USC Department of Biological Sciences

HBIO 439L: Human Performance and Bioenergetics (course can be taken all online)

This problem-based learning course can be taken for 2 units or 4 units

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

Units:
4 units (quantitative approaches)
2 units (qualitative approaches)
Spring 2021— First meeting to be scheduled at a time that fits with the student's timezone

Subsequent meeting times for class and lab component are specific to the student's project timeline designed by student and 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

There will be a Wellness day that falls on Wednesday during the spring semester and the class will not meet on that day (April 7).

Course Description (4 units)

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 normal, elite, and clinical populations, including

a) *Positive learning transfer* during skill acquisition (e.g. task intention / movement integrity / coordination strategies / metabolic cost / role of feedback in improving performance)

b) *Mobility in individuals with and without disability* (e.g. Compare and contrast wheelchair propulsion mechanics of paralympians with clinical populations using wheelchairs)

c) *Mobility of individuals with and without assistive devices*: Compare and contrast locomotion in different contexts (e.g. start-stop mechanics of paralympians with those of clinical populations using assistive devices including prostheses)

d) *Movement mechanics of individuals under physically challenging conditions*: (e.g. Human performance changes with the onset of physiological fatigue; motor complexity, coordination strategies, altered mechanical loading strategies)

e) *Using technology to track personal activity and improvemens in personal health and wellness.* (e.g. Deteremine if data collected using wearable sensors (heart rate, GPS, number of steps, fuel intake, rest) contributes to improvements in human performance.

Data Collection Sites:
Outside, USC Laboratories; US Olympic Training Center, Chula Vista, California;
Rancho Los Amigos National Rehabilitation Center, Downey, California

Spring 2021 : Online Meeting Times and Field work with communities: To be determined within COVID 19 guidelines

Mission: advance science, engineering, and innovation throughout the world 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

Build community of practice with Educators and Scientists
Science education in daily life and the town square
Advocacy for evidence
Vaired pathways toward careers in STEM
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

Goals

To develop a deeper understanding of the central and cross-disciplinary concepts of human biology

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

Apply cross-disciplinary principles to explain structure-function relationships

Independently and collaboratively apply scientifici knowledge, experimental, and analytical skills to produce integrative original work

Formulate working hypotheses from peer-reviewed literature and test using scientific methodology

Present scientific evidence in an ecological context using well-supported rational

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

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 attendance required)
(10%) **weekly communication on progress/challenges using oral, written, and electronic means**
(10%) **Human Subjects Data management, data integrity, security, and privacy**
(10%) **Litererature Review of effective and ineffective approaches to date**
(15%) **integration of multiple sources of information**
(15%) **data visualization of cause effect relationships**
(40%) **project demonstration & technical note**

Standard Grading Scale: >90%=A,> 80%=B, >70%=C, >65%=D, <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.**

For those interested in biomechanics, this provides *an example* of how skills are developed and problems are investigated qualitatively and quantitatively.

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 bibiliography 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 dealing 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 project based on lessons learned in pilot project
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 Project 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)
******course plan may be modified as needed throughout the semester

In addition to in-class contact hours, all courses must also meet a minimum standard for out-of-class time, which accounts for time students spend on homework, readings, writing, and other academic activities. **For each unit of in-class contact time, the university expects two hours of out of class student work per week over a semester.**

Course Description (2 units)

This course is for students interested in 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.

Exemplar topics specific to preserving mobility include integration of concepts from human performance, motor control, mechanical & physiological energy cost in normal, elite, and clinical populations, including

a) *Positive learning transfer* during skill acquisition (e.g. task intention / movement integrity / coordination strategies / metabolic cost / role of feedback in improving performance)

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d) *Movement mechanics of individuals under physically challenging conditions*: (e.g. Human performance changes with the onset of physiological fatigue; motor complexity, coordination strategies, altered mechanical loading strategies)

Data Collection Sites:
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To place biological knowledge into an ethical context and apply biological principles to the resolution of ethical, sociocultural, and environmental issues

Learning Objectives

Apply cross-disciplinary principles to explain structure-function relationships

Independently and collaboratively apply scientifici knowledge, experimental, and analytical skills to produce integrative original work

Formulate working hypotheses from peer-reviewed literature and test using scientific methodology

Present scientific evidence in an ecological context using well-supported rational

Course Notes: 2 units (qualitative approach)

Meeting Times: To be determined together by student and professor (4-units: 200 minutes; 2-units: 100 minutes) While class time is formally scheduled for Wed afternoon, the project 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 regarding 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

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Lab: Quantify metabolic aspects of complex motor skill, evaluate performance variables
4. Qualitative anlaysis of motion - principles & analysis, value what is analyzed
Lab: Define mechanical objectives in each phase of task, compare using qualitative techniques
5. Motor Learning - Complex Motor Skills, integration of multiple sources of information
Lab: Analyze motion using qualitative approaches for understanding of perception-action
6. Visualization of cause effect relationships using qualitative approaches
Lab: analyze critical aspects of performance
7. Propose Pilot Project (Draft of design, implementation, testing, evaluation)
Lab: Develop plan for qualitatively evaluating performance between two conditions

8. Compare and contrast performance using qualitative approaches
Lab: Develop plan for communicating results of performance evaluation
9. Physiology/ Motor Control Analysis using qualitative approaches
Lab: Analyze bioenergetics and motor performance using observed motion
10. Analysis and Interpretation (establishing functionally relevant differences)
Lab: Characterize an individual's observed motion (total body / joint / segment levels)
11. Analysis and Interpretation (data visualization of cause-effect relationships)
Lab: Analyze causes of observed motion (total body level analysis)
12. Propose final project based on lessons learned in pilot project
Lab: Refine and iterate
13. Integrate bioenergetics and human performance components of project
Lab: Explain cause-effect relationships using data visualization or demonstration
14. Final Project Demonstrations with peer review
Lab: Prepare experimental results and discussion (Presentation)
15. Final Project Demonstrations with peer review
Final Exam Component: Oral presentation of project (10 minutes with 5 minutes of questions)
****course plan may be modified as needed throughout the semester
In addition to in-class contact hours, all courses must also meet a minimum standard for out-of-class time, which accounts for time students spend on homework, readings, writing, and other academic activities. **For each unit of in-class contact time, the university expects two hours of out of class student work per week over a semester.**

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.