Clinical and Translational Rehabilitation Health Science (CTRH)

Program Director: Paula E. Papanek, Ph.D.
Clinical and Translational Rehabilitation Science Master's website (http://www.marquette.edu/physical-therapy/clinical-translational-rehabilitation.shtml) or Clinical and Translational Rehabilitation Science Doctorate website (http://www.marquette.edu/physical-therapy/ctrh-phd-program-overview.shtml)

Degrees Offered
Master of Science; Doctor of Philosophy

Learning Outcomes
The clinical and translational rehabilitation health science master's and doctoral programs build on the knowledge and skills of a licensed post-baccalaureate trained clinician, and demands a progressive demonstration or advanced knowledge and skills related to research, teaching and professional development. The program develops research skills that will translate to clinically relevant questions.

Graduates of the master’s degree in clinical and translational rehabilitation health science will:
1. Communicate clinical and translational research knowledge via strong oral skills.
2. Contribute to an original research project in an area of emphasis.

Graduates of the doctoral degree in clinical and translational rehabilitation health science will:
1. Communicate clinical and translational research knowledge via strong oral skills.
2. Design and execute an original research project.
3. Communicate clinical and translational research findings via strong written skills.

Program Descriptions

Master of Science
The master of science degree in clinical and translational rehabilitation health science is open to those with a related science major interested in strengthening their core undergraduate major with advanced course work in research and rehabilitation science.

A master’s degree may strengthen a pre-professional student’s application for entry into physical therapy, physician assistant studies, occupational therapy or medical school. A student may choose from a variety of areas of emphasis for their degree including: community wellness, exercise physiology, neuro control of movement, movement disorders, sports medicine including biomechanics or performance enhancement. Both thesis and non-thesis options are available.

Doctor of Philosophy
The doctor of philosophy in clinical and translational rehabilitation health science builds upon the core competencies of clinical degrees (anatomy, physiology, pharmacology, medical ethics and patient care) with course work in rehabilitation systems physiology, applied neurophysiology, statistics, molecular genetics and research methodology. Students gain extensive research experience in the exercise, rehabilitation and movement disorders research cores housed within the exercise science program and the Department of Physical Therapy. Research includes the use of EMG, motion analysis, biomechanics, isokinetic dynamometry, fMRI, body composition, bone mineral density, diagnostic ultrasound and acute and chronic exercise training to explore mechanisms of dysfunction and develop theories for restoring function in people with movement disorders. Movement disorders cross age, gender and all ethnic boundaries and include populations with multiple sclerosis, post-traumatic stress disorder, traumatic brain injury, stroke, cancer survivors, pediatric obesity, cardiovascular diseases and chronic pain syndromes.

The Clinical and Translational Science Institute of Southeastern Wisconsin is a major partner with Marquette's clinical and translational rehabilitation health science program. Marquette’s participation in this consortium expands opportunities for academic, medical and clinical research within Milwaukee. CTSI partner institutions include the Medical College of Wisconsin, University of Wisconsin-Milwaukee, the Milwaukee School of Engineering, the Zablocki V.A. Medical Center, Children’s Hospital of Wisconsin and Blood Center of Wisconsin.

Prerequisites for Admission

Master of Science Students
All master's applicants will need greater than a 3.000 GPA in their undergraduate work. Current Marquette exercise physiology and athletic training degree students with a 3.000 GPA or better may apply for the accelerated degree program during their junior year for admission into the master’s program for their senior year.
Doctoral Students
Students must have successfully completed either a master’s degree in a related discipline or a post-baccalaureate degree in a clinical profession (physician assistant studies, physical therapy, doctor of medicine, nursing, speech-language pathology, etc.) with a minimum cumulative GPA of 3.000 (based on a 4.00 scale) and meet all application requirements to the Graduate School as outlined below.

Application Deadline
Applications are reviewed 3 times/year (October, January and March). October applicants would typically begin their studies in the fall of the following academic year. January and March applicants would begin the same year in the fall. To maximize potential for acceptance, admissions is done on a rolling basis until positions are filled.

Application Requirements
Applicants must submit, directly to the Graduate School:

1. A completed application form and fee online (http://marquette.edu/grad/future_apply.shtml).
2. Official transcripts from all current and previous colleges/universities except Marquette.
3. A curriculum vitae including work history, formal education, continuing education, licensing and certification, professional organizations, honors and awards, publications, presentations and grants.
4. A personal statement of no more than 500 words addressing your purpose for applying to the program, your ability to successfully complete the program and your goals (short and long term).
5. Three letters of recommendation addressing the applicant’s academic, professional, clinical, personal attributes and potential for meaningful graduate study. At least one academic reference must be included.
6. GRE scores are required for any non-Marquette University graduate applying to the MS degree program. GRE is required for doctoral applicants if their graduate/post-baccalaureate clinical degree was completed at a non-U.S. institution or if their graduate/post-baccalaureate clinical degree GPA is less than 3.000. GRE scores are not required for Marquette University students or graduates unless their degree GPA is below 3.000.
7. (For international applicants only) a minimum acceptable score on the iBT TOEFL exam of 90 overall, with minimum section scores of 25 for listening and speaking, and minimum scores of 20 for reading and writing, or other acceptable proof of English proficiency.

Applicants may wish to submit one example of written work, such as a class project, course assignment, first author publication, grant application, etc. (optional).

An interview with the admission committee is mandatory.

General Information
Students applying to the doctoral program must have successfully completed either a master’s degree in a related discipline or a post-baccalaureate clinical degree (D.P.T., M.P.T., M.P.A., M.S.N., M.D., etc.) with a minimum cumulative GPA of 3.000 (based on a 4.000 scale). Applicants to the master’s program will likely need a significantly higher undergraduate GPA than 3.000 in order to be competitive.

The GRE (if applicable) must have been completed within the previous six years, and official scores must be sent to Marquette University directly from Educational Testing Service.

Academic Standards
A cumulative GPA of 3.00 will be required in the clinical and translational rehabilitation health science program. The Academic Regulations section of this bulletin describes the criteria and procedures for academic warnings, probation, removal of probation, and dismissal. The clinical and translational rehabilitation health science program will strictly follow these policies and procedures.

Clinical and Translational Rehabilitation Health Science Master’s Requirements
The master of science in clinical and translational rehabilitation health science requires a minimum of 36 credit hours. The program of course work and research is determined in consultation with the student’s advisory committee. Each student is advised to take courses that are properly related to academic background and research interests.

Students may choose a thesis or non-thesis option. Thesis students must take 30 credit hours of course work plus 6 thesis credit hours. Non-thesis students must take 36 credit hours of course work. If some prerequisites need to be satisfied, students must complete additional credits for this degree.

Accelerated Degree Program
The accelerated degree program (ADP) is designed for bachelor of science students in exercise physiology or athletic training at Marquette University who wish to complete both their undergraduate degree as well as the master of science degree in clinical and translational health science in just five years.
Students with a GPA of 3.000 or above may apply for admission to the five-year program during their junior year. Students must submit an application to the Graduate School, indicate their interest in the five-year program, and meet all other admission criteria as stated in the Application Requirements section.

ADP students complete graduate course work during their undergraduate senior year, which may be applied toward completion of the master of science degree with appropriate approvals. A maximum of 17 credit hours will count toward the master of science degree in clinical and translational rehabilitation health science. Note, however, that only 12 of the 17 will also count toward the student's undergraduate degree. The extra 5 credit hours completed while earning the bachelor of science will count only toward the graduate degree upon transitioning to the master's program.

Clinical and Translational Rehabilitation Health Science Doctoral Requirements

The program of course work and research for the doctoral degree is determined in consultation with the student’s advisory committee. Each student is advised to take such courses as are properly related to academic background and research interests. A doctoral student must complete a program of study defined, in conjunction with an adviser, on an approved Doctoral Program Planning Form.

A maximum of 24 credit hours from a previously earned master's degree may be counted toward the required post-baccalaureate total of 70 credit hours required for the doctoral degree, resulting in 46 post-master's credit hours. The credit hours required at the post-master's level could be higher, depending on the specific course work taken at the master’s level.

Graduate course work will be selected from basic science foundation topics such as advanced anatomy, physiology, microbiology, genetics, and pharmacology. Selected courses will be documented on the Doctoral Program Planning Form which must be submitted by the end of the first semester.

In addition to the course work completed prior to enrollment in the doctoral program, students may choose to complete graduate course work at partnering CTSI institutions. Once the mentor has been selected, advanced graduate electives may be chosen from any of the CTSI partner institutions (MSOE, MCW, UWM). See the Departmental Graduate Handbook for specific requirements.

Advancement to candidacy for the doctoral degree is considered following successful completion of all requirements specified on the Doctoral Program Planning Form and after passing a doctoral qualifying examination. A typical doctoral student must complete 23 credit hours of core course work, 11 credit hours in advanced electives (minimum of 3 courses), plus six courses (0 credits) of departmental seminar which would expand the student’s knowledge in research theory, statistical analysis, basic biomechanics, kinesiology principles and ethical decision making as well as exposure to research opportunities within the program. In addition, doctoral candidates will complete 12 credit hours of dissertation work. The student must submit and defend a dissertation after completing all other formal requirements for the doctoral degree.

Courses

CTRH 6001. Applied and Rehabilitative Systems Physiology. 3 cr. hrs.
An advanced and in-depth presentation of the impact of disease and rehabilitation on the major and physiologic systems. Systems may include: skeletal muscle, cardiovascular, pulmonary, endocrine, immune, and intermediary metabolism. Addresses clinical and translational models from a systems and disease perspective. Examples may include: aging, fatigue, immobilization, cancer, multiple sclerosis, mitochondrial and metabolic disorders, chronic stress and pain. Prereq: BISC 5135 and BISC 5145.

CTRH 6020. Measurements, Tests, and Techniques in Rehabilitation Science. 3 cr. hrs.
An overview of the tests, measurements and evaluation used in clinical translational rehabilitation research. Advanced discussion of validity and reliability of measurements tools and devices. Topics include physiological and psychosocial testing. Prereq: Graduate standing in CTRH or Nursing. Graduate course in statistics.

CTRH 6030. Advanced Principles and Instrumentation in Biomechanics. 3 cr. hrs.
Presents biomechanical concepts important to the study of human movement and activity and explores the instrumentation used in this study. Discusses and applies biomechanical principles including Newton’s laws, anthropometrics, statistics, dynamics, material properties, kinetics and kinematics. Instrumentation such as electromyography, accelerometers, force transducers, optical sensor and force plates are discussed and utilized in the study of human movement. Discusses the design, implementation and calibration of these instruments. Prereq: CTRH 6001, which may be taken concurrently.

CTRH 6130. Neuromechanical Control and Regulation of Coordinated Movement. 2 cr. hrs.
In-depth study of the neural, mechanical, and muscular determinants that affect the control and regulation of coordinated movement in healthy and pathological populations. Prereq: CTRH 6030.

CTRH 6201. Neurophysiological Principles in Disease and Rehabilitation. 3 cr. hrs.
Examines system level neurophysiological principles in disease and rehabilitation. Prereq: CTRH 6001 and BISC 5135.

CTRH 6250. Neural Control of Locomotion. 3 cr. hrs.
In-depth study of the neural mechanisms underlying locomotor movements, with emphasis on human locomotion. Prereq: CTRH 6201.

CTRH 6290. Brain Dissection. 1 cr. hr.
An in-depth approach to the anatomy of the human brain. Emphasizes correlations between structure and function. Prereq: Graduate standing in CTRH program.
CTRH 6320. Molecular and Biochemical Techniques in Rehabilitation Health Sciences. 1 cr. hr.
Covers medical and forensic molecular biology, including a review of DNA/RNA structure and function, and biochemical analysis. Relevant laboratory techniques include: isolation of genomic DNA from various tissue samples, PCR, RFLP, molecular diagnosis of cancer, detection of infectious agents and identification of inherited diseases. Discusses proper sample processing, handling and storage. Special topics related to specific clinical populations based upon student interests discussed and techniques reviewed. Prereq: CTRH 6001.

CTRH 6380. Contemporary Rehabilitation in Pain. 2 cr. hrs.
Concepts relating to understanding the basic mechanisms of pain transmission, modulation, including how these influence clinical decision making. Prereq: CTRH 6201.

CTRH 6505. Aging and Physical Activity. 2 cr. hrs.
Explores the aging process using a multi-focal approach. Examines mental, physical and social facets of aging and develops the skills to program fitness and wellness activities for older adults of variable levels of health. Allows hands-on experience in leading and programming exercise with older adults while offering an opportunity to provide a valuable community service in the Milwaukee area. Prereq: CTRH 6001.

CTRH 6510. Obesity - A Comprehensive Approach. 2 cr. hrs.
Explores obesity as a disease process using a multi-focal approach. Examines mental, physical and social facets of obesity, as well as, approaches to treatment and prevention. For EXPH/ATTR students, application of classroom material occurs via service learning at a variety of sites in MPS and other area facilities. Prereq: CTRH 6001.

CTRH 6515. Neuromuscular Plasticity in Health and Disease. 3 cr. hrs.
Examines system level neurophysiological adaptations to activity, disease and rehabilitation with emphasis on sensory and motor systems. Prereq: CTRH 6001 and CTRH 6201.

CTRH 6520. Physiological Adaptations to Environmental Stress. 2 cr. hrs.
Systems based physiological responses and adaptations to acute and chronic environmental stress. Considerations given to rest and exercise conditions. Topics may include: spaceflight and microgravity, hyperbaric environments, hypoxia, high altitude, heat and cold. Prereq: CTRH 6001; BISC 5135; and EXPH 4192 or EXPH 5192.

CTRH 6530. Spinal Mechanisms of Motor Control and Implications of Rehabilitation. 2 cr. hrs.
Primarily journal-based discussion with exposure to various motor control laboratories in the Midwest. Prereq: CTRH 6001 and CTRH 6201.

CTRH 6540. Fatigue in Health and Disease. 3 cr. hrs.
An advanced and in depth presentation of the neuromuscular fatigue in healthy, diseased and disabled populations. Explores neural and muscular mechanisms of neuromuscular fatigue for different task conditions and populations that may include: aging, gender, cognitive demand, environmental temperature, practice and neural and muscular disorders, such as, multiple sclerosis, cancer, chronic and acute stress conditions, Alzheimer's disease and stroke. Prereq: CTRH 6201.

CTRH 6550. Physiology of Aging. 3 cr. hrs.
Provides an understanding of the physiology of normal aging and how that differs at times to the pathophysiology of human disease. Presents the normal aging process and disease processes to determine between normal and pathologic presentation, in order to design and implement appropriate therapeutics. Describes modifications in practical areas that will enhance care of the geriatric patient. Topics may include: cardiovascular, respiratory, neural systems, cognition, renal, endocrine, immunology, bone and special senses. Each class session ends in a discussion of the clinical implications as they relate to common practice or professions of choice. Prereq: CTRH 6001.

CTRH 6570. Performance and Rehabilitation. 2 cr. hrs.
Focuses on providing an advanced level understanding of the physiology of performance enhancement as it relates to rehabilitation. Topics include: advanced training procedures, assessment techniques and elite training theories. Discusses common surgical procedures and rehabilitation techniques associated with elite athletes with opportunities for observation as permitted. Addresses various subsets of the population, when appropriate, regarding specificity of responses to speed, agility and power training (elite, college, women and sport specific programs). Understanding is demonstrated by incorporation of and application of background knowledge obtained in other courses (exercise physiology, strength and conditioning, biomechanics, kinesiology and orthopedic physical therapy) into the development of exercise programs for specific populations with the purpose of performance enhancement. Includes consideration of the rehabilitation of elite athletic populations experiencing conditions commonly requiring physical therapy intervention (upper or lower extremity or core injuries). Prereq: CTRH 6001.

CTRH 6600. Project Design and Development in Clinical and Translational Rehabilitation Health. 0-3 cr. hrs.
Provides mentorship in the design and development of the non-thesis master's project to include selecting the topic, population, community or site for project, design of methods and developing the agreements or contracts for the project. 0 credit will be SNC/UNC grade assessment; 1-3 credits will be S/U grade assessment. Prereq: Grad. stndg. in CTRH program.

CTRH 6650. Research Methods in Clinical and Translational Rehabilitation Health Science. 1-6 cr. hrs.
Introduction to and mastery of specific research techniques and methods associated with the research expertise of faculty in clinical and translational rehabilitation health. Prereq: Grad. stndg in CTRH.

CTRH 6931. Topics in Clinical and Translational Rehabilitation Health Science. 1-3 cr. hrs.
Topics of current interest to Clinical and Translational Rehabilitation Health Science.
CTRH 6953. Journal Club in Clinical and Translational Rehabilitation Health Science. 0-3 cr. hrs.
Scholarly presentations by visiting faculty and clinicians, resident faculty and graduate and undergraduate students on current topics related to clinical and translational health. 0 credit will be SNC/UNC grade assessment; 1-3 credits will be S/U grade assessment. Prereq: Graduate standing in CTRH program.

CTRH 6956. Readings and Research in Clinical and Translational Rehabilitation Health Science. 0-3 cr. hrs.
Introduces readings and ongoing research in individual laboratories of faculty within the CTSI. The number of hours varies, but the rotation typically consists of two rotations. Involves laboratory work, attending laboratory meetings, individual meetings with laboratory PI and oral presentation of progress made in this rotation. Directs students toward potential laboratories with interest or expertise as identified by the student in areas related to clinical and translational rehabilitation health. Presents various techniques and methods in individual laboratories. Students select their research mentor and collaborators for their project by the end of the course. S/U grade assessment. Prereq: Graduate standing in CTRH program.

CTRH 6960. Seminar in Clinical and Translational Rehabilitation Health Sciences. 0-3 cr. hrs.
Scholarly presentations by visiting faculty and clinicians, resident faculty and graduate students on current topics related to clinical and translational rehabilitation health. 0 credits SNC/UNC grade assessment, 1-3 credits S/U grade assessment. Prereq: Graduate standing in CTRH program.

CTRH 6958. Readings and Research in Clinical and Translational Rehabilitation Health Science. 0-3 cr. hrs.
In-depth research on a topic or subject matter usually not offered in the established curriculum with faculty and independent of the classroom setting. Prereq: Cons. of Instr. and cons. of prog. dir.

CTRH 8995. Independent Study in Clinical and Translational Rehabilitation Health Sciences. 1-3 cr. hrs.
S/U grade assessment. Prereq: Cons. of instr.

CTRH 8996. Professional Project in Clinical and Translational Rehabilitation Health Sciences. 0-3 cr. hrs.
Fee. SNC/UNC grade assessment. Prereq: Cons. of grad. prog. dir.

CTRH 9970. Graduate Standing Continuation: Less than Half-Time. 0 cr. hrs.
Fee. SNC/UNC grade assessment. Prereq: Cons. of graduate prog. dir.

CTRH 9974. Graduate Fellowship: Full-Time. 0 cr. hrs.
Fee. SNC/UNC grade assessment. Prereq: Cons. of grad. prog. dir.

CTRH 9975. Graduate Assistant Teaching: Full-Time. 0 cr. hrs.
Fee. SNC/UNC grade assessment. Prereq: Cons. of graduate prog. dir.

CTRH 9976. Graduate Assistant Research: Full-Time. 0 cr. hrs.
Fee. SNC/UNC grade assessment. Prereq: Cons. of graduate prog. dir.

CTRH 9984. Master's Comprehensive Examination Preparation: Less than Half-Time. 0 cr. hrs.
Fee. SNC/UNC grade assessment. Prereq: Cons. of graduate prog. dir.

CTRH 9985. Master's Comprehensive Examination Preparation: Half-Time. 0 cr. hrs.
Fee. SNC/UNC grade assessment. Prereq: Cons. of graduate prog. dir.

CTRH 9986. Master's Comprehensive Examination Preparation: Full-Time. 0 cr. hrs.
Fee. SNC/UNC grade assessment. Prereq: Cons. of graduate prog. dir.

CTRH 9987. Doctoral Comprehensive Examination Preparation: Less than Half-Time. 0 cr. hrs.
Fee. SNC/UNC grade assessment. Prereq: Cons. of graduate prog. dir.

CTRH 9988. Doctoral Comprehensive Examination Preparation: Half-Time. 0 cr. hrs.
Fee. SNC/UNC grade assessment. Prereq: Cons. of graduate prog. dir.

CTRH 9989. Doctoral Comprehensive Exam Preparation: Full-Time. 0 cr. hrs.
Fee. SNC/UNC grade assessment. Prereq: Cons. of graduate prog. dir.

CTRH 9991. Professional Project Continuation: Less than Half-Time. 0 cr. hrs.
Fee. SNC/UNC grade assessment. Prereq: Cons. of graduate prog. dir.

CTRH 9992. Professional Project Continuation: Half-Time. 0 cr. hrs.
Fee. SNC/UNC grade assessment. Prereq: Cons. of graduate prog. dir.

CTRH 9993. Professional Project Continuation: Full-Time. 0 cr. hrs.
Fee. SNC/UNC grade assessment. Prereq: Cons. of graduate prog. dir.

CTRH 9994. Master's Thesis Continuation: Less than Half-Time. 0 cr. hrs.
Fee. SNC/UNC grade assessment. Prereq: Cons. of graduate prog. dir.
CTRH 9995. Master’s Thesis Continuation: Half-Time. 0 cr. hrs.
Fee. SNC/UNC grade assessment. Prereq: Cons. of graduate prog. dir.

CTRH 9996. Master’s Thesis Continuation: Full-Time. 0 cr. hrs.
Fee. SNC/UNC grade assessment. Prereq: Cons. of graduate prog. dir.

CTRH 9997. Doctoral Dissertation Continuation: Less than Half-Time. 0 cr. hrs.
Fee. SNC/UNC grade assessment. Prereq: Cons. of graduate prog. dir.

CTRH 9998. Doctoral Dissertation Continuation: Half-Time. 0 cr. hrs.
Fee. SNC/UNC grade assessment. Prereq: Cons. of graduate prog. dir.

CTRH 9999. Doctoral Dissertation Continuation: Full-Time. 0 cr. hrs.
Fee. SNC/UNC grade assessment. Prereq: Cons. of graduate prog. dir.