Mobility Lab
Dr. Brooke Slavens

Movement Analysis for Biomedical Innovation and Technology

**Aim:** Develop novel high-force, energy storing, miniature soft pneumatic actuators, and directly integrate them as the structure for soft robotic upper extremity orthoses for pediatric patients who use walkers or crutches.

**Collaborators:** University of Illinois at Champaign-Urbana

**Funding:** National Science Foundation (NSF) Center for Compact & Efficient Fluid Power

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**IntelliWheels: The Automatic Transmission for Manually Propelled Wheelchairs**

**Aim:** To develop a multi-speed geared wheel system for manual wheelchair users. This system will enhance function while reducing joint forces and moments through a multi-gearing mechanism.

**Collaborators:** IntelliWheels, Inc., TiLite, University of Illinois at Urbana-Champaign, Milwauke VA Medical Center (VAMC)

**Funding:** National Institutes of Health (NIH) Eunice Kennedy Shriver National Institute Of Child Health & Human Development

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**Development of a Clinical Toolkit for Real-time Visualization of Lower Limb Amputee Gait**

**Aim:** To develop a clinical toolkit that integrates and visually represents real-time three-dimensional (3-D) animations and biomechanical metrics for prosthetists to better visually quantify and assess amputee gait. This work is the first of its kind that will utilize quantitative rehabilitation methodology for clinical care.

**Collaborators:** Eastern Michigan University and Kempfer Prosthetics Orthotics, Inc.

**Funding:** UWM CHS Stimulus Program to Accelerate Research Clusters (SPARC)

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**Soft Pneumatic Actuator for Arm Orthosis**

**Aims:** (1) Develop novel high-force, energy storing, miniature soft pneumatic actuators, and (2) directly integrate them as the structure for soft robotic upper extremity orthoses for pediatric patients who use walkers or crutches.

**Collaborators:** University of Illinois at Champaign-Urbana

**Funding:** National Science Foundation (NSF) Center for Compact & Efficient Fluid Power

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**Clinical Partnership**

**Title:** Kinematic evaluation of upper extremity movement pre-and post-tendon transfer in children with upper limb impairments

**Aim:** Provide surgeons quantitative information for surgical decision making.

**Collaborator:** Cincinnati Children's Hospital Medical Center
Evaluation of Rotator Cuff Function, Structure, and Integrity Pre and Post-Shoulder Arthroplasty in Patients with Avascular Necrosis

**Aim:** To determine current effects of shoulder arthroplasty (SA) on rotator cuff in young adults with AVN through movement analysis and novel MRI techniques. Long-term goal is to determine a novel rehabilitation paradigm designed for younger adults with AVN undergoing SA.

**Collaborators:** Medical College of Wisconsin

**Funding:** Medical College of Wisconsin Department of Orthopedic Surgery

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Pre-operative versus Post-Operative Kinematics and Muscle Activation Assessment of the Upper Extremity Following Rotator Cuff Repair

**Aim:** The overall goal of this study is to identify compensatory upper extremity joint motions and muscle recruitment patterns used before repair and during post-operative recovery employing a novel combination of kinematic analyses, EMG, and upper extremity forward simulations.

**Collaborators:** Medical College of Wisconsin

**Funding:** Medical College of Wisconsin Department of Orthopedic Surgery Intramural Grant Program

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Shoulder Biomechanics: A Comparative Study of Wheelchair and Able-bodied Lacrosse Athletes

**Aim:** To evaluate upper extremity joint demands of wheelchair lacrosse athletes during two throwing styles with a lacrosse stick. Long-term goal is to provide recommendations to the Wheelchair Lacrosse USA organizational body for use during Official Rule Book development. The intent is to protect athletes from potential injury due to differences between standard and wheelchair lacrosse.

**Funding:** The Medical College of Wisconsin, Department of Physical Medicine and Rehabilitation, Research Administration Committee Grant Program

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BCI-EEG Driven Robotic Stroke Rehabilitation

**Aim:** To develop a neurological feedback device, which integrates EEG-BCI with an ArmeoSpring arm exoskeleton to evaluate the efficacy of neurologically controlled robotic stroke therapy. The result will be a unique platform to allow a stroke patient to directly control the activation of their rehabilitation therapy.

**Collaborators:** UW-Madison

**Funding:** UW Institute for Clinical and Translational Research

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**Mobility Laboratory**
Innovation Campus
Accelerator—Room 140
1225 Discovery Parkway
Wauwatosa, WI 53226

**Lab Director:** Brooke A Slavens
E-mail: slavens@uwm.edu
Phone: 414-316-3093

**Lab Manager:** Alyssa J. Schnorenberg
Email: paulaj@uwm.edu