Disability Disciplines Doctoral Program

Specialization in Pathokinesiology

Rationale

The Ph.D. program in Disabilities Disciplines promotes the study of disabilities from multiple perspectives including special education, behavior analysis, rehabilitation counseling, speech-language pathology, disabilities studies, and Pathokinesiology. The Pathokinesiology specialization focuses on the scientific study of human movement (kinesiology) as it relates to any abnormal condition (patho) affecting movement and postural dysfunctions. The ultimate goal of research in Pathokinesiology is to help improve the quality of life of individuals who have movement and postural dysfunctions.

The Pathokinesiology specialization will combine strong interdisciplinary experiences with focused disciplinary studies in Pathokinesiology. This training model is aligned with recommendations from the National Institute of Health (NIH) Biomedical Research Group which recently stated that, interdisciplinary training is important to prepare individuals for “careers that involve translational research and development,” and to promote diversity of trainees and the biomedical workforce. Specifically, “many biomedical researchers believe that the greatest potential for scientific advances lie in broader, interdisciplinary research efforts.”

Many Ph.D. programs in kinesiology (or movement science) exist at other institutions; however, the Pathokinesiology specialization is unique in its interdisciplinary nature and its focus on the principles of kinesiology in the context of psychological and physical disability. Graduates of this specialization will be better trained than their peers at other institutions for careers in which a multidisciplinary understanding of ability and disability is crucial. For example, graduates will understand issues of movement or postural dysfunction after stroke in the context of how the disability and specific movement abilities may affect life participation, occupation, mood, and caregiver well-being.

Overview of Specialization

The Disability Disciplines Doctoral Program is a cross-department program administered by the Department of Special Education and Rehabilitation and coordinated by an interdepartmental committee chaired by Dr. Tim Slocum. The Pathokinesiology specialization will be coordinated by Dr. Eadric Bressel. Participating departments and centers include the Department of Special Education and Rehabilitation, the Center for Persons with Disabilities, and the Department of Communicative Disorders and Deaf Education. The program includes six specializations: Special Education, Applied Behavior Analysis with Individuals with Disabilities, Rehabilitation Counseling, Disabilities Studies, Speech-Language Pathology, and Pathokinesiology. The specializations within
the Disabilities Disciplines program share a common core of courses and seminars based on a common professional interest in individuals with disabilities. Each specialization also includes focused disciplinary content and experiences.

Utah State University has a long-standing national reputation in research, service, and training in areas related to individuals with disabilities. The graduate programs in Special Education and in Rehabilitation Counseling were each ranked in the top 20 in the nation by the 2012 US News & World Report Annual Survey of Graduate Schools in the U.S. These are the only two, top-20 programs at USU and two of only four in the State of Utah. The Center for Persons with Disabilities has been a national leader in research and development for over 40 years. Disability-related research and training constitutes the overwhelming majority of external grant funding that comes to the College of Education and Human Services at USU.

There are several advantages for having the Pathokinesiology specialization within the Disabilities Disciplines PhD program. First, it will increase the capacity for research, training, service, and grant development in the Department of Health, Physical Education, and Recreation. Second, the addition of the doctoral specialty area will have substantial benefit for recruiting new faculty. Third, the new specialization will support the University’s effort to strengthen and increase graduate programs in general and doctoral training in particular.

The new specialization in Pathokinesiology shares the core curriculum in the existing Disability Disciplines doctoral program. That core is described below. Subsequent components of this proposal describe the courses, seminars, and internships within the specialization.

Existing Core Courses:

**EDUC 6570 Introduction to Educational and Psychological Research** (3 credits) Introduction to research methods including identifying research questions, conducting research literature reviews, and design and implementation of research projects.

**EDUC 6600 Measurement, Design, & Analysis** (3 credits) This course integrates concepts in measurement, research design, and statistical analysis for research in psychology and education.

**SPED 7920 Doctoral Orientation Seminar** (2 credits) Orients new students to the doctoral program including career planning, program planning, fundamental concepts of scientific research and literature review, and knowledge of the available facilities and faculty members.

**SPED 7940 Journal Reading Group** (1 credit*2 semesters) Under faculty direction, students read and discuss published research. Students learn to critique empirical and theoretical papers as well as current research findings in important areas of Disability Disciplines.
**SPED 7400 Multicultural Issues in Disability** (3 credits) This seminar focuses on the juxtaposition of disability and ethnic/cultural/linguistic diversity. Three broad areas are presented. The first area focuses on the ethnic/cultural/linguistic demography of disability. The second area focuses on the prejudice, discrimination, and handicapism and the ways in which these forces impact an individual who has a disability and who is a member of an ethnic/cultural/linguistic minority group. The third area focuses on practice applications, translating the concept of the first two areas into practical suggestions for professional practice.

**SPED 7820 Cross-Specialization Topical Seminars** (3 credits*2 semesters) In-depth study of special topics in special education, rehabilitation, behavior analysis, and disabilities studies. Seminars examine historical aspects, relevant research, and theoretical positions on selected topics.

**Subtotal = 19 credit hours**

Professional Products and Internship – A set of professional products and internships are required of all students in the Disability Disciplines Doctoral Program. These products and experiences provide opportunities for mentored experience in critical professional skills. They are mentored by faculty within the student’s specialization and shaped to be appropriate to that specialization.

**Portfolio Products and Experiences-mentored by Discipline Faculty**

**PEP 7040 Review of Literature** (1 credit) Guided experience in conducting a comprehensive and systematic review of literature on a topic related to Pathokinesiology.

A review topic in Pathokinesiology will be approved by the major professor prior to initiation of the systematic review. The content of the literature review will then be presented systematically in the form of a text document. It is recommended that the literature review be completed during the first year of doctoral study. However, the exact nature and timing of the assignment will be at the discretion of the major professor and advisory committee.

**PEP 7070 Grant Writing** (1 credit) Guided experience in preparation of grant proposals.

Students will attend a regional grant writing workshop for doctoral students and help prepare a major grant application on a topic in Pathokinesiology. The specific topic and funding agency will be determined by the major professor and the exact timing of the assignment will be at the discretion of the major professor and advisory committee.

**PEP 7060 Research Internship** (1 credit* 2 semesters) Guided experience in conducting research on topics of Pathokinesiology.

Under the direction of a member of the advisory committee, doctoral students will initiate and conduct at least two research experiences in Pathokinesiology.

A research proposal should be approved by the major professor prior to initiation of each project. It is expected that these research projects will
involve development of a research design, data collection and analysis, and interpretation of results.

**PEP 7080** Publication (1 credit* 2 semesters) Individualized experience in which the student writes and submits a scholarly manuscript for publication in peer-reviewed academic journals.

At least two studies will be written for publication and submitted to peer-reviewed journals. These manuscripts may be derived from the activities of the PEP 7060 research internships. It is expected that submission of publications for PEP 7080 will occur before dissertation studies. Additionally, it is not a requirement that manuscripts submitted for publication be “published” to meet this competency.

**PEP 7090** Conference Presentation (1 credit) Individualized, supervised experience in which the student identifies an appropriate conference and then makes a professional presentation.

Topics for presentation should be approved by the major professor and could include those approved for PEP 7060 described above. Specifically, students will be required to first present regionally at a departmental Research Colloquium and then nationally at a conference specific to Pathokinesiology. The departmental presentations will be attended by members of the departmental community (faculty and graduate students), and will consist of a presentation and questions from the advisory committee and the audience. The advisory committee will then deliberate privately to determine whether the work is considered acceptable, and if not, to formulate recommendations for improvement and later resubmission for approval.

**PEP 7340** College Teaching Internship (1 credit) Guided experience in teaching university courses in kinesiology.

The primary responsibility of the students will be teaching at least one course under the supervision of a HPER faculty member. Students must play a primary role in designing the course. The material shall include a detailed syllabus, reading list, assignments, and handouts/overheads/slides. At the discretion of the committee, the course may be an adaptation of an existing course, or it may be a course in a topic area in which the student has not previously taught.

**PEP 7330** Supervision Internship (1 credits) Guided experience in supervising undergraduate and master’s students during practica, student teaching, and other field experiences.

**Subtotal = 9 credit hours**

In addition to the common core coursework and the products and internships, the student must complete the following course requirements:
1. Program Specialization: Courses and seminars that provide in-depth knowledge of his/her chosen area of specialization in Pathokinesiology (13 credits). A list of these possible courses may be found on page 7.

2. Research Tools (from list of electives): A minimum of 6 credit hours in research design and or data analysis in addition to the core courses.

3. Dissertation (PEP 7970): A minimum of 12 credit hours of dissertation. The dissertation is a major research investigation of an original idea. The student first works closely with his/her major professor to prepare a concise and understandable prospectus. After the prospectus has been circulated to the student's dissertation committee, a formal meeting is held and the committee approves or rejects the proposed dissertation project. It will be required that the dissertation will follow a multiple paper format and that papers completed to fulfill research internship and publication requirements may NOT be included in the set of papers submitted as a dissertation. The format of the individual papers will follow the scholarly journal guide for authors.

**Subtotal = 31 credit hours**

**Total credit hours for specialization = 59**

**Admission to Candidacy**

The student is admitted to candidacy for the doctoral degree in Pathokinesiology when the following requirements have been successfully completed. These are not necessarily listed in order of completion:

1. Course Work. Completion of all courses listed on the program of study and approved by the advisory committee with a grade of A or B (B or higher).

2. Annual Review. Each student will submit an annual report (similar to that prepared by academic faculty) documenting achievements from the previous year. The student's academic advisor will present this report for discussion with the advisory committee at the Spring review of graduate student progress.

The advisory committee will review the progress of doctoral students each year. Students will be informed of the evaluation of progress in writing by the specialization coordinator, and a copy of the letter will be placed in the students’ graduate file in the Graduate Adviser's office. Three types of recommendations are made:

   a) the student may continue in his/her program;
   b) the student will be placed on probationary status; or
   c) the student will be terminated.

If a student is placed on probation, the procedure for being removed from probation will be specified in the evaluation letter. When necessary, termination from the doctoral program may be recommended by the advisory committee. Termination is subject to approval by the Dean of the Graduate School. The Chair of the HPER Department will confer with the student if the recommendation includes termination of a teaching assistantship or fellowship.
3. Portfolio Review. The student must prepare a portfolio of their accomplishments for review by the advisory committee. Included in the portfolio will be each of the products and internships listed above. When all the coursework on the program of study has been completed, the student will present a portfolio to the advisory committee at a meeting. The portfolio will be defended orally, with special attention to the way the body of work relates to the existing work in the relevant field(s) of study. This oral defense may be considered the culminating experience of the doctoral work program which is the last step leading to candidacy. Please note the portfolio must be completed and approved prior to the approval of a dissertation proposal.

4. Preliminary Exams. Students will complete a preliminary exam which is conducted after approximately one year of full time study (or the equivalent) and provide a focus for students to attain foundational skills in research design and critique, and disciplinary knowledge. This three part exam is completed across a three day period. Components of the exam are:

   a) Foundations of Pathokinesiology. Specific questions focus on key foundational knowledge of Pathokinesiology.
   b) Design of Research. The student outlines the research design of a research project on a given topic relevant to kinesiology.
   c) Critique of Research. The student critiques a manuscript within Pathokinesiology.

Each of the three sections (a, b, and c) of the preliminary exam will be graded separately as pass or fail. The exam will be graded by the student’s advisory committee and if a student fails any section on his/her first attempt, they may petition the Disability Disciplines Doctoral Committee to retake failed sections. No more than two attempts to pass the preliminary exam will be allowed.
In addition to the Disability Disciplines core coursework, the Pathokinesiology Specialization requires a minimum of **13** credits of specialization coursework selected from the following:

**Proposed Pathokinesiology Course Schedule**

<table>
<thead>
<tr>
<th>Year 1</th>
<th>Course Prefix and Number</th>
<th>Course Title</th>
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</table>
| Fall   | PEP 6XXX/7XXX            | Topics in Biomechanics (2 credit)  
The course will review basic kinematic and kinetic principles and discuss their application to kinesiology. Topics of emphases may include flexibility, vibration, and balance. A strong emphasis will be placed on interpretation of the scientific literature in the topics of interest. |
|        | PEP 6XXX/7XXX            | Neural Basis Motor Function and Dysfunction I (2 credits)  
This course will review fundamental neuroanatomy and neuroscience to establish a working understanding of the motor system, ranging from the cellular to systems level and including topics such as neurophysiology and neuroplasticity. |
| Spring | PEP 7XXX                 | Special Topics in Pathokinesiology (1 credit)  
In-depth study of special topics in Pathokinesiology will include seminars on motor variability, motor learning, muscle mechanics, motor behavior, laterality, biomechanics of injury, and methods in kinesiology. |
|        | PEP 6XXX/7XXX            | Motor Development (2 credits)  
Overview of human movement and behavior changes across the lifespan. Students will acquire knowledge related to phases of motor development, milestones, critical periods, neuroplasticity, and gerontology, as well as theories related to motor development including nature vs. nurture. |

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<tr>
<th>Year 2</th>
<th>Course Prefix and Number</th>
<th>Course Title</th>
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<tbody>
<tr>
<td>Fall</td>
<td>PEP 7XXX</td>
<td>Special Topics in Pathokinesiology (1 credit)</td>
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</table>
| Spring | PEP 7XXX                 | Fundamentals of Motor Behavior (2 credits)  
Principles and theories of motor control and their relevance to exercise science, sport and rehabilitation. Topics include information processing, dynamical systems, coordination, sensorimotor integration, ability, skill and expertise. Emphasis on critical evaluation, understanding, and interpretation of the scientific literature. |
### Year 3

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<th>Course Prefix and Number</th>
<th>Course Title</th>
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<tr>
<td>Fall</td>
<td>PEP 7XXX Special topics in Pathokinesiology (1 credit)</td>
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### Year 4

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<th>Course Prefix and Number</th>
<th>Course Title</th>
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<tr>
<td>Fall/Spring</td>
<td>PEP 7970 Dissertation</td>
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### ELECTIVE COURSES WHICH MAY BE SELECTED TO SUPPORT PATHOKINESIOLOGY (minimum of 6 credits)

<table>
<thead>
<tr>
<th>Course number</th>
<th>Name</th>
<th>Credits</th>
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<tbody>
<tr>
<td>PSY 6650</td>
<td>Theories of Learning: Behavioral Perspective</td>
<td>3</td>
</tr>
<tr>
<td>PSY 7100</td>
<td>Biological Basis of Behavior</td>
<td>3</td>
</tr>
<tr>
<td>PSY 6810</td>
<td>Advanced Topics in Psychophysics</td>
<td>3</td>
</tr>
<tr>
<td>PSY 7820</td>
<td>Neuropsychology</td>
<td>3</td>
</tr>
<tr>
<td>BIOL 6100</td>
<td>Neurobiology</td>
<td>3</td>
</tr>
<tr>
<td>PEP new class/modules</td>
<td>TBD</td>
<td>3</td>
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<tr>
<td></td>
<td><strong>Computer Science</strong></td>
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<tr>
<td>CS 5400</td>
<td>Computer Graphics I</td>
<td>3</td>
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<tr>
<td>CS 6400</td>
<td>Computer Graphics II</td>
<td>3</td>
</tr>
<tr>
<td>CS 7660</td>
<td>Robotics and Autonomous Systems</td>
<td>3</td>
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<tr>
<td>CS 7940</td>
<td>Brain Building</td>
<td>3</td>
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<td></td>
<td><strong>Mechanical and Aerospace Eng.</strong></td>
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<tr>
<td>MAE 5440</td>
<td>Computational Fluid Dynamics</td>
<td>3</td>
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<tr>
<td>MAE 6410</td>
<td>Fluid Dynamics</td>
<td>3</td>
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<tr>
<td>MAE 5300</td>
<td>Vibrations</td>
<td>3</td>
</tr>
<tr>
<td>Course Code</td>
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<tr>
<td>MAE 6180</td>
<td>Dynamics and Vibration</td>
<td>3</td>
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<tr>
<td>MAE 7380</td>
<td>Advanced Dynamics and Vibration</td>
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<tr>
<td><strong>Electrical Eng. and Computers</strong></td>
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<tr>
<td>ECE 6350</td>
<td>Robotics</td>
<td>3</td>
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<tr>
<td><strong>Mathematics</strong></td>
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<tr>
<td>MATH 6410</td>
<td>Ordinary Differential Equations</td>
<td>3</td>
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<tr>
<td>MATH 5460</td>
<td>Intro Theory Appl Nonlinear Dynam Sys</td>
<td></td>
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<tr>
<td><strong>Statistics</strong></td>
<td></td>
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<tr>
<td>STAT 5100</td>
<td>(QI/CI) Linear Regression and Time Series (F)</td>
<td>3</td>
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<tr>
<td>STAT 5200</td>
<td>Design of Experiments (Sp)</td>
<td>3</td>
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<tr>
<td>STAT 5600</td>
<td>Applied Multivariate Statistics (CI)</td>
<td>3</td>
</tr>
<tr>
<td>STAT 6180</td>
<td>Time Series</td>
<td>3</td>
</tr>
<tr>
<td>STAT 6190</td>
<td>Wavelet Methods for Time Series</td>
<td>3</td>
</tr>
<tr>
<td><strong>Other</strong></td>
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<td></td>
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<tr>
<td>COMD 7530</td>
<td>Balance Evaluation and Management</td>
<td>3</td>
</tr>
<tr>
<td>SPED 7700</td>
<td>Single Subject Design</td>
<td>3</td>
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Brief Summary of Pathokinesiology Faculty Research Interests:

Breanna Studenka, PhD (Motor Control):

Research will focus on the planning and production of sequential and rhythmic movements. Doctoral students will be involved with research projects exploring the role of social/contextual factors on characteristics of movement variability, potential therapeutic interventions for persons with movement disorders specifically related to control of sequential, timed movement, and cognitive mechanisms of planning sequential movements based on perception and estimation of postural characteristics.

Specific research questions might be:

- How do people with sensory impairment re-weight the use of visual information when navigating through complex environments?
- How does the time and frequency structure of motor variability change over the course of disease and aging?
- Can we manipulate discrete characteristics of movement, typically difficult for people with Parkinson's disease to perform, making them more continuous and easier to perform?
- Does a person's perception of their ability to perform certain tasks (e.g., due to obesity or disease) influence the difficulty of the activities they choose to perform leading to increased inactivity, or injury?

Sydney Schaefer, PhD (Motor Control):

One major focus of my lab is to characterize how task-specific training drives motor learning after stroke. Stroke is one of the leading causes of adult disability in the United States, and motor learning is a fundamental principle of physical rehabilitation. The purpose of post-stroke rehabilitative services, such as physical and occupational therapy, is to promote the relearning of motor skills through repetitive training. Because many activities of daily living involve arm and hand movements, and because these movements are often impaired following stroke, I use a variety of upper extremity motor tasks to probe the process of motor learning.

Example of project title: “Characterizing the motor learning process during naturalistic upper extremity tasks: How fast, how much, and to what else?”

This project aims to examine the rate, retention, and transfer of motor learning during a feeding task, a sorting task, and a dressing task. These tasks were used in previous motor learning experiments within the lab, and were selected because they simulate activities of daily living that are relevant and meaningful to one’s ability for self-care. To determine the effects of stroke on these aspects of motor learning, these projects require comparisons to data from age-matched control subjects who are neurologically intact.

- Is the rate of learning similar across a set of naturalistic, upper extremity tasks?
• Is the amount of short-term (days) and long-term (weeks) retention similar across a set of naturalistic, upper extremity tasks?
• Is the degree of transferred learning similar across tasks?

A second major focus of mine is to **examine whether movement-related cognitive loads change as a result of motor learning after stroke**. For many, the planning and execution of upper extremity motor tasks, such as feeding or dressing ourselves, require minimal attention. This allows us to do something else simultaneously. Anecdotal evidence suggests, however, that after stroke such upper extremity tasks now require much higher levels of attention. Many individuals with post-stroke motor deficits use high levels of focused attention when performing motor tasks, and often perceive significant cognitive loads associated with their movements (e.g. “I never had to think about moving before!”). We hypothesize that this movement-related cognitive load contributes to the phenomenon of learned nonuse. ‘Learned nonuse’ describes the tendency to not actually use the affected limb in daily life despite having the capacity to use it when being clinically evaluated.

Example of project title: **“Determining the cognitive load associated with upper extremity movement after stroke”**

This project involves the use of a commercially available wrist-worn sensor to determine the cognitive load of moving the affected limb after stroke. The sensor detects electrodermal activity, which has been shown to be a proxy for cognitive load. The sensor can be worn within the lab during training on any of the naturalistic motor tasks mentioned above, and can also be worn outside the lab during one’s daily activities. To determine the effects of stroke on these aspects of motor learning, these projects require comparisons to data from age-matched control subjects who are neurologically intact.

• What, if any, is the movement-related cognitive load in neurologically intact individuals?
• Do individuals with chronic post-stroke hemiparesis show an increase in this load?
• Does the severity of motor impairment predict the amount of cognitive load?
• Does the amount of cognitive load predict limb use in daily life?
• If so, would an intervention targeting the reduction of cognitive load increase limb use?

**Eadric Bressel, PhD (Biomechanics):**

Doctoral students will have the opportunity to be involved in projects that focus on relationships between anatomical structures, mechanics, and injuries and how they pertain to the rehabilitation for people with disabilities. For example, there are excellent opportunities to focus on aquatic-based research for a number of applications, including aquatic therapy for spinal cord injury, stroke, obesity, low back pain, osteoarthritis, and strength conditioning.

**Other Supporting Faculty:**
Dennis Dolny, PhD (Exercise Physiology)

*Adjunct Faculty:*

Bryan Howard, PhD (Bioengineering, Innovative Medical Device Solutions)

Cameron Peterson, MD (Physical Medicine & Rehabilitation, Canyonview Orthopedics)

Trek Lyons, MD (Sports Medicine, Canyonview Orthopedics)

Bryan King, MD (Orthopedics, Canyonview Orthopedics)

Thomas Higginbotham, MD (Orthopedics, Canyonview Orthopedics)

Lori Olson, PT (USU Sports Medicine, IHC)

Brian Larsen, PT (USU Student Health, IHC)

James Davis, MD (Director, USU Student Wellness Center)