

# Exercise and Rehabilitation Science (EXRS)

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**Program Director: Paula E. Papanek, Ph.D.**

**Assistant Director: Kathy Lukaszewicz, P.T., Ph.D.**

Exercise and Rehabilitation Science (<http://www.marquette.edu/physical-therapy/clinical-translational-rehabilitation.shtml>)

## Degrees Offered

Master of Science; Doctor of Philosophy

## Learning Outcomes

The exercise and rehabilitation science (EXRS) master's program is designed to help students gain advanced knowledge in exercise physiology principles while developing skills related to research to help transition successfully to a doctoral program or clinical post-baccalaureate programs. The EXRS doctoral program is built on the knowledge and skills of a licensed post-baccalaureate trained clinician or master's student in a related field and provides students with advanced knowledge and skills related to clinical and translational research in fields including pathokinesiology, neuroscience, motor control, exercise physiology, and sports medicine.

### Graduates of the master's degree in exercise and rehabilitation 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 exercise and rehabilitation 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 exercise and rehabilitation science is open to those with a related science major interested in strengthening their core undergraduate major with advanced course work in research methods, exercise physiology 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, neurologic 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 exercise and rehabilitation 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 core laboratories 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, Type II diabetes, 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 exercise and rehabilitation 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 Versiti 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 undergraduate students studying in a related field (i.e., exercise physiology, biomedical sciences, speech pathology, etc.) 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 4.000 scale) and meet all application requirements as outlined below.

## Application Deadline

Students in the exercise and rehabilitation science (EXRS) program begin their studies in the fall of each academic year. Admissions are made on a rolling basis, so applicants are encouraged to apply early.

All required documentation must be received in the Graduate School by these dates, or earlier:

- August 1 for fall term admissions (June 1 for international applicants)

Applications must be complete by these dates.

## 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](http://marquette.edu/grad/future_apply.shtml)).
2. Copies of all college/university transcripts except Marquette.<sup>1</sup>
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 purpose for applying to the program, ability to successfully complete the program and 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. Required for any non-Marquette University graduate applying to the M.S. degree program. 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. 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.

<sup>1</sup> Upon admission, final official transcripts from all previously attended colleges/universities, with certified English translations if original language is not English, must be submitted to the Graduate School within the first five weeks of the term of admission or a hold preventing registration for future terms will be placed on the student's record.

## 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 must have an undergraduate degree in a related field with a minimum cumulative GPA of 3.000 (based on a 4.000 scale).

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 3.000 is required in the exercise and rehabilitation science program. The Academic Regulations section of this bulletin describes the criteria and procedures for academic warnings, probation, removal of probation, and dismissal. The exercise and rehabilitation science program strictly follows these policies and procedures.

## Exercise and Rehabilitation Science Master's Requirements

The master of science in exercise and rehabilitation science requires a minimum of 36 credit hours. If a student is admitted with prerequisite deficiencies, completion of prerequisite courses does not apply toward degree requirements. 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 their academic background and research interests.

## Thesis Program (Plan A)

The typical master's student in Plan A must complete 21 credit hours of required core course work, 9 credit hours of electives (where no more than 5 credit hours may come from seminar or research methods courses). In addition, master's students in Plan A complete 6 thesis credit hours, for a total of 36 credit hours. Students must defend their thesis to the satisfaction of their committee.

## Non-Thesis Program (Plan B)

The typical master's student in Plan B completes 21 credit hours of required core course work, 12 credit hours of electives (where no more than 3 credit hours may come from seminar or research methods courses), and 3 credit hours in project design and professional project courses for a total of 36 credit hours. Students must develop and submit a project, as approved by their mentor.

## Required Course Work for Plan A and Plan B

Advised by the director of graduate studies and/or the student's mentor, an admitted student creates a program plan of study that fulfills the requirements for a master's degree in exercise and rehabilitation science within that particular student's area of interest. All students are required to take the following courses:

BISC 5135	Clinical Human Anatomy	4
EXPH 5192	Advanced Exercise Physiology	3
EXPH 5195	Advanced Exercise Physiology Laboratory	1
BISC 5145	Human Physiology	4
EXRS 6001	Applied and Rehabilitative Systems Physiology	3
PSYC 8101	Advanced Statistics and Design 1	3
or HEAL 8015	Applied Statistics for Health Sciences	
or MSSC 5720	Statistical Methods	
EXRS 6958	Readings and Research in Exercise and Rehabilitation Science	1
EXRS 6960	Seminar in Exercise and Rehabilitation Science	1
EXRS 6953	Journal Club in Exercise and Rehabilitation Science	1
Plan A (Thesis) or Plan B (Non-thesis) - refer to requirements below.		15
Total Credit Hours		36

## Additional course requirements - Plan A (Thesis Option)

Students select elective courses to develop a plan of study that is consistent with their personal and professional interests.

EXRS 6999	Master's Thesis	6
Additional 9 credits of electives from courses listed below or any approved graduate-level course:		
BISC 5140	Functional Neuroanatomy	3
BISC 5155	Diseases of the Brain	3
BISC 5160	Molecular Pathology	3
BISC 5340	Human and Applied Medical Genetics	3
BISC 7130	Human Gross Anatomy	5
BISC 7180	Clinical Neuroanatomy	3
EXPH 5187	Clinical Exercise Physiology for Special Populations	3
EXPH 7189	Nutrition and Exercise Performance	4
EXRS 6001	Applied and Rehabilitative Systems Physiology	3
EXRS 6020	Measurements, Tests, and Techniques in Rehabilitation Science	3
EXRS 6030	Advanced Principles and Instrumentation in Biomechanics	3
EXRS 6130	Neuromechanical Control and Regulation of Coordinated Movement	2
EXRS 6201	Neurophysiological Principles in Disease and Rehabilitation	3
EXRS 6250	Neural Control of Locomotion	3
EXRS 6290	Brain Dissection	1
EXRS 6320	Molecular and Biochemical Techniques in Rehabilitation Health Science	2
EXRS 6380	Contemporary Rehabilitation in Pain	2
EXRS 6505	Aging and Physical Activity	2
EXRS 6510	Obesity - A Comprehensive Approach	2
EXRS 6515	Neuromuscular Plasticity in Health and Disease	3

EXRS 6520	Physiological Adaptations to Environmental Stress	2
EXRS 6530	Spinal Mechanisms of Motor Control and Implications of Rehabilitation	2
EXRS 6540	Fatigue in Health and Disease	3
EXRS 6550	Physiology of Aging	3
EXRS 6590	Performance and Rehabilitation	2
EXRS 6650	Research Methods in Exercise and Rehabilitation Science <sup>1</sup>	1-6
EXRS 6931	Topics in Exercise and Rehabilitation Science	1-3
EXRS 6960	Seminar in Exercise and Rehabilitation Science <sup>1</sup>	0-3
EXRS 6995	Independent Study in Exercise and Rehabilitation Science	1-3

<sup>1</sup> A maximum of 5 credits from EXRS 6650 and EXRS 6960 combined.

### **Additional course requirements - Plan B (Non-Thesis Option)**

Students select elective courses to develop a plan of study that is consistent with their personal and professional interests.

EXRS 6600	Project Design and Development in Exercise and Rehabilitation Science	1
EXRS 6998	Professional Project in Exercise and Rehabilitation Science	2
Additional 12 credits of electives from courses listed below or any approved graduate-level course:		
BISC 5140	Functional Neuroanatomy	3
BISC 5155	Diseases of the Brain	3
BISC 5160	Molecular Pathology	3
BISC 5340	Human and Applied Medical Genetics	3
BISC 7130	Human Gross Anatomy	5
BISC 7180	Clinical Neuroanatomy	3
EXPH 5187	Clinical Exercise Physiology for Special Populations	3
EXPH 7189	Nutrition and Exercise Performance	4
EXRS 6001	Applied and Rehabilitative Systems Physiology	3
EXRS 6020	Measurements, Tests, and Techniques in Rehabilitation Science	3
EXRS 6030	Advanced Principles and Instrumentation in Biomechanics	3
EXRS 6130	Neuromechanical Control and Regulation of Coordinated Movement	2
EXRS 6201	Neurophysiological Principles in Disease and Rehabilitation	3
EXRS 6250	Neural Control of Locomotion	3
EXRS 6290	Brain Dissection	1
EXRS 6320	Molecular and Biochemical Techniques in Rehabilitation Health Science	2
EXRS 6380	Contemporary Rehabilitation in Pain	2
EXRS 6505	Aging and Physical Activity	2
EXRS 6510	Obesity - A Comprehensive Approach	2
EXRS 6515	Neuromuscular Plasticity in Health and Disease	3
EXRS 6520	Physiological Adaptations to Environmental Stress	2
EXRS 6530	Spinal Mechanisms of Motor Control and Implications of Rehabilitation	2
EXRS 6540	Fatigue in Health and Disease	3
EXRS 6550	Physiology of Aging	3
EXRS 6590	Performance and Rehabilitation	2
EXRS 6650	Research Methods in Exercise and Rehabilitation Science <sup>1</sup>	1-6
EXRS 6931	Topics in Exercise and Rehabilitation Science	1-3
EXRS 6960	Seminar in Exercise and Rehabilitation Science <sup>1</sup>	0-3
EXRS 6995	Independent Study in Exercise and Rehabilitation Science	1-3

<sup>1</sup> A maximum of 5 credits from EXRS 6650 and EXRS 6960 combined.

## Accelerated Degree Program

The accelerated degree program (ADP) is designed for undergraduate students in related fields at Marquette University (i.e., exercise physiology, biomedical sciences, speech pathology) who wish to complete both their undergraduate degree as well as the master of science degree in exercise and rehabilitation 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. Courses are selected from the EXRS required or elective course options listed above, based on the student's academic background and in consultation with the director of graduate studies. A maximum of 17 credit hours can count toward the master of science degree in exercise and rehabilitation science. Note, however, that only 14 of the 17 can also count toward the student's undergraduate degree. The additional 3 credit hours completed while earning the bachelor of science degree count only toward the graduate degree upon transitioning to the master's program.

## Exercise and Rehabilitation Science Doctoral Requirements

The program of course work and research for the doctoral degree in exercise and rehabilitation science is determined in consultation with the student's advisory committee. Each student is advised to take such courses that 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.

Credits from graduate course work transferred in are selected from basic science foundational topics (i.e., advanced anatomy, physiology, microbiology, genetics and pharmacology). Selected courses are documented on the Doctoral Program Planning Form which must be submitted to the Graduate School by the end of the first year.

In addition to the course work completed prior to enrollment in the doctoral program, students may choose to complete graduate course work at a partnering Clinical and Translational Science Institute (CTSI) during their time of study. 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 Student 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.

## Required Post-Master's Course Work

A typical doctoral student must complete 27 credit hours of core course work, 7 credit hours of advanced electives (minimum of 2 courses, with no more than 6 credit hours coming from a seminar or research methods course). All students are required to attend the departmental seminar series which expands 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 complete 12 credit hours of dissertation work for a combined total (including master's transfer credits) of 70 credit hours. The student must submit and defend a dissertation after completing all other formal requirements for the doctoral degree.

EXRS 6001	Applied and Rehabilitative Systems Physiology	3
EXRS 6201	Neurophysiological Principles in Disease and Rehabilitation	3
EXRS 6958	Readings and Research in Exercise and Rehabilitation Science	2
EXRS 6960	Seminar in Exercise and Rehabilitation Science	2
EXRS 6953	Journal Club in Exercise and Rehabilitation Science	2
EXRS 6030	Advanced Principles and Instrumentation in Biomechanics	3
EXRS 6320	Molecular and Biochemical Techniques in Rehabilitation Health Science	2
BISC 5340	Human and Applied Medical Genetics	3
PSYC 8101	Advanced Statistics and Design 1	3
or HEAL 8015	Applied Statistics for Health Sciences	
or MSSC 5720	Statistical Methods	
PSYC 8102	Advanced Statistics and Design 2	3
or EXRS 6020	Measurements, Tests, and Techniques in Rehabilitation Science	
GRAD 6945	Exchange/Medical College of Wisconsin (Methods in Grant Preparation)	1
Elective course work - choose from course options below. <sup>1</sup>		7

EXRS 8999	Doctoral Dissertation	12
Total Credit Hours		46

<sup>1</sup> Elective credits may exceed 7 credit hours depending on amount of credit accepted in transfer from master's degree.

## Elective Course Work

Students select elective courses to develop a plan of study that is consistent with their personal and professional interests.

Students complete 7 credit hours of elective courses from the list below or any approved graduate-level course.

EXRS 6130	Neuromechanical Control and Regulation of Coordinated Movement	2
EXRS 6250	Neural Control of Locomotion	3
EXRS 6290	Brain Dissection	1
EXRS 6380	Contemporary Rehabilitation in Pain	2
EXRS 6505	Aging and Physical Activity	2
EXRS 6510	Obesity - A Comprehensive Approach	2
EXRS 6515	Neuromuscular Plasticity in Health and Disease	3
EXRS 6520	Physiological Adaptations to Environmental Stress	2
EXRS 6530	Spinal Mechanisms of Motor Control and Implications of Rehabilitation	2
EXRS 6540	Fatigue in Health and Disease	3
EXRS 6550	Physiology of Aging	3
EXRS 6590	Performance and Rehabilitation	2
EXRS 6600	Project Design and Development in Exercise and Rehabilitation Science	0-3
EXRS 6650	Research Methods in Exercise and Rehabilitation Science <sup>1</sup>	1-6
EXRS 6960	Seminar in Exercise and Rehabilitation Science <sup>1</sup>	0-3

<sup>1</sup> A maximum of 6 credits from EXRS 6650 Research Methods in Exercise and Rehabilitation Science and EXRS 6960 Seminar in Exercise and Rehabilitation Science combined.

## Courses

### EXRS 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.

### EXRS 6020. Measurements, Tests, and Techniques in Rehabilitation Science. 3 cr. hrs.

An overview of the tests, measurements and evaluation used in exercise and rehabilitation science research. Advanced discussion of validity and reliability of measurements tools and devices. Topics include physiological and psychosocial testing. Prereq: Admitted to the graduate EXRS or NURS program; graduate course in statistics.

### EXRS 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: EXRS 6001 which may be taken concurrently.

### EXRS 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: EXRS 6030.

### EXRS 6201. Neurophysiological Principles in Disease and Rehabilitation. 3 cr. hrs.

Examines system level neurophysiological principles in disease and rehabilitation. Prereq: BISC 5135 and EXRS 6001.

### EXRS 6250. Neural Control of Locomotion. 3 cr. hrs.

In-depth study of the neural mechanisms underlying locomotor movements, with emphasis on human locomotion. Prereq: EXRS 6201.

### EXRS 6290. Brain Dissection. 1 cr. hr.

An in-depth approach to the anatomy of the human brain. Emphasizes correlations between structure and function. Prereq: Admitted to the graduate EXRS program.

**EXRS 6320. Molecular and Biochemical Techniques in Rehabilitation Health Science. 2 cr. hrs.**

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.

**EXRS 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: EXRS 6201.

**EXRS 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: EXRS 6001.

**EXRS 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: EXRS 6001.

**EXRS 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: EXRS 6001 and EXRS 6201.

**EXRS 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: EXRS 6001; BISC 5135; and EXPH 4192 or EXPH 5192.

**EXRS 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: EXRS 6001 and EXRS 6201.

**EXRS 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: EXRS 6201.

**EXRS 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: EXRS 6001.

**EXRS 6590. 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: EXRS 6001.

**EXRS 6600. Project Design and Development in Exercise and Rehabilitation Science. 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: Admitted to the graduate EXRS program.

**EXRS 6650. Research Methods in Exercise and Rehabilitation 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: Admitted to the graduate EXRS program.

**EXRS 6931. Topics in Exercise and Rehabilitation Science. 1-3 cr. hrs.**

Topics of current interest to exercise and rehabilitation science. Prereq: Admitted to the EXRS M.S. or Ph.D. program; or cons. of instr.

**EXRS 6953. Journal Club in Exercise and Rehabilitation 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: Admitted to the graduate EXRS program.

**EXRS 6958. Readings and Research in Exercise and Rehabilitation 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: Admitted to the graduate EXRS program.

**EXRS 6960. Seminar in Exercise and Rehabilitation Science. 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: Admitted to the graduate EXRS program.

**EXRS 6995. Independent Study in Exercise and Rehabilitation Science. 1-3 cr. hrs.**

Independent research or guided study. Prereq: Cons. of instr. and cons. of prog. dir.

**EXRS 6998. Professional Project in Exercise and Rehabilitation Science. 0-3 cr. hrs.**

0 credit will be SNC/UNC grade assessment; 1-3 credits will be S/U grade assessment. Prereq: Cons. of instr.

**EXRS 6999. Master's Thesis. 1-6 cr. hrs.**

S/U grade assessment. Prereq: Cons. of instr.

**EXRS 8995. Independent Study in Exercise and Rehabilitation Science. 1-3 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.

**EXRS 8999. Doctoral Dissertation. 1-12 cr. hrs.**

S/U grade assessment. Prereq: Cons. of instr.

**EXRS 9970. Graduate Standing Continuation: Less than Half-Time. 0 cr. hrs.**

Fee. SNC/UNC grade assessment. Prereq: Cons. of prog. dir.

**EXRS 9974. Graduate Fellowship: Full-Time. 0 cr. hrs.**

Fee. SNC/UNC grade assessment. Prereq: Cons. of prog. dir.

**EXRS 9975. Graduate Assistant Teaching: Full-Time. 0 cr. hrs.**

Fee. SNC/UNC grade assessment. Prereq: Cons. of prog. dir.

**EXRS 9976. Graduate Assistant Research: Full-Time. 0 cr. hrs.**

Fee. SNC/UNC grade assessment. Prereq: Cons. of prog. dir.

**EXRS 9984. Master's Comprehensive Examination Preparation: Less than Half-Time. 0 cr. hrs.**

Fee. SNC/UNC grade assessment. Prereq: Cons. of graduate prog. dir.

**EXRS 9985. Master's Comprehensive Examination Preparation: Half-Time. 0 cr. hrs.**

Fee. SNC/UNC grade assessment. Prereq: Cons. of graduate prog. dir.

**EXRS 9986. Master's Comprehensive Examination Preparation: Full-Time. 0 cr. hrs.**

Fee. SNC/UNC grade assessment. Prereq: Cons. of graduate prog. dir.

**EXRS 9987. Doctoral Comprehensive Examination Preparation: Less than Half-Time. 0 cr. hrs.**

Fee. SNC/UNC grade assessment. Prereq: Cons. of graduate prog. dir.

**EXRS 9988. Doctoral Comprehensive Examination Preparation: Half-Time. 0 cr. hrs.**

Fee. SNC/UNC grade assessment. Prereq: Cons. of graduate prog. dir.

**EXRS 9989. Doctoral Comprehensive Exam Preparation: Full-Time. 0 cr. hrs.**

Fee. SNC/UNC grade assessment. Prereq: Cons. of graduate prog. dir.

**EXRS 9991. Professional Project Continuation: Less than Half-Time. 0 cr. hrs.**

Fee. SNC/UNC grade assessment. Prereq: Cons. of graduate prog. dir.

**EXRS 9992. Professional Project Continuation: Half-Time. 0 cr. hrs.**

Fee. SNC/UNC grade assessment. Prereq: Cons. of graduate prog. dir.

**EXRS 9993. Professional Project Continuation: Full-Time. 0 cr. hrs.**

Fee. SNC/UNC grade assessment. Prereq: Cons. of graduate prog. dir.

**EXRS 9994. Master's Thesis Continuation: Less than Half-Time. 0 cr. hrs.**

Fee. SNC/UNC grade assessment. Prereq: Cons. of graduate prog. dir.

**EXRS 9995. Master's Thesis Continuation: Half-Time. 0 cr. hrs.**

Fee. SNC/UNC grade assessment. Prereq: Cons. of graduate prog. dir.

**EXRS 9996. Master's Thesis Continuation: Full-Time. 0 cr. hrs.**

Fee. SNC/UNC grade assessment. Prereq: Cons. of graduate prog. dir.

**EXRS 9997. Doctoral Dissertation Continuation: Less than Half-Time. 0 cr. hrs.**

Fee. SNC/UNC grade assessment. Prereq: Cons. of graduate prog. dir.

**EXRS 9998. Doctoral Dissertation Continuation: Half-Time. 0 cr. hrs.**

Fee. SNC/UNC grade assessment. Prereq: Cons. of graduate prog. dir.

**EXRS 9999. Doctoral Dissertation Continuation: Full-Time. 0 cr. hrs.**

Fee. SNC/UNC grade assessment. Prereq: Cons. of graduate prog. dir.