

provide the student with the opportunity for experiential learning to apply the Entry Level Athletic Training Clinical Proficiencies in a clinical environment. Clinical education experiences are completed at both on-campus and off-campus clinical sites. During the course of the program, students will have exposure to a variety of clinical instructors, clinical settings, patient populations and health care professions. The University of Michigan's Department of Intercollegiate Athletics provides numerous on-campus clinical sites. The University of Michigan has two main and seven satellite athletic training facilities for intercollegiate athletics. All facilities are fully equipped with state-of-the-art equipment. In addition, students complete clinical experiences at our off-campus affiliated sites. Affiliated sites include local high schools, sports medicine clinics, and occupational/industrial clinics.

MOVEMENT SCIENCE MAJOR

MOVEMENT SCIENCE CURRICULUM MISSION STATEMENT

The Movement Science (MOVESCI) undergraduate curriculum strives to fully develop the intellectual abilities of each student during their learning experiences in the Division of Kinesiology. The program emphasizes the study of human movement from biological and behavioral perspectives across the lifespan. We achieve our mission by offering a diversified program that includes introductory and advanced course work, research and laboratory experiences, and service learning. We evaluate our success by the academic and professional placement of our graduates.

PROGRAM OVERVIEW

The Movement Science major comprises coursework that emphasizes the causes and consequences of human movement from biomechanical, motor control and development, and physiological perspectives. The requirements include courses both in and outside the Division of Kinesiology. The major consists of 103 credit hours (108 for students in the Honors program) with a total of 120 credits are required for graduation.

The Movement Science curriculum emphasizes competencies in five areas:

1. Content emphasizes in the three areas of Movement Science; Biomechanics, Motor Control, and Exercise Physiology
2. Research
3. Scientific communication, including oral, written and graphic skills
4. Computer literacy
5. Service learning

Students will gain these competencies by mastering concepts in courses, by exposure to research in laboratory sections of courses and in independent study and research courses, and through participation in service learning activities.

Content emphases of major areas in Movement Science. The Movement Science major emphasizes content in three major areas: biomechanics, exercise physiology, and motor control and development. Key concepts in each area are given below.

1. BIOMECHANICS

- Ability to describe movement from kinematics and kinetics perspectives.
- Apply biomechanical concepts and principles to analysis of motor skills among diverse and special populations.
- Understand underlying physical mechanisms involved in the control and coordination of movements.
- Understand basic mechanical properties of muscle, tendon, ligament, and bone.
- Relate the mechanical loads placed on the human body to the mechanical properties of tissues.
- Identify basic biomechanical mechanisms used by humans to reduce metabolic cost and fatigue during movement.

2. EXERCISE PHYSIOLOGY

- Understand regulation of different biological functions including cardiovascular, neural, renal, pulmonary, musculoskeletal, and endocrine systems during rest and movement.
- Understand mechanisms causing biological adaptations to chronic exercise at the molecular, cellular, systemic and whole-body level.
- Understand relationships between physical activity, energy, nutrition, chronic disease, and health.
- Understand neural, cardiorespiratory, nutritional, bioenergetic, metabolic and endocrine bases of human performance.
- Understand and appreciate racial, ethnic, age-associated and gender differences in exercise performance and in biological adaptations to movement.
- Assess flexibility, strength, and endurance factors that influence movement and physical performance.

3. MOTOR CONTROL AND DEVELOPMENT

- Ability to describe movement from a kinematic and associated muscle activation pattern perspective.
- Apply motor development and motor control concepts and principles to analysis of motor skills among diverse and special populations.
- Identify and differentiate among the diverse theories of motor skill acquisition.
- Identify factors affecting motor behavior, including physical growth, physiological, perceptual and cognitive changes, and sociocultural practices.
- Understand interaction between perception and action throughout the lifespan.
- Understand basic principles underlying neural and neuromuscular communication.
- Understand the relationship between central nervous system structure and function as it applies to human motor control.

- Understand the normal course of physical growth and maturation throughout the lifespan.

MOVEMENT SCIENCE COURSE OF STUDY

The Movement Science curriculum requires courses in of the following six categories:

1. Core prerequisite courses outside Kinesiology (36 credit hours). These may be distribution courses.
2. Core prerequisite courses in Kinesiology (11 credit hours)
3. Required university distribution courses (36 credit hours)
4. Required core courses in Movement Science (20 credit hours)
5. Elective courses (20 credit hours)
6. Service learning (1 credit hour)

Some required courses count in more than one category. For example, human physiology (PHYSIOL 201) is a required prerequisite course outside Kinesiology, but it also serves as one of the required distribution courses in the Natural Science area.

1. CORE PREREQUISITE COURSES OUTSIDE KINESIOLOGY [36 CREDIT HOURS]

These courses are typically completed prior to taking the 300-level required core courses in Movement Science. Some of the courses are required as prerequisites for the core courses in Movement Science and must be completed prior to enrolling in specific core courses.

- BIOLOGY 162 (5 credits) - Introductory Biology (NS)
- CHEM 130 (3 credits) - General Chemistry: Macroscopic Inv & Reaction Principles (NS)
- ENGLISH 125 (4 credits) - College Writing
- ENGLISH 225 (4 credits) - Argumentative Writing (HU)
- MATH 105 (4 credits) - Data, Functions, Graphs or Math 115 (4 credits) - Calculus I (recommended) (NS)
- MEDADM 401 (4 credits) - The Human Body (NS)
- PHYSICS 125 (4 credits) - General Physics Mechanics and Sound (NS)
Or PHYSICS 140 (4 credits) – General Physics I (NS)
- PHYSIOL 201 (4 credits) - Introduction to Human Physiology (NS)
- PSYCH 111 (4 credits) - Introduction to Psychology (SS)
Or PSYCH 112 (4 credits) – Introduction to Psychology as a Natural Science (NS)

Any anatomy, biology, chemistry, English, math, physics, physiology, or psychology course that is equivalent to the above course offered at the University of Michigan will be considered. However, students wishing to apply to graduate or professional schools need to give consideration to the level of the course and where it was completed (community college, medical school, laboratory-based courses, etc.). Many graduate and professional

programs require higher level mathematics, chemistry, and physics courses (see the list of Movement Science [cognate electives courses](#) on the Division of Kinesiology web page).

2. CORE PREREQUISITE COURSES IN KINESIOLOGY [11 CREDIT HOURS]

The 100-level courses listed below should be completed before taking the required core courses in Movement Science; note that MOVESCI 110 is a prerequisite for many Movement Science courses.

- MOVESCI 110 (3 credits) - Biological and Behavioral Bases of Human Movement
- SM 101 (3 credits) – Public and Small Group Communication
- SM 111 (3 credits) - Historical and Sociological Bases of Human Movement
- PHYSED 316 (2 credits) - First Aid and Safety Education

3. REQUIRED UNIVERSITY DISTRIBUTION COURSES [36 CREDIT HOURS]

Courses in the Core Prerequisite Courses outside Kinesiology category satisfy all of the required Natural Science distribution credits and some of the required Humanities and Social Science distribution credits. Additional Social Science and Humanities courses must be taken to fulfill the Humanities and Social Science distribution requirements.

HUMANITIES (HU) (12 CR)	NATURAL SCIENCES (12 CR)	SOCIAL SCIENCES (SS) (12 CR)
ENGLISH 225 (4 credits)	BIOLOGY 162 (5 credits)	PSYCH 111 (4 credits)
SM 101 (3 credits)	CHEM 130 (3 credits)	<i>additional 8 credits needed</i>
<i>additional 5 credits needed</i>	MATH 105/MATH 115 (4 credits)	
	MEDADM 401 (4 credits)	
	PHYSICS 125/140 (4 credits)	
	PHYSIOL 201 (4 credits)	
	PSYCH 112 (4 credits)	

4. REQUIRED CORE COURSES IN MOVEMENT SCIENCE [20 CREDIT HOURS]

Five courses form the core set of courses that are required of all Movement Science students. These courses serve as prerequisite courses for many of the Movement Science elective courses.

1. MOVESCI 230 (4 credits). Human Musculoskeletal Anatomy. Examines the functional relationship between human musculoskeletal anatomy and body movement. Students will learn the bone names and landmarks, joint structures and movements, and the names, attachments and functions of the major muscles. Includes laboratory experience. *Prerequisites: None.*
2. MOVESCI 250 (4 credits). Statistics and Research Methods in Movement Science. Covers the fundamentals of research design and the applications of statistics to

reading, planning, implementing, and analyzing research in Movement Science. Laboratory experiences are integrated with the course content. *Prerequisites: None.*

3. MOVESCI 320 (4 credits). Motor Control. Introduces students to the neural and behavioral basis of motor control. Topics include nervous system structures involved in planning, executing and learning movements, as well as the principles of motor control that apply to locomotion, reaching and grasping, multi-joint coordination and more complex skills. Motor control principles underlying rehabilitation are also introduced. Includes laboratory experience. *Prerequisites: MOVESCI 110, MEDADM 401 or MOVESCI 230, MOVESCI 250, PHYSIOL 201.*
4. MOVESCI 330 (4 credits). Biomechanics of Human Movement. Applies fundamental biomechanical principles to the human musculoskeletal system. Topics include musculoskeletal mechanics, tissue biomechanics, and quantitative analysis of human movement. Includes laboratory experience. *Prerequisites: MOVESCI 110, MATH 105 or 115, PHYSICS 125 or 140, MEDADM 401 or MOVESCI 230.*
5. MOVESCI 340 (4 credits). Exercise Physiology. Physiological principles of human movement. Topics include bioenergetics, energy expenditure, functions of the cardiovascular, pulmonary, neuromuscular and neuroendocrine systems, training, environmental influences, ergogenic aids, weight control, and body composition. Includes laboratory experience. *Prerequisites: MOVESCI 110, MEDADM 401 or MOVESCI 230, MOVESCI 250, PHYSIOL 201; CHEM 130 recommended.*

5. ELECTIVE COURSE WORK [20 CREDIT HOURS]

Students must complete a minimum of 20 credit hours of elective course work as follows:

- Movement Science lecture-based courses. A minimum of nine credit hours of upper-division Movement Science lecture-based courses from the following choices:

MOVESCI 412 (3 credits) – Scientific Training and Conditioning of Athletes

MOVESCI 421 (3 credits) - Disorders of Voluntary Movement

MOVESCI 422 (3 credits) - Motor Learning

MOVESCI 423 (3 credits) - Sensory-motor Development

MOVESCI 424 (3 credits) - Human Movement & Aging: Changes in Sensorimotor Control

MOVESCI 425 (3 credits) - Motor Behavior and Developmental Disabilities

MOVESCI 426 (3 credits) – Cognitive Neuroscience of Action

MOVESCI 433 (3 credits) - Human Movement and Aging; Functional Ability

MOVESCI 435 (3 credits) – Biomechanics of Human Locomotion

MOVESCI 441 (3 credits) - Exercise and Human Biology

MOVESCI 442 (3 credits) - Hormones and Exercise

MOVESCI 443 (3 credits) - Human Movement and Aging: Hormones and Nutrition

MOVESCI 445 (3 credits) - Human Movement and Aging: Molecular Mechanisms
MOVESCI 471 (3 credits) - Physical Activity, Health and Disease
MOVESCI 474 (3 credits) – Worksite Wellness

- Movement Science independent study courses. Three credit-hours earned from independent study, internships, readings or research in Movement Science can be substituted for one of the required lecture-based courses, listed above, in Movement Science. The upper limit of independent study courses in Movement Science is 20 credit hours. The courses can be chosen from the following choices:

MOVESCI 280 (1-4 credits) - Kinesiology Undergraduate Research Opportunity
MOVESCI 380 (1-3 credits) - Problems in Movement Science
MOVESCI 381 (1-3 credits) - Community Service Learning
MOVESCI 382 (1-3 credits) - Honors Reading
MOVESCI 384 (1-3 credits) - Honors Research
MOVESCI 390 (1-8 credits) - Field Experience in Movement Science
MOVESCI 402 (1-3 credits) - Teaching Experience in Movement Science
MOVESCI 403 (1-4 credits) - Internship
MOVESCI 429 (1-3 credits) - Laboratory Rotation in Motor Control and Development
MOVESCI 439 (1-3 credits) - Laboratory Rotation in Biomechanics
MOVESCI 449 (1-3 credits) - Laboratory Rotation in Exercise Physiology
MOVESCI 488 (1-3 credits) - Independent Study
MOVESCI 489 (1-5 credits) - Senior Thesis
MOVESCI 490 (1-5 credits) - Senior Honors Thesis A
MOVESCI 491 (1-3 credits) – Senior Honors Thesis B

- Cognate courses. A minimum of eleven credit hours of cognate elective courses outside of Movement Science, six credit hours of which must be outside of Kinesiology.

These courses may be taken from other units within the Division of Kinesiology or outside the Division (6 credits minimum). The Movement Science department maintains a list of currently approved [Movement Science Cognate Elective Courses](#) (see the Division of Kinesiology web page). If a course does not appear on the list, students need to get approval by completing a [Petition Form](#) (available online or in the Kinesiology Office of Student Services). Students are encouraged to choose cognate courses that may fulfill graduate or professional school requirements.

6. SERVICE LEARNING [MINIMUM 1 CREDIT HOUR]

Movement Science students are required to engage in service learning by completing one course dedicated to service learning/ community service or a course that provides a minimum of one credit associated with the opportunity for service learning. Two options for service learning are currently available:

Option 1. Successful completion of an approved service-learning course. Students are advised to check the list of [approved service learning courses](#) on the Kinesiology website. To get approval for a different course to satisfy this requirement, students must complete the [Service Learning Course Approval Form](#) that can be obtained from the Office of Student Services. Currently approved courses include:

- MOVESCI 425 (3 credits) - Motor Behavior and Developmental Disabilities
- MOVESCI 443 (3 credits) - Human Movement and Aging: Hormones and Nutrition
- ENGLISH 310 (3 credits) - Discourse and Society
- PSYCH 211 (1-3 credits) - Project Outreach
- PSYCH 305 (1-4 credits) - Psychology Practicum
- PSYCH 307 (3-4 credits) - Directed Experiences with Children
- PSYCH 317 (4 credits) - Community Research
- PSYCH 319 (4 credits) - Empowering Families and Communities
- SOC 389 (2-4 credits) - Project Community

Option 2. Successful completion of the Movement Science service learning course "MOVESCI 381 - Community Service Learning", as arranged with a Movement Science faculty member .

COMPLETION OF THE BS DEGREE IN MOVEMENT SCIENCE

The Bachelor of Science degree in Movement Science requires completion of 120 credit hours. The coursework specifically required for the major comprises 102-103 credits. Therefore, students must elect 17-18 additional credit hours in courses from either inside or outside Kinesiology to complete the degree.

To ensure that all degree requirements have been met, students are required to complete a senior audit through the Office of Student Services in the semester before they expect to graduate. To track their progress, students are encouraged to update their [Undergraduate Record Sheet](#) each semester. [Undergraduate Record Sheets](#) can be obtained from the Office of Student Services. Students are encouraged to meet with their faculty advisors in Movement Science throughout their degree program.

THE MOVEMENT SCIENCE HONORS PROGRAM

The Movement Science honors program in Kinesiology offers qualified students advanced coursework and independent research opportunities in exercise physiology, biomechanics, and motor control and development. Students with strong intellectual interests and the commitment to pursue those interests in a rigorous and challenging environment are eligible for the Movement Science honors program. Honors students are expected to pursue a rigorous and diversified course of study. Students must complete the regular Movement Science curriculum as well as advanced coursework, independent study, and the successful completion of an honors thesis,

completed during the senior year. Students must maintain a 3.5 GPA throughout the program. Each April, a subcommittee of the Movement Science faculty will review each student's academic record and recommend continuation or termination. The program will be administered by the Associate Dean for Research.

ADMISSION TO THE MOVEMENT SCIENCE HONORS PROGRAM

The Division of Kinesiology is committed to achieving an Honors student body characterized by ethnic and racial diversity as well as gender balance.

Following review of applications for admission to the Division of Kinesiology, qualified students will be invited to enter the Honors Program. These invitations are based on evidence of exceptional scholarly ability and motivation. Admission decisions will be based on the following:

1. high school GPA (suitably adjusted for the difficulty of work elected - typically above 3.8)
2. class standing
3. national test scores (SAT of 1200 or above, ACT composite of 32)
4. counselor/teacher recommendations
5. admissions essay

First-year students already enrolled in Kinesiology who are interested in joining the Honors Program may apply to be considered for the Honors Program. [Applications](#) are available in the Office of Student Services and [online](#). Only those students with a GPA of 3.5 in at least one full semester comprised of content-based challenging classes will be admitted to the second year level of the Honors Program.

Second-year Movement Science students may apply to begin the Honors Program as juniors. Only those students with distinguished academic performance (cumulative GPA of 3.5 in a minimum of 50 credit hours, including completion of MOVESCI 250 or equivalent, ENGLISH 225, and all core pre-requisite courses both inside and outside Kinesiology) will be considered for admission.

MOVEMENT SCIENCE HONORS REQUIREMENTS

The Honors program requires students to take the Honors sections of some Movement Science core courses, and to complete independent research experiences, culminating in a Senior Honors Thesis. Each requirement is described below.

Honors Sections. Students complete the honors sections of MOVESCI 320, 330, and 340 by the end of junior year. To receive honors credit, students will complete a special project connected to the course as well as the regular course requirements. In consultation with the faculty instructor, such special projects may, for example, take the form of a literature review or class presentation. Honors students in the same class may work together on a project approved by the faculty instructor. Honors students will fill out a contract with the faculty instructor stating precisely the scope of the honors work. In situations where a student elects to take a core course in his/her second year and has

not yet been accepted into the Honors Program, the student must make arrangements with the appropriate faculty member to complete the honors requirement of the core course.

Honors Independent Study and Honors Research Proposal. Students must complete a minimum of six credits of independent study with a research focus by the end of the junior year. Up to three independent credits obtained prior to a student's junior year can be counted. Honors independent research study experiences typically involve supervised and directed participation in the laboratory of a Movement Science faculty member. In many cases, these independent research study experiences assist the student in identifying a research mentor and help lay the groundwork for the senior honors thesis. Honors students will fill out an [independent study contract](#) form (available in the Office of Student Services and online) with a faculty member stating the nature of the research experience.

A thesis proposal must be submitted to the sponsoring faculty member by the end of winter semester of student's junior year. The proposal should include a rationale for the project, the specific questions to be answered or hypotheses to be tested, the methods to be used, the potential results of the student's proposed research, and a bibliography. The proposal must include the signature of the faculty mentor indicating support of the proposal. It is highly recommended that students arrange to start doing honors thesis research during the spring and/or summer semesters between their junior and senior years. Typically, financial support will be sought from the faculty mentor. In some instances, some financial support may be available from other sources.

Senior Honors Thesis - MOVESCI 490-491 (5 credits). The honors thesis is due three weeks before the end of the winter semester. In March of each academic year, students will make oral presentations of their thesis work in a Division-wide forum, to be arranged with their thesis advisors. While there is no set length requirement, the honors thesis is expected to reflect a rigorous and in-depth analysis of a specific problem in movement science requiring a sustained period of investigation but appropriate for study at the honors undergraduate level. The goal of the honors thesis is to generate new and relevant information that may lead to an abstract submission to a national conference, form the basis for a peer-reviewed manuscript, or provide pilot work for graduate studies.

COMPETENCY CHECK LIST

1. CONTENT EMPHASIS
Students are expected to master key concepts in the three content areas of Movement Science.
2. RESEARCH EXPOSURE
 - a. Exposure to experimental design in MOVESCI 250
 - b. Research exposure in laboratory sections of Movement Science core courses
 - c. Participation in independent study, research laboratory courses, UROP courses (UC 280 and MOVESCI 280), and senior honors courses
3. SCIENTIFIC COMMUNICATION, INCLUDING ORAL, WRITTEN AND GRAPHICS SKILLS

- a. Oral communication skills
 - Students take SM 101
 - Students present research information in different classes
 - b. Writing skills
 - Students write scientific reports, reviews and essays in different courses
 - c. Graphic communication skills
 - Students get such skills in the laboratory sections of the required courses.
4. COMPUTER LITERACY
- a. Exposure to descriptive and inferential statistics in MOVESCI 250
 - b. Exposure in different research experiences and courses
5. SERVICE LEARNING
- Students are expected to enroll in at least one course providing service-learning experiences.

MOVEMENT SCIENCE MINOR

Beginning winter term 2006 Kinesiology now offers a Movement Science to School of Music students only. The Movement Science minor is a course of study focused on the fundamental aspects of human performance. Upon completion of the minor, students will have a broad understanding of the biological and behavioral aspects of human movement.

A minor in Movement Science requires no less than 17 credits of course work that show structure and coherence. All 17 credits are taken in-residence. Students who declare and complete an approved academic minor will receive a notation on their student transcript but not on their diploma.

Policies

1. Each student who wishes to complete an approved academic minor must develop a plan for the academic minor in consultation with a Movement Science faculty member, who must also approve it.
2. After developing a plan for an academic minor, the student works with the Kinesiology Office of Student Services to have the academic minor entered on the student's record.
3. An individually designed academic minor is not allowed.
4. Courses in the academic minor must be elected for a grade.
5. Students may not use more than one course to meet the requirements of both a concentration plan and an academic minor.
6. Courses elected to meet the requirements of an academic minor may be part of the student's area distribution plan.
7. A student must earn an overall GPA of at least 2.0 in the academic minor.
8. No course may be used to satisfy the requirements of more than one academic minor.

Required Courses

1. Requirement courses. Students are required to take the following two courses:

MOVESCI 110 (3) - Biological and Behavioral Bases of Human Movement
(Fall/Winter)

PHYSED 310 (5) - Applied Human Anatomy and Physiology (*MOVESCI 110*)
(winter), or equivalent

2. Elective courses. Students choose courses that total 9 credit hours or more. Two of the courses must be Movement Science courses. Any Movement Science course at the 300 or 400 level can be elected except independent study courses. Other courses can be chosen from the following list.

AT 115 (3) - Prevention and Care of Athletic Injuries (winter)

MOVESCI 230 (4) – Human Musculoskeletal Anatomy (Fall/Winter)

MOVESCI 240 (3) - Introduction to Fitness and Health (fall)

MOVESCI 241 (3) - Exercise, Nutrition and Weight Control (Fall/Winter)

AT 326/PHYSED 326 (3) – Fundamentals of Strength and Conditioning (*PHYSED 310*)
(Fall)

PHYSED 332 (3) - Principles of Motor Behavior (*PHYSED 310*) (winter)

The Physical Education Major

The Physical Education program offers students extensive preparation in education courses leading to K-12 certification, as well as providing students with strong preparation in the liberal arts. Students in Physical Education learn how to communicate to students of varying ages, abilities, and backgrounds the intellectual, physiological, and biomechanical concepts of physical activity. The Physical Education curriculum, including grades K-5 and grades 6-12 Methods courses required of all students, emphasizes the importance of understanding the role of family, community, and school in a student's educational experience, and of psychological and sociological factors that can influence learning. The directed teaching requirement provides students in the program with the opportunity to gain practical teaching experience under the supervision of trained faculty.

Students who complete the Physical Education program will receive a Bachelor of Science (B.S.) degree in Physical Education and a Michigan Secondary Provisional Certificate (K-12). For further information about Physical Education Program requirements, admission procedures, and application deadlines, students should consult the Physical Education Chair within Kinesiology.

The School of Education Office of Student Services also assists students in applying to the program and reviewing Physical Education requirements. This office, along with the Kinesiology Office of Student Services and the Physical Education Chair are the three main sources of information and support for Physical Education students.

Physical Education Admission Criteria