Human Physiology

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Human physiology is the science of the mechanical, physical, and biochemical function of humans, and serves as the foundation of modern medicine. As a discipline, it connects science, medicine, and health, and creates a framework for understanding how the human body adapts to stresses, physical activity, and disease.

Human physiology and anatomy are closely related—anatomy is the study of form, physiology is the study of function, and form and function are intrinsically linked. The study of human physiology integrates knowledge across many levels, including biochemistry, cell physiology, and organ systems. Contemporary research in human physiology explores new ways to maintain or improve the quality of life, the development of new medical therapies and interventions, and the unanswered questions about how the human body works. The Department of Human Physiology serves its students by providing strong training in human physiology and anatomy to prepare them for careers in medicine, allied health professions, and biomedical research.

Faculty

Li-Shan Chou, professor. BS, 1987, Tatung Institute of Technology; MS, 1990, PhD, 1995, Illinois, Chicago. (2000)

Anita Christie, assistant professor. BS, 2001, MS, 2003, Brock; PhD, 2009, Massachusetts, Amherst. (2011)

Brian Dalton, assistant professor. MS, 2006, Memorial University of Newfoundland; PhD, 2010, Western Ontario. (2013)

Sierra Dawson, senior lecturer. BS, 1995, MS, 2000, PhD, 2004, Oregon. (2003)

Hans Dreyer, associate professor. BS, 1998, California State, Long Beach; MS, 2002, PhD, 2004, Southern California. (2009)

Grace Golden, lecturer. BS, 1989, MS, 1991, Oregon; PhD, 2007, Oregon State. (2009)

Michael Hahn, associate professor. BS, 1996, Colorado Mesa; MS, 2000, Iowa State; PhD, 2003, Oregon. (2012)

John Halliwill, professor. BS, 1991, Ohio State; PhD, 1995, Medical College of Virginia. (2002)

Robin Hopkins, instructor. BS, 2005, Simon Fraser; MS, 2009, Western Ontario; PhD, 2014, British Columbia. (2014)

Adrianne Huxtable, assistant professor. BS (Honours), 2003, British Columbia; PhD, 2009, Alberta. (2015)

Andrew Karduna, professor. BS, 1989, Massachusetts Institute of Technology; MS, 1991, Johns Hopkins; PhD, 1995, Pennsylvania. (2002)

Andrew Lovering, associate professor. BS, 1995, PhD, 2003, Texas Tech. (2007)

Philip Matern, instructor. BS, 2003, Gonzaga; MS, 2005, Central Washington; PhD, 2015, California, Davis. (2014)

Carrie McCurdy, assistant professor. BS, 1998, Notre Dame; PhD, 2004, Wisconsin, Madison.(2013)

Christopher Minson, Kenneth and Kenda Singer Endowed Professor in Human Physiology. BS, 1989, Arizona; MA, 1993, San Diego State; PhD, 1997, Pennsylvania State. (2000)

Jon Runyeon, instructor. BS, 1996, MS, 2010, Oregon. (2012)

Courtesy

John Brandon, courtesy research assistant. BS, 1976, Ricker College; MS, 1980, Oregon; AD, 1984, Lane Community College. (1997)

Alice Callahan, courtesy instructor. BS, 2002, Cornell; PhD, 2008, California, Davis. (2014)

Mark Chesnutt, courtesy research associate. BS, 1982, Pacific Lutheran; MD, 1986, Oregon Health and Science. (2012)

Michael Colasurdo, courtesy professor. BS 1980, Portland State; MD, 1984, Oregon Health and Science. (2009)

Dennis Collis, courtesy professor. BS, 1959, Grinnell College; MD, 1963, Washington (St. Louis). (2007)

Mathews Fish, courtesy professor. AB, 1956, California, Berkeley; MD, 1959, California Medical, San Francisco. (2002)

Daniel Fitzpatrick, courtesy associate professor. BS, 1991, MS, 1993, MD, 1997, Iowa. (2007)

Eben Futral, courtesy research associate. BS, 1988, Stanford; MBA, 1999, Arizona State. (2015)

Igor Gladstone, courtesy professor. BS, 1973, MD, 1981, Washington (Seattle). (2009)

Randall Goodman, courtesy research assistant. BS, 1994, Oregon. (2010)

Jerold Hawn, courtesy professor. BS, 1963, Santa Clara; MD, 1967, Georgetown. (2009)

Stanley James, courtesy professor. BS, 1953, MD, 1962, Iowa. (1979)

Brian Jewett, courtesy associate professor. BS, 1990, MS, 1991, Stanford; MD, 1995, Vanderbilt. (2007)

Donald Jones, courtesy professor. BS, 1969, Centenary (Hackettstown); MD, 1973, Louisiana State. (1983)

Sungwoo Kang, courtesy research assistant. BS, 2007, Hangyang; MS, 2009, PhD, 2013, Korea National Sport. (2015)

Paul Kaplan, courtesy research associate; university physician. AB, 1970, Stanford; MD, 1974, California, Los Angeles. (2005)

Vern Katz, courtesy professor. BA, 1971, MD, 1979, California, Los Angeles. (2001)

Peter Kosek, courtesy professor. BA, 1984, Grinnell College; MD, 1988, California, Los Angeles. (2009)

Brett "Brick" Lantz, courtesy professor. BA, 1981, Stanford; MD, 1985, Oklahoma. (2007)

Samuel Lau, courtesy professor. BS, 1984, MD, 1988, Creighton. (2009)

Victor Lin, courtesy associate professor. BS, 1988, Massachusetts Institute of Technology; MS, 1991, California, Berkeley; MD, California, San Francisco. (2002)

Kimber Mattox, courtesy instructor. BA, 2011, Willamette; MS, 2013, Oregon. (2013)

John Melton, courtesy senior research associate. BS, 1979, MD, 1985, New Mexico. (2011)

Jennifer Miner, courtesy instructor. BA, 1998, MS, 2010, Oregon. (2013)

Brian Nichols, courtesy instructor. BS, 1987, MS, 1989, Oregon. (2001)

Richard Padgett, courtesy professor. BS, 1984, East Carolina; MD, 1988, North Carolina, Chapel Hill. (2005)

Joshua Pfeiffer, courtesy assistant professor. BS, 2003, MD, 2008, Washington (Seattle). (2015)

Matthew Shapiro, courtesy research associate. BA, 1979, Cornell; MD, 1983, Columbia. (2015)

Kenneth M. Singer, courtesy professor; team physician. BS, 1961, Massachusetts Institute of Technology; MD, 1965, Columbia University College of Physicians and Surgeons. (1994)

Kimberly Terrell, courtesy instructor. BS 1981, MS, 1983, Oregon. (2006)

Brad Wilkins, courtesy instructor. BS, 1993, Oregon State; MS, 1996, Northern Michigan; PhD, 2003, Oregon. (2014)

Emeriti

Barry T. Bates, professor emeritus. BSE, 1960, Princeton; MEd, 1971, East Stroudsburg; PhD, 1973, Indiana. (1974)

Gary A. Klug, professor emeritus. BS, 1970, MS, 1973, Wisconsin, La Crosse; PhD, 1980, Washington State. (1985)

Louis R. Osternig, professor emeritus. BS, 1965, MS, 1967, California State, Hayward; PhD, 1971, Oregon. (1971)

Richard K. Troxel, senior instructor emeritus. BS, 1975, MS, 1977, Oregon. (1976)

Marjorie Woollacott, professor emerita. BA, 1968, PhD, 1973, Southern California. (1980)

The date in parentheses at the end of each entry is the first year on the University of Oregon faculty.

- **Bachelor of Arts**
- **Bachelor of Science**

Undergraduate Studies

The department offers a program leading to either a bachelor of science (BS) or a bachelor of arts (BA) degree.

At the undergraduate level, students prepare for professional health science programs in fields such as medicine, physical therapy, occupational therapy, nursing, dentistry, pharmacy, education, and research. The rigorous undergraduate curriculum that provides an in-depth exploration of the field as well as a strong foundation for future studies. A degree in human physiology prepares students to be critical thinkers who can independently assess their own personal health, using the guiding principles of scientific inquiry as a model for understanding the world around them.

Careers

The human physiology program provides the scientific foundation necessary for professional studies in medicine, physical therapy, and other health science fields. In addition, graduate work in the field of human physiology provides opportunities to conduct advanced research and to instruct the next generation of scientists and medical professionals.

Preparation

High school preparation should include a strong background in chemistry, biology, mathematics, and physics. Students involved in Advanced Placement (AP) or International Baccalaureate (IB) programs can complete some lower division requirements by earning sufficient test scores. However, some graduate degree programs may require students to complete these courses at the collegiate level.

Transfer Students

Before transferring, students should complete as many general-education requirements and lower-division major requirements as possible, including general chemistry, general biology, general physics, and mathematics. Students should ensure that courses transfer specifically as required sequences. The University's Transfer Course Equivalency (http://registrar.uoregon.edu/transfer-students) tool is a helpful resource. Transfer students should plan on taking upper-division anatomy and human physiology courses at the University of Oregon.

Scholarships

Numerous scholarships are available; a complete list is available on the department website.

Medicine, Dentistry, and Physical Therapy

Students seeking a career in medicine, dentistry, physical therapy, or other health professions should work closely with the human physiology undergraduate advisor as well as Health Professions advisors to plan their program of study to meet the specific admission requirements of the postgraduate schools in which they are interested. Information on additional courses that may be required of most programs is available from the Health Professions Program (http://healthprofessions.uoregon.edu/health-fields) website.

Bachelor of Arts Degree Requirements

Code	Title	Credits
Lower-Division Requirements		
CH 221–223	General Chemistry [1]	12
or CH 224H–226H	Honors General Chemistry	
PHYS 201–203	General Physics	12
or PHYS 251–253	Foundations of Physics I	
CH 227–229	General Chemistry Laboratory	6

or PHYS 204–206	Introductory Physics Laboratory	
BI 211–213	General Biology I-III (may substitute BI 214 for BI 213)	12-15
or BI 281H–283H	Honors Biology I-III	
MATH 246	Calculus for the Biological Sciences I [1]	4
or MATH 251	Calculus I	
HPHY 211	Medical Terminology	3
HPHY 212	Evidence, Inference, and Biostatistics	4
Upper-Division Requirements		
HPHY 321	Human Anatomy I	5
HPHY 322	Human Physiology I	5
HPHY 323	Human Anatomy II	5
HPHY 324	Human Physiology II	5
HPHY 325	Human Anatomy and Physiology III	5
HPHY 371	Physiology of Exercise	4
Upper-Division Electives		16
Select at least two of the following:		
HPHY 333	Motor Control	
HPHY 362	Tissue Injury and Repair	
HPHY 381	Biomechanics	
HPHY 399	Special Studies: [Topic]	
ANTH 362	Human Biological Variation	
ANTH 366	Human Osteology Laboratory	
ANTH 369	Human Growth and Development	
BI 309	Tropical Diseases in Africa	
BI 320	Molecular Genetics	
BI 322	Cell Biology	
BI 358	Investigations in Medical Physiology	
BI 360	Neurobiology	
CH 360	Physiological Biochemistry	
CH 462	Biochemistry	
Select at least one of the following capstone courses:		
HPHY 410	Experimental Course: [Topic]	
HPHY 412	Sleep Physiology	
HPHY 413	Muscle Structure, Function, and Plasticity	
HPHY 414	Muscle Metabolism	
HPHY 433	Neurophysiology of Concussion	
HPHY 434	Movement Disorders	
HPHY 441	Clinical Exercise Physiology	
HPHY 442	Clinical Electrocardiography	
HPHY 460	Lumbar and Pelvic Functional Anatomy	
HPHY 462	Therapeutic Techniques	
HPHY 470	Environmental Physiology	
HPHY 472	Science of Athletic Performance	
HPHY 473	High Altitude Physiology and Medicine	
HPHY 485	Gait Analysis	
HPHY 486	Orthopedic Biomechanics	
Select any of the following:		
HPHY 401	Research: [Topic]	
HPHY 403	Thesis	
HPHY 404	Internship: [Topic]	
HPHY 405	Reading and Conference: [Topic]	
HPHY 406	Special Problems: [Topic]	
HPHY 408	Workshop: [Topic]	
HPHY 409	Practicum: [Topic]	
HPHY 409	Practicum: [Topic] (Anatomy and Physiology Teaching Assistant)	
HPHY 420	Human Cadaver Dissection	

[1] Should be taken in the first year.

Bachelor of Science Degree Requirements

Code	Title	Credits
Lower-Division Requirements		
CH 221–223	General Chemistry [1]	12
or CH 224H–226H	Honors General Chemistry	
PHYS 201–203	General Physics	12
or PHYS 251–253	Foundations of Physics I	
CH 227–229	General Chemistry Laboratory	6
or PHYS 204–206	Introductory Physics Laboratory	
BI 211–213	General Biology I-III (may substitute BI 214 for BI 213)	12-15
or BI 281H–283H	Honors Biology I-III	
MATH 246	Calculus for the Biological Sciences I [1]	4
or MATH 251	Calculus I	
HPHY 211	Medical Terminology	3
HPHY 212	Evidence, Inference, and Biostatistics	4
Upper-Division Requirements		
HPHY 321	Human Anatomy I	5
HPHY 322	Human Physiology I	5
HPHY 323	Human Anatomy II	5
HPHY 324	Human Physiology II	5
HPHY 325	Human Anatomy and Physiology III	5
HPHY 371	Physiology of Exercise	4
Upper-Division Electives		16
Select at least two of the following:		
HPHY 333	Motor Control	
HPHY 362	Tissue Injury and Repair	
HPHY 381	Biomechanics	
HPHY 399	Special Studies: [Topic]	
ANTH 362	Human Biological Variation	
ANTH 366	Human Osteology Laboratory	
ANTH 369	Human Growth and Development	
BI 309	Tropical Diseases in Africa	
BI 320	Molecular Genetics	
BI 322	Cell Biology	
BI 358	Investigations in Medical Physiology	
BI 360	Neurobiology	
CH 360	Physiological Biochemistry	
CH 462	Biochemistry	
Select at least one of the following capstone courses:		

HPHY 410	Experimental Course: [Topic]
HPHY 412	Sleep Physiology
HPHY 413	Muscle Structure, Function, and Plasticity
HPHY 414	Muscle Metabolism
HPHY 433	Neurophysiology of Concussion
HPHY 434	Movement Disorders
HPHY 441	Clinical Exercise Physiology
HPHY 442	Clinical Electrocardiography
HPHY 460	Lumbar and Pelvic Functional Anatomy
HPHY 462	Therapeutic Techniques
HPHY 470	Environmental Physiology
HPHY 472	Science of Athletic Performance
HPHY 473	High Altitude Physiology and Medicine
HPHY 485	Gait Analysis
HPHY 486	Orthopedic Biomechanics
Select any of the following:	
HPHY 401	Research: [Topic]
HPHY 403	Thesis
HPHY 404	Internship: [Topic]
HPHY 405	Reading and Conference: [Topic]
HPHY 406	Special Problems: [Topic]
HPHY 408	Workshop: [Topic]
HPHY 409	Practicum: [Topic]
HPHY 409	Practicum: [Topic] (Anatomy and Physiology Teaching Assistant)
HPHY 420	Human Cadaver Dissection

[1] Should be taken in the first year.

For additional course options, recent additions to course offerings, and sample four-year programs of study, visit the department office or the department website. (http://physiology.uoregon.edu)

Courses required for the major must be taken for letter grades and passed with grades of mid-C or better. Required courses may be repeated only once, including attempts that result in a grade of "W." Students must maintain at least an overall 2.00 grade point average in courses required for the major. Additional requirements for the bachelor's degree are described in the **Bachelor's Degree Requirements** section of this catalog.

Honors

To apply to graduate with departmental honors, a student must have a GPA of 3.50 or better in courses applied toward the human physiology degree requirements and complete an honors thesis under the supervision of a human physiology thesis committee. In addition, human physiology majors enrolled in the Robert Donald Clark Honors College at the University of Oregon are eligible to complete an honors thesis through that program.

- **Master of Science: Athletic Training Emphasis**
- **Master of Science–Doctor of Philosophy: Research-Intensive Emphasis**

Graduate Studies

The Department of Human Physiology offers two graduate programs: the athletic training MS program and the research-intensive MS-PhD program.

Athletic Training MS Program

The department offers a graduate program in human physiology with an emphasis in athletic training leading to the master of science (MS). This curriculum is one of fourteen postprofessional programs accredited by the Commission for the Accreditation of Athletic Training Education (CAATE). The primary goal of this program is to provide classroom and clinical experiences that will allow entry-level certified athletic trainers to grow into professionals with the experience and confidence to be great clinicians. Providing students with advanced clinical skills is our hallmark. The program also provides students with the opportunity to grow as leaders, teachers, and researchers. Admission is granted only to students who are certified by the CAATE Board of Certification or who have qualified for the certification examination. Graduate teaching fellowships (GTF) are available for highly qualified students who are certified as athletic trainers. The GTF award provides a full tuition waiver and a monthly stipend that varies in amount according to the assignment. Employment settings include intercollegiate athletics, club and recreational sports, and intramural athletics. Qualified students can find more information at the Graduate Studies in Athletic Training website (http://pages.uoregon.edu/uogradat). (http://pages.uoregon.edu/uogradat)

Master of Science Degree Requirements: Athletic Training

HPHY 520	Human Cadaver Dissection	1
HPHY 533	Neurophysiology of Concussion	4
HPHY 570	Environmental Physiology	4
HPHY 611	Professional Skills I: Effective Teaching	1
HPHY 660	Basic Science in Clinical Decisions	4
HPHY 661	Manual Therapy: Movement Patterns, Core Stability	2
HPHY 662	Manual Therapy: Spine, Lower Quadrant	2
HPHY 669	The Female Athlete	4
HPHY 671	Therapeutic Restoration of Biomotor Abilities	3
EDUC 614	Educational Statistics	4
HPHY 607	Seminar: [Topic] (Administrative Skills for Clinical Careers)	1
HPHY 607	Seminar: [Topic] (Clinical Research Presentations [two terms])	2
HPHY 607	Seminar: [Topic] (Contemporary Clinical Techniques I,II)	2
HPHY 607	Seminar: [Topic] (Current Professional Topics)	1
HPHY 607	Seminar: [Topic] (Evidence-Based Clinical Practice and Research)	1
HPHY 607	Seminar: [Topic] (Human Physiology [six terms])	6
HPHY 607	Seminar: [Topic] (Leadership Development)	1
HPHY 609	Practicum: [Topic[(Sports Medicine)	3
Select one of the following:		4

HPHY 601	Research: [Topic]	
HPHY 602	Supervised College Teaching	
HPHY 606	Special Problems: [Topic]	
HPHY 609	Practicum: [Topic[(Preceptor)	
Other human physiology courses		
Total Credits		**50**

Exit Requirement

All students participate in a comprehensive defense of their advanced clinical skills during spring term of their graduating year. In addition, they select one of the following two options as their graduation exit requirement:

- **Option 1.** Comprehensive written and oral exams (completed during the final term of study), one-term (4-credit minimum) research experience, and literature review or evidence-based practice manuscript submitted for publication.
- **Option 2.** Original research study conducted, and manuscript submitted for publication.

Additional Requirements

Required courses must be taken for letter grades and passed with grades of B– or better. Students must maintain at least a 3.00 grade point average each term, and will not be eligible to hold a GTF position, take comprehensive exams, or graduate without a cumulative GPA of 3.00. Additional university master's degree requirements are described under Master's Degrees in the **Graduate School** section of this catalog.

Research-Intensive Master of Science–Doctor of Philosophy Program

The department offers a graduate program in human physiology with an emphasis on research leading through the master of science (MS) degree to the doctor of philosophy (PhD) degree. The goal is to provide classroom and research experiences that turn students into professionals with the knowledge and experience to be superior researchers or become university-level educators. This is an individualized program with a strong emphasis on research. Decisions on accepting applicants to the graduate program are made by the faculty members, and are based on available laboratory space and financial support—both of which vary greatly from year to year. Graduate teaching and research fellowships (GTF) are available for highly qualified students to teach undergraduate laboratories or assist in research projects. The GTF award provides a full-tuition waiver and a monthly stipend that varies in amount according to the assignment. For more information, visit the department website.

Master of Science Degree Requirements

HPHY 611–613	Professional Skills I-III	3
HPHY 621–623	Systems Physiology I-III	12
HPHY 607	Seminar: [Topic] [1]	1-5
EDUC 614	Educational Statistics [2]	4
EDUC 640	Applied Statistical Design and Analysis [2]	4
Human physiology courses or other courses most appropriate to student's line of study [3]		4
Total Credits		**28-32**

1. Must register for course every term of enrollment, with one term possibly waived by the director of graduate studies to accommodate the student's research activities or other extenuating circumstances.
2. Statistical analysis courses covering the following topics: descriptive statistics, logic of hypothesis testing, elementary inferential statistics, confidence intervals, one-way analysis of variance, post hoc comparisons, a priori contrasts, within-subjects and between-subjects effects, two-way and higher-order designs, and interactions. For recent additions to these course options, check with the director of graduate studies for the department.
3. Determined in conjunction with program committee.

Additional Requirements

The master of science degree requires completion of a substantial research project. Department faculty members, in consultation with the student, determine the format for the presentation of the project, which will include an oral defense in combination with either a master's thesis, a journal-style manuscript, or a comprehensive project report. Required courses must be taken for letter grades and passed with grades of B– or better. Students must maintain at least a 3.00 grade point average for all courses. Additional university master's degree requirements are described under Master's Degrees in the **Graduate School** section of this catalog.

Doctor of Philosophy Degree Requirements

HPHY 611–613	Professional Skills I-III	3
HPHY 621–623	Systems Physiology I-III	12
HPHY 607	Seminar: [Topic] [1]	1-5
EDUC 614	Educational Statistics [2]	4
EDUC 640	Applied Statistical Design and Analysis [2]	4
Human physiology courses or other courses most appropriate to student's line of study [3]		4
Select one of the following:		4
HPHY 670	Advanced Respiratory Physiology	
HPHY 676	Human Cardiovascular Control	
HPHY 684	Kinematics of Human Movement	
HPHY 685	Kinetics of Human Movement	
HPHY 610	Experimental Course: [Topic]	
HPHY 603	Dissertation [4]	1-16
Total Credits		**33-52**

1. Must register for course every term of enrollment, with one term possibly waived by the director of graduate studies to accommodate the student's research activities or other extenuating circumstances.
2. Statistical analysis courses covering the following topics: descriptive statistics, logic of hypothesis testing, elementary inferential statistics, confidence intervals, one-way analysis of variance, post hoc comparisons, a priori contrasts, within-subjects and between-subjects effects, two-way and higher-order designs, and interactions. For recent additions to these course options, check with the director of graduate studies for the department.
3. Determined in conjunction with program committee.
4. Must register for course every term of enrollment after advancing to candidacy.

The doctoral degree requires completion of a minimum of 135 credits beyond the bachelor's degree; at least 60 of these credits must be completed through human physiology courses. Written and oral doctoral comprehensive examinations are taken after completing a substantial portion of the program of study. Upon passing these examinations, the student is advanced to candidacy. A final oral defense is held after

completion of the dissertation and after all other degree requirements have been met. Required courses must be taken for letter grades and passed with grades of B– or better. Students must maintain at least a 3.00 grade point average for all courses. Additional university doctor of philosophy degree requirements are described under Doctoral Degrees in the **Graduate School** section of this catalog.

Admission Requirements

Applicants for the athletic training MS program should check the Graduate Studies in Athletic Training website (http://pages.uoregon.edu/uogradat) and applicants for the research-intensive MS-PhD program should check the department website (http://physiology.uoregon.edu) for information on the online graduate application and deadlines.

Recommended criteria for applying to all graduate programs include the following:

- Baccalaureate degree from an accredited university with a GPA of 3.40 or higher on a 4.00 scale
- GRE scores of 153 or higher on each of the verbal and quantitative sections (institution code: 4846; department code: 0217)
- Completed course work with a grade of B+ or higher in general chemistry, general biology, and two courses of physiology or combined anatomy and physiology
- International students who have not received a degree from a university in a country whose official language is English must have a TOEFL score of 575 (paper test), or 90 (Internet-based test) or an IELTS overall band score of 7.0.

Minimum requirements for admission to all graduate programs include the following:

- Baccalaureate degree from an accredited university with a GPA of 3.00 or higher on a 4.00 scale
- GRE scores of 148 or higher on each of the verbal and quantitative sections (institution code: 4846; department code: 0217)
- Completed course work with a grade of B– or higher in general chemistry, general biology, and two courses of physiology or combined anatomy and physiology
- International students who have not received a degree from a university in a country whose official language is English must have a TOEFL score of 575 (paper test), or 90 (Internet-based test) or an IELTS overall band score of 7.0

Courses

HPHY 103. Exercise and Performance. 4 Credits.
Structure and function of the human body including movement analysis. Topics include training and exercise responses; sport, daily living, and workplace performance; and injury adaptations.

HPHY 104. Understanding Human Disease. 4 Credits.
Introduces fundamental physiological and anatomical concepts to nonscience majors, to better understand disease and how humans adapt to create solutions to environmental challenges.

HPHY 105. Principles of Nutrition. 4 Credits.
Explores the fundamentals of nutrition and its application to culture, lifestyle, and health as they relate to humans across the lifespan. Course will be taught once or more per academic year.

HPHY 111. The Science of Sex. 4 Credits.
The anatomy and physiology of sex, with assignments and discussion designed to develop scientific literacy.

HPHY 112. The Science of Health. 4 Credits.
Examines and assesses current health claims and controversies.

HPHY 199. Special Studies: [Topic]. 4 Credits.
Repeatable.

HPHY 211. Medical Terminology. 3 Credits.
Explore and develop skills in language and terminology specific to the medical sciences with an emphasis on derivation, meaning, and pronunciation.

HPHY 212. Evidence, Inference, and Biostatistics. 4 Credits.
Explores how data is used as evidence in research and inferred from experiments, and how statistics are used to inform us about human physiology.

HPHY 321. Human Anatomy I. 5 Credits.
Introduction to the human body and histology; nerves; central, autonomic, and peripheral nervous systems; cranial nerves; regional anatomy of the head; special senses. Includes cadaver laboratory. Sequence with HPHY 322, 323, 324, 325.
Prereq: HPHY 211; BI 211 or BI 281H; BI 212 or BI 282H; CH 221 or CH 224H; CH 222 or CH 225H; CH 223 or CH 226H; MATH 246 or MATH 251. Must be passed with grades of C or better.

HPHY 322. Human Physiology I. 5 Credits.
Neuro- and muscular physiology: action potentials; synapses and receptors; skeletal muscle; central, peripheral, and autonomic nervous systems; special senses. Includes human-based laboratory. Sequence with HPHY 321, 323, 324, 325.
Prereq: HPHY 212; BI 211 or BI 281H; BI 212 or BI 282H; CH 221 or CH 224H; CH 222 or CH 225H; CH 223 or CH 226H; MATH 246 or MATH 251. Must be passed with grades of C or better.

HPHY 323. Human Anatomy II. 5 Credits.
Heart, lungs, and vasculature in addition to regional exploration of the musculosketetal system. Includes cadaver laboratory. Sequence with HPHY 321, 322, 324, 325.
Prereq: HPHY 321.

HPHY 324. Human Physiology II. 5 Credits.
Cardiovascular system; respiratory system; immunology. Includes human-based laboratory. Sequence with HPHY 321, 322, 323, 325.
Prereq: HPHY 212, 321, 322.

HPHY 325. Human Anatomy and Physiology III. 5 Credits.
Anatomy and physiology of the digestive, reproductive, and renal systems; endocrinology. Includes combination of cadaver laboratory and human-based laboratory. Sequence with HPHY 321, 322, 323, 324.
Prereq: HPHY 323, HPHY 324. Must be passed with a grade of C or better.

HPHY 333. Motor Control. 4 Credits.
Introduction to the processes of control and coordination in the performance of motor skills. Neurophysiological, mechanical, and cognitive bases of motor skill acquisition.
Prereq: HPHY 321, HPHY 322; or PSY 304.

HPHY 337. Clinical Pharmacology. 4 Credits.
Examines the pharmacokinetics (absorption, distribution, metabolism, excretion), pharmacodynamics, therapeutic considerations and adverse effects of select prototypes from within major clinically relevant drug families.
Prereq: HPHY 325 with a grade of C or better.

HPHY 362. Tissue Injury and Repair. 4 Credits.
Exploration of the physiology of injury and trauma. Emphasis on inflammation and healing of connective tissue injury, tissue biomechanics, mechanisms of injury, and clinical orthopedic evaluation techniques.
Prereq: HPHY 323, HPHY 324.

HPHY 371. Physiology of Exercise. 4 Credits.
Physiology of exercise, physical conditioning, and training; mechanisms and significance of these effects for health and performance.
Prereq: HPHY 323, HPHY 324. Must be passed with a grade of C or better.

HPHY 381. Biomechanics. 4 Credits.
Fundamental principles of physics applied to the analysis of human movement. Emphasis on developing abilities to analyze human movement quantitatively.
Prereq: HPHY 323, HPHY 324, PHYS 201.

HPHY 399. Special Studies: [Topic]. 4 Credits.
Repeatable.
Prereq: HPHY 325 or HPHY 371 with a C or better.

HPHY 401. Research: [Topic]. 1-15 Credits.
Repeatable.

HPHY 403. Thesis. 1-4 Credits.
For honors students during the terms in which they conduct research or write a thesis.

HPHY 404. Internship: [Topic]. 1-16 Credits.
Repeatable. Field experience in an agency, institution, or business. Practice knowledge from courses: planning, organizing, directing, evaluating, and developing professional competence.

HPHY 405. Reading and Conference: [Topic]. 1-15 Credits.
Repeatable. Reading and assignments in connection with other courses for extra credit. Honors readings.

HPHY 406. Special Problems: [Topic]. 1-15 Credits.
Repeatable.

HPHY 407. Seminar: [Topic]. 1-5 Credits.
Repeatable. Topics are offered regularly in such areas as health sciences, motor control, biomechanics, and physiology.

HPHY 408. Workshop: [Topic]. 1-15 Credits.
Repeatable.

HPHY 409. Practicum: [Topic]. 1-15 Credits.
Repeatable. Assist students learning anatomy or physiology in either the lecture or lab courses.

HPHY 410. Experimental Course: [Topic]. 5 Credits.
Repeatable.
Prereq: HPHY 325 or HPHY 371 with a C or better.

HPHY 412. Sleep Physiology. 4 Credits.
Fundamental principles of sleep and how physiology is affected by sleep.
Prereq: HPHY 325 with a C or better.

HPHY 413. Muscle Structure, Function, and Plasticity. 4 Credits.
Physiologic basis for skeletal muscle adaptation to increased and decreased use and injury. Emphasizes how structure dictates function relevant to rehabilitation.
Prereq: HPHY 323, HPHY 324. Must be passed with a grade of C or better.

HPHY 414. Muscle Metabolism. 4 Credits.
Metabolic basis for skeletal muscle adaptation to increased and decreased use, and injury models. Emphasizes interorgan communication; uses clinical models.
Prereq: HPHY 371 with a C or better.

HPHY 420. Human Cadaver Dissection. 1 Credit.
Dissection of one region of a preserved human cadaver and preparation of the specimen for the HPHY 321 and/or 323 laboratory experience. Students are accepted by application, which are due early February.
Prereq: HPHY 323.

HPHY 422. Physiology of Obesity. 4 Credits.
Explores potential causes of the obesity epidemic, cellular mechanisms linking obesity to insulin resistance and metabolic diseases, and interventions in treatment of metabolic disease and obesity.
Prereq: HPHY 325, HPHY 371 with a C or better.

HPHY 433. Neurophysiology of Concussion. 4 Credits.
Investigate diagnosis, deficits, and treatment of mild traumatic brain injury and neurophysiological effects.
Prereq: HPHY 325, HPHY 333 with a grade of C or better.

HPHY 434. Movement Disorders. 4 Credits.
Discusses the clinical manifestations and underlying physiological mechanisms of selected movement disorders. Emphasizes the role of scientific experiment in diagnosis and treatment.
Prereq: HPHY 325, HPHY 333 with a C or better.

HPHY 435. Physiology of Fatigue. 4 Credits.
Investigates neuromuscular function and fatigue and how the underlying physiology can contribute to fatigability discrepancies with respect to extraneous and pathophysiological factors.
Prereq: HPHY 325, HPHY 333 with a C or better.

HPHY 441. Clinical Exercise Physiology. 3 Credits.
Principles of exercise physiology integrated into the clinical setting, with emphasis on cardiovascular and pulmonary diseases.
Prereq: HPHY 371.

HPHY 442. Clinical Electrocardiography. 4 Credits.
Exploration of heart conduction, arrhythmia, and clinical significance of electrocardiography with an emphasis on clinical application.
Prereq: HPHY 324.

HPHY 444. Clinical Anatomy. 4 Credits.
Through case-based learning, students have the opportunity to apply the knowledge of anatomy and physiology in the context of clinical practice and diagnosis.
Prereq: HPHY 325 with a mid-C or better.

HPHY 460. Lumbar and Pelvic Functional Anatomy. 4 Credits.
Application of evidence-based approach to understanding the anatomy and biomechanics of lumbar spine and pelvis and its relationship to health and disease.
Prereq: HPHY 323.

HPHY 462. Therapeutic Techniques. 4 Credits.
Clinical application of therapeutic techniques including modalities and rehabilitation for soft-tissue orthopedic injuries. Offered alternate years.
Prereq: HPHY 362.

HPHY 470. Environmental Physiology. 4 Credits.
Examination of physiological adaptations to acute and chronic exposure to extreme heat, cold, and high altitude.
Prereq: HPHY 371 with a C or better.

HPHY 472. Science of Athletic Performance. 4 Credits.
Theoretical basis and practical application of modern physiological testing of cardiovascular and respiratory function with a focus on exercise and performance.
Pre- or coreq: HPHY 371 with a C or better.

HPHY 473. High Altitude Physiology and Medicine. 4 Credits.
Explores major physiologic responses to high altitude (hypoxia), both adaptive and maladaptive, from systems to molecular level, as well as pathophysiologic conditions at high altitude. Offered alternate years.
Prereq: HPHY 325 and 371 with a C or better.

HPHY 480. Technology Development. 4 Credits.
Provides a foundation in principles of intellectual property and technology transfer, critical to technology development in clinical and sport industries.
Prereq: HPHY 371, HPHY 381.
Prereq: HPHY 323; HPHY 324.

HPHY 485. Gait Analysis. 4 Credits.
Study of walking including the impairments and functional limitations contributing to disabilities. Provides fundamental terminology, techniques, and data interpretation used in gait analysis.
Prereq: HPHY 381 with a C or better.

HPHY 486. Orthopedic Biomechanics. 4 Credits.
Principles of musculoskeletal biomechanics relating to concepts in surgical and nonsurgical orthopedics. Course is beneficial to those pursuing careers in medicine and health sciences.
Prereq: HPHY 381 with a C or better.

HPHY 503. Thesis. 1-16 Credits.
Repeatable.

HPHY 507. Seminar: [Topic]. 1-5 Credits.
Repeatable. Topics are offered regularly in such areas as health sciences, motor control, biomechanics, and physiology.

HPHY 508. Workshop: [Topic]. 1-15 Credits.
Repeatable.

HPHY 510. Experimental Course: [Topic]. 5 Credits.
Repeatable.

HPHY 512. Sleep Physiology. 4 Credits.
Fundamental principles of sleep and how physiology is affected by sleep.

HPHY 513. Muscle Structure, Function, and Plasticity. 4 Credits.
Physiologic basis for skeletal muscle adaptation to increased and decreased use and injury. Emphasizes how structure dictates function relevant to rehabilitation.

HPHY 514. Muscle Metabolism. 4 Credits.
Metabolic basis for skeletal muscle adaptation to increased and decreased use, and injury models. Emphasizes interorgan communication; uses clinical models.

HPHY 520. Human Cadaver Dissection. 1 Credit.
Dissection of one region of a preserved human cadaver and preparation of the specimen for the ANAT 314 or 315 laboratory experience. Students are accepted byapplication, which are due early February.

HPHY 522. Physiology of Obesity. 4 Credits.
Explores potential causes of the obesity epidemic, cellular mechanisms linking obesity to insulin resistance and metabolic diseases, and interventions in treatment of metabolic disease and obesity.

HPHY 533. Neurophysiology of Concussion. 4 Credits.
Investigate diagnosis, deficits, and treatment of mild traumatic brain injury and neurophysiological effects.

HPHY 534. Movement Disorders. 4 Credits.
Discusses the clinical manifestations and underlying physiological mechanisms of selected movement disorders. Emphasizes the role of scientific experiment in diagnosis and treatment.

HPHY 535. Physiology of Fatigue. 4 Credits.
Investigates neuromuscular function and fatigue and how the underlying physiology can contribute to fatigability discrepancies with respect to extraneous and pathophysiological factors.

HPHY 570. Environmental Physiology. 4 Credits.
Examination of physiological adaptations to acute and chronic exposure to extreme heat, cold, and high altitude.

HPHY 573. High Altitude Physiology and Medicine. 4 Credits.
Explores major physiologic responses to high altitude (hypoxia), both adaptive and maladaptive, from systems to molecular level, as well as pathophysiologic conditions at high altitude. Offered alternate years.

HPHY 580. Technology Development. 4 Credits.
Provides a foundation in principles of intellectual property and technology transfer, critical to technology development in clinical and sport industries.

HPHY 585. Gait Analysis. 4 Credits.
Study of walking including the impairments and functional limitations contributing to disabilities. Provides fundamental terminology, techniques, and data interpretation used in gait analysis.
Prereq: HPHY 381.

HPHY 586. Orthopedic Biomechanics. 4 Credits.
Principles of musculoskeletal biomechanics relating to concepts in surgical and nonsurgical orthopedics. Course is beneficial to those pursuing careers in medicine and health sciences.
Prereq: HPHY 381 or equivalent

HPHY 601. Research: [Topic]. 1-16 Credits.
Repeatable.

HPHY 602. Supervised College Teaching. 1-5 Credits.
Repeatable.

HPHY 603. Dissertation. 1-16 Credits.
Repeatable.

HPHY 605. Reading and Conference: [Topic]. 1-15 Credits.
Repeatable.

HPHY 606. Special Problems: [Topic]. 1-16 Credits.
Repeatable. Selected problems in the field of human physiology.

HPHY 607. Seminar: [Topic]. 1-9 Credits.
Repeatable. Topics are offered regularly in such areas as health sciences, motor control, biomechanics, and physiology.

HPHY 608. Workshop: [Topic]. 1-15 Credits.
Repeatable.

HPHY 609. Practicum: [Topic[. 1-15 Credits.
Repeatable.

HPHY 610. Experimental Course: [Topic]. 1-5 Credits.
Repeatable.

HPHY 611. Professional Skills I: Effective Teaching. 1 Credit.
Development of professional skills for academic careers related to human physiology. Sequence with HPHY 612, 613.

HPHY 612. Professional Skills II: Responsible Research. 1 Credit.
Development of professional skills for academic careers related to human physiology. Sequence with HPHY 611, 613.

HPHY 613. Professional Skills III: Career Development. 1 Credit.
Development of professional skills for academic careers related to human physiology. Sequence with HPHY 611, 612.

HPHY 621. Systems Physiology I. 4 Credits.
Advanced overview of neural physiology, neural control of human movement, and the biomechanical constraints underlying that control. Sequence with 622, 623.

HPHY 622. Systems Physiology II. 4 Credits.
Advanced overview of cardiovascular physiology and skeletal muscle cell physiology and metabolism. Series with HPHY 621, 623.

HPHY 623. Systems Physiology III. 4 Credits.
Advanced overview of renal and respiratory physiology. Series with HPHY 621, 622.

HPHY 660. Basic Science in Clinical Decisions. 4 Credits.
Literature-based investigation into the basic science and clinical research underlying clinical decisions in athletic medicine.

HPHY 661. Manual Therapy: Movement Patterns, Core Stability. 2 Credits.
Advanced skills in proprioceptive neuromuscular facilitation (PNF) movement patterns, and both pilates principles and manual therapy to improve core stability. For certified athletic trainers. Offered alternate years.

HPHY 662. Manual Therapy: Spine, Lower Quadrant. 2 Credits.
Advanced skills in muscle energy, mobilization, and trigger-point release techniques for the spine and lower quadrant. For certified athletic trainers. Offered alternate years.

HPHY 669. The Female Athlete. 4 Credits.
Literature-based investigation of the unique anatomy and physiology, as well as social-cultural issues, of the female athlete related to sports medicine.

HPHY 670. Advanced Respiratory Physiology. 4 Credits.
Explores advanced concepts in respiratory physiology; includes exercise adaptations and examples of pathophysiology. Offered alternate years.
Prereq: HPHY 623.

HPHY 671. Therapeutic Restoration of Biomotor Abilities. 3 Credits.
Exploration of advanced rehabilitation techniques for athletic trainers, including advanced program design, evaluation, and movement-sport analysis.
Pre- or coreq: certification as an athletic trainer or physical therapist.

HPHY 676. Human Cardiovascular Control. 4 Credits.
Cardiovascular physiology, including central control of blood pressure and flow regulation. An integrative approach toward how the cardiovascular system is coordinated with overall body function. Offered alternate years.
Prereq: HPHY 623.

HPHY 684. Kinematics of Human Movement. 4 Credits.
Theory and application of kinematic analysis of human motion. Emphasis on 2D and 3D kinematics, including data collection, analysis and modeling. Offered alternate years.
Prereq: HPHY 621.

HPHY 685. Kinetics of Human Movement. 4 Credits.
Experimental methods and mechanical theories associated with the analysis of joint forces and movements during human motion. Offered alternate years.
Prereq: HPHY 621.