What is known/unknown in peer reviewed literature? Expert clinicians?*
2. Movement analysis at whole body level: net imp-Δmom (25%) *mechanical objectives and cause-effect during movement phases?*
4. Limb Joint kinetics (25%) *mechanical demand imposed on muscles groups controlling extremity of interest (leg, arm)?*
3. Kinematic Context for Force Generation: (angle-angle) (25%) *multijoint coordination, MTU Force, length, rate of change in length*
5. Presentation (4 min) and hand-in materials (15%) submitted as .pdf and .ppt files uploaded into individual's google folder
   a) Scientific peer-reviewed journal articles related to research (.pdf uploaded and referenced in slides)
   b) Hand written joint kinetics, FBD, data used, and associated calculations (show all work, single .pdf uploaded, emailed to TA)
   c) Presentation (.ppt file and .pdf versions uploaded, .pdf emailed to TA prior to presentation, Font size at least 18 point)
   d) Response to questions
   e) Self-reflection and peer evaluation of team members (complete confidential survey)

Timely Near-peer feedback: "I like, I wish, I learned' anonymous evaluation of oral presentations by students in lab section

Statement on Academic Integrity, Conduct, and Support Systems

The University of Southern California is foremost a learning community committed to fostering successful scholars and researchers dedicated to the pursuit of knowledge and the transmission of ideas. Academic misconduct is in contrast to the university's mission to educate students through a broad array of first-rank academic, professional, and extracurricular programs and includes any act of dishonesty in the submission of academic work (either in draft or final form).

This course will follow the expectations for academic integrity as stated in the USC Student Handbook. All students are expected to submit assignments that are original work and prepared specifically for the course/section in this academic term. You may not submit work written by others or "recycle" work prepared for other courses without obtaining written permission from the instructor(s). Students suspected of engaging in academic misconduct will be reported to the Office of Academic Integrity.

Other violations of academic misconduct include, but are not limited to, cheating, plagiarism, fabrication (e.g., falsifying data), knowingly assisting others in acts of academic dishonesty, and any act that gains or is intended to gain an unfair academic advantage.

The impact of academic dishonesty is far-reaching and is considered a serious offense against the university and could result in outcomes such as failure on the assignment, failure in the course, suspension, or even expulsion from the university.

For more information about academic integrity see the student handbook or the Office of Academic Integrity's website, and university policies on Research and Scholarship Misconduct.

Academic Conduct:

Collaboration: In this class, you are expected to submit work that demonstrates your individual mastery of the course concepts.
Group work: Unless specifically designated as a 'group project,' all assignments are expected to be completed individually.
Computer programs: Plagiarism includes the submission of code written by, or otherwise obtained from someone else

Use of AI Generators: Since creating, analytical, and critical thinking skills are part of the learning outcomes of this course, all assignments should be prepared by the student working individually or in groups. Students may not have another person or entity complete any substantive portion of the assignment. Developing strong competencies in these areas will prepare you for a competitive workplace. Therefore, using AI-generated tools is prohibited in this course, will be identified as plagiarism, and will be reported to the Office of Academic Integrity.

Course Content Distribution and Synchronous Session Recordings Policies:
USC has policies that prohibit recording and distribution of any synchronous and asynchronous course content outside of the learning environment.

Recording a university class without the express permission of the instructor and announcement to the class, or unless conducted pursuant to an Office of Student Accessibility Services (OSAS) accommodation. Recording can inhibit free discussion in the future, and thus infringe on the academic freedom of other students as well as the instructor. (Living our Unifying Values: The USC Student Handbook, page 13).

Distribution or use of notes, recordings, exams, or other intellectual property, based on university classes or lectures without the express permission of the instructor for purposes other than individual or group study. This includes but is not limited to providing materials for distribution by services publishing course materials. This restriction on unauthorized use also applies to all information, which had been distributed to students or in any way had been displayed for use in relationship to the class, whether obtained in class, via email, on the internet, or via any other media. (Living our Unifying Values: The USC Student Handbook, page 13).

Academic Integrity:

The University of Southern California is a learning community committed to developing successful scholars and researchers dedicated to the pursuit of knowledge and the dissemination of ideas. Academic misconduct, which includes any act of dishonesty in the production or submission of academic work, compromises the integrity of the person who commits the act and can impugn the perceived integrity of the entire university community. It stands in opposition to the university's mission to research, educate, and contribute productively to our community and the world.

All students are expected to submit assignments that represent their own original work, and that have been prepared specifically for the course or section for which they have been submitted. You may not submit work written by others or "recycle" work prepared for other courses without obtaining written permission from the instructor(s).

Other violations of academic integrity include, but are not limited to, cheating, plagiarism, fabrication (e.g., falsifying data), collusion, knowingly assisting others in acts of academic dishonesty, and any act that gains or is intended to gain an unfair academic advantage.

The impact of academic dishonesty is far-reaching and is considered a serious offense against the university. All incidences of academic misconduct will be reported to the Office of Academic Integrity and could result in outcomes such as failure on the assignment, failure in the course, suspension, or even expulsion from the university.

For more information about academic integrity see the student handbook or the Office of Academic Integrity's website, and university policies on Research and Scholarship Misconduct.

Please ask your instructor if you are unsure what constitutes unauthorized assistance on an exam or assignment, or what information requires citation and/or attribution.

Students and Disability Accommodations:

USC welcomes students with disabilities into all of the University's educational programs. The Office of Student Accessibility Services (OSAS) is responsible for the determination of appropriate accommodations for students who encounter disability-related barriers. Once a student has completed the OSAS process (registration, initial appointment, and submitted documentation) and accommodations are determined to be reasonable and appropriate, a Letter of Accommodation (LOA) will be available to generate for each course. The LOA must be given to each course instructor by the student and followed up with a discussion. This should be done as early in the semester as possible as accommodations are not retroactive. More information can be found at osas.usc.edu. You may contact OSAS at (213) 740-0776 or via email at osasfrontdesk@usc.edu.

Support Systems:

Counseling and Mental Health - (213) 740-9355 – 24/7 on call
Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention.

988 Suicide and Crisis Lifeline - 988 for both calls and text messages – 24/7 on call
The 988 Suicide and Crisis Lifeline (formerly known as the National Suicide Prevention Lifeline) provides free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week, across the United States. The Lifeline is comprised of a national network of over 200 local crisis centers, combining custom local care and resources with national standards and best practices. The new, shorter phone number makes it easier for people to remember and access mental health crisis services (though the previous 1 (800) 273-8255 number will continue to function indefinitely) and represents a continued commitment to those in crisis.

Relationship and Sexual Violence Prevention Services (RSVP) - (213) 740-9355(WELL) – 24/7 on call
Free and confidential therapy services, workshops, and training for situations related to gender- and power-based harm (including sexual assault, intimate partner violence, and stalking).

Office for Equity, Equal Opportunity, and Title IX (EEO-TIX) - (213) 740-5086
Information about how to get help or help someone affected by harassment or discrimination, rights of protected classes, reporting options, and additional resources for students, faculty, staff, visitors, and applicants.

Reporting Incidents of Bias or Harassment - (213) 740-5086 or (213) 821-8298
Avenue to report incidents of bias, hate crimes, and microaggressions to the Office for Equity, Equal Opportunity, and Title for appropriate investigation, supportive measures, and response.

The Office of Student Accessibility Services (OSAS) - (213) 740-0776
OSAS ensures equal access for students with disabilities through providing academic accommodations and auxiliary aids in accordance with federal laws and university policy.

USC Campus Support and Intervention - (213) 740-0411
Assists students and families in resolving complex personal, financial, and academic issues adversely affecting their success as a student.

Diversity, Equity and Inclusion - (213) 740-2101
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
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) 442-1200 – 24/7 on call
Non-emergency assistance or information.

Office of the Ombuds - (213) 821-9556 (UPC) / (323-442-0382 (HSC)
A safe and confidential place to share your USC-related issues with a University Ombuds who will work with you to explore options or paths to manage your concern.

Occupational Therapy Faculty Practice - (323) 442-2850 or otfp@med.usc.edu
Confidential Lifestyle Redesign services for USC students to support health promoting habits and routines that enhance quality of life and academic performance.

Week by week plan: Lecture and Lab*

self-check your work each week and provide near-peer mentoring and feedback.

* will be modified as needed

HBIO 408	Lecture Location	Monday	Wed	Labs* PED	Tool building/Habits of Mind
1	SOS B46	Motion analysis, events, phases	Cause-Effect, FBD, MAD	Your set up	Habits, Data analysis
21-Aug		Whole Body (CM)	squat-stand, stand-squat	Own Tools	Community of Practice
2	SOS B46	net impulse=Δmomentum	Compare-Contrast (film strip)	Body parameters	Evidence (video, filmstrip)
28-Aug	lab on own	Mechanical Objectives	with, w/out momentum	CM	Data Visualization
3		*Labor Day Week (no labs)*	*Literature Review*	Field Work/Interview	Literature Library (References)
4-Sep	lab on own	Wed Lecture on Blackboard	interview an expert	Video/Vayu	Find an expert
4	SOS B46	net impulse=Δmomentum	Projectile Motion	Linear Impulse	Ask an expert (network)
11-Sep		Jump Shot: multiple phases	ball/body	Running	Interview based on lit
5	SOS B46	net ang impulse=Δmomentum	Context at Initiation	Angular Impulse	Clarity of Mechanical Objectives
16-Sep		back, reverse dives	stand vs running front	Diving	how context influences mechanisms
6	SOS B46	Performance Improvement	Reduce Risk	**Practical Exam**	**Demonstrate Proficiencies in Lab**
25-Sep		(Land and Go)	(Land and Stop)		
7	SOS B46		Motion Analysis:	Multijoint	Pilot, angle-angle plots
2-Oct		**Midterm Exam**	Segment/Joint Level (STS)	Control	phase plane, Muscle Length, Vel
8	PED B10	**Project Data Collection**	**Data Collection**	**Data Collection**	Verify reference systems
9-Oct		Sign up for times: PED B10		*break*	Synchronize force and video
9	SOS B46	Lower Extremity Joint Kinetics	Lower Extremity Joint Kinetics	Project	*Evidence (video, filmstrip)*
16-Oct		STS horizontal thigh	STS ergonomics	Filmstrip +/-	Data Visualization
10	SOS B46	Lower Extremity Joint Kinetics	Upper Extremity Joint Kinetics	Project	*Regulation of Momentum*
23-Oct		STS seat raised	WC propulsion	Force-tiime plots	implications on flight phases?
11	SOS B46	Preparation for Mech Demand	Preparation for Mech Demand	Project	*Context for Muscle Force*
30-Oct		Resistance training	Resistance training	angle-angle dot plots	Length, change in length/time
12	SOS B46	Preparation for Mech Demand	Review	Project	*In Context at whole body level* ?
6-Nov		Resistance training		NJF, NJMs	Initial conditions? Real world?
13	SOS B46		Project Abstracts Shared	Project	*Interpretation* : Skill Acquisition?
13-Nov		**Midterm Exam**	in class (3 minute 1 slide)	Interpretation	Gaps in Literature?
14	Natural	optional Field Trip on Monday	no class Thanksgiving	Project	*Implications* : Performance
20-Nov	History Museum	Comparative Biomechanics	* free with USC ID	Presentations	Preparation/return to play
15	SOS B46	Review: Whole Body	Review: Joint/Segment level	**Presentations**	*Communication*
27-Nov					M: 5-8PM, T: 5-8PM, W: 5-8 PM
Final 12/11	SOS B46	**Comprehensive**	* grade own work (-/+) needs work (-) can explain and apply to novel situations (+)		

Develop Your Habits of Mind as Part of the Learning Process

1. THINK critically and creatively to solve problems
What, How, Why, Modify, Reflect and Repeat

2. COMMUNICATE effectively in multiple mediums, languages, and settings
Purpose (clarity, Why this? Why now?)
Rationale for approach (structure)
Evidence (accuracy, reliability)
Assimilation with existing knowledge: How experience advanced understanding?

3. COLLABORATE with others to achieve more together
Show respect
Leverage strengths
Build consensus

4. PRODUCE quality work, through initiative, self-direction, and perseverance
Goals: whole-part-whole
Accountability: relevant, understandable, timely
Perseverance: learn, embrace errors as part of growth

5. ADAPT to new challenges by reflecting and growing
Learn
Adjust
Play on, play well together

6. CONTRIBUTE to the success of the community and world
With respect and social awareness
Active participation and listening