THE UNIVERSITY OF IDAHO
NEUROPHYSIOLOGICAL IMAGING AND MODELING LABORATORY

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Ph.D. Student Position – Research Assistant (RA) Tuesday, June 12, 2018

Focus: Biomechanical Characterization and Finite Element Modeling of Arachnoid Trabeculae in Traumatic Brain Injury (TBI)

The Neurophysiological Imaging and Modeling Laboratory (NIML) within the Department of Biological Engineering at the University of Idaho is dedicated to advancing the health and well-being of millions of people affected by central nervous system (CNS) diseases. The NIML seeks highly motivated and critical-thinking students who wish to participate in a dynamic multi-disciplinary research team that makes new discoveries about CNS disorders using state-of-the-art medical imaging and modeling techniques. To learn more about the NIML research program visit www.niml.org.

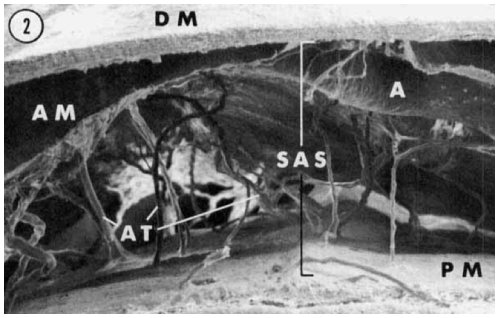

Figure 1. Electron microscopy image of AT (1, 2). DM = dura mater, AM = arachnoid mater, PM = pia mater, SAS = subarachnoid space. Our research will integrate these fibers into a FEM of TBI.

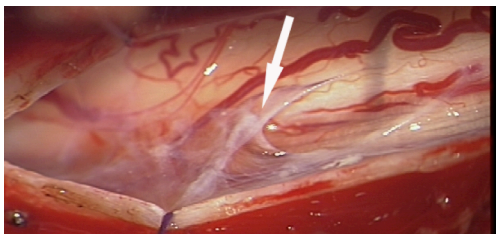

Figure 2. Intraoperative view of arachnoiditis webbing at T2/T3 vertebral level in a spinal cord injury patient (3). Our research will quantify the mechanical and structural properties of AT fibers.

Project Supervisor
Dr. Bryn Martin, Department of Biological Engineering

The PhD Committee
Your studies will be supervised by experts from within the University of Idaho Department of Biological Engineering, Mechanical Engineering and Animal and Veterinary Science and Neurosurgeon research collaborator at California Neuroscience Institute. They will evaluate your progress and provide you with constant support and supervision. The candidate's degree will be granted in Biological Engineering.

Position
An M.S. or Ph.D. student position is offered from August 13th, 2018 with $20,800 salary (tuition and fees and insurance covered in addition to base salary).

Deadline for submission
Accepting applicants until position is filled.

Project description
This is a unique opportunity to apply engineering to biological problems that includes both experimental and numerical components.

Arachnoid trabeculae (AT) are microscopic fibers that help hold the delicate CNS tissue of the brain and spinal cord in place (**Figure 1**). In disease states, or after injury, AT can form "arachnoiditis" with a dense web-like appearance (**Figure 2**). Neurosurgeons can remove these fibers to allow normal cerebrospinal fluid (CSF) movement around CNS tissue. Neurosurgeons often encounter many AT in cerebrovascular surgery (aneurysmal bleeding related) or skull based tumor surgery.

The problem: We know little about the biomechanical properties of AT. At present, the physiological relevance of these small structures is thought to primarily be structural, but they lack integration in most TBI models. While these structures are relatively small in size, their micro- and macro-scale impact on CNS health and disease could be important. *We **hypothesize** that local **increases** in AT fiber density, or **increases** in AT Young's modulus, will elevate cortical surface stress leading to increased risk for traumatic brain injury (TBI) or subdural hemorrhage.*

Research plan: The research assistant will be responsible to characterize AT biomechanics by carrying out a series of ex-vivo studies (Goal 1) that will be used to inform and then build an anatomically detailed FEM model of TBI including AT in various configurations (Goal 2).

Goal 1: Quantify AT structure and mechanical properties: The research assistant will remove AT from fresh lamb heads (N=20) provided by the University of Idaho after slaughter. These fibers will then be tested via various techniques to obtain their mechanical and biochemical properties.

Goal 2: Build a FEM of the brain and assess brain tissue level stresses due to transient impact: The research assistant will build a 3D FEM model of the brain and subject the model to a transient acceleration representative of a sports-related head impact (football / soccer). This model will then be used to conduct a series of experiments to understand how AT may affect brain tissue level stresses.

Qualifications

Applicants will be subject to standard background check. Applicants should hold a B.S. or M.S in Biomedical, Biological, Mechanical or Chemical Engineering or related engineering discipline and have experience in engineering FEM software (MATLAB, ANSYS, ABAQUS, Fluid-solid interaction, FSI). Experience with biological tissue biochemical characterization imaging/staining/testing a plus. *Previous experience and expertise in solid mechanics and finite element modeling is required (either ANSYS or ABAQUS).* Excellent English communication skills (written and oral) and ability to work in a team is expected.

The University of Idaho

The University of Idaho (UI) is a top-choice for students and aspiring leaders from around the globe and is ranked by U.S. News & World Report as 85th in the nations public universities. UI annual research expenditure in 2011 was nearly 100 million dollars. The National Institutes of Health awarded UI $10.6M in 2015 to support creation of the Center for Modeling Complex Interactions and has also created the Integrated Research and Innovation Center for interdisciplinary research across a broad spectrum of science and engineering. UI boasts several unique research resources including the NSF funded big-STEM supercomputer with 8TB of RAM, the Bioinformatics and Computational Biology core, Genomics resources core among many others. It is located in Moscow, Idaho surrounded by the idyllic rolling Palouse hills. Moscow has 24,000 residents and was selected as one of the nations five best places to live among college towns with art galleries, coffee shops, pubs and outdoor activities.

Submission of the application

To apply, please send a cover letter with a short personal statement outlining your research and technical background including any specific experience you have with FEM, CV, copies of your degree transcripts and references to: brynm@uidaho.edu. Applications of disabled persons with the same professional and personal qualification will be treated preferentially. Please indicate a handicap in the cover letter and enclose the relevant certificate.

UI promotes equal opportunities. Applications of female candidates are expressly encouraged and will be treated preferably in case of equal qualifications and suitability.

Further information

For further information, please email Dr. Bryn Martin, brynm@uidaho.edu.