THE UNIVERSITY OF UTAH

ANTH 5451/6451
Human Physical Activity in Evolutionary Perspective

Department of Anthropology
Fall Semester 2024
Monday, 2:00 pm – 5:00 pm; BU C 204

Instructor: Dr. Thomas Kraft
Email: thomas.kraft@utah.edu
Office location: Gardner Commons 4445
Course Canvas page: https://utah.instructure.com/courses/895957

Office hours: By appointment. Meetings can be conducted in person or over zoom. Please email me to set up a time that works for us both.

Required course materials:

1. Lieberman, Daniel E (2020) *Exercised: Why Something We Never Evolved to Do Is Healthy and Rewarding*. Pantheon (available via Inclusive Access (online version only) or at Amazon or other online retailers for <$20)
2. Assigned articles (links and pdfs provided)

Land acknowledgment

The University of Utah sits on land that is the traditional and ancestral homeland of the Shoshone, Paiute, Goshute, and Ute Tribes. We recognize and respect the enduring relationship that exists between many Indigenous peoples and their traditional homelands. We respect the sovereign relationship between tribes, states, and the federal government, and we affirm our commitment, as part of the University of Utah, to a partnership with Native Nations and Urban Indian communities through research, education, and community outreach activities.

Course description

Humans engage in a marvelous diversity of physical activities, from running marathons, to ballet dancing, to fingerpicking guitars. Such activities are not only beautiful, but also characterize who we are as a species. Today, human physical activity and energetics are also among the strongest determinants of our health and longevity.

In this seminar, we will consider the evolutionary factors underlying how and why humans use our bodies the ways we do, and why differences between past and present human physical activity patterns may be causing our bodies to malfunction and suffer from illnesses that our ancestors managed to avoid.

Critical questions include:

- If exercise is so good for you, why do so many people dislike or avoid it?
- Is it bad to slouch? Are humans comparatively slow and weak?

- Is exercise ineffective for losing weight?
- Does running ruin your knees?
- How much does exercise affect our vulnerability to cancer or infectious disease?

Weekly readings and discussions in this seminar course will cover key evidence bearing on these topics from a wide variety of scientific disciplines, including evolutionary biology, paleoanthropology, behavioral ecology, comparative biology, exercise physiology, biomechanics, medicine, and more. This is a 3 credit hour course.

Course Outcomes/Learning objectives:
At the end of the course, students should have obtained:

- An understanding of how evolution has shaped human physical activity and energetics differently than other species.
- A general knowledge of the diversity of physical activities undertaken by peoples from different cultures around the world, including hunter-gatherer and other subsistence societies.
- A broad understanding of the evolutionary theories and principles that biological anthropologists employ to understand energetics and the health impacts of physical activity.
- The ability to read and engage with the primary scientific literature on human energetics, physical activity, and health.
- A grasp of the tools/methodologies available to study physical activity and health from an evolutionary perspective.
- A comprehensive understanding of why and how physical activity is beneficial to human health.

Course prerequisites:
This is a course for upper-level undergraduates and graduate students. Although there are no specific course prerequisites, a background in biological anthropology is assumed and students will be expected to be capable of reading and engaging with articles in the primary literature.

Instructor
Dr. Thomas Kraft (he, him, his)

Email: thomas.kraft@utah.edu

About me: I am a behavioral ecologist interested in how interactions between social behavior, culture, and the environment shape human health and aging. I conduct ethnographic fieldwork with contemporary small-scale subsistence societies (hunter-gatherer and horticulturalist) in tropical environments, utilizing tools and theory from ecology, evolutionary biology, biomedicine, and anthropology to further our understanding of human evolutionary biology. Two questions central to my current research are: How do processes of environmental change, market integration, and sedentarization interact to shape physical activity and health in transitioning populations? And how do changes in social behavior and norms that accompany acculturation affect health disparities? I am a co-founder and director of the Orang Asli Health and Lifeways Project, a longitudinal study of health and behavior in Peninsular Malaysia. For more about my field project in Malaysia, see: https://www.orangaslihealth.org/

Contacting me by email: At some points during the semester, my email inbox gets very full, but

I do want to hear from you. If you email me and do not hear back from me within two business days, please send a follow up email. I will appreciate the gentle reminder.

Teaching and Learning Methods:

This is a discussion (seminar style) course that will involve a great deal of reading followed by in-depth conversation and the dissection of concepts, theories, methods, and ideas. Learning to engage with the primary scientific literature is a key objective of this class, and thus students will be asked to read cutting-edge work that is necessarily dense and geared towards specialists. As part of this class, students will also engage in some experiential learning exercises involving tracking physical activity. There will be no quizzes or exams, and only some classes will include short lectures. Nevertheless, the course is designed to be challenging and you will need to think and work hard to get the most out of it. I expect everyone to learn a lot and have fun in the process.

During class meetings, I will be committed to fostering a learning environment where diverse perspectives are heard and valued. I request that all of you work with me in creating a classroom culture based on open communication, mutual respect, and inclusion. We will approach all discussions with respect and civility to ensure a welcoming space for everyone.

Grading Policy (Evaluation Methods & Criteria):

Category	**Grade contribution**
Weekly journal assignment	25%
Discussion participation	25%
Discussion leads	15%
Physical activity tracking	5%
Final project	30%

University of Utah Grading Scale		
	Score	*GPA*
A	: 93-100	4.0
A-	: 90-92	3.7
B+	: 87-89	3.3
B	: 83-86	3.0
B-	: 80-82	2.7
C+	: 77-79	2.3
C	: 73-76	2.0
C-	: 70-72	1.7
D+	: 67-69	1.3
D	: 63-66	1.0
D-	: 60-62	0.7
E	: 0-59	0.0

Descriptions of requirements for the course:

1. Complete all the assigned readings *prior* to coming to class meetings.
   In all likelihood, this will be the most difficult part of this course. Each week, there

will be multiple readings to complete that consist of book chapters and scientific journal articles. The readings for this course include much of what I consider to be the most interesting and influential scientific writings on the subject of human physical activity. Many of the articles are true classics, and I fully expect you to be fascinated and inspired by them as I have been. Over the course of the semester, we will also read the recently published book, "Exercised: Why Something We Never Evolved to Do Is Healthy and Rewarding" (by Daniel E. Lieberman). This is a new book highlighting cutting edge research on physical activity for a general audience that you are likely to find both enlightening and fun to read.

I realize that scientific journal articles can be dense with information and often hard to follow and fully understand. Whenever you find yourself struggling to grasp what you are reading, always keep in mind that you are not alone. We will have plenty of opportunity to discuss these articles as a group during class meetings where you can ask questions and draw on the collective knowledge of your peers.

In the first few weeks of class, you will have access to the required book chapters via Inclusive Access (I will also post PDF versions of the assigned book chapters on the course Canvas page). After that, you can opt out of the Inclusive Access program and purchase a hard copy of the book at the UofU bookstore or online, or you can opt to continue with Inclusive Access. All other assigned readings for the course are journal articles and listed at the end of this document. PDF versions of these articles will be provided on the course website.

*__For graduate students (enrolled in 6451) only: Note that a number of extra readings marked on the schedule below are required for graduate students, but optional for undergraduate students in the class.__

2. Attend class meetings and participate in discussions.

Attendance at class meetings is expected. Because this is a discussion-based seminar course, participation is critical to the learning experience and will form a significant portion of your grade. At the start of each meeting, there will be some sort of exercise to get the creative juices in our brains flowing. Next, I or another member of the class will provide a short introduction to the topic of the day. Then, for the vast majority of the meeting, we will have a group discussion about the day's topic and assigned readings. Before each meeting, to help prepare for discussions, I will provide you with a list of questions to think about as you complete the assigned readings.

If you cannot attend a particular class meeting due to an emergency or other unforeseen circumstance, please email me *at least 48 hours in advance* of the meeting that you need to miss. To receive credit for a day you cannot be in class, you will be required to submit a written summary of each of the assigned articles for that week (main question, methods applied, findings, and interpretation) and one question you had following your reading. I have great respect for students who are balancing their pursuit of education with the responsibilities of having a job or caring for children and other family members. If you run into challenges that require you to miss a meeting, please let me know so that we can find accommodations.

3. Leading class discussions.

Throughout the semester, you will be asked to lead several of our weekly class discussions by providing an introduction to the reading material and thoughts/questions to guide discussion. During each class, there will therefore be 1-3 Discussion Leaders, each

assigned one of our weekly readings. These discussions usually last for 30 min – 1 hour.

Here are more specific guidelines: Discussion leaders will read and synthesize the content of an assigned article for the week. Typically this should begin with a synopsis of article covering who the authors are and what are their fields of study, the major question addressed by the paper, the methods/approach utilized, the results found, and how the authors interpret their results in terms of answering the overall question addressed by the research. Giving an overview of the paper is key for getting us all on the same page in understanding, and also for giving other students that chance to ask questions to the discussion leader and one another.

However, describing the paper is NOT THE ONLY responsibility of the discussion leader. Once we are all on the same page about the objectives/results/outcome of the paper, the discussion leader should be prepared to engage the class with thought provoking questions on the theme we are discussing. These could be questions about how the research was performed, future research questions, how the paper relates to our own lives/experiences, or how the theme relates to other ideas we've learned about in the class. Discussion leaders should therefore come to class with at least 3 prepared comments or questions meant to foster quality discussion amongst the class and instructor. Discussion leaders will be required to submit a written outline of their plan by the beginning of class.

During our first class meeting I will provide further advice/guidance on how to do this successfully.

4. Complete weekly journal assignment.

Each week throughout the semester, I will post an assignment on Canvas with questions that should be completed *prior to coming to class*. The purpose of these assignments is to ensure that students are keeping up with course readings and gaining comprehension of material. A secondary goal is to develop your own thinking on human physical activity and energetics. Throughout the semester, as you gain an increasingly complex understanding of the subject matter, your entries/responses should be making connections among the various topics covered.

Responses will be submitted electronically via Canvas and one lowest score will be dropped.

***For graduate students (enrolled in 6451) only: You may be required to complete journal assignments with extended questions, particularly those pertaining to readings that are required for graduate students but supplementary for undergraduates.**

5. Keep track of your daily physical activity levels.

Since this is a course on the study of human physical activity, throughout the semester, we are going to study our own physical activity patterns. And we are going to try to do so in a way that promotes social engagement, by using a smartphone app called Pacer (www.mypacer.com). Pacer is a free and easy-to-use tool for measuring daily step counts, as well as sharing information and photos among users. I have created a private group in Pacer called "ANTH 5451/6451 (Fall 2023)" that you all will be invited to join, which will allow us to keep track of our daily step counts as a group. The group is meant for fun and to encourage us to pay closer attention to our physical activity levels. What the group is NOT meant for is competition or to make us feel guilty about our physical activity

levels. If for whatever reason you are uncomfortable sharing your daily step counts with the group, that is absolutely fine. If you want, when you download Pacer, you can create your account using a fake name, which will allow you to join the group without anybody (except me) knowing who you are. You may choose to use Pacer to keep track of your steps but choose not to join the group. If you do not have a smartphone, please let me know, and I will loan you a Fitbit to use to measure your daily step counts. Throughout the semester, you will be asked to reflect on your own data in relation to course material.

6. Final project.

Starting near the middle of the semester, you will be asked to begin planning a final project due at the end of the course that will consist of your choice of the following options:

(i) A practice grant write-up, written in the form of an NSF Graduate Research Fellowship Program (GRFP) application (2-3 pages in length). This application may be based on any topic related to energetics or physical activity covered in the course. For the purposes of the application, you can assume you have access to any field site in the world or specialized equipment, so dream big! Students working on real grants for graduate school or other purposes may petition to write a proposal in an alternative format.

(ii) A short original research paper, making use of quantitative data relevant to topics covered in this class. This would typically involve students who have their own primary data available, but I will also provide the class with relevant data sets from the National Health and Nutrition Examination Survey (NHANES) and instructions on accessing and utilizing these data as well as other available datasets. Papers do not need to include heavy quantitative or statistical analysis unless desired, and should instead focus on the graphical presentation of ideas and hypothesis testing with supporting information.

Final projects will be completed solo, although students with exceptional project ideas may request to work in pairs. Part of the grade will be based on a "project pitch" and short class presentation at the end of the semester. More information on the format/expectations of the final project will be provided during the semester. Some class time will also be devoted to working on these projects.

*__For graduate students (enrolled in 6451) only: Note that final project expectations for graduate students will be different (i.e. considerably higher) than for undergraduates. Specifically, your final project should aim to be of sufficient quality that it could be submitted as a real application by the time it is due.__

Course Policies

Attendance & Punctuality: This is a discussion-based course and thus the quality of the course is dependent on student participation. It is not possible for students to make up material missed in class after the fact. As such, attendance is required. Each student is allowed one unexcused absence during the semester. After that, your participation grade for any missed class will receive no credit. If you are unable to make it to class for a legitimate reason, please contact me in advance so that arrangements can be made on a case by case basis.

Electronic Devices in Class: The use of electronic devices for anything other than class related reasons will not be tolerated.

Canvas: All materials and assignments will be made accessible via a Canvas site online.

Late assignments: Due to the need for students to prepare assignments in advance of coming to class to facilitate productive discussion, late assignments will incur a heavy penalty of 20% per day. Please let me know in advance if you are unable to complete an assignment due to external factors and I will do my best to accommodate.

Pronouns: Class rosters are provided to the instructor with the student's legal name as well as "Preferred first name" (if previously entered by you in the Student Profile section of your CIS account, which managed can be managed at any time). While CIS refers to this as merely a preference, I will honor you by referring to you with the name and pronoun that feels best for you in class or on assignments. Please advise me of any name or pronoun changes so I can help create a learning environment in which you, your name, and your pronoun are respected. If you need any assistance or support, please reach out to the LGBT Resource Center. https://lgbt.utah.edu/campus/faculty_resources.php

Inclusivity: It is my intent that students from all diverse backgrounds and perspectives be well served by this course, that students' learning needs be addressed both in and out of class, and that the diversity that students bring to this class be viewed as a resource, strength and benefit. It is my intent to present materials and activities that are respectful of diversity: gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture. Your suggestions are encouraged and appreciated. Please let me know ways to improve the effectiveness of the course for you personally or for other students or student groups. In addition, if any of our class meetings conflict with your religious events, please let me know so that we can make arrangements for you.

Meeting schedule:

*Articles marked with an asterisk are ONLY REQUIRED FOR GRADUATE STUDENTS (6451 level enrollment). For undergraduates in 5451, these are great supplementary articles but are not required readings. Read these articles only if you are especially interested in the topic. If you are not very interested in the topic, just read the abstract of these articles.

Week	Date	Topic	Readings
Week 1	Aug 19	Introduction	No readings
Week 2	Aug 26	The myth of the athletic savage	Lieberman ch. 1 Norman 1976 McDougall 2004 Lieberman et al. 2020 *Collier 2007 *Gurven & Lieberman 2020
Week 3	Sept 2	NO CLASS: LABOR DAY	

Week 4	Sept 9	Why be physically inactive? (energy expenditure trade-offs)	Lieberman ch. 2 Pontzer 2017a Gibson & Mace 2006 Kramer & Ellison 2010 Pontzer et al. 2016a *Urlacher et al. 2019 Optional: Careau et al. 2021
Week 5	Sept 16	Human physical inactivity: Sitting, squatting, & sleeping	Lieberman ch. 3 & 4 Yetish et al. 2015 Raichlen et al. 2020 Hewes 1955 *Smit et al 2019
Week 6	Sept 23	Why be physically active? (why and how hard do humans work)	Church et al. 2011 Crittenden 2016 Pontzer et al. 2016b Kraft et al. 2021 *Leonard & Robertson 1997 *Kaplan D. 2000
Week 7	Sept 30	Human brawn: Speed, strength, & fighting	Lieberman ch. 5, 6, & 7 Carrier 2004 O'Neill et al. 2017 *Wrangham 2018
Week 8	Oct 7	NO CLASS: FALL BREAK	
Week 9	Oct 14	Human endurance: Walking (including *Australopithecus* & the origins of bipedalism)	Lieberman ch. 8 Lovejoy 1988 Sockol et al. 2007 Pontzer 2017 Pontzer et al 2014* Stern 2000* Ward 2002*
Week 10	Oct 21	Human endurance: Running and dancing	Lieberman ch. 9 Carrier 1984 Bramble & Lieberman 2004 Liebenberg 2006 *Podcast (listen prior to class): "Running after antelope"* *Laland 2016
Week 11	Oct 28	Workshop day: Final project	**Due: final project initial ideas**
Week 12	Nov 4	Social & environmental influences on human physical activity	**Due: final project pitch** Mauss 1935 Bornstein & Borstein 1976 Wallace et al. 2022 Bauman et al. 2012 *Lieberman et al. 2010

Week 13	Nov 11	Gender, race, and physical activity	Marlowe 2007 Young 1980 Roth & Basow 2004 Dutch 2020 *Althoff et al. 2017 *McGuire-Adams & Giles 2018 *Smith-Tran 2020
Week 14	Nov 18	Co-evolution of human brains & physical activity	Lieberman ch. 10 + 11 Raichlen & Alexander 2020 Raichlen & Polk 2013 Raichlen et al. 2012 Keeney et al. 2008*
Week 15	Nov 25	Why is physical activity good for our health?	Lieberman ch. 12 & 13 Lieberman 2015 Pontzer 2018 Lee et al. 2012 *Ekelund et al. 2019 <u>Supp readings:</u> Careau et al. 2021 Kaplan et al. 2017 Shave et al. 2019 *Raichlen et al. 2017 Raichlen & Alexander 2017
Week 16	Dec 2	Final project presentations and closing thoughts	No readings
Week 17	Dec 13	**Final projects due by 5 pm MST**	

Note: This syllabus is meant to serve as an outline and guide for our course. Please note that I may modify it with reasonable notice to you. I may also modify the schedule to accommodate the needs of our class. Any changes will be announced in class and posted on Canvas.

Reading list

Althoff T, et al. (2017) Large-scale physical activity data reveal worldwide activity inequality. Nature 547, 336–339

Bauman AE, et al. (2012) Correlates of physical activity: why are some people physically active and others not? Lancet 380, 258–271

Berenbaum F, et al. (2018) Modern-day environmental factors in the pathogenesis of osteoarthritis. Nature Reviews Rheumatology 14, 674–681

Bornstein MH, Bornstein HG (1976) The pace of life. Nature 259, 557–559

Bramble DM, Lieberman DE (2004) Endurance running and the evolution of Homo. Nature 432, 345–352

Careau, V., Halsey, L.G., Pontzer, H., Ainslie, P.N., Andersen, L.F., Anderson, L.J., Arab, L., Baddou, I., Bedu-Addo, K., Blaak, E.E. and Blanc, S. (2021) Energy compensation and adiposity in humans. Current Biology, 31(20), 4659-4666.

Carrier DR (1984) The energetic paradox of human running and hominid evolution. Current Anthropology 25, 483–495

Carrier DR (2004) The running-fighting dichotomy and the evolution of aggression in hominids. In, From Biped to Strider:

The Emergence of Modern Human Walking, Running, and Resource Transport (J Meldrum, C Hilton eds.) Kluwer/Plenum Press: New York. pp. 135–162

Collier BS (2007) “To bring honor to my village”: Steve Gachupin and the community ceremony of Jemez running and the Pike’s Peak Marathon. *Journal of the West* 46, 62-71.

Chirchir H, et al. (2014) Recent origin of low trabecular bone density. Proceedings of the National Academy of Sciences USA 112, 366–371

Church TS, et al. (2011) Trends over 5 decades in U.S. occupation-related physical activity and their associations with obesity. PLoS ONE 6, e19657

Crittenden AN (2016). Children's foraging and play among the Hadza. In, Origins and Implications of the Evolution of Childhood (CL Meehan, AN Crittenden eds.) University of New Mexico Press: Albuquerque. pp. 155–172

Dunsworth HM, et al. (2012) Metabolic hypothesis for human altriciality. Proceedings of the National Academy of Sciences USA 109, 15212–15216

Ekelund U, et al. (2019) Dose-response associations between accelerometry measured physical activity and sedentary time and all cause mortality: systematic review and harmonised meta-analysis. British Medical Journal 366, l4570

Gibson MA, Mace R (2006) An energy-saving development initiative increases birth rate and childhood malnutrition in rural Ethiopia. PLoS Medicine 3, e87

Hewes G (1955) World distribution of certain postural habits. American Anthropologist 57, 231–244

Hillman CH, et al. (2008) Be smart, exercise your heart: exercise effects on brain and cognition. Nature Reviews Neuroscience 9, 58–65

Holowka NB, et al. (2018) Foot strength and stiffness are related to footwear use in a comparison of minimally- vs. conventionally-shod populations. Scientific Reports 8, 3679

Kaplan H, et al. (2017) Coronary atherosclerosis in indigenous South American Tsimane: a cross-sectional cohort study. Lancet 389, 1730–1739

Kaplan (2000) The darker side of the “original affluent society.” *Journal of Anthropological Research* 56, 301-324.

Kaptchuk TJ, Miller FG (2015) Placebo effects in medicine. New England Journal of Medicine 373, 8–9

Kaptchuk TJ, et al. (2020) Placebos in chronic pain: evidence, theory, ethics, and use in clinical practice. British Medical Journal 370, m1668

Keeney BK, et al. (2008) Differential response to a selective cannabinoid receptor antagonist (SR141716: rimonabant) in female mice from lines selectively bred for high voluntary wheel- running behavior. Behavioral Pharmacology 19, 812–820

Kraft TS, et al. (2021) The energetics of uniquely human subsistence strategies. Science.

Kramer KL, Ellison PT (2010) Pooled energy budgets: resituating human energy allocation trade-offs. Evolutionary Anthropology 19, 136–147

Laland K, et al. (2016) The evolution of dance. *Current Biology* 26, R5-R9.

Lee IM, et al. (2012) Effect of physical inactivity on major non-communicable diseases worldwide: an analysis of burden of disease and life expectancy. Lancet 380, 219–229

Leonard WR, Robertson ML (1997) Comparative primate energetics and hominid evolution. American Journal of Physical Anthropology 102, 265–281

Liebenberg L (2006) Persistence hunting by modern hunter-gatherers. Current Anthropology 47, 1017–1026

Lieberman DE (2015) Is exercise really medicine? An evolutionary perspective. Current Sports Medicine Reports 14, 313–319

Lieberman DE (2020) Exercised: Why Something We Never Evolved to Do Is Healthy and Rewarding. Pantheon: New York.

Lieberman DE, et al. (2006) The human gluteus maximus and its role in running. Journal of Experimental Biology 209, 2143–2155

Lieberman DE, et al. (2010) Foot strike patterns and collision forces in habitually barefoot versus shod runners. Nature 463, 531–535

Lieberman DE, et al. (2020) Running in Tarahumara (Rarámuri) culture: persistence hunting, footracing, dancing, work, and the fallacy of the athletic savage. Current Anthropology 61, 356–379

Lovejoy CO (1988) Evolution of human walking. Scientific American 259, 118–125

Mauss M (1935) Les techniques du corps [Techniques of the body]. Journal de Psychologie 32, 271–293

McDougall C (2004) Secrets of the Tarahumara. Runner's World (December issue)

Norman J (1976) The Tarahumaras: Mexico's long distance runners. National Geographic 149, 702–718

O'Neill MC, et al. (2017) Chimpanzee super strength and human muscle evolution. Proceedings of the National Academy of Sciences USA 114, 7343–7348

Pagnotti GM, et al. (2019) Combating osteoporosis and obesity with exercise: leveraging cell mechanosensitivity. Nature Reviews Endocrinology 15, 339–355

Pontzer, H., Raichlen, D. A., & Rodman, P. S. (2014). Bipedal and quadrupedal locomotion in chimpanzees. Journal of Human Evolution, 66, 64-82.

Pontzer H, et al. (2016a) Constrained total energy expenditure and metabolic adaptation to physical activity in adult humans. Current Biology 26, 410–417

Pontzer H, et al. (2016b) Metabolic acceleration and the evolution of human brain size and life history. Nature 533, 390–392

Pontzer H (2017a) The exercise paradox. *Scientific American*, 316:26-31.

Pontzer H (2017b) Economy and endurance in human evolution. Current Biology 27, R613– R621

Pontzer H (2018) Energy constraint as a novel mechanism linking exercise and health. Physiology 33, 384–393

Raichlen DA, Polk JD (2013) Linking brains and brawn: exercise and the evolution of human neurobiology. Proceedings of the Royal Society B: Biological Sciences 280, 20122250

Raichlen DA, Alexander GE (2017) Adaptive capacity: an evolutionary neuroscience model linking exercise, cognition, and brain health. Trends in Neurosciences 40, 408–421

Raichlen DA, et al. (2012) Wired to run: exercise-induced endocannabinoid signaling in humans and cursorial mammals with implications for the "runner's high". Journal of Experimental Biology 215, 1331–1336

Raichlen DA, et al. (2014) Evidence of Levy walk foraging patterns in human hunter-gatherers. Proceedings of the National Academy of Sciences USA 111, 728–733

Raichlen DA, et al. (2017) Physical activity patterns and biomarkers of cardiovascular disease risk in hunter-gatherers. American Journal of Human Biology 29, e22919

Raichlen DA, et al. (2020) Sitting, squatting, and the evolutionary biology of human inactivity. Proceedings of the National Academy of Sciences USA 117, 7115–7121

Raichlen DA, Alexander GE (2020) Why your brain needs exercise. *Scientific American* 322, 26-31.

Roach NT, et al. (2013) Elastic energy storage in the shoulder and the evolution of high-speed throwing in Homo. Nature 498, 483–486

Shave RE, et al. (2019) Selection of endurance capabilities and the trade-off between pressure and volume in the evolution of the human heart. Proceedings of the National Academy of Sciences USA 116, 19905–19910

Smit AN, et al. (2019) Sleep timing and duration in indigenous villages with and without electric lighting on Tanna Island, Vanuatu. *Scientific Reports* 9, 17278.

Sockol MD, et al. (2007) Chimpanzee locomotor energetics and the origin of human bipedalism. Proceedings of the National Academy of Sciences USA 104, 12265–12269

Stern JT Jr. (2000) Climbing to the top: a personal memoir of Australopithecus afarensis. Evolutionary Anthropology 9, 113–133

Urlacher SS, et al. (2019) Constraint and trade-offs regulate energy expenditure during childhood. Science Advances 5, eaax1065

Venkataraman VV, et al. (2018) Locomotor constraints favour the evolution of the human pygmy phenotype in tropical rainforests. Proceedings of the Royal Society B: Biological Sciences 285, 20181492

Vaanholt LM, et al. (2010) Exercising for life? Energy metabolism, body composition, and longevity in mice exercising at different intensities. *Physiological and Biochemical Zoology* 83, 239-251.

Wallace IJ, et al. (2015) Osteoporosis. Evolution, Medicine, and Public Health 2015, 343

Wallace IJ, et al. (2017) Knee osteoarthritis has doubled in prevalence since the mid-20th century. Proceedings of the

National Academy of Sciences USA 114, 9332–9336

Wallace IJ, et al. (2018) Sports and the human brain: an evolutionary perspective. In, Sports Neurology (B Hainline, RA Stern eds.) Elsevier: San Diego. pp. 3–10

Wallace IJ, et al. (2019) Knee osteoarthritis risk in non-industrial societies undergoing an energy balance transition: evidence from the indigenous Tarahumara of Mexico. Annals of the Rheumatic Diseases 78, 1693–1698

Ward CV (2002) Interpreting the posture and locomotion of Australopithecus afarensis: where do we stand? American Journal of Physical Anthropology 45 (suppl. 35), 185–215

Warden SJ, et al. (2014) Physical activity when young provides lifelong benefits to cortical bone size and strength in men. Proceedings of the National Academy of Sciences USA 111, 5337–5342

Warrener AG, et al. (2015) A wider pelvis does not increase locomotor cost in humans, with implications for the evolution of childbirth. PLoS ONE 10, e0118903

Wiessner P (2014) Embers of society: firelight talk among the Ju/'hoansi Bushmen. Proceedings of the National Academy of Sciences USA 111, 14027–14035

Wrangham R (2018) Two types of aggression in human evolution. Proceedings of the National Academy of Sciences USA 115, 245–253

Yetish G, et al. (2015) Natural sleep and its seasonal variations in three pre-industrial societies. Current Biology 25, 2862–2868

Resources

Ten Simple Rules for Reading a Scientific Paper: For tips on how to read scientific papers, see this article: (https://journals.plos.org/ploscompbiol/article?id=10.1371/journal.pcbi.1008032)

UNIVERSITY POLICIES AND REGULATIONS

1. ***The Americans with Disabilities Act.*** **The University of Utah seeks to provide equal access to its programs, services, and activities for people with disabilities. If you will need accommodations in this class, reasonable prior notice needs to be given to the Center for Disability & Access, 65 Student Services Building, (801) 581-5020. CDS will work with you and the instructor to make arrangements for accommodations. All written information in this course can be made available in an alternative format with prior notification to the Center for Disability & Access.**

    - ***If in-class attendance is a necessary component of the course for pedagogical reasons (e.g., laboratories, studios, or artistic training), state it explicitly.***
    - **In compliance with ADA requirements, some students may need to record course content. Any recordings of course content are for personal use only, should not be shared, and should not be made publicly available. In addition, recordings should be destroyed at the conclusion of the course.**

2. ***University Safety Statement.*** **The University of Utah values the safety of all campus community members. To report suspicious activity or to request a courtesy escort, call campus police at 801-585-COPS (801-585-2677). You will receive important emergency alerts and safety messages regarding campus safety via text message. For more information regarding safety and to view available training resources, including helpful videos, visit https://safeu.utah.edu**

3. ***Addressing Sexual Misconduct.*** **Title IX makes it clear that violence and harassment based on sex and gender (which Includes sexual orientation and gender identity/expression) is a civil rights offense subject to the same kinds of accountability and the same kinds of support**

applied to offenses against other protected categories such as race, national origin, color, religion, age, status as a person with a disability, veteran's status or genetic information. If you or someone you know has been harassed or assaulted, you are encouraged to report it to the Title IX Coordinator in the Office of Equal Opportunity and Affirmative Action, 383 South University Street, 801-581-8365, or the Office of the Dean of Students, 270 Union Building, 801-581-7066. For support and confidential consultation, contact the Center for Student Wellness, 426 SSB, 801-581-7776. To report to the police, contact the Department of Public Safety, 801-585-2677(COPS).

a. **Lauren's Promise: Lauren's Promise is a vow that anyone – faculty, staff, students, parents, and community members – can take to indicate to others that they represent a safe haven for sharing incidents of sexual assault, domestic violence, or stalking. Anyone who makes Lauren's Promise vows to: 1.) listen to and believe those individuals who are being threatened or experiencing sexual assault, dating violence or stalking; 2.) represent a safe haven for sharing incidents of sexual assault, domestic violence, or stalking; and 3.) change campus culture that responds poorly to dating violence and stalking. By making Lauren's Promise, individuals are helping to change campus cultures that respond poorly to dating violence and stalking throughout the nation.**

4. ***Academic Misconduct Statement.*** **It is expected that students adhere to University of Utah policies regarding academic honesty, including but not limited to refraining from cheating, plagiarizing, misrepresenting one's work, and/or inappropriately collaborating. This includes the use of generative artificial intelligence (AI) tools without citation, documentation, or authorization. Students are expected to adhere to the prescribed professional and ethical standards of the profession/discipline for which they are preparing. Any student who engages in academic dishonesty or who violates the professional and ethical standards for their profession/discipline may be subject to academic sanctions as per the University of Utah's Student Code: https://regulations.utah.edu/academics/6-410.php**

5. ***Drop/Withdrawal Policies.*** **Students may drop a course within the first two weeks of a given semester without any penalties. Students may officially withdraw (W) from a class or all classes after the drop deadline through the midpoint of a course. A "W" grade is recorded on the transcript and appropriate tuition/fees are assessed. The grade "W" is not used in calculating the student's GPA. For deadlines to withdraw from full-term, first, and second session classes, see the U's Academic Calendar.**

6. **Other important information to consider including:**
   a. **Student Code: http://regulations.utah.edu/academics/6-400.php**
   b. **Accommodation Policy (see Section Q): http://regulations.utah.edu/academics/6-100.php**

7. ***Supports for Students.*** **Your success at the University of Utah is important to all of us here! If you feel like you need extra support in academics, overcoming personal difficulties, or finding community, the U is here for you. Please refer to the Student Support Services page for the U for updated information.**

8. ***Basic Needs Student Support Statement*****. Success at The University of Utah includes learning about and using available resources. The Basic Needs Collective (BNC) is a coordinated resource referral hub. They educate about and connect students to campus and community**

resources to help them meet their basic needs. As a central location for resource referrals related to food, housing, health insurance, managing finances, legal services, mental health, etc., any student experiencing difficulty with basic needs is encouraged to contact them. Drop into their office located in the Union basement or schedule with them online for an in-person or virtual visit through their webpage: https://basicneeds.utah.edu/.