

BIOMECHANICS, MS

Department of Biomechanics, College of Education, Health, and Human Sciences

The MS in biomechanics is housed within the Department of Biomechanics at the University of Nebraska at Omaha. It is a degree program designed to enable students from Nebraska, nationally, and abroad to develop skills and competencies in the field of biomechanics. This program provides a new understanding of the dynamical aspects of human movement via multidisciplinary research using an evidence-based approach through clinical and translational research.

The goal of the program is to prepare students for the workforce or the pursuit of a doctoral degree. The coursework related to this degree program will provide the students with a strong and broad base which will enable students to enter the workforce at a professional level commensurate with a master's degree or to continue their training in numerous doctoral program areas. An additional strength of the coursework is its emphasis on quantitative sciences. This emphasis allows students to stand out among other candidates for fellowships, assistantships, and scholarships given to these students.

The program is enhanced by an evidence-based approach through interdisciplinary clinical and translational research. This program is designed to be an excellent choice for students planning to continue their education beyond the bachelor's degree in the fields of biomechanics, medicine, physical therapy, occupational therapy, and other science based programs. With the high number of applicants in health professions, the MS in biomechanics gives applicants additional training in movement and quantitative sciences to stand out among other applicants.

Program Contact Information

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Program Website (<https://www.unomaha.edu/college-of-education/biomechanics-core-facility/>)

Other Program Related Information

Fast Track Program

The Department of Biomechanics has developed a Fast Track program for highly qualified and motivated students providing the opportunity to complete a bachelor's degree and a master's degree in an accelerated time frame. With Fast Track, students may count up to 9 graduate hours toward the completion of their undergraduate program as well as the graduate degree program.

Program Specifics:

- This program is available for undergraduate students pursuing a BS in Biomechanics desiring to pursue a MS in Biomechanics.
- Students must have completed no less than 60 undergraduate hours.
- Students must have a minimum undergraduate GPA of 3.0.
- Students must complete the Fast Track Approval form and obtain all signatures and submit to the Office of Graduate Studies prior to first enrollment in a graduate course.

- Students will work with their undergraduate advisor to register for the graduate courses.
- A minimum cumulative GPA of 3.0 is required for graduate coursework to remain in good standing.
- Students remain undergraduates until they meet all the requirements for the undergraduate degree and are eligible for all rights and privileges granted undergraduate status including financial aid.
- Near the end of the undergraduate program, formal application to the graduate program is required. The application fee will be waived, the applicant will need to contact the Office of Graduate Studies for a fee waiver code.
 - Admission to Fast Track does NOT guarantee admission to the graduate program.
 - Applicants for this program are highly encouraged to pursue research opportunities in the Department of Biomechanics or comparable programs.
 - The admit term must be after the completion term of the undergraduate degree.

All 8000 level BMCH courses are eligible for students as part of the Fast Track program.

Admissions

General Application Requirements and Admission Criteria (<http://catalog.unomaha.edu/graduate/admission/>)

Program-Specific Requirements Application Deadlines (Spring 2024, Summer 2024, and Fall 2024)

Applications for this program are accepted on a rolling basis. All materials must be submitted prior to the beginning of the semester in which the student has elected to begin coursework. Priority deadline of February 1 for consideration of department funded graduate assistantships.

Other Requirements

- GPA of 3.0 in undergraduate program
- **Undergraduate Deficiency Courses:**
 - MATH 1950 Calculus I
 - BMCH 2400 Human Physiology & Anatomy I (or equivalent)
 - BMCH 4630 Biomechanics (or equivalent)
- **English Language Proficiency:** Applicants are required to have a command of oral and written English. Those who do not hold a baccalaureate or other advanced degree from the U.S., **OR** a baccalaureate or other advanced degree from a predetermined country on the waiver list (<https://www.unomaha.edu/graduate-studies/prospective-students/Proof%20of%20English%20Proficiency-%20International.pdf>), must meet the minimum language proficiency score requirement in order to be considered for admission.
 - Internet-based TOEFL: 80, IELTS: 6.5, PTE: 53, Duolingo: 110, with no exceptions to this policy.
- **Statement of Purpose:** Written statement of goals and rationale for entering this graduate program. Also, identify the intended area of focus and the name of the faculty advisor with whom you wish to work (maximum one-page).
- **Resume or Curriculum Vitae (CV)**
- **Letters of Recommendation:** Two are required
- **Applicants with International Transcripts:** Any applicant to this program who has completed undergraduate or graduate coursework at an international higher education institution outside of the United States may submit transcripts and degree certificates (with an English translation) in lieu of a course-by-course transcript evaluation from World Education Services (<https://www.wes.org/>) (WES), Educational Credential Evaluators (<https://www.ece.org/>) (ECE), SpanTran (<https://spantran.com/>), or Educational

Perspectives (<https://www.edperspective.org/>). This graduate program will conduct an in-house credential evaluation of the transcript(s).

- UNO reserves the right to require a course-by-course evaluation from WES, ECE, SpanTran, or Educational Perspectives if the program is unable to complete an evaluation or should there be any questions or concerns about the documentation that is received. The applicant will be notified by the individual program if an external course-by-course evaluation is required.
- *Note: If admitted, official transcripts and degree certificates (with an English translation)/official course-by-course transcript evaluation, and any applicable official exam scores are required.

Degree Requirements

Code	Title	Credits
Seminar Requirement (2 semesters)		
BMCH 8000	SEMINAR IN BIOMECHANICS	0
Statistics Requirement-Select 3 hours		
BMCH 8030	BIOSTATISTICS IN BIOMECHANICS I	3
KINS 8040	ADVANCED STATISTICS	
Biomechanics Requirement- Select 3 hours		
BMCH 8450	ADVANCED BIOMECHANICS	3
BMCH 8696	CARDIOVASCULAR BIOMECHANICS	
BMCH 8200	MATLAB FOR MOVEMENT SCIENCES	3
BMCH 8900	INDEPENDENT RESEARCH IN BIOMECHANICS	3
Select Thesis or Non-Thesis Option		
Thesis Option		
BMCH 8990	THESIS IN BIOMECHANICS	24
18 Credit Hours of Electives-Graduate courses with KINS, BMCH or HEKI prefix and other advisor approved courses.		
Non-Thesis Option		
24 Credit Hours of Electives-Graduate courses with KINS, BMCH or HEKI prefix and other advisor approved courses.		
All required courses require a grade of B or better.		
Total Credits		36

Exit Requirements

- Thesis Option- 6 hours BMCH 8990
- Non-Thesis Option - Comprehensive Examination

The student and faculty advisor will determine the Program of Study, including the elective courses and general area of research for the thesis.

Concentrations

Sports Biomechanics Concentration

Code	Title	Credits
BMCH 8646	ORTHOPEDIC BIOMECHANICS	3
BMCH 8686	SPORTS BIOMECHANICS	3
KINS 8076	OPTIMIZING SPORTS PERFORMANCE	3
KINS 8970	TOPICS IN SPORTS MEDICINE	3
Total Credits		12

BMCH 8000 SEMINAR IN BIOMECHANICS (0 credits)

Required non-credit course for graduate students in biomechanics. Intended to familiarize the graduate student with current ongoing biomechanical research at UNO and other institutions. The seminar will additionally include topics focusing on professional development, job and educational opportunities, and biomechanical methodologies.

Prerequisite(s): Must be a student in BMCH graduate program. Not open to non-degree graduate students.

BMCH 8006 BIOMATERIALS (3 credits)

Students will learn the classification, properties, characterization methods, body interactions, applications, and design principles of biomaterials. (Cross-listed with BMCH 4000).

BMCH 8030 BIOSTATISTICS IN BIOMECHANICS I (3 credits)

The focus of the course is to prepare students to understand and apply research and biostatistical methods needed in the design and analysis of biomechanical investigations. The major topics to be covered include research design and multiple linear regression. (Cross-listed with BMKI 9031)

Prerequisite(s): Graduate Standing in Biomechanics program or Department Permission.

BMCH 8100 NONLINEAR ANALYSIS FOR MOVEMENT STUDIES (3 credits)

This course is to introduce different nonlinear methods for the analysis of biological and movement time series. Emphasis will be given on understanding the algorithms behind each nonlinear method. (Cross-listed with BMKI 9101).

Prerequisite(s): Instructor Permission.

BMCH 8106 BIOINSPIRED ROBOTICS (3 credits)

The goal of the course is to involve students in an interdisciplinary vision of biomechanics, biology, engineering and architecture by learning how humans and other animals function in their environment. These design principles from nature can be translated into novel devices, structures, and robots. (Cross-listed with BMCH 4100).

BMCH 8200 MATLAB FOR MOVEMENT SCIENCES (3 credits)

Introduction to Matlab software, plotting data, spectral analysis and the Fourier transform, data smoothing, and image analysis of movement related data. All topics will be implemented using Matlab. (Cross-listed with BMKI 9201).

Prerequisite(s): Instructor permission.

BMCH 8206 METHODS IN BIOMECHANICS I (3 credits)

In this course students learn about the methods and equipment used in biomechanics as well as the analysis of data collected from those methods. Course experiences include both lecture and lab based learning. (Cross-listed with BMCH 4200).

Prerequisite(s): Department Permission

BMCH 8216 METHODS IN BIOMECHANICS II (3 credits)

In this course students learn about advanced methods and equipment used in biomechanics, as well as the analysis of data collected from those methods. Course experiences include both lecture and lab based learning. This course builds on the experience gained in BMCH 4200/8206, Methods in Biomechanics I. (Cross-listed with BMCH 4210).

Prerequisite(s): BMCH 8206 or Department Permission

BMCH 8220 METHODS IN CARDIOVASCULAR BIOMATERIALS RESEARCH (3 credits)

This course contains lecture and lab components focused on cardiovascular biomaterial development and characterization methods used in academia and industry. The lecture component will provide the necessary clinical background of cardiovascular diseases and the theoretical background of cardiovascular biomaterials and state-of-the-art research methods. The lab component will provide practical experience focused on cardiovascular biomaterial design, manufacturing, and characterization methods. (Cross-listed with BMKI 9221).

BMCH 8300 STEM TEACHING METHODS FOR DEVICE DESIGN (3 credits)

STEM Teaching in Biomechanics focuses on principles in teaching including teaching models (Problem-Based, Team-Based, Inquiry-Based teaching), student assessment, classroom logistics/organization, and device design through a mentorship project. (Cross-listed with BMKI 9301, STEM 8300).

BMCH 8400 MOTOR LEARNING I (3 credits)

Discussion and analysis of scientific principles related to the learning of motor skills; review related literature and research in motor learning. The focus of the course is on recent theories of how movements are acquired and performed, and on factors that have implications for motor learning throughout the life span. (Cross-listed with BMKI 9401).

Prerequisite(s): Department Permission.

BMCH 8410 MOTOR CONTROL I (3 credits)

The focus of the course is to explore the study of the conditions and factors that influence the control and performance of motor skills from both neurophysiological and psychobiological perspectives. (Cross-listed with BMKI 9411).

Prerequisite(s): Department Permission. Not open to non-degree graduate students.

BMCH 8420 MOTOR DEVELOPMENT (3 credits)

This course focuses on the study of motor development, the processes that underlie this development and the factors that influence it. Students will gain an understanding of the major theoretical perspectives of motor development across the life span with special emphasis given in child development. (Cross-listed with BMKI 9421).

Prerequisite(s): Department Permission.

BMCH 8450 ADVANCED BIOMECHANICS (3 credits)

The course will address the biomechanical basis of human performance including mechanical analysis of human gait, fundamental movement patterns and techniques used for collecting biomechanical data. (Cross-listed with BMKI 9451).

Prerequisite(s): BMCH 4630 (Biomechanics) [previously PE 4630] or Instructor Permission.

BMCH 8646 ORTHOPEDIC BIOMECHANICS (3 credits)

Orthopedic Biomechanics focuses on the use of biomechanical principles and scientific methods to address clinical questions that are of particular interest to professionals such as orthopedic surgeons, physical therapists, rehabilitation specialists, and others. (Cross-listed with BMCH 4640).

Prerequisite(s): Department Permission

BMCH 8666 CLINICAL IMMERSION FOR RESEARCH AND DESIGN (3 credits)

This course will involve exposure to current clinical practices, identification of unmet clinical needs, and information regarding future career options. In this course, students will be matched with local clinical sites to provide a unique opportunity for innovative and interdisciplinary approaches to problem solving subject to practical constraints. Concepts in clinical rehabilitation, integrated assessments, regulation of medical devices in health care will be covered. This course will review the latest research efforts for rehabilitation in the context of device design and implementation. (Cross-listed with BMCH 4660).

Prerequisite(s): Instructor Permission. Not open to non-degree graduate students.

BMCH 8676 INTRODUCTION TO MECHANICS OF BIOMATERIALS (3 credits)

In this course students will learn how to analyze the stresses and strains in different structures under complex loading conditions with extensive examples from biomaterials and materials generally used in the medical device field. (Cross-listed with BMCH 4670).

Prerequisite(s): BMCH 3000 or Department Permission

BMCH 8686 SPORTS BIOMECHANICS (3 credits)

This course is intended to provide students with a foundational knowledge on how to analyze sport movements through biomechanical analytical methods. Students will utilize foundational biomechanical principles and apply them to a variety of sports and associated movements. (Cross-listed with BMCH 4680).

Prerequisite(s): BMCH 4630

BMCH 8690 MATHEMATICS OF BIOMECHANICAL DATA PROCESSING (3 credits)

Biomechanics is a rapidly changing and technologically dependent field of study. A thorough understanding of the factors influencing outcome measures is critical to correctly interpreting results. Students will be exposed to various data acquisition systems, approaches, and choices required to assess the computational aspects of biomechanical data critically. This course will equip students to complete independent processing from raw data to 3D joint angles and forces. (Cross-listed with BMKI 9691).

Prerequisite(s): Departmental Permission

BMCH 8696 CARDIOVASCULAR BIOMECHANICS (3 credits)

This course will introduce students to cardiovascular biomechanics, emphasizing the integration of analytical and experimental methods to better understand the mechanobiology of tissues. (Cross-listed with BMCH 4690).

Prerequisite(s): BMCH 3000, BMCH 4670, or Department Permission

BMCH 8900 INDEPENDENT RESEARCH IN BIOMECHANICS (1-6 credits)

In this course individuals or groups will conduct research projects for the study and analysis of biomechanical topics.

Prerequisite(s): Permission of the Department and approval by Faculty Advisor. Not open to non-degree graduate students.

BMCH 8910 INDEPENDENT STUDY IN BIOMECHANICS (1-6 credits)

This is a variable credit course designed for graduate students in Biomechanics who would benefit from independent reading assignments and problems. Independent study enables individual students or a small group of students to focus on topics typically not explored in other offerings or to explore topics currently offered in further depth. (Cross-listed with BMKI 9911).

Prerequisite(s): Graduate student in BMCH and approval by Faculty Advisor. Not open to non-degree graduate students.

BMCH 8990 THESIS IN BIOMECHANICS (1-6 credits)

A research project, designed and executed under the supervision of the chair and approval by members of the graduate student's advisory committee. In this project the student will develop skills in research design, research conduct, data analysis, and reporting. The final product of this course will be an original thesis of independent scientific investigation.

Prerequisite(s): Department Permission. Not open to non-degree graduate students.