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1. Description of the Structural Anatomy and Rehabilitation Sciences Graduate Program

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The Structural Anatomy and Rehabilitation Sciences (SARS) Graduate Program is a collaborative, inter-professional program offered by the Center for Anatomical Sciences and the Department of Physical Therapy. Our program offers both M.S. and Ph.D. degrees aligned with research opportunities, coursework, and teaching experiences. These activities are designed to develop and train students who will be qualified to serve as faculty members and independent researchers in various departments at health science centers and universities. The program will focus on anatomy, biomechanics, and movement science using advanced experimental, computational, and clinical tools. The major impetus of the research in the discipline will consist of but not be limited to: 1) biomechanics, including the study of the structure, function, evolution/adaptive significance, and mechanical behavior of musculoskeletal soft and hard tissues, 2) neuroscience of movement production, learning and control; 3) anatomical studies linked to clinical applications in orthopedics and physical therapy, 4) the analysis, design, and/or development of rehabilitation protocols, assessment tools and techniques, assistive devices and instrumentation used in rehabilitation practice, 5) studies of educational pedagogy in anatomy/movement science through the development of novel educational tools, techniques, and assessment strategies.

All students entering the program will complete an integrated biomedical science core curriculum that includes fundamental principles of biochemistry, cellular and molecular biology, microbiology and immunology, pharmacology, physiology, and neurobiology. Beginning with the second semester, students will enroll in additional elective courses for the program such as Applied Biomechanics, Principles of Movement and Motor Control, or anatomy systems courses, to be completed during their graduate career. Students are required to participate in seminar/work in progress and journal club for their first two years. Students will conduct original, publishable research and will be expected to present their results at national scientific conferences. The completion of the M.S. degree typically requires two to three years; the Ph.D. degree is generally completed in four to five years.

Graduates with advanced degrees typically find employment in higher education, industry and government agencies.
Graduate Faculty and Specific Research Programs

Nicoleta Bugnariu, PhD and DPT
Associate Dean of Academic Affairs and Research, School of Health Professions

Dr. Nicoleta Bugnariu is a licensed Physical Therapist and holds a PhD in Neuroscience. Dr. Nicoleta Bugnariu’s research focuses on the underlying mechanisms controlling sensorimotor function in patients across the lifespan. She has research expertise in motor control and neuroscience and has worked clinically with patients with neurologic conditions, in particular stroke patients and frail elderly at risk of falls. Line of research are grouped under the following topics: i) Age-related changes in systems involved in postural control, ii) Balance rehabilitation and falls prevention, iii) Sensory integration and hearing loss impact on balance control, iv) Virtual reality, robotic and prosthetic technologies used as evaluation and rehabilitation tools. Dr. Bugnariu conducts her research in the Human Movement Performance laboratory at UNTHSC where she has been effective at building a network of collaborators, a diverse team of researchers and clinicians with complementary expertise in physical therapy, neuroscience, geriatrics, biomechanics, kinematics, robotics, cognitive psychology, and biomedical engineers. Dr. Bugnariu has a record of positive mentorship and is fully committed to the successful career of her trainees.

Dr. Hao Lui, MPT, MD, PhD
Associate Professor, Physical Therapy

Dr. Liu has spent his research career in neuroscience, anatomy and physical therapy, but in last 18 years his research centers more on balance improvement and fall prevention among older individuals (primarily) and clinical anatomy of the musculoskeletal system in Gross Anatomy lab (secondarily). More specifically, he has led his geriatric research group (faculty members, PhD and DPT students) with focuses on 1) effects of inappropriate use of assistive ambulatory devices (AADs) on gait, balance, and posture; 2) interventions with combination of physical therapy exercise and Chinese medicine to improve gait, balance, strength, and posture in general older population, AAD users, and patient-specific older population; and 3) bioengineering modification and testing of assistive ambulatory devices.

Dr. Liu is a very active in providing community services to local senior living communities. As a faculty member, he and his team had provided geriatric rehabilitation related community services to local senior living communities in central Arkansas area (2003-2009) and in DFW metropolitan area (2010 – now).

Rehana Lovely, Ph.D.
Assistant Professor, Department of Physiology and Anatomy, Center for Anatomical Sciences

Dr. Lovely’s research broadly focuses on collaborating with physical therapists, surgeons and other clinicians to investigate human anatomical variations, mapping of surface projection of the peripheral nerves and pathophysiology of myofascial pain. I am also interested in anatomy education research involving community outreach programs and medical student education.

Scott D. Maddux, Ph.D.
Assistant Professor, Department of Physiology and Anatomy, Center for Anatomical Sciences

My research focuses on human evolution during the Middle and Late Pleistocene with an emphasis on Neandertal and modern human craniofacial anatomy. In particular, I am interested in the developmental, biomechanical, and stochastic processes which produced the characteristic midfacial prognathism of Neandertals and orthognathism of modern humans. Related to these issues, I have corollary interests in patterns of human craniofacial allometry, integration, sexual dimorphism, and eco-geographic variation. To investigate these topics, my laboratory employs multiple techniques and approaches, including medical imaging and laser scanning modalities, linear and geometric morphometrics, and experimental modeling in non-human species. Current research projects are primarily concentrated in two main areas; the influence of climatically-adaptive variation in human
upper respiratory tract anatomy on overall craniofacial morphology; and the “self-domestication” hypothesis as a model for explaining facial retraction as an evolutionary byproduct of selection for increased social tolerance.

Rachel Menegaz, Ph.D.
Assistant Professor, Department of Physiology and Anatomy, Center for Anatomical Sciences
My research explores the growth and function of the mammalian masticatory apparatus. The biomechanical demands imposed by dietary composition are known to affect chewing behavior and joint kinematics and, over time, the growth trajectories of the craniofacial skeleton and its associated soft tissues (joint cartilages, muscles of mastication, etc.). By modulating diet, we are able to affect the overall growth of these tissues, dental eruption and occlusion, and even the biomineralization of the masticatory skeleton and fiber type composition of masticatory muscles. I am particularly interested in how early life history events (such as weaning and dental eruption/replacement) affect feeding, growth, and adult morphological outcomes. Current research themes include: (1) Variation in maturation rates among tissues of the masticatory complex and how this affects feeding performance and plasticity. What happens during the transition between infant-like suckling and adult-like chewing, and what are the structural and behavioral constraints that limit efficient feeding during early childhood? (2) The role of type I collagen in the growth of the craniofacial skeleton. How do collagen disorders, such as osteogenesis imperfecta, affect the facial phenotype? What behavioral and/or pharmaceutical interventions are effective in recovering the phenotype and function in these disorders?

Haylie L. Miller, Ph.D.
Assistant Professor, Department of Physical Therapy
The Autism and Developmental Disorders Research Team has NIH and NSF grant support for a program of research investigating visuomotor integration—the use of visual information to plan, execute, and modify movement—in Autism Spectrum Disorder (ASD). Visuomotor integration is important for many tasks of daily living, like making a sandwich, walking or playing sports, and driving a car. People with ASD have known differences in eye and body movement. Some people with ASD may also receive a diagnosis of Developmental Coordination Disorder because of the level of difficulty they have with movement and coordination. We seek to understand how the visual and motor systems work together to produce functional behaviors. Some of these behaviors include walking, aiming, and moving the body to intercept or avoid objects. To answer questions about how people with ASD might be different from people without ASD, or from people with other developmental disorders like DCD, we use neuropsychological assessments, motor assessments, vision screening, mobile eye-tracking, full-body motion-capture, and force plates. We use several different 3D environments to test visuomotor integration under conditions that simulate real-world demands on attention and performance. We also conduct retrospective studies of motor and visual symptoms of ASD using secondary datasets and electronic medical records from local and national sources.

Magdalena N. Muchlinski, Ph.D.
Associate Professor, Department of Physiology and Anatomy, Center for Anatomical Sciences
My research focuses on primate bioenergetics and sensory ecology within an anthropological framework. Specifically, this work concentrates on how the selective pressures imposed by differences in feeding ecology shape the anatomy, physiology, and evolution of both non-human primates and humans. My research currently focuses on three ongoing projects: (1) The first focuses on the interaction between brain size and the evolution of metabolic strategies. My research examines the role brain size/complexity has played in shaping muscle anatomy and physiology in primates. (2) The second project is a collaborative effort focusing on midfacial growth trajectories in sub-adult primates. With my colleagues, we are exploring the anatomical and developmental basis of the documented sensory trade-off between olfaction and the visual system. (3) The third is a collaborative project examining the evolutionary transition from face touch among non-primate...
mammals to hand touches in primates. This study applies traditional (histology) and genetic (RNA) approaches analysis this important evolutionary transition.

**Rita M. Patterson, PhD**
Professor, Department of Family and Osteopathic Manipulative Medicine.

My background is in biomedical engineering, with specific training and expertise in applied research in Orthopaedics, human performance, and rehabilitation. I have a unique perspective that can bridge and facilitate technology development in clinical settings and applications. In the department of Orthopaedic Surgery and Rehabilitation at the University of Texas Medical Branch in Galveston TX, I had a successful partnership for 20 years with a hand surgeon investigating the anatomic, biomechanic and kinematics of the carpal bones and the upper extremity. I also worked closely with upper extremity physical therapists and rehabilitation science specialists to understand hand function.

At UNTHC, Dr. Patterson works in the Human Movement Performance laboratory. This lab is devoted to improving knowledge of musculoskeletal function in order to assist physicians in the diagnosis and treatment of medical problems. The goals include improved clinical measurements of biomechanical function, objective methods of evaluation, treatment, and therapy, and mathematical/computer models of muscle, joint, and bone mechanics.

**Rustin E. Reeves, PhD**
Professor, Department of Physiology and Anatomy and Director, Center for Anatomical Sciences

Dr. Reeves’ research includes collaboration with physical therapists, orthopedic surgeons, and clinicians to investigate pathological issues from an anatomical and biomechanical perspective. Recent research involves ultrasound diagnosis of ankle injuries and surface mapping of the dorsal scapular nerve for use in pain management. Other areas of interest include K-12 science outreach programs for teachers and students interested in the biomedical sciences. Dr. Reeves is also involved with clinical skills training of area health care professionals utilizing cadavers from the Center’s Willed Body Program. The Center for Anatomical Sciences houses the institution’s BioSkills Laboratory which offers numerous clinical training activities and serves as a research facility for graduate students, faculty, and orthopedic surgeons in the Dallas-Fort Worth area.

**Metin Yavuz, D. Eng**
Associate Professor, Department of Physical Therapy

Diabetic foot ulcers lead to over 100,000 lower extremity amputations every year in America. The outcome is patients who lose their independence, jobs and require substantial rehabilitation on top of a $30 billion burden on the US Healthcare System. Our lab has been emphasizing the need for better preventive devices and healthcare in order to prevent this costly complication. In order to do design and develop better devices, one needs to better understand the pathology of the problem, which has unresolved issues. In this regard, we have been investigating ulceration pathway with a comprehensive biomechanical approach. The American Society of Biomechanics and American Diabetes Association have awarded our groundbreaking work in this area. Recently, we have been also developing preventive devices; such as smart diabetic shoes that will alert a patient and their healthcare provider once it detects a developing ulcer. We are also developing preventive devices for pressure ulcers in permanently seated individuals.
2. Course Offerings

2.1 GSBS and SARS required Courses
Structural anatomy and rehabilitation science students are required to take the following BMSC and PHAN courses:

BMSC core and required courses
BMSC 6201 – Fundamentals of Biomedical Science I
BMSC 6202 – Fundamentals of Biomedical Science II
BMSC 6203 – Fundamentals of Biomedical Science III
BMSC 6204 – Fundamentals of Biomedical Science IV
BMSC 6200 – Experimental Design and Biostatistics
BMSC 5160 – Biomedical Ethics
BMSC 5150 – Lab Rotations
PHAN 6000 – Teaching Practicum
PHAN 6100 – Laboratory Teaching Practicum
PHAN 5140 – Seminar in Current Topics
PHAN 6150 – Journal Club

A student who receives a “C” or “F” in one of the discipline-specific required courses (e.g., PHAN 5401) will be allowed to self-remediate the course and still take the oral qualifying exam in the summer of year 1 or the fall of year 2. A student who receives two or more “C’s” or “F’s” in the discipline-specific required courses must retake those courses in their entirety the following year. If they receive “A’s” and/or “B’s” upon retaking the courses, they will be allowed to take the oral qualifying exam.

2.2 Advanced Courses and Technique Courses
Structural Anatomy and Rehabilitation Science Students must take at least one structural anatomy and one rehabilitation science course (denoted by a asterisk below). 4-6 SCH required for M.S. students and 8-10 SCH required for Ph.D. students from the following:

**Structural Anatomy**
PHAN 5401 – Structural Anatomy
PHAN 5330 – Structural Anatomy of the Human Reproductive System
PHAN 6340 – Structural Anatomy of the Musculoskeletal System
PHAN 5630 – Structural Neuroscience
PHAN 5332 – Structural Anatomy of the Cardiopulmonary System
PHAN 5334 – Structural Anatomy of the Human Digestive and Renal System
PHAN 5400 – Histology
PHAN 1234 – Advanced Head and Neck Anatomy
PHAN 1234 – Embryology

**Rehabilitation Sciences**
PHAN 6307 – Principles of Movement and Motor Control*
PHAN 6308 – Applied Biomechanics*
DPHT 7305 – Applied Anatomy and Kinesiology*
DPHT 7320 – Integrated Control of Movement*
DPHT 7324 – Development and Geriatrics*
DPHT 7323 – Applied Exercise Physiology*
DPHT 7225 – Culture, Teaching and Learning*
DPHT 7254 – Advanced Clinical Diagnostic and Imaging*
DPHT 7256 – Health Promotion*
DPHT 7501 – Clinical Med I*
DPHT 7502 – Clinical Med II*
2.3 Journal Clubs and Seminar Courses
PHAN 5140 – Seminar in Current Topics
PHAN 6150 – Journal Club

2.4 Pedagogy Courses
PHAN 6000 – Teaching Practicum
PHAN 6100 – Laboratory Teaching Practicum

2.5 Other
Students may take courses from other programs as electives with consent from the major professor and the SARS graduate advisor.

2.6 Degree Plan (Nonspecific Template)

Master of Science
The typical degree plan leading to the M.S. degree is outlined below. The degree plan may vary depending on availability of course offerings in a given semester and each student’s background and progress toward the thesis project. This is a template and should be modified accordingly.

MS Degree Plan for Structural Anatomy and Rehabilitation Sciences Track

Year 1: Fall
BMSC 6201 Fundamentals of Biomedical Science I 2
BMSC 6202 Fundamentals of Biomedical Science II 2
BMSC 6203 Fundamentals of Biomedical Science III 2
BMSC 6204 Fundamentals of Biomedical Science IV 2
BMSC 5150 Lab Rotations 1
BMSC 5150 Lab Rotations 1
BMSC 6200 Experimental Design and Biostatistics 2

Year 1: Spring
PHAN 5140 Seminar in Current Topics 1
BMSC 5160 Biomedical Ethics 1
BMSC 5315 Principles of Scientific Communication 2
PHAN 6150 Anatomy Journal Club 1
BMSC 5998 Individual Research 1-4
ELECTIVES ELECTIVES 1-6

Year 1: Summer
BMSC 5998 Individual Research 6

Year 2: Fall
BMSC 5390 Special Problems 1-3
BMSC 5998 Individual Research 1-6
ELECTIVES Electives 1-6

Year 2: Spring
PHAN 6000 Teaching Practicum 1
PHAN 6150 Journal Club 1
BMSC 5998 Individual Research 1-4
ELECTIVE ELECTIVES 1-6

Year 2:
Summer
Doctor of Philosophy (Ph.D)
The typical degree plan leading to the Ph.D. is outlined below. The degree plan may vary depending on availability of course offerings in a given semester and each student’s background and progress toward the thesis project. This is a template and should be modified accordingly.

Year 1: Fall
BMSC 6201  Fundamentals of Biomedical Science I  2
BMSC 6202  Fundamentals of Biomedical Science II  2
BMSC 6203  Fundamentals of Biomedical Science III  2
BMSC 6204  Fundamentals of Biomedical Science IV  2
BMSC 5150  Lab Rotations  1
BMSC 5150  Lab Rotations  1
BMSC 6200  Experimental Design and Biostatistics  2

Year 1: Spring
PHAN 5140  Seminar in Current Topics  1
BMSC 5160  Biomedical Ethics  1
BMSC 5315  Principles of Scientific Communication  2
PHAN 6150  Journal Club  1
BMSC 5998  Individual Research  3
ELECTIVE  ELECTIVES  1-4

Year 1: Summer
BMSC 6390  Special Problems  1-2
BMSC 6998  Individual Research  1-5
Qualifying Exam  0

Year 2: Fall
ELECTIVE  ELECTIVES  1-11
BMSC 6998  Individual Research  1

Year 2: Spring
PHAN 5140  Seminar in Current Topics  1
PHAN 6150  Journal Club  1
BMSC 6998  Individual Research  1-3
PHAN 6000  Teaching Practicum  1
PHAN 6100  Laboratory Teaching Practicum  1
ELECTIVE  ELECTIVES  1-7

Year 2: Summer
BMSC 6998  Individual Research  6
Research Proposal  0

Year 3: Fall
BMSC 6998  Individual Research  2-6
PHAN 6100  Laboratory Teaching Practicum  2-4
ELECTIVE  ELECTIVES  1-5  9 SCH

Year 3: Spring
BMSC 6998  Individual Research  2-4
PHAN 6100  Laboratory Teaching Practicum  2-4
PHAN 6390  Special Problems  1-5  9 SCH

Year 3: Summer
BMSC 6998  Individual Research  1-3
PHAN 6390  Special Problems  1-3  6 SCH

Year 4: Fall
BMSC 6998  Individual Research  2-4
PHAN 6100  Laboratory Teaching Practicum  2-4
BMSC 6395  Doctoral Dissertation  3  9 SCH

Year 4: Spring
BMSC 6395  Doctoral Dissertation  9  9 SCH

D.O./Ph.D. and P.T./Ph.D. DEGREES
At least 60 hours of credits not included in the D.O. or DPT programs are required to obtain a Ph.D. in Structural Anatomy and Rehabilitation Sciences as a second terminal degree.

3. Advancement to Doctoral Candidacy
3.1 Qualifying Examination
The qualifying examination ensures that the doctoral student has mastered information needed to succeed as a Ph.D. in the fields associated with Structural Anatomy and Rehabilitation Sciences (e.g., biomechanics, evolutionary biology, experimental biology, physical therapy, engineering). The qualifying examination within the Structural Anatomy and Rehabilitation Sciences program should be successfully completed after completing the GSBS core, the one Structural anatomy elective, and the one rehabilitation science course with a GPA of at least 3.0. The course requirement to take the exam will be slightly modified for dual degree students. The main goal of the examination is to ensure that each doctoral student has a broad knowledge base in the biomedical sciences, evolutionary biology, and principles of anatomy and rehabilitation science. Students should also be able to discuss concepts associated with biochemistry, immunology, physiology, and cell biology. Students will be expected to work with their committee to create a bibliography. The first draft of the bibliography needs to be submitted at least 6 weeks prior to the oral examination. Faculty will return the bibliography to the student within two weeks. The goal is to provide the entire committee and the student with a working body of scientific knowledge to draw from during the exam. The student is expected to become knowledgeable in their previous course work, reading of textbooks and scientific literature, and discussion with faculty members.

A committee comprised of members of the Structural and Rehabilitation Sciences graduate faculty, other UNTHSC faculty members, and the student’s university member administer the qualifying examination. The graduate advisor in consultation with the student’s major professor will appoint the exam committee. The student’s major professor may attend the qualifying examination, may ask questions, but
cannot be present during the voting or cast a vote. The qualifying examination will be administered in the Summer of year 1 or the Fall of year 2. Two attempts to successfully pass the qualifying examination are allowed. Failure of the student to pass the qualifying examination results in dismissal of the student from the doctoral program. A doctoral student who does not pass may be allowed to complete the requirements for a Master of Science degree (terminal Master’s Degree). It is the responsibility of the student to obtain signatures from the examination committee, university member, graduate advisor, and department chairman upon completion of the exam. The appropriate form may be obtained from the GSBS Forms and Guidelines website.

3.2 Research Proposal
The research proposal is an outline of the dissertation project. It must include a summary of the proposed project, the hypothesis and aims to be investigated, significance and innovation of the project, research design and methodology to be used, a review of the salient literature that supports or opposes the hypothesis, and potential limitations. To take advantage of the advisory committee’s expertise and advice, and to clearly define the project and the committee's expectations, it is imperative that the student meets with his/her advisory committee before preparing the research proposal. The research proposal should be provided to the advisory committee no later than 10 days prior to the defense. However, it is strongly recommended that the student provide their research proposal to their advisory committee earlier (ideally, 4 weeks in advance). This is a professional courtesy to the advisory committee and may assist the student in strengthening their proposal prior to the defense. Research Proposal Guidelines and the Research Proposal approval forms are available on the GSBS Forms and Guidelines website.

The student will set a meeting with his/her mentor and advisory committee including the university member to present and defend the proposal. The student’s advisory committee will determine if the proposal is satisfactory.

For Ph.D. students, the proposal should be completed within a year of having passed their qualifying examination (ideally in the summer of year two). The proposal must be approved by the student’s advisory committee and submitted to the GSBS, at the latest, during the semester prior to the student’s final semester. The formal presentation of the research proposal will only be to the members of the student’s advisory committee. The research proposal must be approved by the advisory committee and the Dean prior to registering for Dissertation (BMSC 6395). Research Proposal Guidelines and the Research Proposal approval forms are available on the GSBS Forms and Guidelines website.

Upon completion of the qualifying exam and the research proposal, a Ph.D. student will be advanced to candidacy. M.S. students are not required to take the qualifying examination but are required to complete the research proposal.

4. Other
4.1 Yearly Progress Reports
The yearly progress report is a formal meeting where the student and advisory committee meet to evaluate your progress. This meeting is intended to help student focus on their personal academic goals within their selected academic field. Please see the GSBS Forms and Guidelines website for the rubric associated with this yearly milestone. This report will allow you to reflect on your academic year and your research progress. During this meeting, faculty may advise on how best to improve.
Again, this meeting is to help teach you how to create and manage your research agenda.

Yearly progress reports are due no later than the last day of the summer semester as defined by the most current academic years calendar. However, it is strongly encouraged that students submit at least a month early.

4.2 Individual Development Plan
The individual development plan (IDP) is a tool to help a student focus on how to leverage their expertise into a satisfying and productive career. Student will be required to complete an IDP throughout their graduate careers at UNTHSC. The individual development plan (IDP) will help students explore career possibilities and set goals to follow the career path that fits them best.

Students will be prompted by the GSBS when an IDP requires submission, revision, or reevaluation.

4.2 Additional Information
In addition to all of the information provided in this document, students should consult the GSBS catalog for admissions information, general degree information, and academic procedure information.