

USC Department of Biological Sciences

HBIO 439L: Human Performance and Bioenergetics*

Student-directed Learning Course

*FORMAT: Self-directed by the student with
guidance by the instructor*

4 units (quantitative approaches)

**Spring 2022— First meeting to be scheduled at a time that
fits with the student's timezone**

*course plan may be modified as needed throughout the semester
**For each unit of class time, the university expects two hours of out of
class student work per week over a semester** (time students spend
on homework, readings, writing, and other academic activities)

**Subsequent meeting times for class and lab component
are specific to the student's line of investigation and
timeline designed by student with the instructor**

*Students are encouraged to contact the Dr. McNitt-Gray
(mcnitt@usc.edu) to sort out any potential time conflicts and course
preparation including prerequisites.*

Location: PED B9-10 Meeting Location

Instructor: Jill L McNitt-Gray

Office Hours: virtual

Contact Info: mcnitt@usc.edu

Course Description

This course is for students interested in problems at the interface of human and technology to advance human health in wellness. Students will learn about the cause-effect relationships governing human performance by gaining hands-on experience analyzing the physiological and biomechanical aspects contributing to human performance through the use of emerging technology.

This is a student-directed, problem-based learning experience. Topics and timelines will vary with student interests and timelines. Project milestones and timeline are determined by the student and the instructor.

Exemplar topics specific to preserving mobility may include integration of concepts from human performance, motor control, mechanical & physiological energy cost in populations of interest. For example:

- a) *Positive learning transfer* during skill acquisition and role of feedback in improving performance
- b) *Preparation to play: increasing capacity and improvement in multijoint control and force generation from prehab to rehab*
- c) *Integration of concepts related to biomechanics, motor control and functional anatomy*
- d) *Integration of technology to track personal activity and improvements in performance*
- e) *Utilization of universal design to create environments where people of all abilities can thrive*

Data Collection Sites:

Outside, USC Undergraduate laboratories
Rancho Los Amigos National Rehabilitation Center, Downey, California

Spring 2022 : Online Meeting Times and Field work with communities: To be determined within COVID 19 guidelines

Mission: advance science, engineering, and innovation for the benefit of all people
(aligned with AAAS- **American Association for the Advancement of Science Mission**)

Think globally, act locally to support communities of practices using universal design principles

Build community of practice with Educators and Scientists
Science education in daily life and the town square
Advocacy for evidence based practices
Personalize learning experiences and personalized pathways toward careers in STEM
Build communities of practice that fosters Diversity, Equity and Inclusion
Strategic distribution of time and resources to sustain economic support of science
Science diplomacy and policy
Lifetime public engagement and translation of science into practice

Overarching Goals:

- To develop a deeper understanding of the central and cross-disciplinary concepts of human biology that are of interest to the student
- To foster students' independent and collaborative work, which entails identifying, exploring, assessing and solving both conceptual and real-world problems through engineering design and the application of the scientific method, basic scientific principles and methodologies
- To place biological knowledge into an ethical context and apply biological principles to the resolution of ethical, sociocultural, and environmental issues

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

Personal Skill Development includes focus on

- Habits of mind and body that support success including regular reflection on process
- Linking learning and clarify next steps on career path
- Value of intersectionality and interdependency in universal design
- Apply cross-disciplinary principles to advance knowledge of structure-function and cause-effect relationships
- Independently and collaboratively apply scientific knowledge, experimental, and analytical skills to produce integrative original work in an area of personal interest

- Formulate working hypotheses from peer-reviewed literature and design approaches to test hypotheses using scientific methodology
- Present scientific evidence in an ecologically relevant context using well-supported rational and effective data visualization approaches

Course Notes: 4 units quantitative approach

Meeting Times: To be determined together by student and professor (4-units: 200 minutes; 2-units: 100 minutes) The problem-based nature of this course requires that the meeting times will be specific to the project.

Students are encouraged to contact the Dr. McNitt-Gray (mcnitt@usc.edu) to sort out any potential time conflicts and course preparation including prerequisites.

Required Readings and Supplementary Materials

Web-Based Lecture Notes, Selected Literature Readings, Electronic Storage Device

Lab Notebook required at all times

Grading Breakdown

Effective application of principles in projects during class (weekly progress required)

(40%) weekly communication on progress/challenges using oral, written, and electronic means

(10%) responsible practices including research involving human subjects, data management, data integrity, security, and privacy (CITI certifications)

(10%) assimilation what is unknown and unknown through literature review of relevant literature and in consultant with experts in the field

(15%) integration of multiple sources of information to advance working knowledge on topics of interest

(15%) visualization of cause-effect or form-function relationships

(10%) culminating end product of choice

Standard Grading Scale: >90% A range, > 80% B range, >70% C range, >65% D range, <65% F

Course and Lab Schedule: A Weekly Breakdown

Weekly Topics: Class and Lab activities are integrated each week and will emphasize the following aspects from both a human biology, engineering, and computer science point of view. Teams can be formed based on mutual interest and complementary skill sets.

Exemplar Processes: Timelines will vary and are determined by student and instructor (personalized syllabus)

For those interested in biomechanics, this provides *an example* of how skills are developed and problems are investigated qualitatively and quantitatively. Lab: includes experimentation in variety of forms specific to the line of investigation.

1. Introduction: Research involving Human Subjects and Data management, security, and privacy

Lab: On-line certification process (CITI certification)

2. Experimental Design and Literature Review, effective and ineffective approaches to date

Lab: Electronic library search and bibliography references (Mendeley)

3. Physiology & Nutrition of Human Performance, integrating behavior data over time

Lab: Quantify metabolic aspects of complex motor skill, evaluate performance variables

4. Kinematic Data - principles & analysis, value what is measured

Lab: Define mechanical objectives in each phase of task, digitally capture human motion / determine critical performance variables

5. Motor Learning - Complex Motor Skills, integration of multiple sources of information to improve performance

Lab: Analyze kinematic data in terms of perception-action, determine multi-joint coordination patterns

6. Kinetic Data - principles & analysis, data visualization of cause effect relationships

Lab: Use reaction force data, analyze critical performance variables

7. Propose Pilot Project (Draft of design, implementation, testing, evaluation)

Lab: Develop plan for quantitatively evaluating performance between two conditions

8. Assimilate results from data collection (apply data management skills and deal with messy data)

Lab: Develop plan for communicating results of performance evaluation

9. Physiology/ Motor Control Analysis (time synchronization of multimodal data collection approaches)

Lab: Analyze bioenergetics and motor performance using observed motion

10. Kinematic data analysis & Interpretation (establishing functionally relevant differences)

Lab: Characterize an individual's observed motion (total body / joint / segment levels)

11. Kinetic data analysis & Interpretation (data visualization of cause-effect relationships)

Lab: Analyze causes of observed motion (total body level analysis)

12. Propose final demonstrative product of learning experiences based on lessons learned

Lab: Refine and iterate analysis and communication

13. Integrate bioenergetics and human performance components of project

Lab: Explain cause-effect relationships using data visualization or demonstration

14. Final Product Demonstrations with peer review

Lab: Prepare experimental results and discussion (3 minute Presentation)

15. Final Project Demonstrations with peer review

Final Exam: Product of student's choosing

Examples include:

Learn by doing experience for audience of choice: MS students, ergonomics administrator, prosthetist
Public Health Info Tool kit, Technical note (J of Biomechanics format)

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:

Counseling and Mental Health - (213) 740-9355 – 24/7 on call
studenthealth.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) 740-9355(WELL), press "0" after hours – 24/7 on call

studenthealth.usc.edu/sexual-assault

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

Office of Equity and Diversity (OED) - (213) 740-5086 | Title IX – (213) 821-8298

equity.usc.edu, titleix.usc.edu

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

usc-advocate.symplicity.com/care_report

Avenue to report incidents of bias, hate crimes, and microaggressions to the Office of Equity and Diversity | Title IX for appropriate investigation, supportive measures, 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 Campus Support and Intervention - (213) 821-4710

campussupport.usc.edu

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.