Graduate Faculty Council Meeting

Tuesday, November 01, 2016, 4-5 pm

Minutes

Members (16): Craig Friedrich (MEEM), Zhenlin Wang (CompSci), Tom Merz (Bus Admin), Kelly Steelman (CogSci), Jiguang Sun (Math), Scott Marratto (RTC), Veronica Webster (CivEnvEng), J. Jiang (BioMed), Leonard Bohmann (Meng), Lei Pan (ChemEng), Qinghui Chen (Kip), Michael Roggemann (Elec), Yoke Khin Yap (Physics), Kari Henquinet (PCMI), Judith Perlinger (Atmos), Ashutosh Tiwari (Chem), Julie King (Chem Eng), Ebenezer Tumban (Bio), Aleksay Smirnov (Geo), Yu Cai (Tech), Melissa Baird (SS)

Guests (7): Debra Charlesworth (Grad Sch), Nancy Byers Sprague (Grad Sch), Nicole Rubino (Grad Sch), Erin Matas (Lib), Will Lytle (GSG), Jaque Smith (Grad Sch)

1) Meeting called to order at 4:03 pm. By Tom Merz

2) New Business
   a. PhD Program Proposal - Integrative Physiology (S. Elmer)
   Now that the Kinesiology program has the infrastructure and a number of tenure track faculty in place they are ready to integrate a PhD program. 80% of the faculty are funded by NSF or NIH grants. See handout for more information on the Integrative Physiology PhD Program Proposal.

There were a number of questions regarding coursework and the independent research project. Some of the questions raised are as follows:

- Few 6000 level courses?
- Brief description of a typical independent research project?
- Timeline in which students complete the independent project?
- If they are working on an independent project and they are not working on funded research, who will be supporting them?
- There is a potential for student confusion. What part of the research credits are for this independent study and what part is for my dissertation? There needs to be a clear expectation of quantity of work to be done. If they don’t complete this independent study but they are making progress on their dissertation, how is this going to be counted? Do they need to complete the independent study before they can take their qualifying exams? What are the timelines if they are not successful with this? You need to be really clear on what the student expectations are. A different class for the independent project would make it clear that it is separate from their PhD research. This would allow it to have a syllabus and be graded. Forestry has a nice research methods course.
- Journals have different delay times, if the student is required to have a publication prior to taking the qualifying exam, will the student be sitting around waiting to take the qualifying exam?
- How long will it take to complete the PhD? 5-6 years?
- A student will spend 2 years on an independent project that does not count towards their dissertation and then they will complete their dissertation in the following year?

Kinesiology will clarify and revise the proposal. An updated proposal will be circulated before the next meeting in December.

We will finish this discussion in the December GFC meeting.
b. Accelerated Master's through Negotiated Agreements Policy (J. Smith)

The proposal is to extend the Accelerated Masters Programs to other Universities through negotiated agreements. This will only be with specific schools/programs. Programs could choose the external universities/programs they want to have negotiated agreements with. The request was for approval of this concept. This would be a tool to incentivize students to apply and join our University. It will still need to be supported by the Dean of the Graduate School and the academic department that has the accelerated masters. The participating institutions would need to be accredited. The faculty would review and work with the other institutions and identify the courses that will be double counted. The GPA requirements would stay the same and the maximum number of credits could not exceed six. This will potentially be bundled with the 3+1+1 agreement that the GFC passed in the previous school year. A common set of application requirements will be beneficial.

- Students will receive their Bachelors from their undergrad institute and a Masters from MTU.
- The Graduate School has surpassed the forecast for the initial Accelerated Masters Proposal

We will continue this discussion in the December meeting

3) Old Business: Old Business will be moved to the December meeting.
   a. Proposal - Coursework Update (D. Charlesworth) – N/A
   b. GLO Update (P. Murthy) – N/A

Motion to adjourn at 5:00 pm.
Graduate Faculty Council—Draft Agenda

November 1, 2016
NOTE: all handouts are connected to a single pdf file.

1. New Business
   a. PhD Program Proposal - Integrative Physiology (S. Elmer)
   b. Accelerated Master's through Negotiated Agreements Policy (J. Smith)

2. Old Business:
   a. Proposal - Coursework Update (D. Charlesworth) - Postponed to December
   b. GLO Update (P. Murthy) - Postponed to December
November 1, 2016
(Last update: 10/11/2016)

Handouts of the Graduate Faculty Council

Michigan Tech
1. GENERAL DESCRIPTION
The faculty members of the Department of Kinesiology and Integrative Physiology (KIP) at Michigan Technological University seek to establish a Doctor of Philosophy (PhD) program in Integrative Physiology. The PhD program in Integrative Physiology is designed for students who wish to pursue careers in academia, research or industry in the areas of integrative and exercise physiology, human biomechanics, and motor learning. For questions or clarification, please contact Dr. Jason R. Carter (department chair) at jcarter@mtu.edu or 906-487-2715.

2. RATIONALE
The KIP department offers two Bachelor of Science (BS) degrees within the fields of kinesiology and integrative physiology, and a Master of Science (MS) degree in kinesiology, but does not currently offer a Doctor of Philosophy (PhD) degree. Over the past 10 years, KIP faculty have served as primary advisors for PhD graduate students via adjunct status primarily through the Biological Sciences department (5 graduated PhD students over past 8 years; 4 active PhD students), Biomedical Engineering (1 graduated PhD student), and Human Factors (1 graduated PhD student). Our motivations for a PhD in Integrative Physiology include the following:

• With 6 tenure-track faculty, 2 staff positions with Ph.D. degrees, and several key affiliated and adjunct appointments with specialties related to integrative physiology, the department has a critical mass to offer a nationally competitive PhD degree in Integrative Physiology.

• 80% of full-time KIP faculty are actively funded by either the National Institutes of Health (NIH) or the National Science Foundation (NSF). In addition, faculty have received funding through agencies such as the American Heart Association (AHA) and American College of Sports Medicine. Over the past year, 100% of KIP faculty have peer-review publications and external grant submissions. There is a robust research environment to support PhD students.

• Having a graduate program in the department will increase national and international visibility, which is consistent with the Michigan Tech Strategic Plan, and will assist with enhanced recruitment of premiere students and faculty.

• Federal agencies such as the NIH, NSF, AHA, and American Diabetes Association all have review criteria that address “infrastructure” and “environment”. A graduate program within the department will strengthen our infrastructure and environment, particularly as it pertains to requests for graduate funding.

• Michigan Technological University has established an innovative Doctorate of Physical Therapy (DPT) partnership with Central Michigan University (CMU). This has resulted in 24 CMU DPT students on Michigan Tech’s campus each year. A long-term goal of this DPT partnership is the development of a DPT/PhD option for some of the top students. Such students would receive a DPT from Central Michigan, and a PhD from a Michigan Tech graduate program. We envision several existing PhD programs as potential partners for the DPT degree (i.e., Biomedical Engineering, Mechanical Engineering, Human Factors), and believe a PhD in Integrative Physiology will also be attractive for DPT students.

3. RELATED PROGRAMS
3.1. Related Programs at Michigan Tech
The programs most closely related to the proposed Integrative Physiology PhD program are the Biological Sciences, Applied Cognitive Science and Human Factors, and Biomedical Engineering PhD programs. These programs have several criteria that have been used to assess their success: 1) upon graduation, PhD students have demonstrated the ability to carry out an advanced and original research project, including its written and oral communication; 2) their projects have synthesized knowledge from different scientific disciplines; and 3) PhD students gain experience as research proposal writers. The departments require presentation and defense of a research proposal, and students are expected to participate in the preparation and writing of proposals for internal and external funding. There are sometimes specific coursework requirements for the PhD; and upon approval of the advisory committees, students can choose elective courses tailored to their background and research interests. Emphasis is placed on research and publication of research. The average student completes the PhD in 4-5 years. We have designed our Integrative Physiology Ph.D. with these successful programs as a template.

3.2. Related Programs at Other Institutions in Michigan

There are 3 Physiology PhD and 3 Kinesiology/Movement Science PhD degree programs in Michigan that relate to the proposed degree (see Table 1). The three existing Physiology PhD programs at University of Michigan, Michigan State, and Wayne State are heavily focused on cellular and molecular physiology. The three existing Kinesiology PhD programs at those same institutions are more focused on applied physiology. We envision our program being a balance between those two of important aspects of physiology (i.e., molecular vs. applied), thus offering a unique curriculum and research experience for students. Our program will include both basic and applied courses/research, with a heavy focus on physiological interactions across systems. We evaluated these programs in order to assure that our graduates will be competitive with those from other institutions. We found that many programs have similar course requirements, and generally require some combination of oral and/or written comprehensive examination. Additionally, we benchmarked nationally, and modeled much of the proposed program after the well respected and highly visible Integrative Physiology PhD program at the University of Colorado-Boulder.

Table 1. Related Programs in Michigan

<table>
<thead>
<tr>
<th>Institution</th>
<th>Ph.D. Degree</th>
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<tbody>
<tr>
<td>University of Michigan</td>
<td>Molecular and Integrative Physiology</td>
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<tr>
<td>University of Michigan</td>
<td>Movement Science</td>
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<tr>
<td>Michigan State University</td>
<td>Physiology</td>
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<tr>
<td>Michigan State University</td>
<td>Kinesiology</td>
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<tr>
<td>Wayne State University</td>
<td>Physiology</td>
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<tr>
<td>Wayne State University</td>
<td>Kinesiology &amp; Sport Studies</td>
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4. PROJECTED ENROLLMENT

Our goal is to have 1-2 Ph.D. students for every tenured/tenure-track faculty member. We currently have six tenure-track faculty. As such, we anticipate a steady state number of approximately 6-12 Ph.D. students.

5. SCHEDULING PLANS
We intend to offer the proposed curriculum using a regular scheduling plan consistent with University policy.

6. CURRICULUM DESIGN
Graduate students entering the Integrative Physiology Ph.D. program must have a Master's degree in kinesiology, physiology, biological sciences, or other relevant disciplines. Faculty from the graduate program must approve the admission of graduate student applicants. Admission will be based on holistic review of the student's application package as well as the availability of space in the program. Candidates with a Master's degree that does not include adequate background in physiology may be required to take some pre-requisite courses prior to acceptance and/or enrollment in the advanced coursework required for the PhD degree (determined by graduate director in consultation with graduate faculty).

6.1. Core Degree Requirements
The program of study and research will be planned and supervised by an advisory committee. The advisory committee must approve each candidate's course work and research topic. Students will be required to take a minimum of 30 credits beyond their master's degree, with the following requirements:

Required Core Courses (10-11 credits)
- Advanced Exercise Physiology (EH 5310; 3 credits)
- Molecular Physiology (EH 5600; 3 credits)
- Graduate Seminar (EH 6100; 1 credit)
- At least one of the following statistical courses:
  - Biostatistics for Health Science Research (BE 5550; 4 credits)
  - Regression Analysis (MA 4710; 3 credits)
  - Design and Analysis of Experiments (MA4720; 3 credits)
  - Statistical Methods (MA 5701; 3 credits)
  - Advanced Statistical Analysis and Design I (PSY 5210; 4 credits)
  - Advanced Statistical Analysis and Design II (PSY 5220; 4 credits)

Research Credits (15+ credits)
- A minimum of 15 research credits are required, and includes an independent, peer-reviewed published research study that was designed and executed by the student. This independent research study may or may not be part of the final dissertation.

Elective Courses (as determined by advisory committee)
- A list of approved elective courses within and outside the department is provided in Section 6.3, and this list will be updated annually by the department. Multiple statistical courses are strongly recommended for this degree. Courses not on this list, but deemed relevant and appropriate by the student, can be used ad hoc if written approval is obtained from the primary advisor and KIP department chair.

6.2. Other Degree Requirements

6.2.1. Advisor and the advisory committee
Based on their research interests, graduate students must choose a primary advisor (or co-advisors), no later than the end of the first academic year. The primary advisor must hold a regular or affiliated appointment in the Department of Kinesiology and Integrative
Physiology and will chair the committee. The primary advisor will help the student select members of the advisory committee. The advisory committee (in addition to the primary advisor) will consist of 2 graduate faculty members within the department and at least one graduate faculty from outside the department.

6.2.2. Comprehensive exam
The comprehensive exam will consist of a written and oral examination, and will evaluate fundamental and applied topics in integrative physiology. The primary advisor will be responsible for soliciting the advisory committee members for content and assessment. Graduate students will be encouraged to take the comprehensive exam after about two years of doctoral study (following completion of required coursework).

6.2.3. Dissertation proposal
The dissertation proposal should contain a review of the literature, a problem statement/rationale, study hypotheses, research design, proposed methods/research strategy, and pilot data when possible. The primary advisor, with input from the committee members, can decide on the proposal format.

6.2.4. Written dissertation
The dissertation will be written and prepared under the supervision of the chair and the advisory committee according to the requirements of the Graduate School.

6.2.5. Final oral examination
The final requirement will be a public oral presentation and an oral examination according to the requirements of the Graduate School.

6.3. Course Offerings

6.3.1. Existing graduate courses
The following is a list of existing courses (in various departments) that demonstrates the breadth of courses currently available to students. We have sought input and obtained approval to include the non-departmental courses via the respective department chairs (i.e. BE, BL, MA, and PSY).

BE 5510 - Cardiovascular Engineering
Fundamental cardiovascular pathology and the biomedical engineering approaches being developed and used toward problems resulting in significant cardiovascular deficiency such as myocardial infarction, chronic kidney disease, atherosclerosis, and heart valve disease. Credits: 3.0

BE 5550 - Biostatistics for Health Science Research
An overview course of biostatistical methods used in the health sciences. Topics include a review of undergraduate statistical concepts, NIH, CDC, and FDA guidelines for clinical trial research, proper use of biostatistical methods including anova models, logistic regression, risk analysis, survivorship analysis and any other statistical methods that are common in the enrolled students' discipline. Credits: variable to 4.0

BE 5940 - Introduction to Tissue Engineering
Explore the application of engineering principles toward the construction/reconstruction of human tissue. Fundamental biological principles involved in tissue engineering are reviewed from an engineering perspective with examples of engineered tissues such as
blood vessels, skin, liver, cartilage and bone. Credits: 3.0

**BE 6900 - Biomedical Engineering Topics**
Biomedical engineering courses will be offered as professional electives dependent upon the interest of the faculty. Credits: variable to 6.0

**BL 4010 - Biochemistry I**
Structure, biochemical properties, and function of important biomolecules such as proteins and nucleic acids. Introduces enzyme biochemistry (structure, function, catalysis, kinetics, and inhibition). Credits: 3.0

**BL 4020 - Biochemistry II**
Dynamic aspects of living systems. Broad exposure to cellular metabolic pathways, intermediary metabolism and its regulation and bioenergetics. Credits: 3.0

**BL 4380 - Cardiopulmonary Physiology**
Using a problem-based learning approach, course examines the physiology of the human body. In-class case-study analyses provide in-depth learning about the cardiovascular and pulmonary systems and their relationship with other organ systems. Promotes development of problem-solving skills. Credits: 3.0

**BL 4840 - Molecular Biology Techniques**
Laboratory techniques in molecular biology, including methods of recombinant DNA technology for identification, cloning, and characterization of genes. Credits: 3.0

**BL 5030 - Molecular Biology**
Molecular biology of gene structure, expression and regulation. Molecular techniques and their application to biotechnology and genomes are covered. Credits: 3.0

**BL 5042 - Scanning Electron Microscopy of Biological Specimens**
Hands-on training in operation of the scanning electron microscope (SEM). Students prepare biological specimens of their choice for observation. Emphasis will be placed on application of advanced techniques. Successful completion of course is prerequisite to becoming a certified SEM operator in the ACMAL. Half semester. Credits: 3.0

**BL 5350 - Special Topics in Physiology**
A discussion of recent developments in physiology. Recent offerings have included respiratory physiology, renal physiology, clinical cardiology, and neurophysiology. Credits: variable to 10.0; Repeatable to a Max of 10

**EH 4200 - Sports Nutrition Seminar**
Human nutrition as it specifically applies to athletes. Specific needs for proteins, carbohydrates, fats, electrolytes and micronutrients. Use of ergogenic aids is covered. Students will research, write and present orally their findings on nutrition topics. Credits: 2.0

**EH 4210 - Exercise Physiology**
Focuses on the functional changes brought by acute and chronic exercise sessions. Topics include muscle structure and function, bioenergetics, cardiovascular and respiratory adaptations, exercise training for sport, sport nutrition, ergogenic aids, and other health and fitness topics. Credits: 3.0
EH 4220 - EKG Interpretation
Course is designed for students who are going to pursue future career related to cardiac rehabilitation, physical therapy and students in the Pre-Med program. Students will learn cardiac electrophysiology, the pathophysiology, the diagnosis, and treatment of cardiac arrhythmias, and related cardiovascular diseases. Class will build bridge between basic sciences and human health. Credits: 2.0

EH 4211 - Exercise Physiology Laboratory
A companion course to EH4210. Hands-on experience in making physiological measurements as related to exercise. Cardiovascular and respiratory changes during exercise will be monitored. A virtual lab is used to simulate changes in physiological measurements that cannot be performed on live subjects. A student designed laboratory project is required. Credit: 1.0

EH 4400 - Motor Learning and Control
Designed for upper level undergraduates or graduates, this course will provide the current theories and concepts involved in the processes of motor skill acquisition and performance from a behavioral perspective. Credits: 3.0

EH 4420 - Motor Development
Designed for upper level undergraduates or graduates, this course will focus on the changes in motor behavior across a life span, and examine the study and practice of fundamental patterns within the context of development theory. Credits: 3.0

EH 4500 - Biomechanics of Human Movement
An in-depth view of the biomechanical properties of the musculoskeletal system. The course provides detailed analyses of the kinetics of human movement, material properties of the component tissues, and dynamic processes of adaptation to stress and strain of the system. Credits: 3.0

EH4511 - Biomechanics of Human Movement Lab
A companion course to EH4500. Hands-on experience, including data collection, analysis, and interpretation using various equipment in biomechanics. Credit: 1.0

EH 5310 - Advanced Exercise Physiology
This course focuses on exercise physiology in both humans and rodents. Topics include detailed muscle physiology, fatigue mechanisms, the autonomic nervous system, advanced cardiovascular adaptations with exercise, exercise metabolism, and environmental exercise physiology. The importance of translational research will be highlighted. Credits: 3.0

EH 5320 - Advanced Biomechanics
This course includes the quantitative analysis of human motion through bioinstrumentation during dynamic performance. A detailed analysis of different movements and movement techniques, from both a clinical and exercise science perspective, as well as investigations into the mechanics of tissues and their function, are integral features of this course. Students will also learn how to interpret the data recorded by biomechanical equipment, and how to apply this to the body of knowledge in sport science. Credits: 3.0
EH 5330 - Advanced Motor Behavior
Peer-reviewed literature will be utilized to acquaint students with scholarly issues and topics in motor learning and control that are relevant to their fields. The theoretical concepts related to motor control, motor learning, and motor development will be covered. Students will be expected to design a scientific research study related to their specific interest goals. Credits: 3.0

EH 5350 - Special Topics in Kinesiology
Selected additional topics in kinesiology for advanced students based on interests of faculty and students. Interested students should contact the Exercise Science, Health and Physical Education department. Credits: variable to 9.0; Repeatable to a Max of 9

EH 5500 - Stress Physiology
This course focuses on stress physiology in humans. Topics include neural and hormonal responses to mental stress, interactions between physical and mental stress, bidirectional relations between stress and disease, and health disparities associated with stress. Credits: 2.0

EH 5510 - Advanced Strength and Conditioning
Advanced theory and practice in development and administration of comprehensive strength and conditioning programs for both the athlete and individual of any level. Includes knowledge, safety concerns and skill techniques necessary for teaching and administering any strength and conditioning facility. This will be done through a combination of lecture, seminar, scientific articles and practical experience. Credits: 3.0

EH 5520 - Sleep and Circadian Physiology
This course focuses on the role of sleep and circadian rhythm on physiological control systems. Topics include basic mechanisms of the sleep-wake cycle, role of sleep and circadian clock on cardiovascular and respiratory control, overview and treatment strategies for common sleep disorders, and techniques in sleep medicine research. Course content will be delivered using a combination of lecture, seminar, scientific articles, and group work. Credits: 3.0

EH 5540 - Neuroendocrine Physiology
This course will focus on understanding how the neural and the endocrine system are regulated under both normal physiological conditions and pathophysiological states. The major objective of this course is to prepare graduate students to develop critical thinking and problem solving skills related to the function of the nervous system and endocrine system, and their complex interaction with each other. This will be done through a combination of lecture, seminar, scientific articles, lab techniques, and group work. Credits: 3.0

EH 5900 - Laboratory Techniques for Integrative Physiology
This course will expose graduate students to various methodologies in integrative physiology. Student will rotate between various laboratories and observe techniques such as microneurography, electrophysiology, molecular physiology, muscular fatigue, etc.; both human and animal methodologies will be examined. Credits: 2.0
EH 5920 - Graduate Seminar
Graduate seminars are designed to facilitate critical discussions of student research projects and peer-reviewed research in related fields. The presenter will provide an overview or seminar of the research of interest, which will establish the foundation for the discussion thereafter. Credit: 1.0

MA 4710 - Regression Analysis
Covers simple, multiple, and polynomial regression; estimation, testing, and prediction; weighted least squares, matrix approach, dummy variables, multicollinearity, model diagnostics and variable selection. A statistical computing package is an integral part of the course. Credits: 3.0

MA 4720 - Design and Analysis of Experiments
Covers construction and analysis of completely randomized, randomized block, incomplete block, Latin squares, factorial, fractional factorial, nested and split-plot designs. Also examines fixed, random and mixed effects models and multiple comparisons and contrasts. The SAS statistical package is an integral part of the course. Credits: 3.0

MA 5701 - Statistical Methods
Introduction to design, conduct, and analysis of statistical studies, with an introduction to statistical computing and preparation of statistical reports. Topics include design, descriptive, and graphical methods, probability models, parameter estimation and hypothesis testing. Credits: 3.0

PSY 5010 - Cognitive Psychology
A systematic survey of classical and contemporary research topics in human information processing and learning. Topics include models of cognition, perception/pattern recognition, attention, the nature of mental representation and processing; the architecture of memory, imagery, concepts, and prototypes; reasoning, decision making, problem solving, and cognitive development. Credits: 3.0

PSY 5210 - Advanced Statistical Analysis and Design I
An overview of research ethics, experimental design, proposal writing, and univariate statistics such as t-tests and ANOVA. Credits: 4.0

PSY 5220 - Advanced Statistical Analysis and Design II
A continuation of PSY 5210 covering multivariate and nonparametric statistics such as MANOVA, ANCOVA, Multiple Regression, faction analysis, and Chi Square. Credits: 4.0

PSY 5850 - Human Factors Psychology
Advanced concepts critical to the design of human-technological systems, such as capitalizing upon human capabilities and compensating for human limitations. Topics may include perceptual and motor abilities, human error and cognitive engineering. Credits: 3.0

PSY 6991 - Special Topics in Human Factors
Study of special topics in human factors as designed by section title. Credits: variable to 3.0; Repeatable to a Max of 9
6.3.2. New graduate courses

The Department of Kinesiology and Integrative Physiology will offer the following new graduate courses for this program. We have the expertise and sufficient number of research-active faculty to deliver this curriculum. Course proposals for the Curriculum Binder Process, as well as draft syllabi, are included in Appendix A.

**New core courses:**
- EH 5600 - Molecular Physiology (3 credits)
- EH 6900 - Doctoral Research in Integrative Physiology

**New elective courses:**
- BL 5044 - Human Pathophysiology
- EH 4990 - Exercise Pharmacology (2 credits)

7. NEW COURSE DESCRIPTIONS

**BL 5044 - Human Pathophysiology**
Human Pathophysiology will cover abnormal function (physiology) and investigate the signs and symptoms of major diseases in humans. The course will be an extension of Anatomy & Physiology (BL2010 and BL2020) by working through the systems of the human body. The course will include a clinical focus and will regularly use a case-study approach. Credits: 3.0

**EH 5600 - Molecular Physiology**
The purpose of this course is to introduce how different biochemical and molecular pathways of the cell work together to produce various physiological functions. Emphasis will be placed on the molecular and cellular mechanisms underlying physiological processes. Structure and function relationship will be addressed throughout the course. Recently published research articles in the area of molecular and cellular physiology will be discussed. Credits: 3.0

**EH 6900 - Doctoral Research in Integrative Physiology**
An original investigation in theoretical or experimental physiology, or both, and submission of a dissertation in partial fulfillment of the requirements for the PhD degree. Credits: variable up to 9.0 per semester

**EH 4990 – Exercise Pharmacology**
This course focuses on understanding the fundamental concept of pharmacology and pharmacological treatment of diseases of various systems including cardiovascular, respiratory, endocrine, neuronal, hormonal and renal systems. Class will build bridge between basic sciences and human health. Credits: 2.0

8. LIBRARY AND OTHER LEARNING RESOURCES
The existing library and learning resources are adequate for the proposed graduate degree; no new resources are requested.

9. COMPUTING ACCESS FEE
No applicable fee

10. CORE AND AFFILIATED FACULTY (RESUMES)
The KIP department has six tenure/tenure-track faculty, as well as several key affiliated or adjunct faculty, that will assist with the proposed degree. The curricula vitae of these faculty members are available at the following website:

http://www.mtu.edu/kip/graduate/doctorate

10.1. Core KIP Faculty

Jason R. Carter, Ph.D.; Professor and Department Chair  
Research Interests: Neural control of circulation, sleep physiology, sympathetic reactivity to mental stress, human performance

Qing-Hui Chen, Ph.D.; Associate Professor  
Research Interests: Neurophysiology, cardiovascular physiology, cardiovascular diseases, metabolic disorders

Zhiying (Jenny) Shan, Ph.D.; Assistant Professor  
Research Interests: Neuroinflammation, neurogenic hypertension, salt sensitive hypertension

Tejin Yoon, Ph.D.; Assistant Professor  
Research Interests: Biomechanics, muscle fatigue, neuromuscular control of human movement

Steven Elmer, Ph.D.; Assistant Professor and Graduate Director  
Research Interests: Muscle physiology, biomechanics, rehabilitation, pedagogy

Kevin Trewartha, Ph.D.; Assistant Professor  
Research Interests: Aging, motor learning; sensorimotor neuroscience

Christopher Schwartz, Ph.D.; Lecturer and Graduate Internship Coordinator  
Research Interests: Autonomic integrative physiology, hypertension, orthostatic intolerance, human performance

Stephanie Hamilton, Ph.D.; Instructor and Undergraduate Internship Coordinator  
Research Interests: Biomechanics, aging, muscle stiffness

10.2. Affiliated and Adjunct Faculty

John J. Durocher, Ph.D.; Assistant Professor, Department of Biological Sciences  
Research Interests: Arterial stiffness, blood pressure, exercise recommendations, metabolic syndrome

L. Syd Johnson, Ph.D.; Assistant Professor, Department of Humanities  
Research Interests: Bioethics, neuroethics, brain injury, concussion

Mark Randell, PT, DPT, FAAOMPT; Director of UP Health System Portage Rehab  
Research Interests: Sports medicine and rehabilitation, human performance
Carl Smoot, D.O.; Director of the Portage Health Sleep Disorders Center
Research Interests: Sleep deprivation and neural control, sleep apnea, sleep and sports performance

Cameron Williams, PT, DPT, MS; DPT Site Coordinator, Central Michigan University
Research Interests: Sports medicine and rehabilitation, human performance

11. DESCRIPTION OF AVAILABLE/NEEDED EQUIPMENT
The KIP department currently has all of the necessary equipment for the proposed program. The department includes six designated research and/or teaching laboratories related to exercise and integrative physiology, biomechanics, and motor behavior. Some relevant pieces of equipment available for this program include:

Integrative Physiology Laboratory
- Microneurography nerve traffic analysis system
- Electrocardiogram units and amplifiers
- Pneumobelt for respiratory excursions
- Venous occlusion plethysmography for limb blood flow measurements (calf and forearm)
- Automated sphygmomanometer – four units
- Wrist actigraphy for sleep monitoring – four units
- Finger plethysmography (i.e., Finometer) for beat-to-beat blood pressure recordings
- 24 hour ambulatory blood pressure monitoring system -- four units
- Limb actigraphy system -- eight units
- Motorized tilt table
- Lower body negative pressure chamber
- Phlebotomy chair and all equipment/accessories needed for venipuncture

Exercise Physiology and Human Performance Laboratory
- Portable Doppler ultrasound system (GE Logiq e)
- Two Metabolic measurement systems (ParvoMedics), including one with spirometry and cardiac output attachments
- Wireless surface EMG system
- Various cycle ergometers for lower- (6) and upper- (4) body submaximal and maximal exercise testing
- Fat calipers, underwater body weighing, and other body composition equipment
- DEXA Scanner

Human Biomechanics Laboratory
- Six Vicon motion-capture cameras
- In-ground force plate in biomechanics laboratory with motion-capture cameras
- Blood lactate analyzers -- two units
- Multi-use Biopac systems for EMG, EEG, ECG, etc.
- Biodex machine for isokinetic testing
- Electrical stimulator and transcranial magnetic stimulator
- Optitrack motion capture system with 8 cameras
- Delsys wire and two wireless EMG system with motor unit decomposition options

Motor Learning and Cognitive Aging Laboratory
- KINARM integrated 2-D virtual reality robotic manipulandum for studying the control of upper limb movement
Molecular Physiology Laboratory

- Radio telemetry transducer system for rat blood pressure and activity recording
- Metabolic cage system for rat metabolism study
- Biotek synergy plate reader for DNA, RNA and protein concentration measurement, and fluorescence intensity assessment
- Biosafety cabinet
- CO₂ incubator for cell culture incubation
- Inverted Leica fluorescence microscope
- PCR machine, electrophoresis system, western blot transfer system
- Backman centrifuge 5804R
- Bacterial incubator

Electrophysiology Laboratory

- Olympus microscope with DIC optics and epifluorescence capabilities
- Amplifier and accompanying computer with data acquisition/analysis software
- Analog-to-digital converters
- Perfusion system
- Bath chamber temperature controller
- Vibrating microtome
- Microelectrode puller
- Digital CCD camera with image analysis software
- Respirators and CO₂ monitors
- Pressure injector
- Stimulator (Master-8, A.M.P.I.) with voltage isolator
- Olympus brightfield microscope
- Tail cuff blood pressure measurement system

Additionally, the KIP department also has shared oversight of departmental exercise training equipment within the Student Development Complex. Specifically, students will have access to the 7,256 ft² student exercise training complex for aerobic and resistance training (i.e., strength and conditioning curriculum). Equipment available in this training complex include:

- **Aerobic equipment**: 12 stationary bicycles, 14 treadmills, 6 elliptical machines, 3 stairmaster machines, 3 rowing ergometers
- **Resistance equipment (free weight)**: 2 full sets of 100 lb (5 lb increment) dumbbells, barbells (10-110 lbs), 5 free weight bench press units (1 incline and 1 decline), 3 squat racks, 1 military press, 3 dual cable crossover units
- **Resistance equipment (free motion and hammer strength machines)** for: bicep, tricep, deltoid, pectoralis, latissimus dorsi, rhomboids, hamstring, quadriceps, gastrocnemius, soleus, and abdominal muscles

There is sufficient equipment and space currently available for the proposed graduate degree, and no new resources are requested for equipment. The department expects to continue making strategic investments of available internal (i.e., department general fund, laboratory fees, summer teaching return, etc.) and external (i.e., external research grants) resources to build upon the existing infrastructure.

### 12. ESTIMATED PROGRAM COSTS
We project a gradual enrollment increase to a 3rd year steady state of 8 PhD students, and estimate costs and revenue for this new program in Table 2. The following assumptions are included in this estimate:

- The department has had two funded GA lines granted to through the original Exercise Science B.S. degree approved in 2006, and have served a vital role in assisting with laboratory teaching and research within the department, as well as beyond the department (assisting with Anatomy & Physiology laboratories in Biological Sciences). Since 2006, we have added a B.S. in Sports and Fitness Management (2008) and a M.S. in Kinesiology (2014), but have not requested any new GA lines. Therefore, these two original GA lines are “funded” through revenue generated from our existing B.S. and M.S. degrees, thus are not included as expenses within the program cost analysis.
- The program cost analysis assumes 5% increase per year for both graduate tuition and minimum stipend amounts as posted by the Graduate School.
- The program cost analysis assumes 1:1 ratio of external/self-supported students at regular tuition rate (9 credits/semester) vs. research-only tuition rate (3 credits/semester) in 2017-18 and 2019-20, and 2 regular vs. 1 research-only externally/self-supported students in 2018-19.
- By year 3, we strive to have a 1:1 ratio of internal vs. externally/self-supported PhD students in our program.

Table 2. Program Cost Analysis

<table>
<thead>
<tr>
<th></th>
<th>2017-18</th>
<th>2018-19</th>
<th>2019-20</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total # of projected Ph.D. students</td>
<td>6</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td>Existing GA lines</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>New GA lines</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>External/Self-Supported</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Tuition per credit</td>
<td>$905</td>
<td>$950</td>
<td>$998</td>
</tr>
<tr>
<td>External/self-support credits</td>
<td>24 credits</td>
<td>42 credits</td>
<td>48 credits</td>
</tr>
<tr>
<td>Tuition revenue from external/self-support</td>
<td>$21,720</td>
<td>$39,900</td>
<td>$47,904</td>
</tr>
<tr>
<td>Cost of 2 new GA stipends</td>
<td>$32,502</td>
<td>$34,127</td>
<td>$35,833</td>
</tr>
<tr>
<td>Income developed from program</td>
<td>-$10,782</td>
<td>$5,773</td>
<td>$12,071</td>
</tr>
</tbody>
</table>

We recognize additional resources required for student recruitment and other administrative duties, but these will be handled by existing departmental budgets.

Appendix B includes additional budgetary information per University Senate policy 51-04.

13. SPACE
There are no new requests for additional space related to this program.

14. POLICIES, REGULATIONS, AND RULES
All policies, regulations, and rules have been previously outlined, and are superseded by University policy (including Graduate School policies).

15. ACCREDITATION REQUIREMENTS
There are no specific accreditation requirements.

16. INTERNAL STATUS OF THE PROPOSAL
This proposal has been preliminarily reviewed and modified in consultation with the KIP department faculty, KIP graduate director, and KIP chair. We are now seeking review and feedback from the following: Dean of the College of Sciences and Arts, College of Sciences and Arts College Council, Dean of the Graduate School, Graduate Faculty Council, Provost and Deans Council, and University Senate.

17. PLANNED IMPLEMENTATION DATE
We aim to have this degree available in Fall 2017.

Introduced to Senate:
Adopted by Senate:
Approved by Administration:
Approved by Board of Control:
Accelerated Master’s Through Negotiated Agreements Policy

Introduction

A double-counting proposal was submitted to the Graduate Faculty Council in November of 2015 by Dr. Min Song from the computer science department. His intent was to utilize double-counting of credits towards two degrees within a negotiated 3+1+1 agreement. This proposal did receive the support of the Graduate Faculty Council. It has since been determined that Senate approval is needed for both the 3+1+1 concept and accelerated master’s through negotiated agreement to move forward. The Senate Academic Committee has been notified that the following proposal is being reviewed by the Graduate Faculty Council. If it moves forward to the Senate Academic Committee for review, they have been asked if it should be in the form of a new proposal or an amendment to the already approved Accelerated Master’s Programs Proposal (Senate 13-11).

Background

Currently we are seeing strong interest and growth in our accelerated master’s programs from Michigan Tech undergraduate students. There are significant benefits for our students to pursue accelerated degrees. The benefits for students include:

- Higher starting salaries and lifetime earnings
- Reduced time-to-degree
- Ability to double-count up to six credits towards their bachelor’s and master’s degrees
- Eligibility to use Senior Rule credits

To leverage the success and broaden the interest in our accelerated master’s programs these benefits could be extended to students at select colleges/universities throughout the world. The initial goal for this concept would be to target accredited US institutions with high concentrations of domestic students to bolster our domestic graduate student population. This type of agreement could be effective in creating a streamlined pathway for Historically Black Colleges and Universities (HBCU) students to our campus. Also, institutions like Rose-Hulman Institute of Technology, Milwaukee School of Engineering, Northland College, and Alma College would be schools to target for an accelerated master’s partnership. These are accredited institutions with a high percentage of quality domestic students and few, if any graduate programs.
<table>
<thead>
<tr>
<th>Institution</th>
<th>Undergraduate Enrollment</th>
<th>% Domestic Students</th>
<th>Graduate Programs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rose Hulman Institute of Technology</td>
<td>2,233</td>
<td>96%</td>
<td>11 no PhD</td>
</tr>
<tr>
<td>Northland College</td>
<td>584</td>
<td>98.5%</td>
<td>0</td>
</tr>
<tr>
<td>Alma College</td>
<td>1,451</td>
<td>99%</td>
<td>0</td>
</tr>
<tr>
<td>Milwaukee School of Engineering</td>
<td>2,939</td>
<td>87.8%</td>
<td>10 no PhD</td>
</tr>
</tbody>
</table>

If this policy was in place, the Graduate School would look for faculty who have relationships and connections to other institutions to champion the agreements. Faculty are the key to this concept; they need to feel comfortable with the rigor and quality of the programs in the negotiated agreement. To ensure the highest quality of participating students, Michigan Tech faculty will be asked to review the curricula and determine the coursework that can be double-counted for the accelerated master’s.

**Proposal**

To increase the growth of master's students, the Graduate School is proposing that students from targeted colleges/universities be allowed the privilege of participating in our Accelerated Master's programs through negotiated agreements. This privilege would only be allowed if:

- The agreement is supported by the Dean of the Graduate School
- The agreement is supported by the academic program housing the Michigan Tech accelerated master’s program
- The participating institution is accredited
- The faculty of the academic program at Michigan Tech has reviewed the participating college/university's program curriculum and coursework and identified the coursework credits which could be double-counted
- The participating students meet all of Michigan Tech’s academic and GPA requirements for both the Senate Accelerated Master's Policy and the individual accelerated master’s program
- The maximum number of credits that can be double-counted does not exceed six
- The student applies and is accepted before receiving their bachelor’s degree
- The student enrolls within one semester after receiving their bachelor’s degree

This proposal may also be applied to students who are participating in an active 3+1+1 negotiated agreement.
Students who are seeking admission to accelerated master’s programs through a negotiated agreement will need to apply to the Graduate School through our standard application process and be accepted by the academic programs. They would also receive the benefits of our current transfer credit policy - http://www.mtu.edu/gradschool/administration/academics/policies-procedures/transfer/. This would be their "Senior Rule".

The Graduate School recommends having a common set of admission requirements for negotiated accelerated master’s agreements. Student applicants must submit the following:

- Graduate School Application (Indicating that they are part of a negotiated agreement)
- Student Statements
- Official Transcripts
- TOEFL (If student’s bachelor’s degree is from an international institution)
- 2 Letters of Recommendation (Recommended)
- Resume/Vitae (Recommended)
- No GRE/GMAT Required (Recommended)

Rationale

For negotiated agreements to be successful, there must be an incentive for students and institutions to participate. This proposal provides a streamlined application process with financial and time-to-degree incentives for qualified students. At the institutional level, it allows for partner institutions to start a collaborative relationship with Michigan Tech and provide their students with new graduate level opportunities that are not available at their institutions. For Michigan Tech, the proposal allow us to strategically target and select institutions with desirable student populations for our graduate programs. It will allow us to incentivize students to apply to our programs, while maintaining admissions control by our faculty.
**Background:**
Full-time enrollment is generally defined as nine credits in an academic semester and at least one credit in the summer. We have several exceptions in place to allow students to be full-time at less than nine credits. See our web page for all current exceptions.

The Graduate School is reviewing all of our web pages and has found an exception in place that doesn’t seem to serve a purpose at this time and is not being used. We would like to request removal of this exception.

**One current exception:**
A graduate student taking fewer than nine credits during an academic-year semester is considered full-time at Michigan Tech in the following instance:

- The student has successfully completed all of the courses required for their course work only degree during the preceding semester (including summer).

**Proposal:**
Remove the exception that a coursework student can be full-time at less than nine credits for the semester following completion of their required coursework for the following reasons:

1. International students who have completed their coursework requirements are not able to remain at Michigan Tech after degree completion, so this rule does not assist them.
2. Students may be hired as student employees for one semester following degree completion, so this rule does not assist them.
3. This rule has not been utilized by any students in recent memory.
4. It does not seem ethical to allow students to be full-time at less than nine-credits when their degree requirements are complete.

Domestic students who wish to further defer their loans because of their full-time student status would be affected by removing this rule. Per Financial Aid, students may qualify for other deferments, so it does not seem necessary to provide an additional mechanism.