

**NUTR 272: Physical Activity, Nutrition & Health
Spring 2024**

Class Meetings: *Tuesdays, from 6:00-8:30pm*

Remote—on Zoom; one, in-person Lab at Tufts HNRCA—NEPS Lab

Class Zoom link: <https://tufts.zoom.us/j/99223694425?pwd=WkRSNFlnNTVsTndoMFQwWWZ2b1VXdz09>

Passcode: **998058**

Instructor: **Jason Aziz, Ph.D.**
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Instructor Office Hours: *By appointment, on Zoom (separate Zoom link)*

Semester Hour Units: 3.0

Prerequisites: NUTR202 or NUTR245/246 required and undergraduate-level physiology *recommended*

This syllabus is adapted from work, and with express consent by Kieran Reid, Ph.D., MPH

Course Description: This course is designed to give students a basic understanding of the fundamental principles of exercise physiology and how physical activity influences health throughout the lifespan. Students will examine how physical activity/exercise and nutrition can work both independently and synergistically to improve human performance and health outcomes. In addition, the course will evaluate how the built environment influences physical activity behavior and the importance of theory-based motivational strategies for exercise. Students will learn the key elements of exercise prescription and attend a laboratory practical to observe state of the art methods for assessing physical fitness and human performance. The course will also cover the latest trends in physical activity related research including wearable technology, sedentary behavior, and lifestyle medicine.

Course Objectives: By the end of this course, students will be able to:

- Describe the acute and chronic physiological responses to exercise and the influence of factors such as age, sex, and chronic disease.
- Summarize the major components of the current physical activity guidelines and specify the proportion of various population subgroups who adhere to these guidelines (e.g., children, adults, older adults).
- Identify, analyze, and interpret how the built environment influences physical activity participation for individuals and communities.
- Explain how physical activity and nutritional factors act, synergistically and independently, to alter individual responses to each other.
- Discuss the basic principles of exercise prescription and develop an individualized exercise prescription plan.
- Describe how important measures of human performance are assessed in the laboratory.
- Demonstrate critical thinking skills around current trends and controversies in physical activity and nutrition such as fit versus fat, individual responsibility versus environmental causes of obesity, exercise duration versus intensity, ergogenic aids in sports nutrition, the utility of wearable technology, etc.

Texts or Materials:

- Required:** There is no required textbook for this course. I will post selected readings (Textbook chapters, journal articles, media articles, etc.) as appropriate.
- Recommended:** *Physiology of Sport and Exercise*, 6th Edition, edited by Jack Wilmore and David Costill. Human Kinetics, 2015. Available at the Tufts University Health Sciences Bookstore. On reserve at Health Sciences Library.
- Policy Document:** *Physical Activity Guidelines for Americans, 2nd Edition, 2018—on Canvas.*
- Use of Canvas:** This course will employ the Canvas learning management system (LMS) as the digital platform. Readings, announcements, and assignments will be managed through this system. [Canvas](https://canvas.tufts.edu) (<https://canvas.tufts.edu>). I welcome suggestions on the optimal use of Canvas for you!

Academic Conduct: Each student is responsible for upholding the highest standards of academic integrity, as specified in the Friedman School's Policies and Procedures Handbook: <https://nutrition.tufts.edu/sites/default/files/documents-forms/PoliciesProceduresHandbook20-21Jan11.pdf> and Tufts University policies (<http://students.tufts.edu/student-affairs/student-life-policies/academic-integrity-policy>). It is the responsibility of each student to understand and comply with these standards, as violations will be sanctioned by penalties ranging from failure on an assignment and the course to dismissal from the school.

Classroom Conduct: You are graduate students and, therefore, I consider you a professional. The expectation is that you behave in such a way. It is expected that you attend online lectures, engage in the subject matter and class discussions, and—at times—drive the direction of class discussions. You have the role of not only a learner, but teacher as well.

Assessment and Grading: Grades will be based on the following:

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|-------------------------------------|-----|
| 1. Class participation (Weekly) | 10% |
| a. Attendance | |
| b. Contribution to class discussion | |
| 2. Discussion Forum Posts (3) | 21% |
| 3. Mid-term exam (March 26th) | 25% |
| 4. Hot-topic debate/presentation | 19% |
| 5. Policy Brief (Due: May 6th) | 25% |

Class participation: Includes attendance and verbal in-class participation.

Discussion Forum Posts: There will be three discussion topics that require your engagement. A topic will be posted to a Discussion Forum, and you are to create a thoughtful original post/commentary (approx. 250 words) sharing your perspectives on the topic. Then, you are to comment on a classmate's original post, offering an alternative perspective to their commentary. An underlying goal here is to hone your skills in giving and receiving constructive feedback; a difficult skill to develop; but important, nonetheless. A rubric will be posted on the instructions for the Discussion topic. The topics for Discussion Forums are:

- Oh-NO, Ozempic!
- High-fructose Corn Syrup
- Fit VS Fat

Mid-term exam: Consists of multiple choice, brief definitions, and short answer questions.

Hot-topic Debate/Presentation: Students will be randomly assigned to an ergogenic aid of popular interest. You will be required to research your product and create a brief PowerPoint (or Google Slides) presentation to summarize your findings and recommendation for/against your assigned product. You will present your findings during a class session (on Zoom). A maximum of 7 slides should be presented, summarizing scientific evidence and opining on its strength, describing its efficacy, and making a recommendation. Your classmates will have the opportunity to ask questions or

critique your positions (Friedman rules apply!) A rubric will be provided to guide your endeavor. Some of the supplements for analysis:

- *Creatine Monohydrate*
- *Collagen-like Peptides*
- *Pre-workout drinks*
- *Beet Juice*
- *Whey Protein*
- *Beta Alanine*
- *Chocolate Milk*
- *Tart Cherry Juice*
- *L-carnitine*
- *caffeine*

Physical Activity Policy Brief: You will be required to synthesize the major concepts of the epidemiology of physical inactivity and sub-optimal diet from the course, and—in true Friedman fashion—draft a Policy Brief targeted towards informing and influencing Public Health policymakers to create laws/policies to support a more physically-active society and/or a food environment. The level of influence may be at the municipal, state, federal, or global level. This will challenge your skills and abilities to, using the written word, communicate succinctly; a key attribute to drafting policy. Briefly, the Policy Brief must:

- Be succinct and concise: no more than two pages, single spaced.
- Targeted to a well-defined audience (Government, Institutions, Agencies)
- Communicate a policy that is feasible and would, prospectively, be acceptable at the level of government that you've identified. In order to achieve this, you might consider policies that are:
 - Cost-effective
 - Culturally appropriate
 - Aligned with the political appetite of the targeted population(s)

I will provide guidance to support this endeavor. Consider writing a Policy Brief that you could actually send to a legislative body...or one which may be adapted to an OP/ED—I can help you consider this.

The spirit of this assignment is to help you acknowledge and possibly overcome some of the challenges in this area of work. Very bright people have been working on this issue for decades and little progress has been made. What can you add to the field? Friedman alumni, faculty and, YES—students have a strong history of moving the needle in the real world. This is not merely a class assignment, but rather a challenge to have an impact on an important common interest that we share.

Assignments received after their deadline **will not be accepted or graded unless an extension is approved in advance**. Students who are unable to complete an assignment exam on time for any reason should notify the instructor and teaching assistant by email prior to the deadline, with a brief explanation for why the extension is needed.

Grading Range: At the Friedman School, a passing grade in the course is B- or better. Course grades will be based on the below (subject to revision during the course):

A	> 94%
A-	90 - <94%
B+	87 - <90%
B	84 - <87%
B-	80 - <84%

Accommodation of Disabilities: Tufts University is committed to providing equal access and support to all students through the provision of reasonable accommodations so that each student may access their curricula and achieve their personal and academic potential. If you have a disability that requires reasonable accommodations, please contact the Friedman School Assistant Dean of Student Affairs at 617-636-6719 to make arrangements for determination of

appropriate accommodations. Please be aware that accommodation cannot be enacted retroactively, making timeliness a critical aspect for their provision.

Diversity Statement: We believe that the diversity of student experiences and perspectives is essential to the deepening of knowledge in this course. We consider it part of our responsibility as instructors to address the learning needs of all of the students in this course. We will present materials that are respectful of diversity: race, color, ethnicity, gender, age, disability, religious beliefs, political preference, sexual orientation, gender identity, socioeconomic status, citizenship, language, or national origin among other personal characteristics.

Course Topics and Assignment Schedule at a Glance: *This schedule is subject to modification at the instructor's discretion.*

DATE OF CLASS	COURSE TOPIC	LECTURER	ASSIGNMENTS DUE
January 23	Week 1: Course Overview/ Introduction to Physical Activity: Definitions, Policies and Trends	Jason Aziz, Ph.D.	Read: PA Guidelines for Americans (2018); PA guidelines summary (JAMA), and PA Guidelines Editorial.
January 30	Week 2: Skeletal Muscle Physiology; <i>Mechanical and Metabolic Properties</i>	Jason Aziz, Ph.D.	Review SM Structure and Function (.pdf OR .ppt) Read SM VDR article on Canvas—consider the role of Ca ⁺⁺ in SM contraction.
February 6	Week 3: Physical Activity and the Built Environment	Jason Aziz, Ph.D.	Canvas Discussion #1: High-fructose Corn Syrup
February 13	Week 4: Bioenergetics, Metabolism & Hormonal Control	Roger Fielding, Ph.D.	Review Dr. Fielding's Slides: <i>Energy Systems, Hormonal Control and Metabolism During Exercise</i> Read: What do muscles have to do with lipoproteins Review: Insulin's Control Over Glycolysis slide Read: Exercise-induced cAMPK article.
February 20	Week 5: Cardiovascular Control During Exercise/Thermoregulation & Environmental Physiology	Jason Aziz, Ph.D.	Canvas Discussion #2: Oh-NO, Ozempic!
February 27	Week 6: Measuring Physical Activity/Physical Activity & Nutrition; Fueling episodic VS light-moderate PA	Jason Aziz, Ph.D.	

March 5	Week 7: Lifestyle Medicine/ Complementary Medicine in the US Healthcare System	Jason Aziz, Ph.D.	Read Journal Articles: Bridging Gaps (Pojednic) Eisenberg/CAM Blue Zones (Loomis)
March 12	Methods for Assessing Physical Activity, Fitness and Functional Status—Lab Primer Midterm Exam Review	Jason Aziz, Ph.D.	Review Lab Itinerary Read materials on indirect calorimetry and estimation of $VO_{2(max)}$ Prepare for Dr. Mozaffarian's GLP-1 RA and Food is Medicine presentation @ Friedman Seminar (3/13)
March 19	Spring Recess—NO CLASS!	🌴🌴🌴🌴	Re-energize yourself—Add a new physical demand to your body—Set a new personal lifestyle goal.
March 26	Midterm Exam		On Canvas
April 2	Exercise Physiology Laboratory IN-PERSON: CLASS LOCATION—Jean Mayer USDA Human Nutrition Research Center on Aging—NEPS Laboratory	Jason Aziz, Ph.D. /Marissa Peaslee	Assimilate data from Lab and prepare your Lab report for submission— Meet w/Dr. Aziz for review
April 9	Pediatric Physical Activity	TBD	
April 16	Behavior Strategies Exercise Program Design	TBD Jason Aziz, Ph.D.	
April 23	Physical Activity, Nutrition and Aging: From the Clinic to the Community	Kieran Reid, Ph.D.	Canvas Discussion #3: Fit VS Fat
April 30	Translating the course content—Summary of clinical and Public Health implications of our important work. Last Class— You've made it!	Jason Aziz, Ph.D.	Assignment Review
May 7			Policy Brief—Due May 6th

Detailed Description of Course Topics, Assignment Schedule, and the Learning Goals for Each Class Session:

Class Dates, Topics, Learning Objectives and Assignments

** This schedule is subject to modification at the instructor's discretion.*

Week 1: January 23rd

Course Overview/ Introduction to Physical Activity: Definitions, Policies and Trends

This class will provide students with an overview of the course for the entire semester and orient the students to the latest physical activity definitions, policies, and trends.

Learning Objectives:

- Describe course objectives, Canvas course site resources and student responsibilities for the course.
- Define basic physical activity and physical fitness terminology.
- Describe how physical activity is measured.
- Summarize current physical activity and exercise patterns of different age groups and genders within the US.
- Describe organizational and governmental recommendations regarding physical activity and exercise.

Week 2: January 30th

Skeletal Muscle Physiology; *Mechanical and Metabolic Properties*

This class will orient the students to the basis of human movement at the muscular and neurological level.

Learning Objectives:

- Describe the structure and function of skeletal muscle – from the cellular to organ level.
- Explain how muscles function during exercise and how force is generated to result in movement.
- Understand the complexity of how the nervous system plans, initiates and coordinates human movement.
- Summarize the muscular and neurological changes that occur with exercise training (both resistance and cardiovascular).

Week 3: February 6th

Physical Activity and the Built Environment

During this class we will explore effective strategies for influencing physical activity behaviors at the individual and community level.

Learning Objectives:

- Describe the various behavioral strategies for influencing physical activity patterns at both the individual and community level.
- Discuss strategies for individual and community program development.
- Explain how the built environment influences physical activity participation.
- Identify key factors that can improve the built environment.
- Describe the criteria to assess the 'walkability' of a community.

Week 4: February 13th

Bioenergetics, Metabolism & Hormonal Control

Guest Lecturer: *Roger Fielding, Ph.D.*

This session will familiarize students with how the body meets the energy needs of our skeletal muscles and orient students to how hormones play a key role in exercise responses.

Learning Objectives:

- Examine how our primary source of energy, ATP, is provided through three energy systems.
- Describe how energy expenditure and the source of this energy changes from rest to exercise.
- Explain the mechanisms of fatigue when this occurs from excess energy demands.
- Summarize the metabolic pathways in the context of varying patterns of physical activity.

Week 5: February 20th

Cardiovascular Control During Exercise/ Thermoregulation & Environmental Physiology

This session will cover how the cardiovascular and respiratory systems provide oxygen and fuel to active muscles and rid the body of carbon dioxide and metabolic wastes and how these systems adapt to exercise training. We will also discuss thermoregulation during exercise and how altitude impacts physiology and responses to exercise at altitude.

Learning Objectives:

- Describe the structure and function of the cardiovascular system: the heart, blood vessels, and blood.
- Summarize how the cardiovascular system provides active muscles with an adequate blood supply that varies with the intensity of work.
- Explain the biological changes that occur that contribute to “endurance capacity” and how this may impact performance.
- Describe how thermoregulation is controlled at rest and during exercise.
- Summarize the physiological changes that occur when exercising at altitude.

Week 6: February 27th

Measuring Physical Activity/

Physical Activity and Nutrition

This class will focus on understanding how Physical Activity is measured, and how Physical Activity and Nutritional Factors interact to alter responses to each other.

Learning Objectives:

- Describe the several validated approaches to measuring PA in free-living humans.
- Describe the strengths/limitations of each.
- Describe statistical approaches used to analyze and interpret PA measures; including standard multivariate model (MV), isothermal substitution model (ISM), and compositional data analysis (CODA).
- Describe how the fates of specific fuels—and their metabolites—are altered between the resting, physically-active, and intensely-exercised states.
- Differential effects between acute, sub-acute, and long-term exercise on energy metabolism.
- Identify optimal exercise/PA and nutritional approaches to balance physical performance with whole-body energy requirements.

Week 7: March 5th

Lifestyle Medicine/Complementary Medicine in the US Healthcare System

This session will discuss the promotion of physical activity and better nutrition in the clinical setting.

Learning Objectives:

- Assess the impact of lifestyle behaviors on the rates of death, disease, and health care costs.
- Describe how evidence-based practices in health coaching can foster sustained behavior change for increasing physical activity and better dietary habits.
- Discuss the emergence of “Lifestyle Medicine” and how it may improve the personal lifestyle choices of healthcare providers, and thus, can positively impact patients.
- Describe barriers for the uptake of clinical therapies as primary targets for medical providers and insurers.

CLASS 8: March 12th

Lab Primer--Methods for Assessing Physical Activity, Fitness and Function

In preparation for the **laboratory practical**, we will begin our orientation on various physiological measurements in the Exercise Physiology Laboratory.

Learning Objectives:

- Distinguish between two measures of energy expenditure in free-living humans.
 - Indirect calorimetry
 - Doubly labeled water
- How to interpret the indirect calorimetry assessment to estimate maximal aerobic capacity ($\text{VO}_{2(\text{max})}$), lactate threshold, energy expenditure, and substrate partitioning.
- Learn the various measures of joint flexibility and assessments of lower extremity muscle strength, muscle power and muscle contraction velocity.

- Compare and contrast the utility of anthropometric measures of body composition (skinfolds, circumferences, body fat percentage).
- Discover how to objectively measure physical functioning in older adults.

March 19th—SPRING RECESS...NO CLASS!

CLASS 9: March 26th

Midterm Exam—on Canvas

Sports Nutrition and Ergogenic Aids

This session will focus on how people who exercise can optimize athletic performance through proper nutrition, but also *potentially* through ergogenic aids including some legal and some illegal substances. This module will help you to prepare the evaluation of your assigned ergogenic aid.

Learning Objectives:

- Describe the dietary needs of individuals who exercise and those of athletes.
- Explain how nutritional supplementation and diet manipulation may potentially improve performance.
- Summarize the various pharmacological, hormonal, and physiological agents that have been proposed to improve performance.
- Identify potential benefits, proven effects, and health risks that have been associated with the use of ergogenic aids.

CLASS 10: April 2nd

Methods for Assessing Physical Activity, Fitness and Function, and Energy Expenditure (HNRCA 13th FLOOR)

During this hands-on **laboratory practical**, we will perform and/or observe various physical fitness and human performance assessments.

Learning Objectives:

- Observe and interpret the assessment of maximal aerobic capacity testing ($\text{VO}_{2(\text{max})}$).
- Measure joint flexibility and assess lower extremity muscle strength, muscle power and muscle contraction velocity.
- Compare and contrast the utility of anthropometric measures of body composition (skinfolds, circumferences, body fat percentage).
- Discover how to objectively measure physical functioning in older adults.

You will prepare a detailed report to communicate the findings to the subject and/or clinician.

CLASS 11: April 9th

Pediatric Physical Activity

Guest Lecturer: TBD

This session will cover key physiological differences in pediatric exercise physiology and also the principles for conducting PA-related research in community settings. Particular emphasis will be given to programming for high-risk (e.g., overweight/obese, low-fit, low-income) pediatric populations.

Learning Objectives:

- Explain the challenges in keeping children physically active.
- Summarize emerging evidence linking physical activity and brain development, cognitive functioning, and academic performance and achievement among children and adolescents.
- Identify the challenges in promoting physical activity among certain pediatric demographics and in different environments (school-time, etc.).
- Discuss the benefits and challenges of conducting research in uncontrolled community settings.

CLASS 12: April 16th

Behavior Strategies

Guest Lecturer: TBD

Most people have at least a rudimentary understanding of the benefits of exercise, yet few are meeting the physical activity guidelines. In this class, we will examine the gap between knowledge and behavior and learn strategies based on behavioral theory to bridge this gap.

Learning Objectives:

- Describe the fundamentals of Self-Determination Theory.
- Explain the fundamentals of Transtheoretical Model (Stages of Change) and Self-Efficacy.
- Define the stage of change for exercise.
- How to apply strategies for moving others through the stages of change/behavior change.

Exercise Program Design

Jason Aziz, Ph.D.

This session will guide you through the process of designing various types/modes of exercise programs.

Learning Objectives:

- Explain the physiological target(s) of various exercise interventions---what's the goal?
- Embark on a systematic approach to executing/delivering an exercise program to an individual, a group of individuals, and a population of individuals, using digital technology.
- Lead/cue individuals to take-on prescribed movements; in-person, or remotely.

CLASS 13: April 23rd

Physical Activity, Nutrition and Aging: From the Clinic to the Community

Guest Lecturer: *Kieran Reid, PhD, MPH*

This session will focus on how physical activity reduces the risk of developing chronic diseases associated with aging, with a significant focus on mobility-disability and cognitive decline. We will also discuss the impact of translating effective physical activity and nutrition interventions from the clinical setting to real-world community-based settings.

Learning Objectives:

- Summarize how physical activity/exercise reduces risk of age-related chronic disease and functional decline in adults and older adults.
- Discriminate the proposed mechanisms for the role of exercise in improving symptoms of chronic conditions.
- Compare the relationship between acute, long-term, and active living physical activity patterns for mobility and cognition in aging humans.
- Describe the local impact of the Fit-4-Life Program – an award-winning community-based physical activity and nutritional counselling program for older adults.

CLASS 14: April 30th

Course Summary

Learning Objectives:

- Summarize how physical activity/exercise and nutrition independently and synergistically act to reduce the risk of chronic disease and mortality in populations.
- Identify the direction of future research to fill current gaps in knowledge.
- Identify policy levers that may encourage improvements in physical activity and nutrition status in populations.