INTEGRATIVE PHYSIOLOGY

Physiology is the branch of biology concerned with the function in living organisms. The department's academic framework is built on an understanding of how humans and animals operate at the genetic, cellular, organ and systemic levels. Our multidisciplinary curriculum requires that students enroll in foundational courses covering anatomy, mathematics, physics, physiology and statistics. With this fundamental knowledge, students pursue additional coursework in biomechanics, cell physiology, endocrinology, immunology, exercise physiology, neurophysiology and sleep physiology.

Graduates of our integrative physiology program are expected to:

- Demonstrate a mastery of core anatomical and physiological concepts.
- Apply knowledge of the human body to novel, real-world contexts.
- Extract meaning from visual representations of data, such as graphs, tables and images.
- Synthesize ideas and concepts from multiple sources to develop a more comprehensive understanding of integrative physiology.
- Apply the scientific method to address questions related to integrative physiology.
- Demonstrate effective communication and collaboration skills.

These objectives are accomplished through a curriculum that includes both required courses and elective experiences. The required courses form the foundational knowledge base, while the elective courses offer opportunities to delve into specific topics. Elective options include seminars, internships, independent study, teaching opportunities, Latin honors and research projects covering a broad spectrum of physiological disciplines.

For more information, visit the Integrative Physiology website (http://www.colorado.edu/iphy/).

Course code for this program is IPHY.

Bachelor's Degree

- Integrative Physiology - Bachelor of Arts (BA) (https://catalog.colorado.edu/undergraduate/colleges-schools/arts-sciences/programs-study/integrative-physiology/integrative-physiology-bachelor-arts-ba/)

Faculty

While many faculty teach both undergraduate and graduate students, some instruct students at the undergraduate level only. For more information, contact the faculty member's home department.

Alderete, Tanya Lynn (https://experts.colorado.edu/display/fisid_159723/)
Assistant Professor; PhD, University of Southern California

Bekoff, Anne (https://experts.colorado.edu/display/fisid_100613/)
Professor Emeritus; PhD, Washington University

Boyko, Marie (https://experts.colorado.edu/display/fisid_100073/)
Senior Instructor Emeritus; MA, University of Colorado Boulder

Brunt, Vienna E (https://experts.colorado.edu/display/fisid_158297/)
Assistant Professor Adjunct; PhD, University of Oregon

Bustamante, Heidi Margarita (https://experts.colorado.edu/display/fisid_146491/)
Associate Teaching Professor; MS, University of Colorado Boulder

Byrnes, William (https://experts.colorado.edu/display/fisid_100643/)
Associate Professor Emeritus; PhD, University of Wisconsin–Madison

Carey, Cynthia
Professor Emerita

Casagrand, Janet L. (https://experts.colorado.edu/display/fisid_100934/)
Associate Teaching Professor; PhD, Case Western Reserve University

Chonchol, Michel
Professor Adjunct; MD, Universidad Central de Venezuela, Caracas

Clayton, S. Zachary
Assistant Research Professor

Craighead, H Daniel (https://experts.colorado.edu/display/fisid_159477/)
Assistant Research Professor; PhD, Pennsylvania State University

Depner, Christopher
Assistant Professor Adjunct; PhD, Oregon State University

DeSouza, Christopher A. (https://experts.colorado.edu/display/fisid_107460/)
Distinguished Professor; PhD, University of Maryland, College Park

Diniz-Behn, Cecelia
Assistant Professor Adjunct

Eaton, Robert
Professor Emeritus

Ehringer, Marissa A. (https://experts.colorado.edu/display/fisid_126595/)
Professor, Chair; PhD, University of Colorado Denver

Enoka, Roger M. (https://experts.colorado.edu/display/fisid_110122/)
Associate Chair, Professor; PhD, University of Washington

Fleshner, Monika R. (https://experts.colorado.edu/display/fisid_103304/)
Professor; PhD, University of Colorado Boulder

Floriano, Maureen (https://experts.colorado.edu/display/fisid_169506/)
Assistant Teaching Professor; PhD, Case Western Reserve University

Foley, Teresa E. (https://experts.colorado.edu/display/fisid_147351/)
Teaching Professor of Distinction; PhD, University of Colorado Boulder

Fowler, John S.
Professor Emeritus

Gleeson, Todd T. (https://experts.colorado.edu/display/fisid_105480/)
Professor Emeritus; PhD, University of California, Irvine

Grabowski, Alena Marie (https://experts.colorado.edu/display/fisid_149727/)
Associate Professor; PhD, University of Colorado Boulder

Harsh, John R. (https://experts.colorado.edu/display/fisid_155406/)
Professor Adjunct

Hayman, Allison P. (https://experts.colorado.edu/display/fisid_156275/)
Assistant Professor Adjunct

Heisler, Ruth E. (https://experts.colorado.edu/display/fisid_103195/)
Teaching Professor of Distinction; MA, University of Colorado Boulder

Hobbs, Steven L. (https://experts.colorado.edu/display/fisid_143724/)
Associate Teaching Professor; PhD, University of Colorado Boulder

Hoeffer, Charles Albert (https://experts.colorado.edu/display/fisid_153384/)
Associate Professor; PhD, University of Arizona

Johnson, Thomas E. (https://experts.colorado.edu/display/fisid_104242/)
Professor Emeritus; PhD, University of Washington

Kim, Sewan (https://experts.colorado.edu/display/fisid_174402/)
Assistant Teaching Professor; PhD, University of Colorado Boulder

Kram, Rodger (https://experts.colorado.edu/display/fisid_118476/)
Associate Professor Emeritus; Ph.D. , Harvard University

LeBourgeois, Monique Katherine
Associate Professor; PhD, University of Southern Mississippi

Link, Christopher D. (https://experts.colorado.edu/display/fisid_109073/)
Associate Professor; PhD, University of Massachusetts at Amherst

Lowry, Christopher (https://experts.colorado.edu/display/fisid_143371/)
Professor; PhD, Oregon State University

Lynch, G. Robert
Professor Emeritus

Maldonado, Tammy A. (https://experts.colorado.edu/individual/fisid_104105/)
Assistant Teaching Professor; PhD, University of Colorado Boulder

Mazzeo, Robert (https://experts.colorado.edu/display/fisid_101031/)
Associate Professor Emeritus, Associate Chair; PhD, University of California, Berkeley

McQueen, Matthew B. (https://experts.colorado.edu/display/fisid_143785/)
Professor Adjoint; DSc, Harvard University

Melanson, Edward
Professor Adjunct

Moore, Russell (https://experts.colorado.edu/display/fisid_105756/)
Professor; PhD, Washington State University

Norris, David O.
Professor Emeritus

Nowak, Kristen
Assistant Professor Adjunct

Opp, Mark R. (https://experts.colorado.edu/display/fisid_158898/)
Professor; PhD, Washington State University

Robichaux, Waldean
Professor Emeritus

Rossman, J. Matthew (https://experts.colorado.edu/display/fisid_156619/)
Assistant Research Professor; PhD, University of Utah

Rowe, K. Rachel (https://experts.colorado.edu/display/fisid_168365/)
Assistant Professor; PhD, University of Kentucky

Saul, Leif J. (https://experts.colorado.edu/display/fisid_116130/)
Associate Teaching Professor; PhD, University of California, Berkeley

Schaetzel, Amanda E. (https://experts.colorado.edu/display/fisid_154385/)
Assistant Teaching Professor; PhD, University of Colorado Boulder

Seals, Douglas R. (https://experts.colorado.edu/display/fisid_103375/)
Distinguished Professor; PhD, University of Wisconsin–Madison

Sherwood, David
Associate Professor Emeritus

Shi, Jia (https://experts.colorado.edu/display/fisid_143673/)
Associate Teaching Professor; PhD, Boston University

Stitzel, Jerry A. (https://experts.colorado.edu/display/fisid_102954/)
Professor; PhD, Johns Hopkins University

Stob, Nicole R. (https://experts.colorado.edu/individual/fisid_134529/)
Assistant Teaching Professor; PhD, Colorado State University

Tan, Andrew Q. (https://experts.colorado.edu/display/fisid_167426/)
Assistant Teaching Professor; PhD, Northwestern University

Tsai, Pei-San (https://experts.colorado.edu/display/fisid_115292/)
Professor; PhD, University of California, Berkeley

Wright Jr., Kenneth P. (https://experts.colorado.edu/display/fisid_125586/)
Distinguished Professor; PhD, Bowling Green State University

Courses

IPHY 1020 (1) Introduction to Integrative Physiology
Introduces students to Integrative Physiology. Provides an overview of the major and how it differs from other biology programs; how to get involved in clubs, research, and/or internship opportunities; strategies for succeeding in IPHY courses; and career options. This is a first-year colloquium course specifically designed for freshman and other students exploring their educational and career opportunities.

IPHY 1030 (1-2) Introduction to the Health Professions
Introduces students to careers in healthcare. This exploratory course is designed to expose students to the wide spectrum of healthcare occupations available and the knowledge of basic requirements and personal attributes needed to enter such career fields. Students will discover potential careers that match their skills and interests. Other topics include locations and areas healthcare professionals practice, including the lesser-known areas, as well as cultural and economic factors impacting health equity and access. This course is designed for first-year and second-year students. Open to all majors and exploratory students.

IPHY 1040 (1) Medical Professional Speaker Series
Fall semester only, meets one time per week. For students enrolled in Health Professions Residential Academic Program (HPRAP). Introduction to careers by working professionals from a variety of medical fields.
Grading Basis: Pass/Fail

IPHY 1111 (2) Analysis of Human Movement with Smart-Phone Technology
Learn how to measure and analyze human movement using a smart-phone application. After being provided with some background information on human physiology, students will learn how to acquire, process, and analyze signals detected by the app. Students will be required to participate in a group project that they present in poster format to their peers.
Requisites: Restricted to students with 0-56 credits (Freshmen or Sophomore) only.
Grading Basis: Letter Grade
Additional Information: Arts Sci Gen Ed: Distribution-Natural Sci Lab

IPHY 1131 (2) Using model organisms to study human disease: hands-on research
Provides a hands-on laboratory research experience, including undertaking science scholarship, designing and performing experiments, and analysis of quantitative data. Students will also be exposed to basic concepts in genetics and molecular biology, as well as the rationale for current experimental approaches for understanding human disease.
Grading Basis: Letter Grade
Additional Information: Arts Sci Gen Ed: Distribution-Natural Sci Lab
Arts Sci Gen Ed: Distribution-Natural Sciences

IPHY 1181 (2) Biological Probiotic/Drug Discovery Through Hands-on Screens
Provides introduction to research and laboratory experience. Students will work in teams to screen novel mycobacterial strains for use as probiotics or immunoregulatory/anti-inflammatory drugs using THP-1 cells, a human monocytic cell line. Topics covered include the hygiene or "Old Friends" hypothesis, the human microbiome, approaches to screening for new probiotics of therapeutics and statistical analysis of the data.
Equivalent - Duplicate Degree Credit Not Granted: MCDB 1181
Grading Basis: Letter Grade

IPHY 1211 (2)
Using Sensor Technology to Study the Effects of Light on Human Health
Introduces you the basics of photobiology, measurement of light (including a discussion of humancentric vs. radiometric units for quantifying light exposure), and light effects on human physiology and longterm health. You will also be taught how to program light sensors, extract raw data, process, analyze and visualize it (incl. basic statistics in R).
Grading Basis: Letter Grade

IPHY 1600 (3) Basic Human Anatomy & Physiology
Focuses on basic knowledge of human body structures and functions. Topics include an orientation to the human body, basic chemistry and cell structure, the integumentary, skeletal, muscular, nervous, endocrine, cardiovascular, lymphatic, immune, respiratory, digestive, urinary, and reproductive systems. Open to all majors and exploratory students. Integrative Physiology (IPHY) majors should take IPHY 3410 and 3430 to fulfill the anatomy and physiology degree requirements.
Additional Information: Arts Sci Gen Ed: Distribution-Natural Sciences

IPHY 1950 (3) Introduction to Scientific Writing in Integrative Physiology
Gives students practical tools that they will need as majors in Integrative Physiology or other sciences: skills in finding, reading, and using professional scientific publications; understanding of the formats required by various scientific documents; practice in writing about science for different purposes and audiences; and tools for analyzing and developing their own writing processes.
Requisites: Restricted to students with 0-86 credits (Freshmen, Sophomore or Juniors) only.
Additional Information: Arts Sci Core Curr: Written Communication
Arts Sci Gen Ed: Written Communication-Lower
MAPS Course: English

IPHY 2010 (1-3) Seminar in Integrative Physiology
Introduces a small group of lower-division students to current research topics in integrative physiology. Emphasizes relevant applications to real-world situations.
Repeatable: Repeatable for up to 6.00 total credit hours. Allows multiple enrollment in term.
Additional Information: Arts Sci Gen Ed: Distribution-Natural Sciences

IPHY 2030 (2) Preparing for a Career in the Health Professions
This course is designed to help students learn the basic requirements and personal attributes needed to enter the healthcare professions, while building the primary elements of their application to health professional schools. Students will explore the ways in which they can gain shadowing, volunteering, and other clinical experiences that both fit their career path and reflect their personal goals and values. Students will also spend time working on one of the biggest components of their application - their personal statement. This course is specifically designed for sophomores, juniors, and seniors who are new to navigating admissions processes.
Recommended: Prerequisite IPHY 1030.

IPHY 2400 (2) Introduction to Medical Terminology for Future Health Professionals
Introduces medical terminology used within the health professions. Word roots, prefixes and suffixes used in medical records for major body systems will be examined and explained. The structure and functions of the major systems will be defined and described. Open to all majors and exploratory students.
Grading Basis: Letter Grade
Additional Information: Arts Sci Gen Ed: Distribution-Natural Sciences

IPHY 2420 (3) Introduction to Nutrition
Focuses on the basic anatomy, physiology, and chemistry of nutrition. Topics include weight management, the role of diet and lifestyle in disease prevention, specific nutrient deficiencies and toxicities, nutrition standards and guidelines, sports nutrition recommendations, agricultural practices, and food policy issues.
Equivalent - Duplicate Degree Credit Not Granted: IPHY 3400
Additional Information: Arts Sci Core Curr: Natural Science Non-Sequence
Arts Sci Gen Ed: Distribution-Natural Sciences

IPHY 2692 (3) Foundations in Public Health
Get a comprehensive overview of public health as well as an in-depth introduction to specific public health-related topics. Beginning with a historical overview, students will explore major public health concepts such as the basic principles of epidemiology, the biomedical basis of disease, social and behavioral determinants of health, and systems thinking. Learn about the concepts of measuring and evaluating the health of populations, principles of communicable and non-communicable diseases, environmental and occupational health, the economics of health, and the role of public health workers in society.
Equivalent - Duplicate Degree Credit Not Granted: GEOG 2692 and PBHL 2692
Additional Information: Arts Sci Gen Ed: Distribution-Social Sciences

IPHY 2910 (1-6) Practicum in Integrative Physiology
Offers lower-division students practical experience in laboratory, clinical, or field settings with direct supervision. Students can earn 1 credit for every 45 hours of intern work. Consult with departmental internship coordinator for approval.
Repeatable: Repeatable for up to 6.00 total credit hours.
Requisites: Restricted to students with 0-56 credits (Freshmen or Sophomore) only.

IPHY 3010 (1-2) Teaching in Integrative Physiology
Provides an opportunity for students to assist in specific lecture, recitation, or laboratory sections under direct faculty supervision. Students can earn 1 credit for 30-49 hours of class contact time or 2 credits for 50+ hours. Consult with faculty member for approval.
Repeatable: Repeatable for up to 6.00 total credit hours. Allows multiple enrollment in term.
Recommended: Prerequisite Students must have earned B- or higher in the course they are assisting.

IPHY 3020 (1) Next Steps: Preparing for Life After Graduation
Helps upper-division students prepare for what comes after graduation. Topics include exploring careers; how to write a resume or CV; interviewing tips; how to build your portfolio; asking for letters of recommendations. This course is specifically designed for juniors starting to prepare for the next stage post-graduation.
Equivalent - Duplicate Degree Credit Not Granted: EBIO 3020 and MCDB 3020
Requisites: Restricted to students with 57-180 credits (Juniors or Seniors).
Grading Basis: Pass/Fail

IPHY 3280 (4) Intro to Data Science and Biostatistics
Builds a foundation for modern data analysis and experimental design in the context of human physiology, health and disease. An intuitive understanding of probability, statistical methods, test outcomes and data relationships are emphasized over rigorous mathematical proofs. Foundational analytical skills using R and R Studio are developed using real and simulated data.
Additional Information: Arts Sci Gen Ed: Quantitative Reasoning Math

IPHY 3410 (3) Human Anatomy
Explores the cells, tissues, and organs that compose the different anatomical systems including integumentary, skeletal, muscular, digestive, respiratory, cardiovascular, lymphatic, nervous, urinary and reproductive.All registration restrictions will be strictly enforced by the department.
Requisites: Requires prerequisite 1-semester biology lecture of EBIO 1210 or MCDB 1150 or CHEN 2810 (minimum grade C-).
Recommended: Prerequisite EBIO 1220.
Additional Information: Arts Sci Gen Ed: Distribution-Natural Sciences

IPHY 3415 (2) Human Anatomy Laboratory
Introduces structures of the human anatomical systems using human cadavers and animal tissue. This laboratory is meant to complement IPHY 3410.
Equivalent - Duplicate Degree Credit Not Granted: IPHY 3417
Requisites: Requires prerequisite or corequisite of IPHY 3410 (minimum grade C-).
Additional Information: Arts Sci Gen Ed: Distribution-Natural Sci Lab Arts Sci Gen Ed: Distribution-Natural Sciences

IPHY 3417 (2) Virtual Human Anatomy Laboratory
Introduces structures of the human anatomical systems using a virtual interactive anatomy program. This online laboratory is meant to complement IPHY 3410. As an online course, this lab may not fulfill prerequisites for post-baccalaureate, graduate, or other allied health programs. Please consult with your Biology advisor before enrollment.
Equivalent - Duplicate Degree Credit Not Granted: IPHY 3415
Requisites: Requires prerequisite or corequisite of IPHY 3410 (minimum grade C-).
Additional Information: Arts Sci Gen Ed: Distribution-Natural Sciences Arts Sci Gen Ed: Distribution-Natural Sci Lab

IPHY 3430 (4) Human Physiology
Introduces the physiology of the endocrine, nervous, muscular, cardiovascular, respiratory, urinary, digestive, reproductive and immune systems. Each system will be integrated into the larger contexts of homeostasis and adaptation during pathology and challenges. Students must enroll in lecture and recitation sections.
Equivalent - Duplicate Degree Credit Not Granted: IPHY 3470
Requisites: Requires prerequisite courses of IPHY 3410 and prerequisite or corequisite of CHEM 1133/1134 (all minimum grade C-).
Recommended: Prerequisite IPHY 3415.
Additional Information: Arts Sci Gen Ed: Distribution-Natural Sciences

IPHY 3435 (2) Physiology Lab
Introduces laboratory experience in selected aspects of human physiology with a focus on applying the scientific method in experimentation. This laboratory is meant to complement IPHY 3430. Students should take IPHY 3435 or IPHY 3437 to fulfill degree requirements. All registration restrictions will be strictly enforced by the department.
Equivalent - Duplicate Degree Credit Not Granted: IPHY 3437
Requisites: Requires prerequisite course of IPHY 3280 or EBIO 1010 or MATH 2510 or PSYC 2111 or SOCY 2061, and prerequisite or corequisite course of IPHY 3430 (all minimum grade C-).
Additional Information: Arts Sci Gen Ed: Distribution-Natural Sci Lab Arts Sci Gen Ed: Distribution-Natural Sciences

IPHY 3437 (2) Virtual Human Physiology Laboratory
Introduces online laboratory experiences for select aspects of human physiology using laboratory simulations. This online laboratory is meant to complement IPHY 3430. As an online course, this lab may not fulfill prerequisites for post-baccalaureate, graduate, or other allied health programs. Please consult with your Biology advisor before enrollment. Students should take IPHY 3435 or IPHY 3437 to fulfill degree requirements.
Equivalent - Duplicate Degree Credit Not Granted: IPHY 3435
Requisites: Requires prerequisite course of IPHY 3280 or EBIO 1010 or MATH 2510 or PSYC 2111 or SOCY 2061, and prerequisite or corequisite course of IPHY 3430 (all minimum grade C-).
Additional Information: Arts Sci Gen Ed: Distribution-Natural Sci Lab Arts Sci Gen Ed: Distribution-Natural Sciences

IPHY 3440 (3) Clinical Nutrition
Exploration of clinical nutrition concepts from a health care provider perspective. Examines how and why diseases develop and what nutritional therapy and intervention is appropriate for disease resolution.
Requisites: Requires prerequisite of IPHY 2420 (minimum grade C-). Restricted to students with 57-180 credits (Junior or Senior) Integrative Physiology (IPHY) majors only.
Additional Information: Arts Sci Gen Ed: Distribution-Natural Sciences

IPHY 3490 (3) Introduction to Epidemiology
Examines the history and uses of epidemiology, measures of disease frequency and occurrence, association and causality, analytic epidemiology, evidence-based screening and outbreak investigations.
Recommended: Prerequisites IPHY 2800 or IPHY 3280; and SOCY 2061 and PSYC 3101.
Additional Information: Arts Sci Gen Ed: Distribution-Natural Sciences

IPHY 3590 (3) Health and Function over the Adult Lifespan
Examines topics in the field of biomedical aging in the context of public health including: lifespan, changing demographics of aging, health span, genetics of aging; physiology of aging (changes in function with age; biological mechanisms of aging); clinical disorders of aging (aging and chronic diseases; clinical syndromes in geriatric medicine); lifestyle and pharmacological strategies for preserving health and function with aging. Department enforced requisites: One year of general biology (lecture + lab) and a statistics course (IPHY 3280 or EBIO 1010 or MATH 2510 or PSYC 2111 or SOCY 2061).

IPHY 3700 (3) Scientific Writing in Integrative Physiology
Takes a process-based approach to writing. Assignments and classroom experiences emphasize critical thinking, using scientific evidence and reasoning to construct original arguments, and applying conventions and problem-solving skills to craft successful documents.
Requisites: Restricted to students with 57-180 credits (Junior or Senior) Integrative Physiology (IPHY) or Neuroscience (NRSC) majors only.
Recommended: Prerequisite Statistics course (IPHY 3280 or EBIO 1010 or MATH 2510 or PSYC 2111 or SOCY 2061).
Additional Information: Arts Sci Core Curr: Written Communication
Arts Sci Gen Ed: Written Communication-Upper

IPHY 4010 (1-3) Seminar in Integrative Physiology
Introduces a small group of students to current research topics in integrative physiology, evaluation of current research and discussion of critical issues.
Repeatable: Repeatable for up to 6.00 total credit hours. Allows multiple enrollment in term.
Requisites: Restricted to students with 27-180 credits (Sophomores, Juniors or Seniors) only.
Recommended: Prerequisite Statistics course (IPHY 3280 or EBIO 1010 or MATH 2510 or PSYC 2111 or SOCY 2061).
Additional Information: Arts Sci Gen Ed: Distribution-Natural Sciences

IPHY 4040 (3) History of Medicine
Explores the history of western European medicine from the Middle Ages to the 19th century with a focus on the influence of social events and how these shaped the process and evolution of medicine. Projects explore topics of student interest that might include pharmacology, pathology, mental illness, optometry, dentistry, women in medicine, and the influence of war on medical practices. This is a three-week (Maymester) Education Abroad Global Seminar.
Requisites: Requires prerequisite course of IPHY 3410 (minimum grade C-)

IPHY 4041 (3) Global Health and Disease
This course will provide a comprehensive study of community health and common diseases with a specific geographical case study that will vary. Students will have the opportunity to learn about these topics through observations, discussions, visiting local clinics, and hospitals, and interaction with local communities. This is a three-week Education Abroad Global Seminar.
Requisites: Requires prerequisite course of IPHY 3410 (minimum grade C-).

IPHY 4060 (4) Cell Physiology
Focuses on the molecular machines and cellular sub-compartments that allow cells to renew, replicate, and function in the context of multicellular organisms. Students must enroll in lecture and lab sections.
Requisites: Requires prerequisite course of IPHY 3430 and IPHY 3435 or IPHY 3437 (all minimum grade C-). Restricted to Integrative Physiology (IPHY) or Neuroscience (NRSC) majors only.
Additional Information: Arts Sci Gen Ed: Distribution-Natural Sciences

IPHY 4200 (3) Physiological Genetics and Genomics
Covers fundamental concepts in molecular genetics/genomics with physiological applications. Topics include structure and function of nucleic acids, genome structure, genetic and genomic research tools, methods for identifying disease-causing mutations, regulation of gene expression, pharmacogenetics, gene therapy and ethical issues in modern genomics. First course of a 3-course series recommended for IBG students. Includes a recitation section.
Equivalent - Duplicate Degree Credit Not Granted: IPHY 5200
Requisites: Restricted to students with 27-180 credits (Sophomores, Juniors or Seniors) only.
Additional Information: Arts Sci Gen Ed: Distribution-Natural Sciences

IPHY 4300 (3) Pathophysiology of Disease
Uses case studies to explore various disease states of the organ systems within the body and the underlying mechanisms that contribute to the manifestations of these diseases. Additionally, students will examine the importance of epidemiology in the understanding of disease as well as discuss infectious disease, and the role of genetics in congenital defects and cancer.
Requisites: Requires prerequisite courses of IPHY 3410 and (IPHY 3430 or IPHY 3470) (minimum grade C-).
Grading Basis: Letter Grade

IPHY 4420 (3) Nutrition and Human Performance
Examines nutrient use during exercise and the nutrient needs of athletes and active individuals, including strategies to improve physical performance and recovery through dietary manipulations and dietary supplements.
Requisites: Requires prerequisite course of IPHY 2420 or IPHY 3400 (minimum grade C-).

IPHY 4440 (4) Endocrinology
Introduces mammalian endocrine system. Provides a thorough analysis of chemical communication by hormones and related bioregulators with emphasis on the major endocrine systems such as the thyroid, gonad, pituitary and the brain. All registration restrictions will be strictly enforced by the department.
Equivalent - Duplicate Degree Credit Not Granted: IPHY 5440
Requisites: Requires prerequisite courses of IPHY 3430 and IPHY 3435 or IPHY 3437 (minimum grade C-). Restricted to Integrative Physiology (IPHY) or Neuroscience (NRSC) majors only.
Additional Information: Arts Sci Gen Ed: Distribution-Natural Sciences

IPHY 4470 (3) Biology of Human Reproduction
Anatomy and physiology of human reproduction, including gender determination, embryology, puberty, menstrual cycle, pregnancy, lactation, menopause, sexual behavior, sexual abnormalities and contraception. Open to all majors. Department enforced requisite: one year of general biology (lecture + lab). Recommended: IPHY 3430 and IPHY 4440.
Additional Information: Arts Sci Gen Ed: Distribution-Natural Sciences

IPHY 4480 (3) Comparative Reproduction
Focuses on comparative anatomy and physiology of reproductive system and the evolution of reproductive behavior in vertebrates and invertebrates. Topics include courtship, mating, fertilization, estrous and menstrual cycles and environmental control of seasonal reproduction. Department enforced prerequisite: one year of general biology (lecture + lab). Recommended: Prerequisite IPHY 3430.
Additional Information: Arts Sci Gen Ed: Distribution-Natural Sciences

IPHY 4490 (3) Case Studies in Public Health
Explores case studies in public health in how they have influenced our approach to disease outbreaks and disease resolution. Examines famous case studies in infectious disease, zoonoses and non-infectious diseases, including environmental and occupational exposure to see how they have changed our understanding of disease and responses by health and medical personnel. Examines special populations within public health, as well as discuss modern public health challenges.
Requisites: Requires prerequisite courses of IPHY 3490 (minimum grade D-).
Grading Basis: Letter Grade
Additional Information: Arts Sci Gen Ed: Distribution-Natural Sciences

IPHY 4540 (5) Biomechanics
Applies the principles of physics and physiology to analyze the movement of humans and other animals. Assesses the mechanical properties of muscles, tendons, ligaments and bones. Quantitatively analyzes forces, torque, mechanical energy, power impulses and momentum associated with human movement. Students enroll in a lab, and the enrolled lab will have a designated recitation and lecture attached. All registration restrictions will be strictly enforced by the department.
Equivalent - Duplicate Degree Credit Not Granted: IPHY 5540
Requisites: Requires prerequisite courses of IPHY 3430 and physics (PHYS 1110 or PHYS 2010) (all minimum grade C-). Restricted to Integrative Physiology (IPHY), Neuroscience (NRSC), or College of Engineering majors only.
Recommended: Prerequisites IPHY 3415 and calculus (MATH 1300 or MATH 1310 or APPM 1350) and statistics (IPHY 3280 or EBIO 1010 or MATH 2510 or PSYC 2111 or SOCY 2061).
Additional Information: Arts Sci Gen Ed: Distribution-Natural Sciences

IPHY 4580 (3) Sleep Physiology
Describes the physiology, neurobiology, and functions of sleep and circadian rhythms; explains the impact of sleep and circadian rhythms, as well as sleep and circadian disruptions and disorders on immune, endocrine, thermoregulatory, cardiovascular, respiratory, and neural systems; examines changes in sleep and circadian rhythms across the life span. The integrative nature of sleep and circadian rhythms in normal physiological and cognitive functions and their importance in health and disease processes will be emphasized. All registration restrictions will be strictly enforced by the department.
Equivalent - Duplicate Degree Credit Not Granted: IPHY 5580
Requisites: Requires prerequisite course of IPHY 3430 (minimum grade C-). Restricted to Integrative Physiology (IPHY) or Neuroscience (NRSC) majors only.
Recommended: Prerequisites Statistics course (IPHY 3280 or EBIO 1010 or MATH 2510 or PSYC 2111 or SOCY 2061).
Additional Information: Arts Sci Gen Ed: Distribution-Natural Sciences

IPHY 4600 (3) Immunology
Studies the immune system, a multi-cellular system that functions to protect us from disease. Introduces concepts associated with the development and function of individual cells of the immune system (T-cells, B-cells, neutrophils, dendritic cells, macrophages), as well as their integrative roles in physiology and host defense. This course requires a conceptual understanding of the material and emphasizes problem-solving skills through case studies. All registration restrictions will be strictly enforced by the department.
Equivalent - Duplicate Degree Credit Not Granted: IPHY 5600
Requisites: Requires prerequisite course of IPHY 3430 (minimum grade C-). Restricted to Integrative Physiology (IPHY) or Neuroscience (NRSC) majors only.
Recommended: Prerequisite or corequisite IPHY 4060.
Additional Information: Arts Sci Gen Ed: Distribution-Natural Sciences

IPHY 4650 (5) Exercise Physiology
Examines physiological and biochemical adjustments that occur in the body with acute and chronic exercise. Topics center on physiological mechanisms pertaining to metabolic, cardiovascular, and hormonal alterations, the role of exercise in health and disease, soreness and fatigue, immune function, as well as exercise during varied environmental conditions. Students enroll in the lab, and a designated recitation and lecture are attached to the lab.
Equivalent - Duplicate Degree Credit Not Granted: IPHY 5650
Requisites: Requires prerequisite course of IPHY 3430 and IPHY 3435 or IPHY 3437 (all minimum grade C-). Restricted to Integrative Physiology (IPHY) or Neuroscience (NRSC) majors only.
Additional Information: Arts Sci Gen Ed: Distribution-Natural Sciences

IPHY 4720 (4) Neurophysiology
Explores the function of the nervous system, including how the properties of neurons influence nervous system activity, how the nervous system controls the activity of muscles and how the sensory effects of muscle activity influence the function of the nervous system. All registration restrictions will be strictly enforced by the department.
Equivalent - Duplicate Degree Credit Not Granted: IPHY 5720
Requisites: Requires prerequisite courses of IPHY 3430 and IPHY 3435 or IPHY 3437 (all minimum grade C-). Restricted to Integrative Physiology (IPHY) or Neuroscience (NRSC) majors only.
Grading Basis: Letter Grade
Additional Information: Arts Sci Gen Ed: Distribution-Natural Sciences

IPHY 4780 (3) Sleep, Circadian Rhythms, and Health
Examines the history of the fields of sleep and circadian rhythms; lifespan development of sleep and rhythms; observational, physiological, and clinical measures of sleep; screening for sleep and circadian disorders; associations between poor sleep and circadian misalignment and health; and evidenced-based sleep and circadian interventions/ preventions in healthy and clinical samples. Dept. enforced requisite: one year of biology (lecture and lab).
Equivalent - Duplicate Degree Credit Not Granted: IPHY 5780

IPHY 4800 (3) Molecular Evolution: How Natural Selection has Shaped the Molecules of Life
This course explores how Darwin¿s idea has shaped the structures of DNA, RNA and proteins across the long history of life on earth. Natural selection driving the evolution these macromolecules and subsequent developmental pathways will be fully appreciated as the process that ultimately produced the amazing variety of species on this planet. Looking ahead, our recent efforts to harness the power of evolution in the test tube to develop new therapies will be covered.
Requisites: Requires prerequisite courses of MCDB 3135 and MCDB 3145 (minimum grade C-).

IPHY 4850 (1) Honors Thesis Seminar
The course is specifically designed for students who are enrolled in the IPHY Honors program and have a faculty mentor. The course follows a workshop-based approach and aims to guide students through the various stages of writing and defending a thesis. It also provides an opportunity to share and receive feedback on works in progress. Throughout the course, students will have the chance to explore the scientific writing format, improve their writing process, and effectively communicate about science. Additionally, student will have the opportunity to practice a thesis defense talk.
Recommended: Prerequisite IPHY 3700; and IPHY 4870 (taken concurrently).

IPHY 4860 (1-8) Independent Study: Undergraduate
An opportunity for upper-division students to earn academic credit for working under the individual direction of a faculty member. Twenty-five hours of work is required for each hour of academic credit given. Consult with faculty mentor and undergraduate coordinator for approval. Department enforced prerequisites: Cumulative GPA of 2.0 and completion of at least one upper-division IPHY course. Students may register for more than one section per term.
Repeatable: Repeatable for up to 8.00 total credit hours. Allows multiple enrollment in term.
Requisites: Restricted to students with 57-180 credits (Juniors or Seniors).

IPHY 4870 (1-6) Honors Thesis
An opportunity for students enrolled in the IPHY Honors program to earn academic credit for working on their thesis. Twenty-five hours of work is required for each hour of academic credit given. Consult for faculty mentor for approval.
Recommended: Prerequisites IPHY 3700; and IPHY 4850 (taken concurrently).
Additional Information: Arts Sciences Honors Course

IPHY 4880 (3) Advanced Data Analysis in Biomedical Research
Provides advanced training on statistics and scientific reasoning in laboratory and clinical research. Conceptual foundations of classical and modern statistical techniques is reviewed. Multiple class projects consist of written reports on statistical analysis of data representative of the student's field of interest. The use of statistical packages, primarily R, is required.
Equivalent - Duplicate Degree Credit Not Granted: IPHY 5880
Requisites: Requires prerequisite course of IPHY 2800 or IPHY 3280 or EB10 1010 or MATH 2510 or PSYC 2111 or SOCY 2061 (minimum grade C).
Grading Basis: Letter Grade

IPHY 4900 (1-3) Public Health Practicum
Offers practical experience in Public Health with direct supervision.
Equivalent - Duplicate Degree Credit Not Granted: EBIO 4900 and MCDB 4900
Repeatable: Repeatable for up to 6.00 total credit hours.

IPHY 4930 (1-6) Internship
Offers upper-division students practical experience in laboratory, clinical, and field settings with direct supervision Students can earn 1 credit for every 45 hours of intern work. Consult with departmental internship coordinator for approval. Department enforced prerequisite: Cumulative GPA of 2.0 and completion of two upper-division IPHY courses.
Repeatable: Repeatable for up to 6.00 total credit hours. Allows multiple enrollment in term.
Requisites: Restricted to students with 57-180 credits (Juniors or Seniors).

IPHY 4940 (1-6) Application for Clinical Internship
Provides upper-division students an opportunity for internship experience in a clinic and hospital setting with an established Affiliation Agreement with CU Boulder. Students can earn 1 credit for every 45 hours of intern work. Consult with departmental internship coordinator for approval. Department enforced prerequisite: Cumulative GPA of 2.0 and completion of two upper-division courses.
Repeatable: Repeatable for up to 6.00 total credit hours. Allows multiple enrollment in term.
Requisites: Restricted to students with 57-180 credits (Juniors or Seniors).

IPHY 4950 (1-6) Global Study Abroad Internship
Provides an opportunity for students to combine international experiential learning and academic theory as a means to gain professional experience and to develop a new perspective on a career field. Contact the Study Abroad office (abroad@colorado.edu) for information on available opportunities and to find out how to enroll in this course.
Repeatable: Repeatable for up to 6.00 total credit hours.