Title
Proposal for a Graduate Program in Rehabilitation Science Leading to the Degree of Doctor of Philosophy in Rehabilitation Science at the University of California, San Francisco.

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SECTION 1: INTRODUCTION

1.1. Aims and Objectives

The UCSF Department of Physical Therapy and Rehabilitation Science, in collaboration with faculty from the Department of Physical Therapy at San Francisco State University (SFSU), seeks to offer a unique opportunity to study rehabilitation science. While the historical perspective for PhD programs within this field has been to address the clinical sciences, we envision a non-traditional approach that addresses the broader perspective of both basic and clinical sciences in the areas of musculoskeletal and neurorehabilitation. Such an approach offers substantial opportunity for cross-fertilization between the basic and clinical sciences and is in line with the definition of rehabilitation science, as put forth by the Institute of Medicine (IOM).

As defined by the IOM, rehabilitation science encompasses “basic and applied aspects of health services, social sciences, and engineering as they relate (1) to the restoration of functional capacity in a person and (2) the interaction of that person with the surrounding environment”1.

This proposal aims to establish the first PhD in Rehabilitation Science program at a publicly funded higher education institution in the State of California. The PhD Program in Rehabilitation Science is a logical and much needed step in the development of the Graduate Program in Physical Therapy at UCSF and fills an important gap for the UCSF Graduate Division. The existing joint UCSF/SFSU Doctor of Physical Therapy Science (DPTSc) program will be phased out as the new PhD Program in Rehabilitation Science is implemented.

The PhD in Rehabilitation Science program leverages the current collaboration with San Francisco State University, by including a wide variety of faculty with diverse knowledge and expertise in the field of rehabilitation science. The new PhD program will contribute to the discipline of rehabilitation science while also furthering the health sciences, advancing healthcare goals of the university, and increasing consumer access to evidence based health care. The proposed PhD program is unique in the State of California, as well as the University of California system. Within UCSF, the PhD program maximizes the integration of the depth and breadth of offerings and opportunities for training in a number of interdisciplinary areas related to rehabilitation science.

The proposed size of the program will begin with two students admitted every other year. This model was established given the number of current faculty in the Department of Physical Therapy and Rehabilitation Science and the funding available to support PhD students. We anticipate a moderate growth with a maximum size of 2 students admitted every year (8-10 students in the program at any given time). This size will allow us to provide adequate funding and mentorship support to students. With more funded faculty and a T-32 training grant, there may be potential for the program to admit more students. The projected size of the program is in line with the size of institutions with similar degree programs (see Table 1 on page 6).

The specific aims and objectives of the PhD program are as follows:

1. Create a preeminent center of learning and discovery in rehabilitation science at the doctoral level.
2. Leverage the expertise of faculty within the academic program at both UCSF and SFSU to strengthen and expand the training in rehabilitation sciences available to students and develop academic areas of focus that draw on the strengths of our faculty and the campus.
3. Take advantage of the highly interdisciplinary nature of UCSF and the diversity at SFSU to expand the learning opportunities and enrich the collaborative science research experience for our graduate students.
4. Enhance interactions with the broader academic community in rehabilitation science centers of excellence at the national level.

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A central goal of the program is to capitalize on the highly interdisciplinary nature of UCSF and create an academic program that integrates multiple disciplines. PhD students will have the opportunity to participate in specialized training in areas that will ensure distinction of the PhD program at UCSF. These specialized areas include:

**Musculoskeletal Biomechanics**
Musculoskeletal Biomechanics is one of the foundational sciences of physical therapy and rehabilitation science. Motion analysis and applied biomechanics have roots from over a century ago; however, with recent advances in technology, new and innovative ways to assess and record human movement are being developed. Furthermore, reduction in costs for some biomechanics research methods is resulting in larger numbers of laboratories performing these investigations. The result has been an explosion in high-quality biomechanics research performed across the country and beyond. These discoveries are being translated immediately to the clinic for improved patient care.

The proposed program will train new investigators on the latest advancements in musculoskeletal biomechanics and prepare them for careers in research in academia and industry. General areas of study in the Musculoskeletal Biomechanics track include: 1) assessment of normal and pathological human movement using motion analysis and kinematic imaging techniques, and 2) quantitative imaging of the musculoskeletal system, including advanced quantitative magnetic resonance imaging (MRI), spiral computed tomography (CT), high-resolution peripheral quantitative computed tomography (HRpqCT), and Positron Emission Tomography (PET). The UCSF Human Performance Center is a state-of-the-art motion analysis laboratory with a 10-camera VICON optical motion capture system and three AMTI force platforms for measurement of ground reaction forces. This laboratory, which is dedicated to research, is the only active motion capture system at UCSF. The UCSF Musculoskeletal Quantitative Imaging Research (MQIR) group is a large group of interdisciplinary researchers dedicated to advancing quantitative imaging for clinical implementation and development of post-processing and training procedures for research and clinical use. This group has access to two 3T research-dedicated MR scanners, one whole-body 7T MRI scanner, HRpqCT, CT, PET, PET-MR, and micro-CT scanners. This infrastructure and network of expertise, in combination with the patient population at UCSF, creates an ideal environment for training research scientists in the area of musculoskeletal biomechanics and rehabilitation science.

**Clinically Informed Neuroscience**
The field of neurorehabilitation has made significant advances over the past two decades in developing metrics to assess functionality and applying these metrics to treatment paradigms. Despite this progress, we have yet to fully appreciate the guiding principles underlying activity-based neuroplasticity and restoration of function. The ability to transform how rehabilitation is implemented in the clinic is dependent upon defining these basic principles in the context models of neurotrauma, neuroinflammation, and neurodegenerative disease, with an emphasis on the translation of these laboratory findings to the clinical arena.

The Clinically Informed Neuroscience track will offer two pathways of investigation. The first pathway is invested in a clinically-based platform, which will focus on neural injury and neurodegenerative disease, with the objectives of assessing disability, applying new technologies to improve functionality, and testing the underlying basis of activity-based restoration of function and outcomes research. To achieve these objectives, students will have access to state-of-the-art motion analysis; robotics, including lower extremity exoskeletons with biofeedback to support locomotion; specialized equipment such as the G-trainer by Alter G, an anti-gravity treadmill to support learning-based training; and the motion analysis equipment in the PT Movement Research Laboratory at San Francisco State University. Students will have the opportunity to interrogate the functionality of the brain and neuroplasticity through state-of-the-art MRI-based technologies and transmagnetic stimulation in the Departments of Radiology and Biomedical Imaging and Neurology, which oversees a rich patient database for stroke and multiple sclerosis for outcomes research. In addition, the Department of Physical Therapy at SFSU provides students with opportunities to participate in research on balance-based torso weighting interventions for patients with multiple sclerosis and a recently developed program to study movement accuracy. Access to the UCSF patient population, through the collaborative departmental efforts of Physical Therapy and Rehabilitation Science, Neurology and Neurological Surgery, will position the students’ science at the forefront of clinical care.
The second pathway within the Clinically Informed Neuroscience track is devoted to laboratory-based translational research that will focus on experimental models of neurodegeneration and chronic neuroinflammation and the interplay between defined activity and key molecular events driving motor, sensory and cognitive decline or recovery. This pathway is supported by laboratories that are uniquely positioned to study structure and function and the molecular basis for damage and reparative processes. These laboratories combine high-level imaging microscopes with molecular biology platforms to study structure and function. Essential to this research is the Neurobehavioral Core for Rehabilitation Research, a facility operated by the Department of Physical Therapy and Rehabilitation Science that provides state-of-the art instrumentation to fully profile motor, sensory and cognitive function and assess voluntary or forced activity in the context of disease-based animal models. The Core not only provides ample opportunity for students to measure neurological function, but also to address activity as a determinant of outcome. Additional support for this pathway will come from UCSF-sponsored Core services, including: 1) the Biological Imaging Developmental Center that provides instrumentation for novel imaging, including spinning disk confocal microscopy and confocal microscopy with capability for multi-color and spectral imaging, 2) the Parnassus Flow Cytometry Core, and 3) the Mouse Genetics Core, operated by the Diabetes Center. This pathway will interface with the graduate programs in Neuroscience, Biomedical Sciences and Stem Cell Biology. Students will have the opportunity to attend classes and seminars within these programs including mini-courses that are uniquely tailored to specific research topics.

Falling between the Musculoskeletal Biomechanics track and the Clinically Informed Neuroscience track is the cross-cutting field of chronic pain. UCSF has a strong basic science group in the neural underpinnings of pain physiology, housed primarily in the Neuroscience and Biomedical Science graduate programs. There are also strong pre-clinical and clinical programs in the treatment of acute and chronic pain, housed primarily in the Departments of Anatomy, Physiology, Anesthesia, Neurology, Physiological Nursing, and Psychiatry. What is less robust, however, is the linkage between the basic science of pain physiology and the clinical care of patients in musculoskeletal and neurological rehabilitation. The Department of Physical Therapy and Rehabilitation Science is a participant in the Center of Excellence in Pain Education, and contributes to the case study components of the educational program. Experienced faculty in pain science have expressed their support of the PhD program in Rehabilitation Science, and this collaboration will help forge research linkages between the basic science laboratories and the clinical care of patients with acute or chronic pain.

1.2. Historical Background

Historical Development of the Field

With the increased number of aging individuals in society and the survival of patients with previously fatal illnesses, organ transplants, trauma, and cancer, patients need education and rehabilitation to resume independence and maximize the quality of life. In addition to reform in health care delivery and managed care, the expanding population with health care needs requires that scientific knowledge and technology continue to advance and be transitioned rapidly into clinical care.

The field of rehabilitation science is interdisciplinary and seeks to understand the relationships among physiological, environmental, occupational, and psychosocial causes, course, and consequences of functional disability and how to improve quality of life by enabling human function and performance. Basic and applied research from the health sciences, social sciences and other related fields are directed towards enhancing physical and psychosocial functioning and quality of life of people with disabilities.

As a result of the efforts to help soldiers recovering from injuries after World War II, the field of rehabilitation science was officially recognized as a subspecialty in 1946. The field expanded quickly beyond the use of orthotics

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and assistive devices to include the use of therapies and medications to increase mobility and function. At the national level, the National Institute of Child and Health Development (NICHD) was established in 1962 to meet a number of pressing priorities, including responding to the need for understanding mental and intellectual disabilities. Development of the field of disability research soon led to studies that not only sought to understand disability, but to identify or develop ways to improve the health and quality of life for individuals suffering from disabilities³. After the implementation of the Americans with Disabilities Act in 1990, Congress passed responsibility for rehabilitation science research to the National Institutes of Health. In 1991, the National Center for Medical Rehabilitation Research (NCMRR) was founded as a Center within the NICHD. The NCMRR is committed to funding research in rehabilitation science, offering numerous mechanisms for funding, including postdoc awards (F-32), career development awards (K-awards), training grants (T-32) and various research awards (R01, R03, R21, etc.). Over the past 22 years, the NCMRR has been the major galvanizing force for rehabilitation research, and has made substantial contributions to the field of medical rehabilitation research using their original interdisciplinary research priorities as guidelines that are still used today. These research priorities include⁴:

- Improving functional mobility
- Promoting behavioral adaptation to functional losses
- Assessing the efficacy and outcomes to medical rehabilitation therapies and practices
- Developing improved assistive technology
- Understanding whole body system responses to physical impairments and functional changes
- Developing more precise methods of measuring impairments, disabilities, and societal and functional limitations
- Training research scientists in the field of rehabilitation

Given the position of the Department of Physical Therapy and Rehabilitation Science at UCSF and the scholarly interests and NIH-level funding of its faculty, the Department is poised to offer a PhD program that will address these research priorities in rehabilitation science.

Historical Development of Doctoral Programs in the Department of Physical Therapy and Rehabilitation Science

Currently, the Department of Physical Therapy and Rehabilitation Science offers both a joint UCSF/SFSU Entry-level Doctor of Physical Therapy (DPT) degree and a joint UCSF/SFSU Doctor of Physical Therapy Science (DPTSc) degree. The Entry-level Doctor of Physical Therapy degree is a 3-year joint program between UCSF and San Francisco State University. In 2013, the program received re-accreditation through 2021 from the Commission on Accreditation in Physical Therapy Education (CAPTE). The program runs for 36 continuous months and includes 32 weeks of full-time clinical affiliations. This program accepts 50 students per year and is designed to prepare scholarly clinicians. The curriculum is built on a strong theoretical foundation in basic, medical and applied sciences. Critical thinking and clinical reasoning skills are developed within an integrated program that prepares students to work collaboratively with patients across the lifespan to improve health and wellness, address disability challenges, and optimize function. Graduates excel in the National Licensing Examination and are considered top applicants for positions in physical therapy practice.

The Doctor of Physical Therapy Science (DPTSc) degree was originally created in 1999, and was designed for experienced clinicians to return to the University to expand their academic studies and develop their skills as clinical researchers, educators, and clinical specialists. At the time of the original proposal, the DPTSc was the only research-based doctoral program in physical therapy for the University of California or the California State University. The DPTSc program was the proposed degree, rather than a PhD program, after careful consideration.

of the resources allocated for teaching and research, which were more in line with an advanced professional doctoral degree. However, as the health care sciences have evolved, new faculty members have been recruited to support a stronger research effort. This success has resulted in the highest level of extramural funding achieved in the history of the Department of Physical Therapy and Rehabilitation Science. With the expansion of our faculty and research, we are now optimally positioned to provide a PhD program that would support an academic doctorate-level curriculum in rehabilitation science.

Of note, there is an increasing trend in the field of Physical Therapy and Rehabilitation Science to move away from advanced clinical doctoral degrees such as the DPTSc, and toward research degrees. Currently, the advanced clinical doctoral degree available in the United States is the Doctor of Physical Therapy Science (DPTSc) / Doctor of Science in Physical Therapy (DScPT). In 2010, the American Physical Therapy Association’s (APTA) website listed eleven advanced clinical doctorate programs and in 2013, this number had reduced to seven programs. UCSF/SFSU is the only institution in the country offering a DPTSc degree, while seven universities offer other advanced clinical doctorate programs:

1. Andrews University, Berrien Springs, MI (DScPT in manual physical therapy)
2. Boston University, Boston, MA (ScD in rehabilitation sciences)
3. Loma Linda University, Loma Linda, CA (DScpt in physical therapy)
4. Oakland University, Rochester, MI (DScPT in physical therapy)
5. Texas Tech University Health Sciences Center, Lubbock, TX (ScD in physical therapy)
6. University of Oklahoma Health Sciences Center, Oklahoma City, OK (DSc in rehabilitation sciences)
7. University of Tennessee Health Sciences Center, Memphis, TN (ScD in physical therapy)

Two post-professional graduate educational and research degrees are available in physical therapy: the Doctor of Philosophy (PhD) or Doctor of Science (DSc/ScD). In 2013, the APTA’s website listed 43 research doctoral programs (8 with concentrations in physical therapy and 22 in rehabilitation science)5. Currently, no other public institution in California offers a PhD in Rehabilitation Science. The institutions that offer a research doctoral degree in California are all private institutions, including:

1. The Ola Grimsby Institute, San Diego, CA (PhD in Orthopedic Manual Therapy)
2. University of Southern California, Los Angeles, CA (PhD in Biokinesiology)
3. Loma Linda University, Loma Linda, CA (PhD in Rehabilitation Science)

Across the country, the institutions that offer a PhD in Rehabilitation Science are primarily housed in the large, state flagship Universities located in the Midwest and along the East Coast. Included in the table below is the current list of PhD in Rehabilitation Science programs, along with PhD programs that have similarities to the proposed PhD program at UCSF. The proposed program at UCSF is highlighted in green for comparison purposes.

### Table 1: Institutions Offering PhD in Rehabilitation Science or Comparable Field

<table>
<thead>
<tr>
<th>Institution</th>
<th>State</th>
<th>Type</th>
<th>Degree</th>
<th>Average Enrollment</th>
<th>Training Grants Awarded to the University</th>
<th>Training Grants in Rehabilitation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drexel University</td>
<td>PA</td>
<td>Private</td>
<td>PhD in Rehabilitation Sciences</td>
<td>3-4 per year</td>
<td>2012: $0 (n=0) 2013: $0 (n=0)</td>
<td>2012: $0 2013: $0</td>
</tr>
<tr>
<td>Duquesne University</td>
<td>PA</td>
<td>Private</td>
<td>PhD in Rehabilitation Science</td>
<td>0-2 per year</td>
<td>2012: $0 (n=0) 2013: $0 (n=0)</td>
<td>2012: $0 2013: $0</td>
</tr>
<tr>
<td>Loma Linda University</td>
<td>CA</td>
<td>Private</td>
<td>PhD in Rehabilitation Science</td>
<td>1-2 per year</td>
<td>2012: $0 (n=0) 2013: $0 (n=0)</td>
<td>2012: $0 2013: $0</td>
</tr>
<tr>
<td>Medical University of South Carolina</td>
<td>SC</td>
<td>Public</td>
<td>PhD in Health &amp; Rehabilitation Science</td>
<td>3-6 per year</td>
<td>2012: $3,523,823 (n=14) 2013: $3,603,611 (n=13)</td>
<td>2012: $0 2013: $0</td>
</tr>
</tbody>
</table>

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5 Directory of postprofessional doctoral and graduate programs  
<table>
<thead>
<tr>
<th>Institution</th>
<th>State</th>
<th>Type</th>
<th>Degree</th>
<th>Average Enrollment</th>
<th>Training Grants Awarded to the University</th>
<th>Training Grants in Rehabilitation</th>
</tr>
</thead>
<tbody>
<tr>
<td>MGH Institute of Health Professions</td>
<td>MA</td>
<td>Private</td>
<td>PhD in Rehabilitation Sciences</td>
<td>6 per year</td>
<td>2012: $5,764,405 (n=21) 2013: $5,789,139 (n=19)</td>
<td>2012: $0  2013: $0</td>
</tr>
<tr>
<td>Northwestern University</td>
<td>IL</td>
<td>Private</td>
<td>PhD in Movement &amp; Rehabilitation Science</td>
<td>up to 6 per year</td>
<td>2012: $8,054,128 (n=32) 2013: $7,325,680 (n=30)</td>
<td>2012: $708,233  2013: $626,729</td>
</tr>
<tr>
<td>Ohio State University</td>
<td>OH</td>
<td>Public</td>
<td>PhD in Health &amp; Rehabilitation Sciences</td>
<td>3 per year</td>
<td>2012: $2,973,598 (n=13) 2013: $3,268,764 (n=16)</td>
<td>2012: $0  2013: $0</td>
</tr>
<tr>
<td>The University of North Carolina at Chapel Hill</td>
<td>NC</td>
<td>Public</td>
<td>PhD in Human Movement Science</td>
<td>4-8 per year</td>
<td>2012: $15,722,227 (n=57) 2013: $14,818,902 (n=50)</td>
<td>2012: $318,397  2013: $432,763</td>
</tr>
<tr>
<td>Texas Tech University Health Sciences Center</td>
<td>TX</td>
<td>Public</td>
<td>PhD in Rehabilitation Sciences</td>
<td>2-5 per year</td>
<td>2012: $0 (n=0) 2013: $0 (n=0)</td>
<td>2012: $0  2013: $0</td>
</tr>
<tr>
<td>University of Alabama at Birmingham</td>
<td>AL</td>
<td>Public</td>
<td>PhD in Rehabilitation Science</td>
<td>4 per year</td>
<td>2012: $4,560,500 (n=22) 2013: $5,275,467 (n=21)</td>
<td>2012: $195,471  2013: $262,501</td>
</tr>
<tr>
<td>University at Buffalo, The State University of New York</td>
<td>NY</td>
<td>Public</td>
<td>PhD in Rehabilitation Science</td>
<td>1-2 per year</td>
<td>2012: $607,953 (n=4) 2013: $805,318 (n=5)</td>
<td>2012: $0  2013: $0</td>
</tr>
<tr>
<td>University of California, San Francisco</td>
<td>CA</td>
<td>Public</td>
<td>PhD in Rehabilitation Science</td>
<td>2 every other year</td>
<td>2012: $18,004,693 (n=57) 2013: $18,350,321 (n=55)</td>
<td>2012: N/A  2013: N/A</td>
</tr>
<tr>
<td>University of Colorado Denver</td>
<td>CO</td>
<td>Public</td>
<td>PhD in Rehabilitation Science</td>
<td>3 per year</td>
<td>2012: $6,919,474 (n=26) 2013: $7,560,108 (n=31)</td>
<td>2012: $0  2013: $0</td>
</tr>
<tr>
<td>University of Delaware</td>
<td>DE</td>
<td>Public</td>
<td>PhD in Biomechanics &amp; Movement Science</td>
<td>2-4 per year</td>
<td>2012: $346,526 (n=2) 2013: $394,142 (n=2)</td>
<td>2012: $67,866  2013: $155,291</td>
</tr>
<tr>
<td>University of Florida</td>
<td>FL</td>
<td>Public</td>
<td>PhD in Rehabilitation Science</td>
<td>3-4 per year</td>
<td>2012: $2,464,065 (n=13) 2013: $1,948,748 (n=11)</td>
<td>2012: $205,731  2013: $0</td>
</tr>
<tr>
<td>University of Iowa</td>
<td>IA</td>
<td>Public</td>
<td>PhD in Rehabilitation Science</td>
<td>1-2 per year</td>
<td>2012: $7,195,268 (n=25) 2013: $7,263,834 (n=26)</td>
<td>2012: $0  2013: $0</td>
</tr>
<tr>
<td>University of Kansas Medical Center</td>
<td>KS</td>
<td>Public</td>
<td>PhD in Rehabilitation Science</td>
<td>3-8 per year</td>
<td>2012: $1,604,541 (n=4) 2013: $1,530,652 (n=8)</td>
<td>2012: $214,931  2013: $174,859</td>
</tr>
<tr>
<td>University of Kentucky</td>
<td>KY</td>
<td>Public</td>
<td>PhD in Rehabilitation Science</td>
<td>4-7 per year</td>
<td>2012: $2,185,694 (n=11) 2013: $1,744,988 (n=10)</td>
<td>2012: $0  2013: $0</td>
</tr>
<tr>
<td>University of Maryland</td>
<td>MD</td>
<td>Public</td>
<td>PhD in Physical Rehabilitation Science</td>
<td>12 per year</td>
<td>2012: $3,841,749 (n=18) 2013: $3,562,960 (n=17)</td>
<td>2012: $0  2013: $0</td>
</tr>
<tr>
<td>University of Medical Sciences Arizona</td>
<td>AZ</td>
<td>Private</td>
<td>PhD in Rehabilitation Science</td>
<td>under 10 per year</td>
<td>2012: $1,927,366 (n=13) 2013: $1,182,950 (n=8)</td>
<td>2012: $0  2013: $0</td>
</tr>
<tr>
<td>University of Minnesota</td>
<td>MN</td>
<td>Public</td>
<td>PhD in Rehabilitation Science</td>
<td>2-3 per year</td>
<td>2012: $9,868,557 (n=34) 2013: $9,903,968 (n=31)</td>
<td>2012: $256,351  2013: $274,442</td>
</tr>
<tr>
<td>University of Pittsburgh</td>
<td>PA</td>
<td>Private</td>
<td>PhD in Rehabilitation Science</td>
<td>2 per year</td>
<td>2012: $12,620,803 (n=57) 2013: $13,516,467 (n=58)</td>
<td>2012: $28,157  2013: $28,157</td>
</tr>
<tr>
<td>University of Southern California</td>
<td>CA</td>
<td>Private</td>
<td>PhD in Biokinesiology</td>
<td>6 per year</td>
<td>2012: $3,058,674 (n=10) 2013: $2,104,168 (n=8)</td>
<td>2012: $0  2013: $0</td>
</tr>
<tr>
<td>University of Texas Medical Branch</td>
<td>TX</td>
<td>Public</td>
<td>PhD in Rehabilitation Sciences</td>
<td>2-5 per year</td>
<td>2012: $1,943,937 (n=9) 2013: $2,082,273 (n=9)</td>
<td>2012: $0  2013: $0</td>
</tr>
<tr>
<td>University of Washington</td>
<td>WA</td>
<td>Public</td>
<td>PhD in Rehabilitation Science</td>
<td>2 per year</td>
<td>2012: $21,983,127 (n=61) 2013: $20,272,808 (n=56)</td>
<td>2012: $0  2013: $0</td>
</tr>
<tr>
<td>Virginia Commonwealth University</td>
<td>VA</td>
<td>Public</td>
<td>PhD in Rehabilitation &amp; Movement Science</td>
<td>1-2 per year</td>
<td>2012: $1,801,414 (n=6) 2013: $1,384,248 (n=6)</td>
<td>2012: $0  2013: $0</td>
</tr>
<tr>
<td>Washington University at St. Louis</td>
<td>MO</td>
<td>Private</td>
<td>PhD in Movement Science</td>
<td>2-3 per year</td>
<td>2012: $16,949,967 (n=50) 2013: $16,764,449 (n=50)</td>
<td>2012: $153,637  2013: $143,012</td>
</tr>
</tbody>
</table>

The only PhD in Rehabilitation Science programs offered in the west include:

1. Loma Linda University
2. Texas Tech University Health Sciences Center
3. University of Colorado at Denver
4. University of Medical Sciences Arizona
Of these, only the Universities of Washington, Colorado, and Texas are public institutions.

The DPTSc degree was designed to educate scholarly clinicians, and to graduate individuals who would be prepared to become academic faculty in Physical Therapy programs or who could return as leaders in the clinical setting. The program has been successful in graduating individuals who were able to achieve these two goals; however, we have struggled to develop graduates who are competitive for research positions in comprehensive doctorate universities, based on the Carnegie Classification system. Examples of the career placement of DPTSc graduates is outlined in the table below. It’s worth noting that the DPTSc graduates who have been successful in receiving NIH extramural funding have been those who were recruited into the Department of Physical Therapy and Rehabilitation Science at UCSF. These faculty have been provided the mentorship and guidance needed to successfully secure NIH extramural funding to develop independent research agendas.

Table 2: Alumni of the UCSF/SFSU DPTSc Program

<table>
<thead>
<tr>
<th>Alumnus</th>
<th>Current Position</th>
<th>Publishing Activity</th>
<th>NIH Funding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boyd, Benjamin</td>
<td>Assistant Professor, Samuel Merritt University, Physical Therapy Program</td>
<td>Yes</td>
<td>• None</td>
</tr>
<tr>
<td>Dolberg, Rebecca</td>
<td>Program Director, Physical Therapy Assistant Program, Carrington College</td>
<td>Yes</td>
<td>• None</td>
</tr>
<tr>
<td>Fitzsimmons, Amber</td>
<td>Assistant Professor, UCSF Departments of Physical Therapy &amp; Rehabilitation Science and Anatomy</td>
<td>Yes</td>
<td>• Graduated August 2013; plans to pursue funding in the next year</td>
</tr>
<tr>
<td>Gilleran, Tim</td>
<td>Assistant Adjunct Professor, Samuel Merritt University, Physical Therapy Program</td>
<td>No</td>
<td>• None</td>
</tr>
<tr>
<td>Gorman, Sharon</td>
<td>Associate Professor, Samuel Merritt University, Physical Therapy Program</td>
<td>Yes</td>
<td>• None</td>
</tr>
<tr>
<td>Katzman, Wendy</td>
<td>Associate Clinical Professor, UCSF Department of Physical Therapy &amp; Rehabilitation Science</td>
<td>Yes</td>
<td>• BIRCWH K-12 Award • CTSI KL2 Award • R01 grant from the National Institute on Aging</td>
</tr>
<tr>
<td>Kinder, Jennifer</td>
<td>Therapist, Apex Physical Therapy</td>
<td>Yes</td>
<td>• None</td>
</tr>
<tr>
<td>Rivera, Monica</td>
<td>Assistant Adjunct Professor, Samuel Merritt University, Physical Therapy Program; Lecturer, UCSF &amp; SFSU</td>
<td>No</td>
<td>• None</td>
</tr>
<tr>
<td>Smoot, Betty</td>
<td>Assistant Professor, UCSF Departments of Physical Therapy &amp; Rehabilitation Science and Anatomy</td>
<td>Yes</td>
<td>• CTSI KL2 Award</td>
</tr>
<tr>
<td>Wampler, Meredith</td>
<td>Lead Therapist, Harrison Medical Center; Adjunct Faculty, University of Puget Sound</td>
<td>Yes</td>
<td>• None</td>
</tr>
</tbody>
</table>

The PhD in Rehabilitation Science degree is needed at UCSF to meet the growing demand for faculty who are able to perform independent, original research to further the field of rehabilitation science. The DPTSc degree was targeted for clinician-scientists, whose research success was dependent on working with a pre-established research team. The PhD Program, however, would allow the Department to train scientists who will complete postdoctoral training and take their research to another comprehensive doctorate university, and be a leader in his/her respective field. Graduates will be secure in starting their own research programs at other institutions with the tools necessary to collaborate with other scientists in pursuing extramural funding.

We believe the PhD program, compared to the DPTSc program, is more closely aligned with the broader mission of UCSF - advancing health worldwide. The aim of this PhD program is to move the field of rehabilitation science
research forward, and this type of work is well suited for an institution such as UCSF.

The primary difference between the proposed PhD degree and the current DPTSc degree is the level of rigor expected of students. This rigor is reflected in the increased required number of research units, the lengthened time for completion of the program, and the expectation that students will be performing independent, original research, rather than joining a current research project at UCSF. We believe this model is more in line with other PhD programs at UCSF. Additionally, the PhD program would allow us to recruit students who are interested in a PhD degree, but may possess a degree outside the field of physical therapy.

Departmental Strength in the Field

When the outpatient physical therapy facility at the UCSF Medical Center closed in 2003, the Department of Physical Therapy and Rehabilitation Science was established within the School of Medicine with an objective of opening a clinical practice. The Department underwent a number of moves thereafter - from 374 Parnassus to 7th Avenue to 9th Avenue and then Mt. Zion, where space was allocated to 1701 Divisadero and Hellman. Under the new chair, Dr. Kimberly Topp, the Department consolidated its efforts at 1701 Divisadero, and thereafter relocated to new space, dedicated to both an outpatient clinic and health and wellness center, at the Mission Bay campus.

The Department underwent major changes over the last decade. While the Department historically placed great emphasis on teaching, clinical work and research, the five core faculty in the Department had substantial teaching loads and extramural funding for research was very limited. However, it is noteworthy that Nancy Byl, PT, MPH, PhD, although lacking independent NIH-funding, established an internationally recognized expertise in focal dystonia.

With the initiation of joint appointments with other departments at UCSF, the face of the Department of Physical Therapy and Rehabilitation Science began to change with the recruitments of Linda Noble, Susanna Rosi and Richard Souza into the Academic Senate series. These faculty members have successfully secured and maintained extramural funding, including NIH support, and have subsequently served as the backbone for building research programs within the Department that are focused on musculoskeletal and neurological rehabilitation. Additionally, the Department hired three graduates from the DPTSc program into faculty positions - Wendy Katzman as a Clinical Professor, and Betty Smoot and Amber Fitzsimmons as Adjunct Professors. Dr. Katzman and Dr. Smoot have subsequently received funding for their research, including a KL2 award and a R01 grant from the National Institute on Aging to study the effects of exercise on functional capabilities in persons with hyperkyphosis.

The Department of Physical Therapy and Rehabilitation Science currently has 12 faculty members with primary appointments in the Department, 3 with a primary focus in teaching, 5 with a primary focus in research, and 4 with a primary focus in clinical practice. Of these, 4 are members of the Academic Senate, and 1 is an Emeritus Professor. The Department currently has 2 state-funded faculty FTE’s. Research faculty maintain laboratory space at the China Basin (Richard Souza), SFGH (Susanna Rosi), Mission Bay (Wendy Katzman) and Parnassus (Linda Noble) campuses. Department faculty members were awarded $19 million in grants and contracts in 2011/12, placing the Department five times higher than the national average of $3.5 million. Of note, faculty hold joint appointments and submit grant applications through the Departments of Neurological Surgery, Orthopaedic Surgery or Radiology, as well as through the Department of Physical Therapy and Rehabilitation Science. The table below lists only the awards submitted through the Department of Physical Therapy and Rehabilitation Science.
The Department of Physical Therapy at San Francisco State University has five faculty members, and the FTEs for SFSU faculty are state-supported. All five faculty are members of the SFSU Academic Senate. Two of the five faculty have a primary focus on research, while the remaining three focus on teaching and administration. In 2011/12, SFSU faculty were awarded $828,726 in grants and contracts. Two faculty (Sandy Radtka and Diane Allen) conduct research in the PT Movement Research Lab at SFSU, which is equipped with a motion analysis system, forceplates, electromyography and GaitRite system. Diane Allen, Associate Professor, received an NIH AREA grant to study the effects of torso weighting on patients with multiple sclerosis and a Patient Centered Outcomes Research Initiative (PCORI) grant to study the effects of perceived movement ability.

1.3. **Timetable for Development of the Program**

The goal is to matriculate the first students and begin classes in the fall of 2015. Prior to that time, the program must seek review and approval of the Deans at UCSF, the Graduate Council, Academic Senate, and the Chancellor. Then, a system-wide review by the Coordinating Committee on Graduate Affairs (CCGA) and the University of California Office of the President (UCOP) will begin. An extensive curriculum is currently in place in physical therapy and rehabilitation science at the doctoral level. Many faculty members teach in the existing physical therapy degree programs and additional faculty recruitments will be strategically chosen according to training needs in the PhD program.

Proposed Approval Process Timeline:

- **Campus Review**
  - Relevant Deans: Graduate Division/SOM – November 2013 (1 month)
  - Graduate Council: February 2014 (1 month)
  - Divisional Academic Senate: February-March 2014 (2 months)
  - Chancellor: March 2014 (1 month)

- **System-wide Review**
  - Coordinating Committee on Graduate Affairs: April-June 2014 (3 months)
  - UCOP Provost/Sr. VP, President Approve: September 2014 (1 month)

- **Program Launch**
  - New Program Announced and Applications Received: Late Fall 2014
  - Program Admissions: Winter/Spring Quarter 2015
  - Program Begins: Fall Quarter 2015

On August 1, 2013, Chris Cullander, Director in the Office of Institutional Research, confirmed with the Western Association of Schools and Colleges (WASC) that the PhD in Rehabilitation Science Program does not require a substantive change review. The PhD Program is currently accounted for in the UCSF Campus Enrollment Plan, with projected students enrolled in the 2015-16 academic year and each year thereafter.
The establishment of the PhD in Rehabilitation Science will coincide with the dis-establishment of the Doctor of Physical Therapy Science degree program. We do not plan to enroll new DPTSc students while the PhD program is under review. The existing student in the DPTSc program will continue in the program until graduation, which is anticipated for 2016.

1.4. Relation of Proposed Program to Similar Programs on Campus

The proposed PhD program will be most closely related to four current doctoral programs at UCSF. It is expected that the programs will be complementary rather than competitive.

1) PhD in Neuroscience

Students interested in the PhD in the Neuroscience program may also be interested in the proposed PhD in Rehabilitation Science program, which will have an option for a neuroscience emphasis. While there is likely to be synergism between the two programs in that both utilize clinically-relevant animal models of CNS injury/disease, the proposed program is distinguished by its emphasis on the intersection between cell injury, inflammation, neuroplasticity, stem cell biology, and activity-based restoration of function. The latter is a key distinguishing feature of this proposed program where there will be opportunity to study topics such as patterned activity to maximize plasticity and behavioral recovery, and synergism or incompatibility between combinatorial approaches that merge pharmacologic-induced plasticity with defined patterns of rehabilitation. Examples include voluntary or forced locomotion or reaching tasks, and fundamental consequences of rehabilitation on neuroinflammatory pathways, delayed cell loss, stem cell-directed axonal plasticity, and wound healing events that govern recovery processes.

Courses offered within Neuroscience that we anticipate would be of interest to our PhD students:
- NS 219 Topics in Basic or Translational Neuroscience
- NS 225 Neurobiology of Disease
- NS 245 Behavioral Neuroscience

Courses offered within the PhD in Rehabilitation Science that may be of interest to students in Neuroscience:
- RS 100 Introduction to Rehabilitation Science
- RS 340 Activity and Its Effects on CNS Disease/Injury Across the Lifespan

2) PhD in Biomedical Sciences

Neurobiology in the Biomedical Sciences program is one of eight thematic areas. The Biomedical Sciences program may attract similar applicants as those interested in the proposed PhD in Rehabilitation Science program. A key distinction of the proposed PhD program in Rehabilitation Science is an emphasis on activity-based restoration of function in the context of clinically-relevant animal models of acute neural injury and reparative processes, neurodegenerative diseases, and neuroinflammation in the adult and/or developing central nervous system.

Courses offered within Biomedical Sciences that we anticipate would be of interest to our PhD students:
- BMS 225A Human Disease: Technologies and Biomedical Applications
- BMS 225B Tissue and Organ Biology
- BMS 255 Basic Genetics and Genomics
- BMS 260 Cell Biology

Courses within the PhD in Rehabilitation Science that may be of interest to students in Biomedical Sciences:
- RS 100 Introduction to Rehabilitation Science
- RS 130 Basics in Musculoskeletal Imaging
- RS 150 Gross and Regional Anatomy
- RS 340 Activity and Its Effects on CNS Disease/Injury Across the Lifespan
- RS 400 Topics in Clinically Informed Neuroscience (e.g. Challenges in Translation of Science to the Clinic)
3) PhD in Epidemiology and Translational Science
Applicants interested in handling large data sets from existing studies may be interested in the PhD program in Epidemiology and Translational Science, as well as the proposed PhD in Rehabilitation Science program. The Program in Epidemiology and Translational Science educates students in methods for studying disease etiology and prevention, evaluating treatment efficacy, and implementing evidence-based clinical care and population health. The Department of Physical Therapy and Rehabilitation Science has faculty who work with large datasets in bone health, orthopaedics, and oncology, and there may be some fortuitous overlap in methodology in evaluating treatment efficacy and prevention studies. We anticipate that students in Rehabilitation Science will enroll in courses in biostatistics and research design, offered by the Department of Epidemiology. Furthermore, students in Epidemiology and Translational Science will be welcomed into courses within the PhD program in Rehabilitation Science.

Courses offered within Epidemiology that we anticipate would be of interest to our PhD students:
- EPI 150.03/202 Designing Clinical Research
- TICR Summer Clinical Research Workshop
  - EPI 150.03 Designing Clinical Research
  - EPI 218 Database Management Systems for Clinical Research
  - EPI 227 Building a Career in Clinical Research

Courses within the PhD in Rehabilitation Science that may be of interest to students in Epidemiology:
- RS 100 Introduction to Rehabilitation Science
- RS 130 Basics in Musculoskeletal Imaging
- RS 150 Gross and Regional Anatomy
- ANA 207 Neuroscience
- RS 340 Activity and Its Effects on CNS Disease/Injury Across the Lifespan
- RS 400 Topics in Clinically Informed Neuroscience (e.g. Challenges in Translation of Science to the Clinic)

4) PhD in Bioengineering
Students interested in the proposed PhD in Rehabilitation Science may also be interested in the joint UCSF/UC Berkeley PhD in Bioengineering. While the current areas of study within the PhD in Bioengineering include similarities, the two programs differ in the emphasis placed on engineering versus rehabilitation. For example, one of the emphases for the PhD in Bioengineering is in Biomechanics. Specific projects within the Biomechanics emphasis are rooted in tissue and/or fluid mechanics and involve cellular or tissue level investigations. In contrast, students enrolled in the PhD in Rehabilitation Science program would likely focus on applied or clinical biomechanics, using whole body technology, such as motion analysis, functional testing (balance tests), or joint imaging. We anticipate cross-pollination with the PhD in Bioengineering, as well as with related programs, including the Masters of Science in Biomedical Imaging (MSBI) and the Masters in Translational Medicine (MTM). Additionally, the formation of the PhD in Rehabilitation Science would lead to several new courses in applied biomechanics and clinical imaging biomechanics that would be available to students in the PhD in Bioengineering program.

Courses offered within Bioengineering, Biomedical Imaging, or Translational Medicine that we anticipate would be of interest to our PhD students:
- Bioengineering:
  - BioE 221 Tissue Mechanobiology
  - BioE 25 Careers in Biotechnology
- Translational Medicine
  - Epi 150.03 Designing Clinical Research
- Biomedical Imaging:
  - BI 201 Principles of MR Imaging
  - BI 202 Physical Principles of CT, PET, and SPECT Imaging
  - BI 240 Musculoskeletal Imaging
Courses within the PhD in Rehabilitation Science that may be of interest to students in Bioengineering, Biomedical Imaging, or Translational Medicine:

- RS 100 Introduction to Rehabilitation Science
- RS 330 Biomechanics of Human Motion

1.5. Interrelationship of the Program with other University of California Institutions

The current academic programs in the Department work collaboratively with many other departments at UCSF to offer the existing Doctor of Physical Therapy (DPT) and Doctor of Physical Therapy Science (DPTSc) degree programs. The programs are advised by an interdisciplinary, interschool faculty. In addition, students enroll in core coursework offered by a variety of departments, such as pathology, physiology, pharmacy, and biostatistics. Furthermore, given that UCSF does not currently have a strong cadre of faculty and researchers in the areas of exercise physiology and muscle biology, we have connected with UC Irvine for academic expertise from Vince Caiozzo, PhD, who delivers this content for our students.

Currently, UCSF is the only University of California campus with a Department of Physical Therapy and Rehabilitation Science offering an academic program. UC Davis and UC Irvine both have residency programs in Physical Medicine and Rehabilitation for medical trainees. These programs aim to provide trainees with exposure to patients with a wide range of physical impairments and disabilities who may benefit from physiatric medical care. However, these programs are only available to physicians, and not to others interested in the rehabilitation sciences. These two medical residency programs are focused on clinical medicine, whereas the PhD would be a research-based program, informed by laboratory-based translational research and investigative and applied clinical practice.

The Center of Research Translation grant on Osteoarthritis, is a collaboration between UCSF and UC Davis. Richard Souza, PT, PhD is a co-investigator on this large program grant and has regular meetings with faculty from UC Davis, including Nancy Lane and Barton Wise, two rheumatologists and leaders in clinical research in osteoarthritis. These relationships would be leveraged to expose students within the proposed PhD program to research ideas and methodology across the UC campuses. An additional informal collaboration exists with Samuel Ward, PT, PhD from the Department of Radiology at UC San Diego.

Additionally, educational opportunities are available through the annual UCLA Neurotrauma Meeting. This meeting brings together faculty and young investigators, including graduate students, across all UC campuses in a forum that focuses on traumatic brain injury. This meeting provides a unique opportunity for students to present their data as part of the Young Investigator’s Sessions and to network with other researchers. We anticipate that students in the Clinically Informed Neuroscience track may attend this meeting.

Programs at other University of California institutions that may be related to the PhD in Rehabilitation Science include:
### Table 4: Programs at Other UC Campuses

<table>
<thead>
<tr>
<th>Institution</th>
<th>Programs</th>
</tr>
</thead>
</table>
| UC Berkeley   | **PhD in Bioengineering**  
                 | **PhD in Epidemiology**  
                 | **PhD in Neuroscience** |
| UC Davis      | **PhD in Biomedical Engineering**  
                 | **PhD in Epidemiology**  
                 | **PhD in Neuroscience**  
                 | **PhD in Human Development** |
| UC Irvine     | **PhD in Biomedical Engineering**  
                 | **PhD in Epidemiology** |
| UC Los Angeles| **PhD in Bioengineering**  
                 | **PhD in Biomedical Engineering**  
                 | **PhD in Biomedical Physics**  
                 | **PhD in Epidemiology**  
                 | **PhD in Neuroscience**  
                 | **PhD in Human Genetics**  
                 | **PhD in Bioinformatics** |
| UC Riverside  | **PhD in Bioengineering**  
                 | **PhD in Biomedical Sciences**  
                 | **PhD in Neuroscience**  
                 | **PhD in Genetics, Genomics, and Bioinformatics** |
| UC San Diego  | **PhD in Bioengineering**  
                 | **PhD in Biomedical Sciences**  
                 | **PhD in Neurosciences**  
                 | **PhD in Public Health**  
                 | **PhD in Bioinformatics and Systems Biology** |
| UC Santa Barbara | **PhD in Dynamical Neuroscience**                                    |
| UC Santa Cruz | **PhD in Biomolecular Engineering & Informatics**                      |

Of note, the Neuroscience Programs within the University of California are focused primarily in cellular, molecular and behavioral studies. The UC Davis areas of emphasis are cellular, molecular, developmental, systems, and cognitive neuroscience. UC Los Angeles emphasizes addiction; learning and memory; neural development, degeneration and repair; neurogenetics; neuroimaging/cognitive; and synapses, cells and circuits. UC Riverside’s areas of research are cellular and molecular; development and plasticity; systems neuroscience and behavior; computational neuroscience; cognitive neuroscience; and medical neuroscience. UC Riverside’s program includes a seminar class in neural regeneration and repair, which may have some content overlap with the PhD in Rehabilitation Science. UC San Diego includes three areas of basic neuroscience before specialization: cellular, molecular, developmental; systems; and cognitive, clinical, behavioral. UC Santa Barbara describes research areas in cognitive psychology, neuroimaging, biology, physics, computer science and engineering.

Additionally, San Francisco State University offers a MS degree in Kinesiology, which will offer potential for collaboration with the funded faculty in the department. Kate Hamel, PhD and David Anderson, PhD each have laboratories at SFSU in biomechanics.

1.6. **Department or Group that will Administer the Program**

The PhD in Rehabilitation Science Program will be housed and administered in the Department of Physical Therapy and Rehabilitation Science. The PhD Program Steering Committee will govern the proposed PhD program. The Steering Committee will be comprised of the following members:
• Department Chairs at UCSF and SFSU
• PhD Program Director
• Faculty Leads for each of the two tracks
• One member of the Academic Faculty from within the UCSF Department or a faculty member who holds a primary appointment at SFSU with a WOS appointment at UCSF
• One UCSF faculty member outside the Department

Duties and responsibilities of this Committee include serving as the Admissions and Curriculum Committees; setting academic standards and establishing requirements for enrollment in the program; making recommendations to the Graduate Dean concerning dismissal of students who fail to fulfill requirements of the program; arranging for the scheduled periodic evaluation of the program; and conducting biennial reviews of program membership.

The Program Director will be a UCSF faculty member and will serve a 3-year renewable term, elected by the Steering Committee, with the following duties and responsibilities: vote as a member of the Steering Committee; act as a liaison between the PhD Program and the Graduate Division, UCSF administration, outside organizations, programs, and students; and oversee funding and resources of the program in consultation with the Department Management Services Officer.

The Faculty Leads for the Musculoskeletal Biomechanics and Clinically Informed Neuroscience tracks will be UCSF faculty members and will be responsible for overseeing the student’s program of study within each track, planning coursework, and communicating staffing needs to the PhD Program Director.

1.7. Plan for Evaluation of the Program

Both formative and summative assessments will be utilized to thoroughly monitor and evaluate the effectiveness of the PhD in Rehabilitation Science program. Students will be required to submit electronic evaluations at the end of each course and upon completion of the program. These evaluations will enable students to identify perceived strengths and weaknesses of the curriculum and reflect on how well the courses meet the overall learning goals of the program. The information gathered from these evaluations will be compiled and analyzed by the Steering Committee and used to improve curriculum and instructional methods and develop additional courses if necessary.

Longitudinal data will also be gathered from alumni to track the professional development of graduates. At two and five years post-graduation, each graduate will be required to submit a CV and to complete a graduate survey, which will assess the impact of the program on their current skills and expertise, as well as how the program affected their ability to find desired employment. This system of tracking student outcomes will contribute to the long-term evaluation of the PhD in Rehabilitation Science program.

In addition to the internal evaluation activities described above, the evaluation of the PhD program will be included as part of the periodic review and evaluation of the Department of Physical Therapy and Rehabilitation Science under the Chair’s Stewardship Review. Additionally, the UCSF Graduate Division and Graduate Council conducts reviews of all UCSF graduate programs without a T-32 grant approximately every eight years. These reviews ensure continued program quality and provide impartial feedback on the program. The review process itself is composed of a self-study, student surveys, an external review, and a post-review follow-up.
SECTION 2: PROGRAM

2.1. Admissions Requirements and Undergraduate Preparation

Minimum criteria for admission to the PhD program are set by the UCSF Graduate Division and include a bachelor’s degree and prior grade point average greater than 3.0 or its equivalent. A bachelor’s, master’s or a doctoral degree in physical therapy, neuroscience, exercise physiology, biomedical engineering, or a related rehabilitation science or professional field will be required for admission into the PhD program.

Applicants must have taken the Graduate Record Examination (GRE) within five years of applying, and scores will be considered in the evaluation for admission. While no minimum GRE scores are set by the Graduate Division, applicants will be required to obtain a minimum 50th percentile score on both the Verbal and Quantitative Reasoning sections of the GRE and a 4.5 on the Analytical Writing section.

Admission requirements for students from foreign countries are the same as for domestic students. In addition, international applicants from non-English speaking countries must demonstrate proficiency in English by completing one year of study with a minimum 3.0 GPA at an accredited college or university in the United States, or by obtaining the following minimum scores on the Test of English as a Foreign Language (TOEFL): 550 on paper-based test; 213 on computer-based test; 80 on internet-based test; or 7 on the International English Language Testing System.

Applicants must also submit their CV and a Statement of Purpose (3 to 5 pages) discussing their background, interests, research goals, purpose in applying for graduate study and plans for the future. Applicants must indicate what they hope to gain from being a doctoral student in Rehabilitation Science, how their interests fit with those of the program’s faculty, and any other pertinent information supportive of their application and qualifications.

Finally, applicants must submit three letters of recommendation. Final approval for admission into the PhD program is granted by the Admissions Committee.

The admissions requirements and procedures of the PhD in Rehabilitation Science program are in line with comparable programs at other institutions. Included below is a table of each institution offering a PhD in Rehabilitation Science (or related field) and the admissions requirements.

Table 5: Admissions Requirements at Institutions with PhD in Rehabilitation Science Programs

<table>
<thead>
<tr>
<th>Institution</th>
<th>Required Degree</th>
<th>Major</th>
<th>GRE Required</th>
<th>Statement of Goals</th>
<th>Letters of Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drexel University</td>
<td>Bachelors</td>
<td>health or rehab-related field; Masters or DPT preferred</td>
<td>Yes</td>
<td>Yes + CV + 2 years clinical experience</td>
<td>3 LORs</td>
</tr>
<tr>
<td>Duquesne University</td>
<td>DPT or Masters</td>
<td>Physical therapy, athletic training, occupational therapy or related field</td>
<td>Yes</td>
<td>Yes + 2 years professional experience</td>
<td>3 LORs</td>
</tr>
<tr>
<td>Loma Linda University</td>
<td>Bachelors or Masters (must hold licensure/certification)</td>
<td>allied health profession area or rehab related field</td>
<td>Yes</td>
<td>Faculty letter of support</td>
<td>None</td>
</tr>
<tr>
<td>Medical University of South Carolina</td>
<td>Bachelors or graduate degree</td>
<td>any major that will allow applicants to focus on functional limitations, pathology and impairment, and health services</td>
<td>Yes</td>
<td>Yes</td>
<td>3 LORs</td>
</tr>
<tr>
<td>Institution</td>
<td>Required Degree</td>
<td>Major</td>
<td>GRE Required</td>
<td>Statement of Goals</td>
<td>Letters of Reference</td>
</tr>
<tr>
<td>-------------------------------------------------</td>
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<td>----------------------</td>
</tr>
<tr>
<td>MGH Institute of Health Professions</td>
<td>Bachelors</td>
<td>physical or occupational therapy, speech-language pathology, rehabilitation nursing, psychiatry</td>
<td>Yes</td>
<td>Yes</td>
<td>3 LORs</td>
</tr>
<tr>
<td>Northwestern University</td>
<td>Bachelors</td>
<td>physical therapy, occupational therapy, other health professions, exercise science, biomechanics, engineering, basic sciences</td>
<td>Yes</td>
<td>Yes + 1 lab research experience</td>
<td>3 LORs</td>
</tr>
<tr>
<td>University at Buffalo, The State University of New York</td>
<td>Bachelors</td>
<td>field related to rehab science</td>
<td>Yes</td>
<td>Yes</td>
<td>2 LORs</td>
</tr>
<tr>
<td>The Ohio State University</td>
<td>Masters preferred</td>
<td>Must have a MS in Health &amp; Rehab Science; Masters in Occupational Therapy/ Physical Therapy; Doctor of Physical Therapy; or MS in Dietetics</td>
<td>Yes</td>
<td>Yes + CV</td>
<td>3 LORs</td>
</tr>
<tr>
<td>The University of North Carolina at Chapel Hill</td>
<td>Masters preferred</td>
<td>field related to human movement (e.g. physical therapy, exercise science, athletic training, biomedical engineering, anatomy, etc.)</td>
<td>Yes</td>
<td>Yes + CV</td>
<td>3 LORs</td>
</tr>
<tr>
<td>Texas Tech University Health Sciences Center</td>
<td>Bachelors</td>
<td>physical therapy, occupational therapy, athletic training, kinesiology, biology, medicine, biomedical engineering, etc.</td>
<td>Yes</td>
<td>Yes + CV</td>
<td>3 LORs</td>
</tr>
<tr>
<td>University of Alabama at Birmingham</td>
<td>Bachelors or Masters</td>
<td>occupational therapy, physical therapy, engineering, exercise science, neuroscience, medicine, nursing, or other health related professions</td>
<td>Yes</td>
<td>None</td>
<td>3 LORs</td>
</tr>
<tr>
<td>University of Colorado Denver</td>
<td>Bachelors</td>
<td>science, health or engineering</td>
<td>Yes</td>
<td>Yes</td>
<td>3 LORs</td>
</tr>
<tr>
<td>University of Delaware</td>
<td>Bachelors</td>
<td>movement-related field</td>
<td>Yes</td>
<td>Yes</td>
<td>3 LORs</td>
</tr>
<tr>
<td>University of Florida</td>
<td>Bachelors</td>
<td>field that can be applied to PhD</td>
<td>Yes</td>
<td>Yes + prof/clinical experience in rehab area</td>
<td>3 LORs</td>
</tr>
<tr>
<td>University of Iowa</td>
<td>Bachelors</td>
<td>physical therapy, occupational therapy, engineering, biology, chemistry</td>
<td>Yes</td>
<td>Yes</td>
<td>3 LORs</td>
</tr>
<tr>
<td>University of Kansas Medical Center</td>
<td>Bachelors</td>
<td>biological sciences, statistics, calculus</td>
<td>Yes</td>
<td>Yes + CV</td>
<td>3 LORs</td>
</tr>
<tr>
<td>University of Kentucky</td>
<td>Masters</td>
<td>communication disorders, physical therapy, occupational therapy, or athletic training</td>
<td>Yes</td>
<td>Yes + CV</td>
<td>3 LORs</td>
</tr>
<tr>
<td>University of Maryland</td>
<td>Bachelors</td>
<td>biology, engineering, exercise physiology, exercise science, kinesiology, medicine, nursing, occupational therapy, physical therapy</td>
<td>Yes</td>
<td>Yes</td>
<td>3 LORs</td>
</tr>
<tr>
<td>University of Medical Sciences Arizona</td>
<td>Masters</td>
<td>Health related field</td>
<td>No</td>
<td>Yes</td>
<td>2 LORs</td>
</tr>
<tr>
<td>University of Minnesota</td>
<td>Bachelors</td>
<td>field related to rehab science</td>
<td>Yes</td>
<td>Yes + CV</td>
<td>3 LORs</td>
</tr>
<tr>
<td>Institution</td>
<td>Required Degree</td>
<td>Major</td>
<td>GRE Required</td>
<td>Statement of Goals</td>
<td>Letters of Reference</td>
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<tr>
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</tr>
<tr>
<td>University of Pittsburgh</td>
<td>Masters</td>
<td>Rehab related field</td>
<td>Yes</td>
<td>Yes + CV + Writing sample</td>
<td>3-5 LORs</td>
</tr>
<tr>
<td>University of Southern California</td>
<td>Bachelors</td>
<td>science major; research-based</td>
<td>Yes</td>
<td>Yes + CV</td>
<td>3 LORs</td>
</tr>
<tr>
<td>University of Texas Medical Branch</td>
<td>Bachelors</td>
<td>rehabilitation medicine/ science, physical and occupational therapy,</td>
<td>Yes</td>
<td>Yes + clinical and research experience</td>
<td>3 LORs</td>
</tr>
<tr>
<td></td>
<td></td>
<td>nursing, neuroscience, exercise sciences, kinesiology, bioengineering,</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>human factor engineering/design, and rehabilitation/clinical psychology</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>University of Washington</td>
<td>Bachelors</td>
<td>occupational therapy, physical therapy, speech/ language pathology,</td>
<td>Yes</td>
<td>Yes + CV</td>
<td>3 LORs</td>
</tr>
<tr>
<td></td>
<td></td>
<td>rehab counseling, prosthetics &amp; orthotics, medicine, nursing,</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>engineering, or other fields related to rehab science</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Virginia Commonwealth University</td>
<td>Masters</td>
<td>movement science related field</td>
<td>Yes</td>
<td>Yes</td>
<td>3 LORs</td>
</tr>
<tr>
<td>Washington University in St. Louis</td>
<td>Bachelors</td>
<td>movement science related discipline: physical therapy,</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>exercise physiology, kinesiology, occupational therapy,</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>biomechanical engineering</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2.2. **Foreign Language Competence**

A Test of English as a Foreign Language (TOEFL) for those who do not speak English as a primary language will be required (see Section 2.1 above).

2.3. **Program of Study**

Two focused areas of specialization will be established that represent the expertise of our Department as well as the UCSF community as a whole. They include: Musculoskeletal Biomechanics and Clinically Informed Neuroscience. These areas of specialization are supported by established research infrastructure, including basic science laboratories on the Parnassus and SFGH campuses, movement analysis labs on the Mission Bay campus, imaging facilities, clinical physical therapy and health and wellness facilities, and the Neurobehavioral Core for Rehabilitation Research (see Appendix B for equipment available for research purposes in the Physical Therapy Outpatient Practice). The latter is a Core facility, supported by the Department of Physical Therapy and Rehabilitation Science that is available to the research community to study behavior of mouse models of injuries/diseases and to address activity-based restoration of function. In addition, SFSU has a movement analysis lab and a lab dedicated to clinical research.

These two areas of specialization include academic coursework offered at UCSF, and represent research interests of current faculty within the Department of Physical Therapy and Rehabilitation Science. Specifically, the unit requirements and required/elective courses in each area of specialization would be as follows.

**Specific Field of Emphasis:** Rehabilitation Science

**Plan:** Doctor B

**Unit Requirements:**

- Total core units: 12
Required and Recommended Courses:

First year: Focus on core courses in Rehabilitation Science, Statistics, Research Ethics, and Basic Sciences

The primary focus of the first two years of the PhD program will be to expose the student to the basic core courses in Rehabilitation Science and provide opportunity for students to experience and ultimately select a laboratory and Principal Investigator with whom to complete their dissertation. Courses taken in the first year include: RS 100 Introduction to Rehabilitation Science, BMS 214 Ethics and the Responsible Conduct of Research, EPI 150.03/202 Designing Clinical Research, biostatistics courses, and other basic science courses needed, based upon the student’s needs and interests (Anatomy, Physiology, Neuroscience, Statics and Dynamics, etc.). The remainder of the first year of study will be filled with Research Lab rotations (10-20 hours/week), the teaching assistantship or practicum, and the Doctoral Colloquium.

Also during their first year, with the guidance of the Steering Committee, students will each form a Graduate Committee of at least three faculty members comprised of two faculty within the PhD Program, and one member from an external department whose expertise is related to the candidate’s research interest (this may be too early for a dissertation topic). The Chair of the Committee will be a member of the PhD Program faculty and may be the student’s primary research mentor. One faculty member should be from the chosen sub-field and presumed dissertation topic of the student. The Graduate Committee will review the student’s plan of study, actively advise him/her on appropriate choices, and make decisions as to acceptable progress. Guidelines for typical and acceptable courses of study will be used, but exceptions may be liberally considered by the Graduate Committee depending on the needs of the student. The Graduate Committees will be overseen by the Steering Committee to ensure consistency in the expectations for training and a level of achieved competence by all students.

Students will be required to complete three quarters of lab rotations (3 units each), similar to the lab rotation requirement in other established PhD Programs at UCSF (e.g. Biomedical Sciences, Biological and Medical Informatics and Pharmaceutical Sciences and Pharmacogenomics). The objective of these rotations is for the student to have the opportunity to:

1. Apply concepts taught in formal classes
2. Learn practical aspects of conducting research, including how to work within a multidisciplinary team
3. Acquire exposure to areas of research other than the student’s primary area
4. Launch projects with potential for developing into qualifying examination or dissertation research topic
5. Decide on a primary research mentor, if not already identified

Three lab rotations will be required over three quarters before advancing to Candidacy status. A plan for which research teams to rotate with should be part of the Year 1 Plan of Study approved by the Graduate Committee. The subject matter for each rotation, however, is not prescribed by the PhD Program and would be determined by the needs of the research team and the student.

In the lab rotations, PhD students will participate in active research teams at UCSF or SFSU, or affiliated institutions. The PI and the student will set a plan for the lab rotation, including expectations. The PI is responsible for monitoring participation and student learning in the lab rotation.

Second year: Begin to focus on specific area of research in either the Musculoskeletal Biomechanics or Clinically Informed Neuroscience track

Within the first two years of study, the student, with the assistance of his/her Graduate Committee, will be
expected to choose a research emphasis, concordant with the expected dissertation topic, that will guide topic-specific and experiential study. Formulation of the topic will be the responsibility of the student with the oversight and advice of his/her Graduate Committee and primary research mentor.

By the end of the second year in the PhD program, the student is expected to have selected a research focus and a primary research mentor. The goal of the second year is to allow the student to finalize his/her dissertation focus and obtain the necessary knowledge and skills to successfully execute the dissertation. Coursework to be taken during this time includes electives within the selected domain, such as RS 330 Biomechanics of Human Motion or RS 340 Activity and Its Effects on CNS Disease/Injury Across the Lifespan, additional courses in biostatistics, and continuing with the Doctoral Colloquium. It is expected that the student will have at least 20 hours per week for research experiences, including pilot studies for the dissertation proposal, as appropriate.

The primary research mentor will be the principal advisor and supporter of the graduate student. The primary research mentor must have the means to provide financial support from existing research grants for tuition and stipend for years three and beyond.

Figure 1: Committee Structure

2.4. Field Examination

None.

2.5. Qualifying Examination

In the PhD program, doctoral students must take and pass a combined written and oral Qualifying Examination. The Qualifying Examination provides evidence the student is able to:

- Critically read, understand, and evaluate current literature in the discipline
- Integrate and synthesize ideas within the field
- Demonstrate comprehensive knowledge of the literature in the field
- Critically evaluate empirical evidence
- Demonstrate a comprehensive understanding of techniques critical to scholarship in the field
- Communicate clearly and effectively to specialist and non-specialist audiences
After completing all required coursework in the first two years, including at least five quarters, a student may apply to the Graduate Division to take the qualifying examination with the written approval of the Chair of his or her Graduate Committee. The examination is offered at the convenience of the student and his or her Graduate Committee and consists of a detailed six-page National Institutes of Health (NIH) style grant proposal to answer a rehabilitation science research question in a field related to his/her primary research area (sections of the NIH style grant proposal will include: 1) Introduction; 2) Specific aims; and 3) Research strategy, including the significance, innovation, and approach to be utilized). Students submit their proposal to the Qualifying Examination Committee at least 30 days prior to the date of their scheduled qualifying examination. The student must meet individually with each member of the Qualifying Examination Committee at least once prior to scheduling the qualifying examination. The Qualifying Examination Committee is comprised of a minimum of four faculty members, three of whom must be UCSF Academic Senate faculty members in the PhD program. Faculty from SFSU or other academic institutions as well as non-Academic Senate UCSF faculty can, with written permission from the Graduate Division, serve on the Qualifying Examination Committee. The faculty member designated the chair of the Qualifying Examination Committee must be a UCSF Academic Senate member who is a faculty member in the PhD program. The chair of the Qualifying Examination Committee cannot be the same individual who chairs the student’s Graduate Committee.

The oral portion of the qualifying examination lasts up to three hours and is closed to the general public, with the exception of the primary research mentor, who is only an observer. The student will be allowed to make a 10-15 minute presentation on his/her research plan with a dry erase board made available for a “chalk talk”. Questions for the oral examination will typically be based on the presentation, but can include materials covered from any required class in the curriculum, as well as anything pertaining to the student’s area of specialization. The purpose of the oral examination is to determine the student’s mastery of content within the rehabilitation science program. Upon finishing their course of study and taking the examination, students should be able to apply reasoning related to rehabilitation science to their chosen substantive areas and resolve methodological problems. The examination will cover the breadth and depth of a student’s knowledge in his/her area of specialization within the field of rehabilitation science.

In accordance with the UCSF Graduate Division guidelines, at least one meeting of the whole committee must be held to discuss the results of the examination. The committee may grade the examination either “Pass” (or “Contingent Pass”, pending response to committee concerns on the proposal) or “Fail”. In line with UCSF Graduate Division guidelines, if a student fails the examination, the committee must make a recommendation for or against a second examination. The committee must be the same as for the original exam. If the student failed in all areas, the re-examination must be on all subjects involved. A partial failure, in which the student passes some fields, but not others, also counts as a first examination. However, re-examination after partial failure may be restricted to those areas in which the original performance was unsatisfactory. The minimum time between examinations is three months. Students who fail the oral examination a second time will be dismissed from the PhD program.

2.6. Dissertation

Each doctoral student conducts research under the supervision of a primary research mentor and a Dissertation Committee. The student and primary research mentor recommend a Dissertation Committee, which is formally appointed by the Graduate Division. Once a student successfully passes the qualifying examination, the student’s Graduate Committee will disband, and a Dissertation Committee will be formed. This Committee will be composed of three faculty knowledgeable in the field related to the student’s research. The Dissertation Committee is responsible for overseeing the research conducted by the student, and offering an outside, unbiased assessment to the primary research mentor. The chair of the Dissertation Committee must be a UCSF Academic Senate faculty member and member of the PhD program. The chair of the Dissertation Committee may have been a member, but not the chair, of the student’s Qualifying Examination Committee, and may not be the student’s primary research mentor. A Dissertation Committee must have a minimum of three faculty members in the PhD program. Faculty from SFSU or other universities may be appointed to serve on the Dissertation Committee. All research involving
human subjects, including analyses of previously collected data, must have been approved (or declared exempt) in writing by the UCSF Committee for Human Research in order to be included in a dissertation, regardless of which or how many other such committees elsewhere have previously approved the research. Additionally, research using animals must have been approved in writing by the UCSF Institutional Care and Use Committee in order to be included in the dissertation.

The goal for the dissertation is to provide the student independent-investigator involvement, including idea conception, study design, methodological structure, acquisition, processing, and interpretation, with mentoring and oversight from the Dissertation Committee. It is anticipated that the student’s dissertation will include two or three separate projects addressing a single focused dissertation objective with sufficient depth and breadth to contribute to the body of literature in the field. The expectation is that this work will generate at least three independent manuscripts, to be published in peer-reviewed journals.

2.7. Final Examination

Dissertation Defense
A closed Defense of the Dissertation will be required for all students. Each student will have 45 minutes to orally present his/her dissertation written project, including the background, methods, results, discussion, and conclusions, to the Dissertation Committee and primary research mentor. This presentation and subsequent questioning will represent the acceptance or refusal by the Committee of the student’s body of work throughout the dissertation process. After the formal presentation by the student, the Committee will be allowed to ask questions, propose changes to the written dissertation, and/or request additional investigations, which must be within the scope of the approved research proposal. At the completion of the questioning, the student will be asked to leave the room while the Committee discusses the student’s performance and ultimately decides if the body of work satisfactorily meets the requirements of the Doctor of Philosophy in Rehabilitation Science. Once a decision has been made, the student will be informed of the outcome. Options include: Pass without modification to written dissertation; Pass With Modifications to the written dissertation; and Failure of Initial Attempt with an option to revise the dissertation and re-present.

Final Presentation
After the Dissertation Committee has approved the completed dissertation, a final presentation will be required for all students, prior to graduation. The presentation will be open to the local scientific community, general public, and family and friends. Announcements will be made to the appropriate UCSF, SFSU, and outside communities regarding the dissertation presentation. After the completion of the presentation, the student will be required to field questions from the general audience.

2.8. Explanation of Special Requirements

None.

2.9. Relationship of Master’s and Doctor’s Programs

As detailed above under the Admissions section, admission to the PhD program will require that an applicant has a baccalaureate degree, and a master’s degree will be optional, but preferred. If an applicant is accepted without a master’s degree, the applicant will take a required set of preparatory courses as a first step in his/her training.

2.10. Special Preparation for Careers in Teaching

In the PhD program, all doctoral students are expected to teach, serving as a Teaching Assistant for a course at least one quarter or semester in length before the Qualifying Examination. This teaching experience requires students to organize their own knowledge in the field so that they can effectively present and explain the material to others. It also serves as an important foundation for future academic positions.
In addition, students in the program may receive additional teaching training by enrolling in a teaching training through the Haile T. Debas Academy of Medical Educators and the Office of Medical Education, which offers courses and workshops for faculty and pre-doctoral fellows in writing a course syllabus, assessment instruments, and innovative teaching techniques. PhD students may also take advantage of the Teaching Improvement Program/Teaching Observation Program offered through the Academy.

2.11. Sample Program

Below is an initial proposed curriculum. There are two general tracks available to students. All students will take the following courses (new courses indicated with an asterisk):


YEAR 1

Fall Quarter
- C - *RS 100 Introduction to Rehabilitation Science (2 units)
- C - *RS 150 Gross and Regional Anatomy (1 unit)
- D - RS 300 Doctoral Colloquium (1 unit)
- LR - *RS 200 Research Lab Rotation (3 units) or at SFSU PT 996 Directed Studies (3 semester units)

Winter Quarter
- C - Biostat 187 Introduction to Statistical Theory and Practice (5 units)
- D - RS 300 Doctoral Colloquium (1 unit)
- LR - *RS 200 Research Lab Rotation (3 units) or at SFSU PT 996 Directed Studies (3 semester units)

Spring Quarter
- C - BMS 214 Ethics and the Responsible Conduct of Research (2 units)
- C - EPI 150.03/202 Designing Clinical Research (2 units)
- D - RS 300 Doctoral Colloquium (1 unit)
- LR/E - *RS 200 Research Lab Rotation or at SFSU PT 996 Directed Studies (3 semester units)

Summer Quarter
- T - *RS 310 Teaching Practicum (3 units) or at SFSU PT 960 Teaching Practicum (3 units)
- D - RS 300 Doctoral Colloquium (1 unit)
- D - *RS 350 Research (5 units) or at SFSU PT 997 Research (2 semester units)

YEAR 2

Fall Quarter
- E - Elective (3 units)
- D - RS 300 Doctoral Colloquium (1 unit)
- D - *RS 350 Research (5 units) or at SFSU PT 997 Research (2 semester units)

Winter Quarter
- E - Elective (3 units)
- D - RS 300 Doctoral Colloquium (1 unit)
- D - *RS 350 Research (5 units) or at SFSU PT 997 Research (2 semester units)

Spring Quarter
- E - Elective (3 units)
- D - RS 300 Doctoral Colloquium (1 unit)
- D - *RS 350 Research (5 units) or at SFSU PT 997 Research (2 semester units)
- Qualifying Examination

Summer Quarter
- D - RS 300 Doctoral Colloquium (1 unit)
- D - *RS 350 Research (8 units) or at SFSU PT 997 Research (2 semester units)
YEAR 3
- D - All quarters will be RS 350 Research (8 units) and RS 300 Doctoral Colloquium (1 unit)

Total core units: 12 quarter units (year 1)

Total lab rotation units: 6-9 quarter units (year 1)
  Rotations in labs; students must enroll in rotations for at least two quarters in the fall, winter, and/or spring of the first year.

Total elective units: 9-12 quarter units (year 2)

Total research units (research + quarterly 1-unit doctoral seminar): 108 quarter units (years 1 through 4)
  36 quarter units (years 1 and 2), and 72 quarter units (years 3 and 4)

Grand total units: 135 - 141 quarter units

Students enroll in elective coursework, based on consultation with their Graduate Committee, in the second year of the program. Given the interdisciplinary nature of the program and the UCSF academic culture, included below is only a short list of the available opportunities for students:

Required Coursework:
- *RS 100 Introduction to Rehabilitation Science (2 units)
- *RS 150 Gross and Regional Anatomy (1 unit)
- Biostat 187 Introduction to Statistical Theory and Practice or equivalent (5 units)
- BMS 214 Ethics and the Responsible Conduct of Research (2 units)
- EPI 150.03/202 Designing Clinical Research (2 units)

Elective Coursework of Interest to All Students:
- BioE 25 Careers in Biotechnology (1 unit)
- BMS 225A Human Disease: Technologies and Biomedical Applications (1.5 units)
- BMS 225B Tissue and Organ Biology (3 units)
- BMS 255 Basic Genetics and Genomics (4 units)
- BMS 260 Cell Biology (4 units)
- MICRO 204 Molecular and Cellular Immunology (3 units)
- PT 251 Research Design (3.5 units)
- TICR Summer Clinical Research Workshop (required to take 2+ courses in series)
  - EPI 150.03 Designing Clinical Research (2 units)
  - Biostat 212 Introduction to Statistical Computing in Clinical Research (1 unit)
  - EPI 218 Database Management Systems for Clinical Research (1 unit)
  - EPI 227 Building a Career in Clinical Research (0.5 unit)

Elective Coursework within the Musculoskeletal Biomechanics in Rehabilitation Science emphasis:
- BI 201 Principles of MR Imaging (4 units)
- BI 202 Physical Principles of CT, PET, and SPECT Imaging (4 units)
- BI 240 Musculoskeletal Imaging (3 units)
- BioE 221 Tissue Mechanobiology (2.5-3 units)
- *RS 130 Basics in Musculoskeletal Imaging (3 units)
- *RS 330 Biomechanics of Human Motion (2 units)
- *RS 331 Running Biomechanics and Overuse Injuries - Journal Club (2 units)

Elective Coursework within the Clinically Informed Neuroscience emphasis:
- ANA 207 Neuroscience (5 units)
- N 294B Medical Genetics for Nursing (3 units)
• NS 219 Topics in Basic or Translational Neuroscience (topics include: Epigenetics in the Brain; Brain Injury; Molecular Genetic Tools; Basal Ganglia; Neuroinflammation) (3 units)
• NS 225 Neurobiology of Disease (3 units)
• NS 245 Behavioral Neuroscience (3 units)
• PT 420 Mentored Research (2.5 units)
• *RS 110 Principles and Applications of Evidence-based Practice (3 units) and at SFSU PT 910 Evidence Based Practice (4 semester units)
• *RS 340 Activity and Its Effects on CNS Disease/Injury Across the Lifespan (2 units)
• RS 400 Topics in Clinically Informed Neuroscience (e.g. Challenges in Translation of Science to the Clinic) (2 units)

Many other courses are offered as part of other existing graduate programs at UCSF, SFSU, and at other institutions and UC campuses through the Intercampus Exchange Program.

2.12. Normative Time from Matriculation to Degree

The time needed to complete the PhD in Rehabilitation Science will vary depending on the student’s training and experience prior to enrolling in the PhD program and the time it takes to complete the dissertation research. Students who have completed undergraduate level training require at least two years to complete their coursework and pass their qualifying examination, followed by an additional two to three years to complete their research and file the dissertation. Those who have completed Masters level training may progress more quickly through the coursework. Thus, the mean time to completion of a PhD in Rehabilitation Science for students entering with a Bachelor’s degree is expected to be approximately five years. To facilitate timely progress in the program, all students will be required to complete annual progress reports and to discuss them with their adviser and Graduate Committee or Dissertation Committee.
SECTION 3: PROJECTED NEED

3.1. **Student Demand for the Program**

We propose an enrollment of two new students every other year for six years, until 12 students are enrolled. We expect no difficulty in admitting this number of high quality applicants, as most top-rated programs in rehabilitation science turn away strong applicants. The following is a table of peer institutions, which includes the number of applications received each year and the number of students admitted. It is clear from this information that there are many more students interested in PhD programs in Rehabilitation Science than there are available openings.

**Table 6: Student Demand at Peer Institutions**

<table>
<thead>
<tr>
<th>Institution</th>
<th># Apps</th>
<th># Students Admitted</th>
<th>Employment of Graduates</th>
<th>Top 5 Areas of Training</th>
<th>Funding Sources</th>
<th>Faculty Openings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duquesne University</td>
<td>5 per year</td>
<td>0-2 per year</td>
<td>100% academia</td>
<td>1) Orthopedics 2) Clinical Biomechanics</td>
<td>Graduate assistant funding from the dept</td>
<td>Not at the present time</td>
</tr>
<tr>
<td>Ohio State University</td>
<td>6 per year</td>
<td>3 per year</td>
<td>67% academia 33% clinical research</td>
<td>1) Pediatrics 2) Biomechanics 3) Neuro 4) Human Factors 5) Diet &amp; Nutrition</td>
<td>No training grants; students are on grants of their mentors; some receive University fellowships</td>
<td>2 openings in PT: one in ortho and one in neuro</td>
</tr>
<tr>
<td>University of Delaware</td>
<td>30-40 per year</td>
<td>2-4 per year</td>
<td>80% academia 15% industry 5% non-research</td>
<td>1) Applied Anatomy and Biomechanics 2) Exercise Physiology 3) Tissue/Molecular Biomechanics 4) Motor Control &amp; Behavior 5) Rehabilitation Engineering</td>
<td>40% on TA-ship funded by department; remainder are primarily on faculty grants</td>
<td>Yes, 2-3 openings appropriate for PhD in Rehab Science</td>
</tr>
<tr>
<td>University of Minnesota</td>
<td>12 per year</td>
<td>2-3 per year</td>
<td>95% into academia</td>
<td>1) Muscle adaptation 2) Musculoskeletal Injuries 3) Outcomes of Therapeutic Intervention 4) Postural Control 5) Stroke Recovery and Neuroplasticity</td>
<td>Mentor’s grants, TA positions, funds from country of origin, university fellowships, PT Foundation, NIH predoc awards, AHA predoc awards</td>
<td>Yes, openings in cardiopulmonary and rehab</td>
</tr>
<tr>
<td>University of Southern California</td>
<td>30 per year</td>
<td>6 per year</td>
<td>95% into academia</td>
<td>1) Biomechanics 2) Computational Neurorehabilitation 3) Exercise Physiology 4) Motor Learning and Motor Control 5) Neuroplasticity and Imaging</td>
<td>TA and RA positions. RA positions come from grants</td>
<td>None</td>
</tr>
<tr>
<td>Washington University at St. Louis</td>
<td>15-20 per year</td>
<td>2-3 per year</td>
<td>mainly into academia (90-95%) and some go to industry (5-10%)</td>
<td>1) Translational Physiology 2) Movement and Movement-related Dysfunction 3) Musculoskeletal Analysis</td>
<td>T32 (supports 3 students per year), departmental funds (2 students supported), F31s, TL1 program (3 students funded), R01s or other grants to the PIs of the labs the students are working in</td>
<td>anticipate hiring 3-5 tenure faculty in the next five years</td>
</tr>
</tbody>
</table>
On the demand side, the need for medical scientists is rapidly increasing as the general population begins to age. The Bureau of Labor Statistics has documented in the Occupational Outlook Handbook that the number of Medical Scientist positions is expected to increase by 36% (from 100,000 to 136,400 positions) between 2010 and 2020, a rate much higher than the national average for all occupations. Additionally, the growth of Postsecondary Teacher positions is projected to increase by 17% as enrollments at postsecondary institutions continue to rise.

According to the aggregate program data for APTA-accredited Physical Therapy programs, in 2011-12, there were 132 current vacancies in allocated faculty positions, and 83 projected vacancies in allocated faculty positions. In 2012-13, there were 153 current vacancies in allocated faculty positions, and 105 projected vacancies in allocated faculty positions. The average age of core faculty in APTA-accredited Physical Therapy programs is between 50 and 60 years of age, and 71% of all core faculty are between 45 and 65 years of age. Additionally, in 2012-13, 88% of core faculty in APTA-accredited Physical Therapy programs were self-identified as White or Caucasian. These statistics support the growing need for the next generation of a diverse pool of qualified academic researchers and educators who can contribute to the body of research and educate future physical therapists who represent the diversity of the communities they will serve.

3.2. Opportunities for Placement of Graduates

Graduates of the PhD Program in Rehabilitation Science will be prepared as researchers, educators, and leaders in the field of rehabilitation science. Our interdisciplinary educational approach prepares students to conduct collaborative and translational research by integrating knowledge from multiple perspectives ranging from the cellular to the systems level to solve complex problems of physical disablement. Upon graduation, students will pursue academic careers in research and higher education. These individuals will be prepared to address research, education, service delivery, and policy challenges requiring an interdisciplinary perspective. Openings in academia for faculty positions are numerous in this field, and range in positions in Physical Therapy, Gerontology, Oncology, Physiotherapy, Health Sciences, Rehabilitation, and Movement Science departments.

Exceptional students with substantial experience prior to completion of the PhD may be prepared to begin faculty positions immediately upon completion of their dissertation. However, in order to be successful in rigorous academic settings, a postdoctoral fellowship will be recommended to graduates after completion of the PhD. During a postdoctoral fellowship, graduates will complete the process of publishing their dissertation research and work as full-time researchers with a faculty mentor (typically not the primary research mentor). The objective of the postdoctoral fellowship is to provide the graduate time to develop a line of independent investigation to launch their career so that upon accepting a faculty position, the graduate’s area of scholarship is defined and the individual is well on his/her way to securing substantial extramural funding to launch an original research program. Graduates will have developed extensive skills as teachers while in the program, also preparing them to succeed in this demanding aspect of the academic career.

3.3. Importance to the Discipline

The PhD Program in Rehabilitation Science will be housed within UCSF, which will allow it to become a premier opportunity for researchers interested in the field. UCSF is first among public institutions and ranked second among all institutions nationwide in research support from the National Institutes of Health (NIH) for fiscal year 2011. UCSF is also one of the leading institutional recipients of science-based stimulus funds under the American Recovery and Reinvestment Act. Acclaimed faculty conducting investigations involving humans, as well as animal

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models, are discovering new solutions for preventing and treating a wide array of diseases, including cardiovascular disease, neurological disorders, cancer, diabetes, genetic disorders, immunological and infectious disease, and reproductive and developmental disorders. UCSF has started multiple groups within the University specifically related to the field of Rehabilitation Science, including the Institute for Health and Aging, the Cardiovascular Research Institute, and the Institute for Neurodegenerative Diseases.

Additionally, the Physical Therapy profession has developed a set of research goals that the proposed PhD program will be able to directly address. The proposed PhD program will initially focus on a subset of the profession’s priorities, including:

- **Basic Science Research**
  - Examine how genetic, anatomical, biomechanical, physiological, or environmental factors contribute to excessive stress, injury, or abnormal development of body tissues and systems, and measure the effects of physical therapy interventions on structural properties and physiological responses of healthy, injured, or diseased tissues.
  - Examine skill acquisition and motor development in individuals with movement disorders.
  - Examine the relationships between biomarkers and impairments in body structure and function, limitations in activity, and restrictions in participation.
  - Define the role for physical therapy in the maturation and modeling of genetically engineered tissues.
  - Determine the mechanisms by which existing and novel physical therapy interventions modify disease and age-related or injury-induced changes in normal cellular structure and function using appropriate human and animal models.

- **Clinical Research**
  - Examine the relationships among levels of functioning and disability, health conditions, and contextual factors for conditions commonly managed by physical therapists, and develop and evaluate models of health and disability to guide the investigation, prevention, and treatment of these health conditions.
  - Evaluate or develop effective physical therapy interventions and technologies to address movement disorders and chronic disease, and to prevent or reduce the risk of disability and optimize health outcomes.
  - Develop and evaluate effective patient/client classification methods and decision support tools, effectiveness and efficacy of physical therapy interventions, criteria for progression in levels of care, contextual and adherence factors that affect prognosis and predictors of recovery, in order to optimize clinical decision making and patient/client outcomes.

- **Education/Professional Development**
  - Develop and evaluate the most effective methods for facilitating physical therapist acquisition and use of available information resources for evidence-based practice.
  - Evaluate the skills needed by practitioners to provide optimal patient/client care, patient/client advocacy, and cost-effective care.

- **Epidemiology**
  - Examine the incidence, prevalence, and natural course of health conditions and impairments of body functions and structure, activity limitations, and participation restrictions associated with health conditions commonly managed by physical therapists.
  - Investigate the effects of contextual factors on the effectiveness of interventions provided by physical therapists.

- **Health Services Research/Policy**
  - Evaluate the incorporation of patient/client values and expectations in decision-making, and the effect of physical therapy interventions and service delivery models on economic and patient/client outcomes and consumer choice.

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• Develop innovative medical informatics applications for physical therapy and assess their impact on clinical decision making and patient/client outcomes.

• Measurement Development and Validation
  o Develop new measurement tools and evidence to guide selection and interpretation of measures to enhance clinical decision making for specific conditions and populations.
  o Determine how contemporary technology (e.g. ultrasound, gene array, magnetic resonance) can be used to measure the effects of injury/disease and physical therapy intervention on body structure and function.

3.4. Ways in which the Program will Meet the Needs of Society

As the population continues to age, the development of programs in the interdisciplinary field of rehabilitation will be essential to ensure new research is produced to support the healthcare needs of society. The professions of physical and occupational therapy are expected to expand in upcoming decades with longer projected age spans of the general population and the increased prevalence of obesity. With this increased demand, rehabilitation specialists will be needed to provide effective and efficient care. However, the current evidence behind the practice of physical and occupational therapy is lacking in nearly all areas of clinical practice. Rehabilitation scientists with advanced research training are in critical demand to begin to evaluate these issues, to evaluate the effectiveness of current injury prevention and rehabilitation science, and to develop new potential injury prevention and rehabilitation strategies.

The program has established two areas of specialization within the field of rehabilitation science, given the healthcare needs of society. The Clinically Informed Neuroscience specialization was developed based on the increased prevalence of neurodegenerative diseases (e.g. Multiple Sclerosis, Parkinson’s Disease), stroke and traumatic brain injuries (TBI) in the US population. According to the CDC, stroke kills almost 130,000 Americans each year—1 in every 19 deaths. Every year, more than 795,000 people in the United States have a stroke; about 610,000 of these are first or new strokes and one in four are recurrent strokes. Currently, stroke costs the United States an estimated $38.6 billion each year, which includes the cost of health care services, medications, and missed days of work. Stroke is a leading cause of serious long-term disability10. Additionally, an estimated 1.7 million people sustain a traumatic brain injury (TBI) annually. Of them, 52,000 die, 275,000 are hospitalized, and 1.365 million—nearly 80%—are treated and released from an emergency department. Direct medical costs and indirect costs of TBI, such as lost productivity, totaled an estimated $60 billion in the United States in 200011.

The Musculoskeletal Biomechanics specialization was established to address the increasing prevalence of arthritis in the aging and obese population. According to the CDC, arthritis is the most common cause of disability in the United States, limiting the activities of nearly 21 million adults. Scientific studies have shown that physical activity can reduce pain and improve function, mood, and quality of life for adults with arthritis. Physical activity can also help manage other chronic conditions that are common among adults with arthritis, such as diabetes, heart disease, and obesity. Currently, 50 million people are affected with arthritis and it is estimated that one in two people will get symptomatic knee osteoarthritis in their lifetime12. Additionally, more than 36% of adults in the US are currently obese, and medical costs associated with obesity were estimated at $147 billion in 200813.

3.5. Relationship of the Program to Research and/or Professional Interests of Faculty

The formation of a PhD Program in Rehabilitation Science has been part of the Department’s strategic plan since 2008. The multiple research programs and interests of the faculty members would benefit greatly from the

constant presence of PhD-level graduate students within the department. Existing research programs in basic neuroscience, radiology, orthopedic surgery, and biomechanics, along with a faculty representation in the Musculoskeletal Quantitative Imaging Research (MQIR) group in the Department of Radiology and Biomedical Imaging, the mini courses offered through the Neuroscience community, and a variety of grand round options, all provide opportunities for graduate students to develop projects for their dissertations and other research and educational interests. Department faculty currently have access to other UCSF programs in Bioengineering, Neuroscience, and the Biomedical Sciences, but none of those areas has a focus on rehabilitation.

The Department sees the top priority of the PhD program to find a strong match between the current research projects of program faculty and incoming PhD student interest. Given this priority, the Department intends to start the program by focusing on a few key areas of rehabilitation science from ongoing research lines of the Department faculty.

### 3.6. Program Differentiation

The proposed PhD in Rehabilitation Science has two primary characteristics that differentiate it from other existing programs within the UC system or in the State of California.

First, since the program will be based within a school of medicine, as compared to a school of public health, the orientation toward and opportunities for training and research in clinical problem solving and translational sciences as well as links to excellent basic science departments are very strong. UCSF is world famous for the outstanding quality of its basic sciences and opportunities abound for lab rotations and other training in basic science laboratories for interested students. Likewise, the campus’ excellent professional schools, all rated within the top three in NIH funding nationwide, provide opportunities to learn about the application of rehabilitation science in the clinical setting. A comparison of T-32 grant activity at UCSF and comparable institutions demonstrates the high level of grant activity at UCSF as compared to other institutions offering a similar degree program.

### Table 7: Comparison of T-32 Grant Activity in 2012 and 2013

<table>
<thead>
<tr>
<th>Institution</th>
<th>University Training Grants</th>
<th>Rehabilitation Training Grants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drexel University</td>
<td>2012: $0 (n=0) 2013: $0 (n=0)</td>
<td>2012: $0 2013: $0</td>
</tr>
<tr>
<td>Duquesne University</td>
<td>2012: $0 (n=0) 2013: $0 (n=0)</td>
<td>2012: $0 2013: $0</td>
</tr>
<tr>
<td>Loma Linda University</td>
<td>2012: $0 (n=0) 2013: $0 (n=0)</td>
<td>2012: $0 2013: $0</td>
</tr>
<tr>
<td>Medical University of South Carolina</td>
<td>2012: $3,523,823 (n=14) 2013: $3,603,611 (n=13)</td>
<td>2012: $0 2013: $0</td>
</tr>
<tr>
<td>MGH Institute of Health Professions</td>
<td>2012: $5,764,405 (n=21) 2013: $6,589,139 (n=19)</td>
<td>2012: $0 2013: $0</td>
</tr>
<tr>
<td>Northwestern University</td>
<td>2012: $8,054,128 (n=32) 2013: $7,325,680 (n=30)</td>
<td>2012: $708,233 2013: $626,729</td>
</tr>
<tr>
<td>The Ohio State University</td>
<td>2012: $2,973,598 (n=13) 2013: $3,268,764 (n=16)</td>
<td>2012: $0 2013: $0</td>
</tr>
<tr>
<td>The University of North Carolina at Chapel Hill</td>
<td>2012: $15,722,227 (n=57) 2013: $14,818,902 (n=50)</td>
<td>2012: $318,397 2013: $432,763</td>
</tr>
<tr>
<td>Texas Tech University Health Sciences Center</td>
<td>2012: $0 (n=0) 2013: $0 (n=0)</td>
<td>2012: $0 2013: $0</td>
</tr>
<tr>
<td>University of Alabama at Birmingham</td>
<td>2012: $4,560,500 (n=22) 2013: $5,275,467 (n=21)</td>
<td>2012: $195,471 2013: $262,501</td>
</tr>
<tr>
<td>University at Buffalo, The State University of New York</td>
<td>2012: $607,953 (n=4) 2013: $805,318 (n=5)</td>
<td>2012: $0 2013: $0</td>
</tr>
<tr>
<td>Institution</td>
<td>University Training Grants</td>
<td>Rehabilitation Training Grants</td>
</tr>
<tr>
<td>-------------------------------------------------------</td>
<td>----------------------------</td>
<td>--------------------------------</td>
</tr>
<tr>
<td>University of California, San Francisco</td>
<td>2012: $18,004,693 (n=57)</td>
<td>2012: N/A</td>
</tr>
<tr>
<td></td>
<td>2013: $18,350,321 (n=55)</td>
<td>2013: N/A</td>
</tr>
<tr>
<td>University of Colorado Denver</td>
<td>2012: $6,919,474 (n=26)</td>
<td>2012: $0</td>
</tr>
<tr>
<td></td>
<td>2013: $7,560,108 (n=31)</td>
<td>2013: $0</td>
</tr>
<tr>
<td>University of Delaware</td>
<td>2012: $346,526 (n=2)</td>
<td>2012: $67,866</td>
</tr>
<tr>
<td></td>
<td>2013: $394,142 (n=2)</td>
<td>2013: $155,291</td>
</tr>
<tr>
<td>University of Florida</td>
<td>2012: $2,464,065 (n=13)</td>
<td>2012: $205,731</td>
</tr>
<tr>
<td></td>
<td>2013: $1,948,748 (n=11)</td>
<td>2013: $0</td>
</tr>
<tr>
<td>University of Iowa</td>
<td>2012: $7,195,268 (n=25)</td>
<td>2012: $0</td>
</tr>
<tr>
<td></td>
<td>2013: $7,263,834 (n=26)</td>
<td>2013: $0</td>
</tr>
<tr>
<td>University of Kansas Medical Center</td>
<td>2012: $1,604,541 (n=4)</td>
<td>2012: $214,931</td>
</tr>
<tr>
<td></td>
<td>2013: $1,530,652 (n=8)</td>
<td>2013: $174,859</td>
</tr>
<tr>
<td>University of Kentucky</td>
<td>2012: $2,185,694 (n=11)</td>
<td>2012: $0</td>
</tr>
<tr>
<td></td>
<td>2013: $1,744,988 (n=10)</td>
<td>2013: $0</td>
</tr>
<tr>
<td>University of Maryland</td>
<td>2012: $3,841,749 (n=18)</td>
<td>2012: $0</td>
</tr>
<tr>
<td></td>
<td>2013: $3,562,960 (n=17)</td>
<td>2013: $0</td>
</tr>
<tr>
<td>University of Medical Sciences Arizona</td>
<td>2012: $1,927,366 (n=13)</td>
<td>2012: $0</td>
</tr>
<tr>
<td></td>
<td>2013: $1,182,950 (n=8)</td>
<td>2013: $0</td>
</tr>
<tr>
<td>University of Minnesota</td>
<td>2012: $9,886,557 (n=34)</td>
<td>2012: $256,351</td>
</tr>
<tr>
<td></td>
<td>2013: $9,903,968 (n=31)</td>
<td>2013: $274,442</td>
</tr>
<tr>
<td>University of Pittsburgh</td>
<td>2012: $12,620,803 (n=57)</td>
<td>2012: $28,157</td>
</tr>
<tr>
<td></td>
<td>2013: $13,516,467 (n=58)</td>
<td>2013: $28,157</td>
</tr>
<tr>
<td>University of Southern California</td>
<td>2012: $3,058,674 (n=10)</td>
<td>2012: $0</td>
</tr>
<tr>
<td></td>
<td>2013: $2,104,168 (n=8)</td>
<td>2013: $0</td>
</tr>
<tr>
<td>University of Texas Medical Branch</td>
<td>2012: $1,943,937 (n=9)</td>
<td>2012: $0</td>
</tr>
<tr>
<td></td>
<td>2013: $2,082,273 (n=9)</td>
<td>2013: $0</td>
</tr>
<tr>
<td>University of Washington</td>
<td>2012: $21,983,127 (n=61)</td>
<td>2012: $0</td>
</tr>
<tr>
<td></td>
<td>2013: $20,272,808 (n=56)</td>
<td>2013: $0</td>
</tr>
<tr>
<td>Virginia Commonwealth University</td>
<td>2012: $1,801,414 (n=6)</td>
<td>2012: $0</td>
</tr>
<tr>
<td></td>
<td>2013: $1,384,248 (n=6)</td>
<td>2013: $0</td>
</tr>
<tr>
<td>Washington University at St. Louis</td>
<td>2012: $16,949,967 (n=50)</td>
<td>2012: $153,637</td>
</tr>
<tr>
<td></td>
<td>2013: $16,764,449 (n=50)</td>
<td>2013: $143,012</td>
</tr>
</tbody>
</table>

Second, the campus is home to a very strong social science tradition and opportunities exist in behavioral and social epidemiology and community participatory research. Therefore, this multidisciplinary environment creates the setting for transdisciplinary approaches for training and research, which is a foundational value for the Department and program.
SECTION 4: FACULTY

The following are faculty members in the PhD in Rehabilitation Science program who are primarily housed in the Department of Physical Therapy and Rehabilitation Science and in the Department of Physical Therapy at San Francisco State University:

Table 8: Faculty in UCSF Department of Physical Therapy and Rehabilitation Science & SFSU Department of Physical Therapy

<table>
<thead>
<tr>
<th>Name</th>
<th>Title</th>
<th>Area of Expertise</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diane Allen, PT, PhD</td>
<td>WOS Faculty, UCSF Associate Professor, SFSU</td>
<td>Motion analysis, neurorehabilitation, Multiple Sclerosis, tests and measures</td>
</tr>
<tr>
<td>Nancy Byl, PT, MPH, PhD</td>
<td>Professor and Chair Emeritus</td>
<td>Focal dystonia, Parkinson’s disease, repetitive strain injury, CVA, outcomes research</td>
</tr>
<tr>
<td>Amber Fitzsimmons, PT, DPTSc</td>
<td>Assistant Professor (joint appointment in Anatomy)</td>
<td>Interprofessional education, geriatrics</td>
</tr>
<tr>
<td>Wendy Katzman, PT, DPTSc</td>
<td>Associate Professor</td>
<td>Osteoporosis, kyphosis, geriatrics</td>
</tr>
<tr>
<td>Jeannette Lee, PT, PhD</td>
<td>WOS Faculty, UCSF Associate Professor, SFSU</td>
<td>Oncology</td>
</tr>
<tr>
<td>Linda Noble, PhD</td>
<td>Professor (joint appointment in Neurological Surgery)</td>
<td>Brain and spinal cord injury; injury and repair mechanisms</td>
</tr>
<tr>
<td>Sandra Radtka, PT, PhD</td>
<td>WOS Faculty, UCSF Professor, SFSU</td>
<td>Motion analysis, pediatric neurorehabilitation</td>
</tr>
<tr>
<td>Susanna Rosi, PhD</td>
<td>Associate Professor (joint appointment in Neurological Surgery)</td>
<td>Neuroscience, neuroinflammation, the aged brain</td>
</tr>
<tr>
<td>Betty Smoot, PT, DPTSc</td>
<td>Assistant Professor (joint appointment in Anatomy)</td>
<td>Breast cancer related lymphedema</td>
</tr>
<tr>
<td>Richard Souza, PT, PhD</td>
<td>Associate Professor (joint appointments in Orthopaedic Surgery and Radiology and Biomedical Imaging)</td>
<td>Biomechanics, advanced quantitative imaging, lower extremity overuse injuries</td>
</tr>
<tr>
<td>Kimberly Topp, PT, PhD</td>
<td>Professor and Chair (joint appointment in Anatomy)</td>
<td>Cell biology of peripheral nerve, chemotherapy induced neuropathy</td>
</tr>
<tr>
<td>Linda Wanek, PT, PhD</td>
<td>WOS Faculty, UCSF Professor and Chair, SFSU</td>
<td>Musculoskeletal rehabilitation; muscle cell biology</td>
</tr>
</tbody>
</table>

Faculty outside the Department of Physical Therapy and Rehabilitation Science must be vetted through an approval process. The faculty member will provide one letter of support from a current faculty member in the PhD in Rehabilitation Science program and one letter from the faculty member’s department chair, as well as a copy of a current CV. The letters should attest to the items in the criteria list below, and the letter from the chair should also describe available lab space and grant support. The application packet is reviewed by the PhD Program Steering Committee, and membership is voted on at quarterly meetings. In certain cases, prospective faculty members may be asked to give a seminar to the PhD in Rehabilitation Science community before admission is approved.

Basic criteria for inclusion in the PhD in Rehabilitation Science Program faculty includes:

1. Research relevant to one or both of the specializations in the PhD in Rehabilitation Science program (musculoskeletal biomechanics or clinically informed neuroscience).
2. NIH R01 support to ensure external peer review and support for a student’s project.
3. Confidence that the individual would be a suitable mentor for a graduate student, which may include such considerations as time devoted to research if the candidate will have clinical responsibilities, publication record, funding resources, training record, etc.
4. Membership in the UCSF Academic Senate (may be waived in certain cases).
Faculty membership is reviewed every three years and renewal is contingent upon demonstrated involvement in the PhD program. Opportunities for involvement include teaching in PhD courses and participation in journal clubs, attending PhD in Rehabilitation Science retreats, serving on Qualifying Examination, Graduate, or Dissertation Committees, participating in the student interview process, serving as a primary research mentor, or hosting students through their laboratory rotations.

The following are faculty outside the Department of Physical Therapy and Rehabilitation Science who will be initial members of the faculty in the PhD program in Rehabilitation Science:

**Table 9: Faculty in the PhD Program Who Are Appointed in Other Departments at UCSF**

<table>
<thead>
<tr>
<th>Name</th>
<th>Title</th>
<th>Area of Expertise</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gary Abrams, MD</td>
<td>Professor and Director of Neurorehabilitation, Neurology Rehabilitation Section Chief, San Francisco VA Medical Center</td>
<td>Neurorehabilitation</td>
</tr>
<tr>
<td>Allan Basbaum, PhD</td>
<td>Professor and Chair Anatomy</td>
<td>Neurological basis of pain and its control</td>
</tr>
<tr>
<td>Michael Beattie, PhD</td>
<td>Professor Neurological Surgery</td>
<td>Spinal cord injury</td>
</tr>
<tr>
<td>Jacqueline Bresnahan, PhD</td>
<td>Professor Neurological Surgery</td>
<td>Spinal cord injury</td>
</tr>
<tr>
<td>Sibel Demir-Deviren, MD</td>
<td>Associate Professor Orthopedic Surgery</td>
<td>Chronic low back pain, degenerative disc disease</td>
</tr>
<tr>
<td>Brian Feeley, MD</td>
<td>Assistant Professor Orthopedic Surgery</td>
<td>Knee and shoulder orthopaedic injuries, surgical procedures</td>
</tr>
<tr>
<td>Adam Ferguson, PhD</td>
<td>Assistant Professor Neurological Surgery</td>
<td>Informatics and spinal cord injury</td>
</tr>
<tr>
<td>Donna Ferriero, MD</td>
<td>Professor Pediatrics</td>
<td>Neonatal hypoxia/ ischemia</td>
</tr>
<tr>
<td>Karunesh Ganguly, PhD</td>
<td>Assistant Professor Neurology</td>
<td>Neurorehabilitation</td>
</tr>
<tr>
<td>Kate Hamel, PhD</td>
<td>Assistant Professor Kinesiology, SFSU</td>
<td>Biomechanics and falls in the elderly</td>
</tr>
<tr>
<td>Robert Hiatt, MD, PhD</td>
<td>Professor Epidemiology and Biostatistics</td>
<td>Oncology and disease prevention; epidemiology and public health</td>
</tr>
<tr>
<td>Galateia Kazakia, PhD</td>
<td>Assistant Professor Radiology and Biomedical Imaging</td>
<td>Bone microarchitecture, quantitative computed tomography, mechanisms of bone failure to load.</td>
</tr>
<tr>
<td>Thomas Lang, PhD</td>
<td>Professor Radiology and Biomedical Imaging</td>
<td>Quantitative computed tomography, positron emission tomography, bone and muscle adaptations to stimuli.</td>
</tr>
<tr>
<td>Jon Levine, MD, PhD</td>
<td>Professor Oral and Maxillofacial Surgery</td>
<td>Signaling in pain sensory neurons; neural-endocrine control of inflammation; musculoskeletal pain</td>
</tr>
<tr>
<td>Xiaojuan Li, PhD</td>
<td>Associate Professor Radiology and Biomedical Imaging</td>
<td>Post-traumatic osteoarthritis, quantitative magnetic resonance imaging.</td>
</tr>
<tr>
<td>Thomas Link, MD, PhD</td>
<td>Professor Radiology and Biomedical Imaging</td>
<td>Imaging of osteoporosis, imaging techniques for assessment of bone quality and density</td>
</tr>
<tr>
<td>Jialing Liu, PhD</td>
<td>Professor Neurological Surgery</td>
<td>Stroke</td>
</tr>
<tr>
<td>Name</td>
<td>Title</td>
<td>Area of Expertise</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>----------------------------------------</td>
<td>-----------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Anthony Luke, MD, MPH</td>
<td>Professor Orthopaedic Surgery</td>
<td>Sports injuries, particularly running overuse injuries</td>
</tr>
<tr>
<td>Benjamin Ma, MD</td>
<td>Associate Professor Orthopaedic Surgery</td>
<td>Orthopaedic surgical approaches, post-traumatic osteoarthritis</td>
</tr>
<tr>
<td>Sharmila Majumdar, PhD</td>
<td>Professor Radiology and Biomedical Imaging</td>
<td>Osteoporosis, osteoarthritis, radiology and quantitative imaging</td>
</tr>
<tr>
<td>Mervyn Maze, MB ChB</td>
<td>Professor and Chair Anesthesia and Perioperative Care</td>
<td>Exercise and inflammation post-anesthesia</td>
</tr>
<tr>
<td>Patrick McQuillen, MD</td>
<td>Associate Professor Pediatrics/Critical Care</td>
<td>Disorders of brain development</td>
</tr>
<tr>
<td>Christine Miaskowski, RN, PhD</td>
<td>Professor Physiological Nursing</td>
<td>Pain and symptomatology in oncology</td>
</tr>
<tr>
<td>Sri Nagarajan, PhD</td>
<td>Associate Professor Radiology and Biomedical Imaging</td>
<td>Functional brain imaging, brain plasticity, learning, sensorimotor control</td>
</tr>
<tr>
<td>Mark Schumacher, PhD, MD</td>
<td>Professor Anesthesia and Perioperative Care</td>
<td>Ion channels and nociceptors; chronic pain</td>
</tr>
<tr>
<td>Raymond Swanson, MD</td>
<td>Professor Neurology</td>
<td>Excitotoxic and oxidative neuronal death, Parkinson’s disease</td>
</tr>
<tr>
<td>Zena Vexler, PhD</td>
<td>Professor Neurology</td>
<td>Neonatal stroke</td>
</tr>
<tr>
<td>Midori Yenari, MD</td>
<td>Professor Neurology</td>
<td>Stroke</td>
</tr>
</tbody>
</table>
SECTION 5: COURSES

The following are present and proposed courses for the PhD in Rehabilitation Science (proposed courses are indicated with an asterisk). Given the relatively small class size of the PhD program (2 students every other year), there will be minimal to no impact on existing course loads.

Department of Physical Therapy and Rehabilitation Science

PT 251 Research Design (3.5 units)
Instructor: Betty Smoot, PT, DPTSc
This course explores the underlying theoretical concepts that guide the design of clinical research studies. Students will be introduced to the scientific method and to a variety of research methods and designs. Students will 1) learn research designs that will be applicable to their future physical therapy practice, 2) develop a research question and design an appropriate study for that question, and 3) learn to critically appraise and become proficient consumers of research literature.

PT 420 Mentored Research Concentration (2.5 units)
Instructor: Varies
Students have the option of pursuing a research concentration pathway. This pathway includes all requirements of the PT 419 Research Seminar. As a mentored research experience, students are both supervised and work alone or as part of a team on a research project. Research mentors include faculty within the UCSF/SFSU Graduate Program in Physical Therapy, UCSF/SFSU researchers outside of the Program, as well as faculty at consortium institutions.

*RS 100 Introduction to Rehabilitation Science (2 units)
Instructor: Richard Souza, PT, PhD & Linda Noble, PhD
The purpose of this course is twofold: 1) to provide an introduction to the areas of rehabilitation science research, and 2) to provide historical perspective on the major issues in rehabilitation science. Students will learn about resources and on-going research projects within the University. Students will also read classic papers of the last 150 years with the objective of understanding the fundamental discoveries that shape the discipline of rehabilitation science.

*RS 110 Principles and Applications of Evidence-based Practice (3 units)
Instructor: Diane Allen, PT, PhD
This course provides instruction on the principles of evidence-based clinical practice, and statistical methods reporting efficacy and effectiveness. Students learn hierarchical levels of evidence and complete a meta-analysis of research findings in an area of interest. The seminar component of the course will enable the student to delve deep into a topic related to his/her dissertation research area.

*RS 130 Basics in Musculoskeletal Imaging (3 units)
Instructor: Richard Souza, PT, PhD
The purpose of this class is to understand the principles behind various imaging procedures, and develop skills in looking at musculoskeletal images. These skills would be beneficial to the student exploring research careers in areas that use imaging as a tool or outcome. Course content will be provided in part through established coursework in the DPT curriculum (PT 210) but will include the addition of a weekly seminar with the Course Director to review the latest literature in musculoskeletal imaging.

*RS 150 Gross and Regional Anatomy (1 unit)
Instructor: Kimberly Topp, PT, PhD
This course provides an opportunity for students to investigate a regional of human anatomy, which has direct relevance to his/her area of research interest. The course includes mentored cadaveric dissection, radiological imaging of the same regional anatomy, ultrasound imaging and focused study of unembalmed material. The primary goals are to gain a deep understanding of the region of interest and to relate the knowledge to studies in...
the Musculoskeletal Biomechanics or Clinically Informed Neuroscience tracks. Example foci are lower limb joints, nerve paths, spinal cord in situ.

**RS 200 Laboratory Rotation** (5 units)
**Instructor:** Various
This course allows the students to rotate through different faculty laboratories to learn new instrumentation and scientific methodology as well as undertake an individual study with emphasis on special problems in rehabilitation science including areas related to the student’s long term interests, future research interests or clinical specialization.

**RS 300 Doctoral Colloquium** (1 unit)
**Instructor:** Richard Souza, PT, PhD & Linda Noble, PhD
PhD students in Rehabilitation Sciences program enroll in this seminar throughout their course of doctoral studies. This course provides a forum for discussion of the current research of students and faculty members, as well as discussions of practice influence on research and translation of research to practice. The course also serves as a forum for topics in professional development, including manuscript reviews; selection of journals for publication of one’s work; ethical decisions in publication, grant review, authorship; participation in professional organizations; best practices in teaching, research decisions, collaborations, mentoring; and scholarship and funding opportunities, strategies and decisions.

**RS 310 Teaching Practicum** (1-4 units)
**Instructor:** Varies
Training in teaching in a course offered by the Graduate Program in Physical Therapy under the supervision of instructor in charge. Laboratory teaching, presentation of lecture material, experience in setting up and correcting of examinations, and participation in course are included.

**RS 330 Biomechanics of Human Motion** (2 units)
**Instructor:** Richard Souza, PT, PhD
The course will introduce the student to concepts of mechanics as they apply to human motion. Primary areas of study will include anthropometry, kinematics, kinetics, muscle function, and muscle modeling. Emphasis will be placed on the biomechanics of locomotion using the inverse dynamics approach for calculating moments of force and joint power. The course will also provide practical experimentation and interpretation examples which build upon general biomechanical concepts (e.g. inverse dynamics). Weekly discussions will focus on the interpretation of these data and the extrapolation of these advanced concepts using clinical examples.

**RS 331 Running Biomechanics and Overuse Injuries - Journal Club** (2 units)
**Instructor:** Richard Souza, PT, PhD
Students will have the opportunity to be part of an evidence-based approach to evaluating and treating running injuries through a comprehensive biomechanics evaluation. This course will consist of three parts: 1) observing UCSF RunSafe running assessments throughout the year; 2) reading, analyzing and presenting recent literature in a journal club format; and 3) processing, analyzing and presenting video-based running biomechanics data. The UCSF RunSafe and Running Biomechanics Elective will be mentored by Richard Souza, PT, PhD. The RunSafe observations and data processing will take place at the Human Performance Center at the Orthopaedic Institute on the Mission Bay campus. A final running biomechanics evaluation and presentation will be performed by all students that take this elective through evaluating of each others running form. This will be presented to Dr. Souza at the end of the elective and will be graded as pass or no pass.

**RS 340 Activity and Its Effects on CNS Disease/Injury Across the Lifespan** (2 units)
**Instructor:** Linda Noble, PT, PhD
This reading-intensive mini-course, led by Linda Noble, PhD, will explore the interaction between defined activity and its effects on clinically relevant models of neurodegeneration, neural injury, and neuroinflammation. This 2-week course will review the current literature, led by faculty in the Departments of Physical Therapy and Rehabilitation Science, Neurological Surgery, Anatomy, Physiology and Neurology.
RS 400 Topics in Clinically Informed Neuroscience (2 units)
Instructor: Linda Noble, PT, PhD
This mini-course will investigate the research literature that would support specific interventions in human disease, and the specific challenges in applying the research findings in the clinical environment. There will be discussion about the translation of bench research to clinical populations, as well as discussions of how clinical observations may inform and improve bench science. Course topics will be relevant for students in either the Musculoskeletal Biomechanics or the Clinically Informed Neuroscience track.

RS 350 Research (1-8 units)
Instructor: Varies
Laboratory rotations for doctoral students enrolled in the PhD in Rehabilitation Science Program.

SFSU Department of Physical Therapy

PT 910 Evidence Based Practice (4 semester units)
Instructor: Diane Allen, PT, PhD
Students will continue the evidence-based review they started in PT 209, performing a meta analysis to answer their own research question. Students will present their findings orally and in a publication-style manuscript for the DPT culminating experience.

PT 960 Teaching Practicum (3 semester units)
Instructor: Varies
Develop necessary teaching skills for classroom, clinic, and laboratory. Students take this course at least twice and teach in the clinic at least one semester and in the classroom, one semester.

PT 996 Directed Studies (3 semester units)
Instructor: Varies
Development of research skills in preparation for doctoral laboratory original research. Student will be in a laboratory setting with faculty, post-doctoral and pre-doctoral students. Consists of seminars, journal clubs, and laboratory assignments.

PT 997 Research (2 semester units)
Instructor: Varies
Collection of data on original research project under the direction of dissertation advisor and dissertation committee. Determination of objectives and evaluation criteria by advisor based on stage of the project.

Department of Anatomy

ANA 207 Neuroscience (5 units)
Instructor: Susanna Rosi, PhD
The structural organization and function of the physiology of the central nervous system with an emphasis on the physiology of striated muscle and peripheral nerve relative to control mechanisms within the nervous system is presented. Emphasis is on clinical functional correlations of motor control.

Department of Bioengineering

BioE 25 Careers in Biotechnology (1 unit)
This introductory seminar is designed to give freshmen and sophomores an opportunity to explore specialties related to engineering in the pharmaceutical/biotech field. A series of one-hour seminars will be presented by industry professionals, professors, and researchers. Topics may include biotechnology and pharmaceutical manufacturing; process and control engineering; drug inspection process; research and development; compliance and validation; construction process for a GMP facility; project management; and engineered solutions to
environmental challenges. This course is of interest to students in all areas of engineering and biology, including industrial engineering and manufacturing, chemical engineering, and bioengineering.

**BioE 221 Tissue Mechanobiology** (2.5 - 3.0 units)
A central role for many tissues is to support physical forces (tension, compression, shear, pressure). This course will introduce the mechanisms by which cells respond to load; how these mechanisms are relevant to normal function & disease etiology; progression; prevention & treatment; an overview of tissue mechanics (relationships between force, stress/strain), mechanisms of cell/matrix interactions, examples of tissue modeling & remodeling in response to physical stimuli.

Department of Biomedical Imaging

**BI 201 Principles of MR Imaging** (4 units)
This course aims to teach the basic principles behind magnetic resonance imaging. Topics taught physics of magnetic resonance, including resonance, excitation, and relaxation; image formation with excitation pulses and gradients fields; image reconstruction via the Fourier Transform (including review of Fourier Transform); MRI scanner hardware, including magnets and coils; image contrast; artifacts due to flow, motion, and field variations. Time-permitting, modern MRI techniques will also be covered, including fast imaging methods and multi-coil configurations.

**BI 202 Physical Principles of CT, PET, and SPECT Imaging** (4 units)
This course is designed to provide the basic knowledge base to understand the physical principles of x-ray computed tomography (CT), positron emission tomography (PET), and single photon emission computed tomography (SPECT). Through "real" examples of how x-ray CT, PET, and SPECT are used in medical diagnosis and disease management, we will combine physical and mathematical foundations with actual applications for thorough understanding of the principles of these imaging techniques. Principles and developments of advanced CT, PET, and SPECT imaging technologies will be also discussed as integral parts of this course.

**BI 240 Musculoskeletal Imaging** (3 units)
This course will utilize the basics learnt in the core imaging courses, and explore the specific theoretical and experimental needs for imaging the musculoskeletal system and tissues. It will focus on tissue composition, system function, and address quantitative imaging aspects that link imaging metrics to biochemistry, biomechanics, function and movement. The course will explore the role of imaging and image processing in understanding, and studying, musculoskeletal degeneration, aging, injury, as well as regenerative strategies, and therapeutic approaches.

Department of Biomedical Sciences

**BMS 214 Ethics and the Responsible Conduct of Research** (2 units)
This course will cover topics related to the responsible conduct of research such as conflicts of interest, responsible authorship, policies regarding the use of human and animal subjects, handling misconduct, proper data management, research funding rules and procedures. Students will review and present case studies for class discussion.

**BMS 225A Human Disease: Technologies & Biomedical Applications** (1.5 units)
Integrative course emphasizing technologies for cell & molecular biology and the application of these methods to understand human disease. Intended to provide a foundation for graduate students in methods used to understand human cells, tissues, & organs, and to illustrate how these methods illuminate physiology and pathobiology. Rather than a comprehensive course, selected topics will be discussed in depth. The emphasis may shift each year, depending upon which topics are relevant and timely.

**BMS 225B Tissue and Organ Biology** (3 units)
An integrative course emphasizing frontiers in cell and molecular biology of human tissue and organ systems. It is
intended to provide a foundation in human anatomy, histology, immunology, physiology and pathobiology for
graduate students. Rather than a comprehensive course, selected topics will be discussed in depth. The emphasis
may shift each year, depending on which topics are relevant and timely.

**BMS 255 Basic Genetics and Genomics** (4 units)
The scope of this graduate level course in genetics is to convey an understanding of basic genomics and molecular
genetics, of the use of genetic animal model systems and of the analytical principles of simple and complex human
genetic traits.

**BMS 260 Cell Biology** (4 units)
The scope of this course is to convey an understanding of the function and organization of molecules and
organelles inside and outside the cell and how these are used to construct a multicellular tissue and organ. The
course will concentrate on questions related to how cells function, including how they grow, divide and die, and
how they move, secrete and communicate.

**Department of Biostatistics**

**Biostat 187 Intro Statistical Theory & Practice** (5 units)
Review of basic statistical theory, sampling, descriptive statistics, and probability. Presentation of confidence
intervals, hypothesis testing, one- and two-factor analysis of variance, correlation, simple linear regression, and
chi-square tests. A preparation for more advanced work.

**Department of Epidemiology and Translational Science**

**EPI 150.03 Designing Clinical Research For Residents And Students** (2 units)
This course guides residents and students through the essential components for writing a clinical research
protocol, developed around their own clinical research question. Students attend lectures and small group
seminars as well as a peer review session in the last week of the course. The course will cover research questions,
hypotheses, specific aims, study types, sample size estimation, power calculations, and data analysis.

**EPI 218 Data Management for Clinical Research** (1 units)
Instruction in choosing the appropriate data management system, design of research data bases, options in data
entry, form and report generation, computer security, and budgeting for data management personnel and
equipment.

**EPI 227 Building an Academic Career** (0.5 units)
Trainees learn about choosing a mentor, time management, generating finished projects, getting grants and
getting a job; about how UCSF administration works, and about sources of clinical research funding including
industry and foundations in addition to NIH and other government agencies.

**Department of Microbiology**

**MICRO 204 Molecular and Cellular Immunology** (3 units)
Topics to be covered: hematopoiesis, structure and genetics of immunoglobulins, lymphocyte surface molecules,
T cell receptors, signal transduction, antigen presentation, MHC restriction, tolerance, T cell effector mechanisms,
lymphocynes, and autoimmunity.

**Department of Neuroscience**

**NS 219 Special Topics in Basic and Translational Neuroscience** (3 units)
Each course offering will focus on the literature of a current important area of Neuroscience research. Students
will be expected to read assigned papers critically before class and to present and discuss papers in class. Students
will also be expected to write and present a brief research proposal based upon their reading. Topics in molecular,
cellular, developmental, systems and computational neuroscience, and neurological and behavioral disorders will be covered in separate course offerings.

**NS 225 Neurobiology of Disease** (3 units)
Lectures and student-led discussions on physiological and molecular bases of diseases such as Alzheimer’s, Parkinson’s, multiple sclerosis, epilepsy, autism, addiction, triple repeat and prion diseases.

**NS 245 Neurobiology of Behavior** (3 units)
Lectures and discussion of primary research concerning the neural basis of behavior. Topics will include basic concepts of learning and neuroethology with examples from vertebrate and invertebrate systems. A comparative approach will be taken to understanding psychological constructs such as drive, motivation and emotion. Emphasis is on neural circuit analysis of behaviors such as sound localization, drug self-administration and fear conditioning.

**Department of Nursing**

**N 294B Medical Genetics for Nursing** (3 units)
Course addresses the genetic basis of human disease (cardiovascular, oncology, gerontology); genetic screening and diagnosis, ethical, legal and social implications related to genetic information and technology; ethnic, racial and cultural considerations for providing genetic services; and genetic therapeutics, such as, pharmacogenetics, gene therapy, stem cell transplants, enzyme replacement.

**TICR Summer Clinical Research Workshop**

**EPI 150.03 Designing Clinical Research For Residents And Students** (2 units)
This course guides residents and students through the essential components for writing a clinical research protocol, developed around their own clinical research question. Students attend lectures and small group seminars as well as a peer review session in the last week of the course. The course will cover research questions, hypotheses, specific aims, study types, sample size estimation, power calculations, and data analysis.

**BIOSTAT 212 Introduction to Statistical Computing in Clinical Research** (1 unit)
This course will introduce clinical researchers to the use of computer software for managing and analyzing clinical research data. Currently available statistical packages will be described and the roles of spreadsheet and relational database programs discussed. Use of STATA for managing, cleaning, describing, and analyzing data will be taught in lecture and laboratory sessions.

**EPI 218 Data Management for Clinical Research** (1 units)
Instruction in choosing the appropriate data management system, design of research data bases, options in data entry, form and report generation, computer security, and budgeting for data management personnel and equipment.

**EPI 227 Building an Academic Career** (0.5 units)
Trainees learn about choosing a mentor, time management, generating finished projects, getting grants and getting a job; about how UCSF administration works, and about sources of clinical research funding including industry and foundations in addition to NIH and other government agencies.
SECTION 6: RESOURCE REQUIREMENTS

Included with this proposal is the budget for the PhD in Rehabilitation Science program for five years (2016-2020). In 2016, we project two students entering the program, and one of these students will likely qualify for a merit-based scholarship. Both students will be supported by the block allocation provided by the Graduate Division, covering tuition and a stipend in the amount of $21,500 per student. Additional funding sources in 2016 to cover program expenses include Kean Foundation funding. In 2017, these same two students will move forward in the program, supported again by the block allocation from the Graduate Division, which will cover tuition and a stipend of $21,500 per student. Additional revenues for this year include projections for two students qualifying for merit-based scholarship funding, and internal reallocation of departmental discretionary funds (reserves) and/or development funds.

Two new students will be added to the program every other year. It is anticipated that all new students entering the program will be supported by the department for the first two years, and supported in subsequent years by grant funding from primary investigators’ grants. We project that by 2018 we will have secured a T-32 training grant and these funds will be used going forward to support students during the first two years of the program. Admission into the training program will be based upon qualifications and availability of slots at the time of application.

Faculty whose salaries are partially supported by state funding will be instructors in this program and there will be no impact to their participation in the current Doctor of Physical Therapy (DPT) program.

1) FTE Faculty
The PhD Program team includes a Program Director and instructors, totaling the equivalent of 0.3 faculty FTEs. There will be no impact to the existing DPT program in this model.

2) Library Acquisition
There are no anticipated additional costs for library acquisitions as most of the books and journals necessary for the PhD program are already available in the library or online. Students will have access to online resources for articles, such as PubMed and Google Scholar. The PhD in Rehabilitation Science program will also be supported by the online resources of the UC Digital Library system.

3) Computing Costs
All students are expected to have a computer and internet access. A laptop or tablet is needed for on-campus class activities and homework. Students are expected to be experienced in using Microsoft Word, Excel, PowerPoint, the Web, Adobe Reader, Anti-virus software, and E-mail. Students receive the standard desktop support available from the UCSF Library and IT Services.

4) Equipment
No additional equipment costs are anticipated.

5) Space and Other Capital Facilities
Faculty: Office space to accommodate faculty and staff for the program is provided by the Department of Physical Therapy and Rehabilitation Science, as well as home departments of other faculty involved in the program (including Anatomy, Radiology and Biomedical Imaging, and Neurological Surgery).

Classes: Students will enroll in pre-existing courses, and the addition of two students will not require additional classroom space. Our students will be able to take advantage of the range of classrooms currently available to the Department faculty. Large classrooms are used for shared keynote lectures and educational activities and smaller rooms scheduled for breakout sessions.
6) **Other Operating Costs**
Non-faculty payroll costs include 0.06 FTE of staff support (MSO, Finance Analyst, and Program Administrator).

7) **Impact on Existing Doctor of Physical Therapy Degree Program**
There is no anticipated financial impact on the existing Doctor of Physical Therapy Degree Program.
SECTION 7: GRADUATE STUDENT SUPPORT

The PhD Program will cover the tuition costs and provide a $21,500 stipend during the first two years of the program using a combination of block funding provided by the Graduate Division, scholarship funds, and a T-32 training grant. After this point, the expectation is that students will join the primary research mentor’s grant with the same level of support (covering tuition plus a stipend).

The Program will encourage students to seek merit-based scholarship or fellowship funding during the first two years. The UCSF Graduate Division offers a range of scholarships in which PhD in Rehabilitation Science students will be eligible. They include:

- ARCS (Achievement Rewards for College Scientists) Scholarship - $12,000 stipend
- Chuan Lyu Chancellor’s Fellowship - $40,000 award
- CRCC (Cancer Research Coordinating Committee) Fellowship - $30,000 stipend
- DYFP (Dissertation-Year Fellowship Program) - $23,000 stipend
- Eugene Cota-Robles Fellowship - $14,000 stipend
- Fletcher Jones Fellowship - $20,000 stipend
- Graduate Research Mentorship Fellowship – $12,000 stipend
- Julius R. and Patricia A. Krevans Fellowship - $10,000 stipend
- Lloyd M. Kozloff Fellowship - $10,000 stipend
- Matilda Edlund Scholarship - $20,000 stipend
- NIGMS IMSD (Initiative for Maximizing Student Diversity) Program - $30,000 stipend
- Ralph H. Kellogg Endowed Chancellor’s Fellowship - $25,000 stipend

California PT Fund – up to $10,000 research grant

Foundation for Physical Therapy
- Florence P. Kendall Doctoral Scholarship – 1-year, $5,000 scholarship
- Promotion of Doctoral Studies (PODS) I Scholarship - 1-year, $7,500 scholarship
- Promotion of Doctoral Studies (PODS) II Scholarship - 1-year, $15,000 scholarship
SECTION 8: GOVERNANCE

The PhD program is being offered by a unit that offers graduate degrees.
SECTION 9: CHANGES IN SENATE REGULATIONS

None anticipated.