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## EXERCISE SCIENCE

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Associate Professor: Jung Kim (on leave fall 2018)

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### About the Department

The mission of the Exercise Science Department is to provide a scientific background which promotes critical thinking as it relates to health, wellness and the attainment of human potential. The scientific process and clear articulation of ideas are introduced through a curriculum that investigates the impact of physical activity on the quantity and quality of life.

### Departmental Goals

The primary goals of the Exercise Science Department are to:

1. Apply the scientific method of inquiry to issues and questions in the exercise science field;
2. Communicate effectively through discussion, written work, and oral presentation;
3. Demonstrate ability to assess, analyze, and evaluate from observation and sound data collection;
4. Articulate a personal standard of ethics and key values for work in the profession of exercise science;
5. Demonstrate ability to work independently and to assume a leadership role in the field of exercise science;
6. Complete a successful transition to advanced study within and outside the field of exercise science.

The sequencing of courses within the department is a well thought out progression of both knowledge and skills. First-year students often fulfill Chemistry 110/120 or 115/230, Math 160, and Biology 111. These courses provide a foundation of quantitative and scientific background necessary for upper division courses within the Exercise Science major. Second year courses include Introductory Research Methods (EXSC 200), and the year-long Human Anatomy and Human Physiology sequence (EXSC 221/222). Usually, Physics 111 is fulfilled in the second year also. In the third year, students choose three units from four options: Biomechanics, Exercise Physiology, Nutrition, or Neuromuscular Adaptation. In the fourth year, students will complete two units from four advanced course options: Advanced Biomechanics, Advanced Exercise Physiology, Advanced Nutrition or Advanced Neuromuscular Adaptation with each of the advanced classes requiring a thesis activity. Additionally, students will choose two Exercise Science electives from 300-400 level course offerings.

### General Requirements for the Major or Minor

General university degree requirements stipulate that 1) at least four units of the major or three units of the minor be taken in residence at Puget Sound; 2) students earn a GPA of 2.0 in courses taken for the major or the minor; and 3) all courses taken for a major or minor must be taken for graded credit. Any exceptions to these stipulations are indicated in the major and minor degree requirements listed below.

### Requirements for the Bachelor of Science Degree

Completion of the following 5 areas:

1. EXSC 200 Introductory Research Methods; EXSC 221 Human Physiology; and EXSC 222 Human Anatomy.
2. Biology 111; Chemistry 110/120 or 115/230; Math 160; and Physics 111. Note: Most Physical Therapy programs require a second se-

mester of physics (Physics 112).

3. Three units from EXSC 301 Nutrition and Energy Balance; EXSC 328 Neuromuscular Adaptation; EXSC 329 Exercise Physiology; and EXSC 336 Biomechanics.
4. Two units from EXSC 401 Advanced Nutrition and Energy Balance; EXSC 428 Advanced Neuromuscular Adaptation; EXSC 429 Advanced Exercise Physiology; and EXSC 436 Advanced Biomechanics
5. Two units at the 300 level or higher in Exercise Science that are not counted toward the major in another capacity.

### Requirements for the Minor

A Minor in Exercise Science requires completion of six courses to include EXSC 200, 221 and 222; two of the following 300 level courses: EXSC 301, 328, 329, or 336; and one of the following 400 level courses: EXSC 401, 428, 429, or 436.

### Notes

1. A grade of C or higher must be earned in each course for the major or minor.
2. The Exercise Science Department reserves the option of either excluding courses more than 10 years old from applying to a major or minor or requiring such courses to be repeated.

### Course Offerings

Unless otherwise specified, each course carries 1 unit of credit and is offered at least once each academic year. Please see "Frequency of Course Offerings."

**200 Introductory Research Methods** This course is intended to introduce the student to reading and critiquing original research in exercise science. Common research techniques and terms are explored as they pertain to collecting data on human subjects. Students lead discussions, use statistical software for data analysis, and learn lab writing skills. *Prerequisite: MATH 160 or permission of instructor. Offered each semester.*

**221 Human Physiology** This course studies the functions of the different human systems including endocrine, muscular, nervous, circulatory, respiratory, and others. *Prerequisite: BIOL 111, CHEM 110/120 or 115/230, EXSC 222, all with grades of C or higher. Offered Spring semester only.*

**222 Human Anatomy** This course presents a systemic approach to studying the human body. This includes microscopic and gross anatomy of the circulatory, digestive, endocrine, muscular, skeletal systems and others. *Prerequisite: BIOL 111 with a grade of C or higher. Offered Fall semester only.*

**280 Directed Research** This course provides a laboratory research experience for sophomores under the direction of a faculty member. Students may initiate a project or join a research project in the mentor's lab. Student and mentor fill out a department contract. A written research paper and a reflective summary of the research experience must be submitted for a final grade. *Prerequisite: BIO 111, CHEM 110, MATH 160 and instructor permission.*

**301 Nutrition and Energy Balance** This course provides students with the basic concepts of nutrition and energy balance as they relate to health and the prevention of disease. The functions of the six essential nutrients are explored in detail with attention to their roles in metabolism, optimal health, and chronic diseases. The energy values of food

and physical activity are quantified while undertaking an in depth case study and written analysis of personal dietary intake and physical activity. Students will read scientific literature, develop informed opinions, and debate controversial issues such as organically grown and genetically modified foods, and dietary supplements. Other potential topics include, nutrition and dieting fads, advertising, weight control and the obesity epidemic, sport nutrition, menu planning, and nutritional needs throughout the life cycle. *Prerequisite: BIOL 101 or 111. Offered each fall.*

**327 Evaluation of Sports Injuries** This introductory course explores the management of conditions limiting the functional capabilities of the physically active individual whose activities may range from occupational tasks to recreational sports. Information dealing with the prevention, recognition and management of these injuries or conditions is presented. Practical application of taping and bandaging techniques is also included. *Offered occasionally.*

**328 Neuromuscular Adaptation** This course explores the role of the nervous system in controlling movement and learning coordinated motor tasks such as locomotion and physical activity. A survey of the nervous system and sensorimotor control set the stage for an exploration of topics such as neuromuscular activation and neuromotor control, neuromuscular fatigue, neuroendocrine regulation, endurance and strength training adaptations of the nervous system, and the neuromuscular responses to decreased activity. Other current topics such as the activity-dependent expression of neurotrophic factors and their effects on neurorehabilitation may be explored. *Prerequisites: EXSC 200, 221, and 222. Recommended: NRSC 201. Offered each Fall.*

**329 Exercise Physiology** This course explores the body's acute responses and long-term adaptations to various levels of exercise and modes of activities. Students focus on understanding how the body's bioenergetic, cardiovascular, respiratory, neuromuscular, and endocrine systems respond to the physiological stress of exercise and how physical activity and exercise training affect health, disease, and the quality of life. Throughout the course, variations in responses between gender and age groups are considered. Lecture and laboratory topics include bioenergetics, cardiorespiratory and neuromuscular function, ergometry, fatigue, body composition, growth and maturation, inactivity-related diseases, and other current topics. Formal laboratory reports and a review of literature are required. *Prerequisites: EXSC 200, 221, and 222. Offered each Fall.*

**330 Sport Nutrition and Ergogenic Aids** This seminar reviews the requirements for energy macronutrients (carbohydrates, proteins, and lipids), micronutrients (vitamins and minerals), and fluid intake as well as basic principles of digestion and absorption. The regulations on the sale of dietary supplements in the US is discussed and debated. The specific ergogenic aids covered in the course are determined by the interests of the students in consultation with the instructor. Groups of two or three students work together to locate, select, and lead discussion/presentations of primary research studies that address their topics of interest. Each student also designs a diet plan for a specific athlete and presents the plan to the class. *Prerequisite: EXSC 221/222 and 301. Offered occasionally.*

**331 Scientific Writing in Exercise Science** This class is a writing-intensive experience that is designed for those students who anticipate submitting an application for summer research, completing a senior thesis and or continuing to graduate school. The writing includes an application for approval from the Institutional Review Board, a grant proposal, a review of literature, and a poster or oral presentation. Both peer and faculty review the written submissions. Each student will present their results in a poster format. *Prerequisites: At least two of the follow-*

*ing: EXSC 301, 328, 329, 336, or concurrent enrollment or permission of instructor. Offered each year.*

**336 Biomechanics** This course explores a qualitative and quantitative approach to human movement. Functional anatomy and kinematics are explored. Students may be exposed to a variety of biomechanical equipment including motion analysis, force plate, EMG, isokinetic dynamometers, and others. Each student will complete a review of literature and an analysis of a human motion. *Prerequisites: EXSC 222 and PHYS 111. Offered each Spring.*

**380 Directed Research** This course provides a laboratory research experience for juniors under the direction of a faculty member. Students may initiate a project or join a research project in the mentor's lab. Student and mentor fill out a department contract. A written research paper, a reflective summary of the research experience, and an oral or poster presentation must be submitted for a final grade. *Prerequisite: BIO 111, CHEM 110, MATH 160 and instructor permission.*

**401 Advanced Nutrition and Energy Balance** This course explores the role of dietary factors in health and disease in greater depth and with more critical analyses of current scientific literature. Course topics may include the role of phytochemicals, nutrigenomics, the female athlete triad, eating disorders, hydration and thermoregulation, macronutrient intake, weight loss diets, food-borne illness and safety of the food supply, clinical dietetics, and other current topics. Students will work in small collaborations to identify a relevant question, research the literature, and design and complete a research thesis. Laboratory experiences include resting metabolism, substrate utilization during rest and exercise, measuring nutrient-related blood markers such as glucose, hemoglobin A1C, and lipoproteins, and conducting original research for theses. *Prerequisites: EXSC 200, 221, 222, and 301. Offered every other year.*

**424 Recent Advances in Cellular and Molecular Mechanisms of Neuroplasticity** This course explores the cellular and molecular mechanisms related to neuroplasticity. Topics such as Alzheimer's, stroke, Parkinson's, muscular dystrophy, cerebral palsy, multiple sclerosis, aging, spinal cord injury, and others will be discussed. Up-to-date molecular and cellular findings from the topics listed above and their effects on our understanding of neuroplasticity and/or neurorehabilitation will be explored. *Prerequisites: EXSC 200, 221, and 222, or consent of instructor. Recommended: NRSC 201. Offered every other year.*

**428 Advanced Neuromuscular Adaptation** This course explores in greater depth and breadth the role of the nervous system in the coordination of physiological systems that support physical activity and exercise. Factors that influence the neural control of motor output and/or cognition such as traumatic injuries to the neural tissue, disease states, microgravity, increased activity, inactivity, and aging are considered in depth. Topics include the effects of neural, molecular, and cellular markers on motor and cognitive functions, activity-dependent plasticity of the nervous system and neurorehabilitation, and alterations in sensorimotor control. Laboratory experiments utilize cellular, molecular and histochemical techniques to assess changes in skeletal muscle and neural properties using models of increased and decreased activity. Students will work in small collaborations to identify a relevant question, research the literature, and design and complete a research thesis. *Prerequisite: EXSC 328. Recommended: NRSC 201. Offered every other year.*

**429 Advanced Exercise Physiology** This course explores in greater breadth and depth the body's acute responses and long-term adaptations to exercise. Students read original research to explore the cellular

and molecular mechanisms by which physical activity and exercise training affect health and chronic disease. Environmental challenges to human activity caused by heat, cold, altitude, hyperbaric conditions, and microgravity are investigated in lectures and/or laboratories. Topics also may include the endocrine control of substrate metabolism, biochemical markers of fitness and metabolism, mitochondrial biogenesis, plasticity of muscle fiber types, and cardiovascular dynamics and autonomic regulation of blood flow, fluid homeostasis, and others. Students will work in small collaborations to identify a relevant question, research the literature, and design and complete a research thesis. *Prerequisite: EXSC 329. Offered every other year.*

**430 Special Topics in Exercise Science** This seminar class is structured according to the expertise and research interests of the professor. Each topic will be unique and encompass a current issue in the field of exercise science. *Prerequisite: must have completed two of the following: EXSC 301, 328, 329, 336, concurrent enrollment or permission of instructor. Offered as needed. May be repeated.*

**436 Advanced Biomechanics** A scientific foundation of the study of human motion is explored as it relates to the integration of concepts and principles from biology and physics. In particular, mechanical principles are used to study the internal and external forces acting on the human body and the effects produced by those forces. Students become familiar with the equipment commonly used in biomechanics including video, force platforms, motion analysis, and electromyography. *Prerequisite: PHYS 111, EXSC 336, or permission of the instructor. Offered every other year.*

**437 Psycho-Social Issues in Exercise and Sport** Participation, performance, and satisfaction in sport and exercise are mediated by social structures, as well as individual psychological traits and states. This seminar examines how psychological and social variables affect learning and performance in all types of physical activity, including leisure recreation, fitness, physical education classes, and competitive sport. Emphasis is placed on integrating sound theory with useful practical applications. Students examine how to implement psychological skills training for peak sport performance, how to create positive social climates, and how emerging sport and exercise trends shape the future. *Offered occasionally.*

**438 Equipment Design** This course is intended to familiarize the student with the process of designing sports and/or injury prevention equipment. The course is interdisciplinary in nature, combining exercise science and marketing concepts and theories. In this course, students will learn fundamentals concepts related to product development, consumer behavior and market analysis, as well as basic biomechanical skills needed to formulate methodology to test products and make claims based on the results. In this process students build product briefs, gain consumer insights, and develop a go-to-market plan. The culmination of the semester projects will allow the student to formulate go-to market plans. The students work closely with designers and developers to take a product from inception of idea to prototype development to pilot testing. Ultimately the students decide if the product is ready for mass production and release. Students will gain conceptual and practical knowledge of research methodologies used in both science and business. *Prerequisite: Math 160 or equivalent. Offered occasionally.*

**439 Designing Interdisciplinary Exercise Prescriptions** This course will focus on designing programs intended to improve performance or quality of life with special populations. The student will perform a semester long project designing a complete program for a specific client. The student may choose an elite athlete or disease model in-

tended to improve performance or health. A background in nutrition, exercise physiology, biomechanics and neuroscience will help lay the foundation for a well rounded program intended to address all aspects of the individual. Diet, agility, balance, strength, aerobic, anaerobic training, as well as the combination of training effects will be explored. Contraindications to exercise will also be examined as they relate to health. *Prerequisite: must have completed three of the following: EXSC 301, 328, 329, 336. Offered occasionally.*

**440 Biomechanics of Sports Injuries** This course is designed to study the mechanical bases of musculoskeletal injury, to better understand the mechanisms that seem to cause injury, the effect injury has on the musculoskeletal structures, and hopefully, to study how injury may be prevented. Many different types of injury will be discussed with the students responsible for leading these discussions. Students will write a review article on an injury condition and present their findings to the class. *Prerequisites: At least two of the following : EXSC 327, 336, and 436, or concurrent enrollment, or permission of instructor. Offered Occasionally.*

**480 Directed Research** This course provides a laboratory research experience for seniors under the direction of a faculty member. Students may initiate a project or join a research project in the mentor's lab. Student and mentor fill out a department contract. A written research paper, a reflective summary of the research experience, and an oral or poster presentation must be submitted for a final grade. *Prerequisite: BIO 111, CHEM 110, MATH 160 and instructor permission.*

**490 Senior Thesis in Exercise Science** Experimental research is performed under the guidance and in the area of expertise of a faculty member that may include specialized topics in kinesiology/biomechanics, exercise physiology, nutrition and physical activity or neuroscience. Students must write a proposal that is approved by the department thesis advisor and the Institutional Review Board, carry out the research, write the thesis, and orally defend the thesis at a research symposium. Application details can be obtained from the Scientific Writing instructor, faculty research advisor, or department chair. *Prerequisite: EXSC 331 and permission of the advisor.*

**495/496 Independent Study** 0.5 - 1 unit Research under the close supervision of a faculty member on a topic agreed upon. Application and proposal must be submitted to the department chair and research advisor. Recommended for majors prior to the senior research semester. *Prerequisite: Junior or senior standing, EXSC major and permission of advisor.*