



HBIO 309 – The Human Machine

Units: 4

Class Period: Fall 2025 TTH 2:00 – 3:20 pm

Location: Dr. Joseph Medicine Crow Center for International and Public Affairs - DMC 252

Instructor: Dr Chrisandra Kufeldt

Email: kufeldt@usc.edu

Please contact me through email. I will respond to your emails immediately during working hours. Do not expect a response during evening hours or weekends.

Office: AHF B10C, Goodall Office Suite in Basement of Hancock

Office Hours: TBD

I understand that my office hours may not accommodate everyone. I am happy to meet with students at an alternative time or through zoom. Please contact me to schedule a preferred time.

Course Description

The purpose of this course is to learn about biomechanics – the forces acting on and generated within the human body. We will examine human anatomy and function in an evolutionary context to understand how the human body works and how it differs from other animals, specifically non-human primates. In this course we will cover basic human anatomy, bone and muscle development and structure; the biomechanics of walking, running, throwing, manual dexterity, the sensory system, and head biomechanics. We will explore the biomechanics of these structures using an active approach. No prior knowledge of anatomy is required. In addition to covering basic anatomy, biomechanics, and evolution, this course will review the methods used to understand human movement patterns.

Learning Objectives

This is a lecture-based, active-learning course for students with a background in anthropology and biology with a focus on evolution and anatomy. As a result of completing this course, students will be able to:

- 1) Describe the role of evolutionary processes in generating modern human anatomy.

- 2) Discuss the interaction between form and function in human anatomy.
- 3) Explain how our evolutionary history interacts with anatomy and physiology to determine health outcomes.
- 4) Identify and describe the structure/function of bones and muscles in the human body.
- 5) Apply cross-disciplinary scientific principles to explain how humans operate, adapt, or evolve.
- 6) To apply scientific knowledge as well as analytical and experimental skills to produce integrative independent original work.
- 7) To discuss the interplay and relative influence of biology and social context on dimensions of human diversity and health.

Course Notes

All course materials including syllabus, pdfs of lecture, assigned readings, grades, and assignment rubrics can be found on Brightspace. Additionally, course announcements, assignment and scheduling amendments can also be found here.

Required Readings and Supplementary Materials

No textbook encapsulates all the material covered in this course and instead multiple resources are used. There are three books listed below that may be of interest for those that feel they need extra help or are just overall interested in the subject matter, (all of these books can be found on used book sites like AbeBooks, they are slightly pricier on Amazon). In the class schedule I provide specific chapters from each book each week.

To be clear this is a suggestion – not a requirement. All the exam questions will come from my lecture slides. Similarly, I will also post readings that will supplement lecture or provide an even greater understanding of the material. Please note the course readings are not the same as the readings for the reading response questions.

Readings for each week will be posted as PDFs on Brightspace.

Suggested Readings:

Langdon, J.H., 2005. *The Human Strategy: An Evolutionary Perspective on Human Anatomy*. New York: Oxford University Press.

Alexander, R. M., 1992. *The Human Machine*. London: Natural History Museum Publications.

Aiello, L., Dean, C.M., 1990. *An Introduction to Human Evolutionary Anatomy*. London: Academic Press Limited.

Sharing of Course Materials Outside of the Learning Environment is Strictly Prohibited

USC has a strict policy (Campus Section 11.12[B]) that prohibits sharing of *any* synchronous and asynchronous course content outside of the learning environment. Any student who violates this policy will be prosecuted to the maximum extent allowable by the USC Student Conduct Code, including failure of the course and suspension from the University.

Distribution or use of notes or recordings based on university classes or lectures without the express permission of the instructor for purposes other than individual or group study is a violation of the USC Student Conduct Code. This includes, but is not limited to, providing materials for distribution by services publishing class notes. 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. (See Section C.1 Class Notes Policy).

Grading and Assessment

Participation for this course is *very* important since most of your grade is based on in- and out-of-class activities and exams, therefore regular attendance is crucial to maintain a high grade.

Every student must complete all assignments. This course requires reading, writing, and critical thinking.

Final grades will be determined on the following rubric:

1. 11 quizzes @ 5 points each
2. Reading Response @ 15 points each
3. Climbing gym activity @ 50 points
4. Exams I @ 50 points
5. Exam II @ 50 points
6. Final Project @ 70 points

Total: 350 points

1. In-class activities

In-class activities will include weekly questions or short quizzes based on the previous weeks' lectures.

2. Reading Response

Throughout the semester, I will post response questions for specific readings. All readings are on Brightspace, and questions will be posted there. There will be 10 response questions scattered throughout the semester and ***you must answer 5 of them (you can choose which five to answer)***. All response questions are due by 12:00 pm on the due date and must be uploaded to Brightspace. Since all questions are posted as of the first day of class, plan appropriately. Responses should be 1-2 pages in length.

3. Out-of-class activities

Biomechanics and functional morphology are fascinating topics, but there are times when we need to go outside the classroom to understand the principles behind what you are learning in lecture. To this end, there will be a trip to the climbing gym:

September 26 – Climbing gym <https://touchstoneclimbing.com/cliffs-of-id/>
Tickets will be provided for you. But please plan accordingly – wear appropriate attire, arrive on time, don't eat a huge lunch right before!

3. Exams

Students will be given two in-class exams which will evaluate your knowledge on the lectures of human anatomy and biomechanics through each section. See the schedule and make travel plans accordingly. Tip: Weekly quiz questions will appear on the exams.

4. Final Project

Students will turn in a final project on the biomechanics of sport – any sport you like, this is an open topic. The final project needs to include (1) video – either of you performing the sport or taken by you, (2) five-page paper explaining the biomechanics of the chosen sport. A minimum of ten citations is required, my lectures do not count and should not be used as a citation. A rubric for the final presentation is available on Brightspace.

Final grades will be determined by the following grading scale:

330 – 350 points	94 – 100%	= A
320 – 315 points	90.0 – 93.99%	= A-
314 – 305 points	87.6 – 89.99%	= B+
304 – 294 points	84 – 87.5%	= B
293 – 280 points	80 – 83.99%	= B-
279 – 270 points	77.6 – 79.99%	= C+
269 – 259 points	74 – 77.5%	= C
258 – 245 points	70 – 73.99%	= C-
244 – 210 points	60 – 69.99%	= D
209 ↓ points	59% and below	= F

A note on missed or late work

There are no make-ups for missed quizzes or reading responses. If there is an illness, it is the student's responsibility to contact me immediately to discuss the option of making up work or missing an exam since the schedule is available ahead of time.

Course Specific Policies

This is an active-learning course, and most of the course will be discussion-based. Students are expected to contribute to the discussion in every class and should be familiar with the assigned readings. Like all research, some aspects of this course will be collaborative. The goal of team-based activities is to provide students with an opportunity for clarifying their own thoughts on course material, for synthesizing multiple opinions, and for accessing more information than can be accomplished alone. The instructor will determine small groups by assignment in the second week of the course.

A few ground rules are expected to promote full participation.

- Students will silence all cell phones/tablets/laptops during class. These items are only permitted for the taking of notes and accessing course material via the course website; any other use may result in a loss of this privilege.
- To promote a respectful, professional, and productive classroom environment, the following expectations will be maintained during all class sessions.
 - Do not interrupt when someone else is speaking.
 - You can criticize ideas, but not each other.
 - Avoid inflammatory language.
 - Support assertions with evidence from lectures or readings or speak from personal experience.
 - Do not dominate the discussion.
 - Make a single point each time you speak, rather than making a series.

Attendance

Students are permitted only excused absences from this class (see institutional guidelines). Unexcused absences receive no attendance points for the day. I understand that life gets in the way, so you are allowed **two** unexcused absences.

Academic Integrity

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](#).

Course Policy on AI

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 Schedule

<u>Week 1</u>		
<i>Human Evolution</i>		
Tuesday	August 26	Introduction
Thursday	August 28	Human Evolution (Brief review)
		Readings: Overview of evolutionary concepts – Lewin, R., Foley, R., 2004. <i>The Principles of Evolutionary Theory</i> Langdon, J.H., 2005. <i>The Human Strategy</i> , Chapters 2 – 3. Aiello, L., Dean, M.C., 1990. <i>Human Evolutionary Anatomy</i> , Chapter 1.
<u>Week 2</u>		

		<i>Human Anatomy</i>
Tuesday	September 2	Bones
Thursday	September 4	Muscles
		Readings: Langdon, J., 2005, The Human Strategy. Chapter 3. Aiello, Aiello, L., Dean, M.C., 1990. Human Evolutionary Anatomy. Chapter 2 – 3.
<u>Week 3</u>		
		<i>Lower Limb</i>
Tuesday	September 9	Biomechanics
Thursday	September 11	Lower Limb Anatomy Due: Reading Response
		Readings: Aiello, L., Dean, M.C., 1990. Human Evolutionary Anatomy, Chapter 2; Langdon, J.H., 2005. The Human Strategy, Chapter 8.
<u>Week 4</u>		
Tuesday	September 16	Lower Limb cont. start Walking I
Thursday	September 18	Walking I cont. start Walking II
		Readings: Alexander, R.M., 1992. The Human Machine, Chapter 5; Aiello, L., Dean, M.C., 1990. Human Evolutionary Anatomy, Chapters 14; Langdon, J.H., 2005. The Human Strategy, Chapter 9; McNutt, E.J., Zipfel, B., DeSilva, J.M., 2018. The evolution of the human foot. Evolutionary Anthropology 27, 197 – 217.
<u>Week 5</u>		
Tuesday	September 23	Walking II cont.
Thursday	September 25	Activity: Climbing gym
		Reading: Stern, J.T., 2000. Climbing to the top: a personal memoir of <i>Australopithecus afarensis</i> , Evolutionary Anthropology 9, 113-133.
<u>Week 6</u>		
Tuesday	September 30	In-class activity with bones and muscles
Thursday	October 2	Review and Questions Due: Reading Response
		Reading: Alexander, R.M., 1992. The Human Machine, Chapter 6.

Week 7

Tuesday	October 7	Exam I
Thursday	October 9	Fall Recess

Week 8

<i>Running</i>		
Tuesday	October 14	Running I
Thursday	October 16	Running II
		Readings: Alexander, R.M., 1992. The Human Machine, Chapters 1, 10; Langdon, J.H., 2005. The Human Strategy, Chapter 7; Aiello, L., Dean, M., 1990. Human Evolutionary Anatomy, Chapter 16. Bramble, D.M., Lieberman, D.L., 2004. Endurance running and the evolution of <i>Homo</i> . Nature 432, 345-348.

Week 9

Tuesday	October 21	Upper Limb
Thursday	October 23	Reaching and Throwing Due: Reading Response
		Readings: Alexander, R.C., Human Machine, Chapter 2; Aiello, L., Dean, Human Evolutionary Anatomy, Chapters 17 – 18. Roach, N.T., Richmond, B.G., 2015. Clavicle length, throwing performance, and the reconstruction of the <i>Homo erectus</i> shoulder. Journal of Human Evolution 80, 107-113.

Week 10

Tuesday	October 28	Hand Anatomy
Thursday	October 30	Head Anatomy
		Readings: Kivell, T.L., et al., 2023. Form, function, and the evolution of the human hand. Yearbook of Biological Anthropology 181(76), 6 – 57; Marzke, M.W., Marzke, R.F., 2000. Evolution of the Human Hand: Approaches to acquiring, analyzing, and interpreting the anatomical evidence. Journal of Anatomy 197, 121 – 140.

Week 11

		<i>Sensory System and Head Biomechanics</i>	
Tuesday	November 4	Eating and Digestion	
Thursday	November 6	Eyes and vision, ears, hearing, and balance	
		Readings: Langdon, J.H., <i>The Human Strategy</i> , Chapter 4; Aiello & Dean, <i>Human Evolutionary Anatomy</i> , Chapters 4 – 5. Langdon, J., <i>The Human Strategy</i> , Chapter 14; Alexander, R.M., <i>The Human Machine</i> , Chapter 11;	
<u>Week 12</u>			
Tuesday	November 11	Eating and Digestion	Due: Reading Response
Thursday	November 13	Exam II	
		Reading: Aiello, L.C., Wheeler, P. The expensive tissue hypothesis. <i>Current Anthropology</i> 36, 199 – 213.	
<u>Week 13</u>			
Tuesday	November 18	Brain structure and function	
Thursday	November 20	Brain structure and function cont.	
		Readings: Kobayashi, H., Koshima, S., 2001. Unique morphology of the human eye and its adaptive meaning: comparative studies on external morphology of the primate eye. <i>Journal of Human Evolution</i> 40, 419 – 435. Langdon, J.H., <i>The Human Strategy</i> , Chapters, 12, 10; Aiello & Dean, <i>Human Evolutionary Anatomy</i> , Chapter 10.	
<u>Week 14</u>			
Tuesday	November 25	Evolution of Speech	
Thursday	November 28	Thanksgiving break	
<u>Week 15</u>			
Tuesday	December 2	Speech	
Thursday	December 4	Wrap up	Due: Reading Response
		Reading: Tecumsah Fitch, W. (2000). The evolution of speech: A comparative review. <i>Trends in Cognitive Sciences</i> . 4, 258-267. Alexander, R.M., <i>The Human Machine</i> , Chapter 14; Aiello & Dean, <i>Human Evolutionary Anatomy</i> , Chapter 13.	

Week 16

Thursday	December 12	Final Project Due
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Statement on Academic Conduct and Support Systems

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.