

Madison J. Haugen

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EDUCATION

PhD Candidate in Biomedical Engineering

Fall 2018 - Present

College of Engineering, University of Wisconsin - Madison
Vascular Tissue Biomechanics Laboratory - Advised by Dr. Naomi Chesler

Bachelor of Biomedical Engineering *with distinction*

September 2014 - May 2018

College of Science and Engineering, University of Minnesota – Twin Cities
Awards: Dean's List (Fall 2014, Fall and Spring 2015, Fall and Spring 2016, and Fall 2017)
GPA: 3.82

PUBLICATIONS AND PRESENTATIONS

Bermel EA, **Haugen MH**, Gacek E, and Barocas VH. Mechanical Characterization of the Lumbar Facet Capsular Ligament using Three Point Bending. In Preparation.

Haugen MH, 2017. Three Point Bending Mechanics of the Lumbar Facet Capsular Ligament, UMN Undergraduate Research Symposium. (*Presentation*)

HONORS AND AWARDS

- National Science Foundation: Graduate Research Fellowship Program, Honorable Mention Award 2018
- College of Science and Engineering Merit Scholarship – UMN 2017 - 2018
- Presidential Academic Scholarship - UMN 2014 - 2018
- Medtronic SWenet Scholarship 2017
- Undergraduate Research Opportunities Program Award – UMN 2017

RESEARCH EXPERIENCE

Undergraduate Research Assistant

December 2015 – May 2018

Department of Biomedical Engineering, UMN
Advised by Dr. Victor Barocas and Dr. Arin Ellingsby
Funding Award: Undergraduate Research Opportunities Program

Project: Bending Mechanics of the Facet Capsular Ligament in the Lumbar Spine

Previous work has suggested that the facet capsular ligament, for which degeneration is associated with low back pain, is bilayered with the anterior side primarily composed of elastin and the posterior side primarily collagen. The hypothesis of my work was that the fiber composition varies across the ligament relative to the sagittal plane and is important in the ligament's mechanical behavior. I characterized the mechanical properties of the lumbar facet capsular ligament using both computational modeling and experimental methods. I executed spine dissections, designed and fabricated prototypes for a three-point bending apparatus, and generated a finite-element model of the ligament. I optimized the model with experimental data to extract Young's Moduli. The variation in fiber composition was verified using histological analysis. The properties I identified are to be used in further modeling to mimic healthy behavior and studying the effects of physiological change in order to determine significant factors in degeneration and low back pain.

Project: Finite Element Modeling of the Spine: L1 – Sacrum

Fall 2017 – Spring 2018

I improved upon a previously developed model of the lumbar spine by separating the singular part that was generated from an MRI scan into multiple parts, to allow changing of parameters, such as disc height or ligament stiffness. This relates to my previous project in that having a model of the full lumbar spine for which the parameters of each tissue, ligament, or section of bone can be applied yields a combined resource for analyzing degeneration. This required use ABAQUS, MATLAB, and manipulation of finite element files and parameters.

EMPLOYMENT EXPERIENCE

Supply Management Intern: Medtronic – Mounds View, MN

May 2018 – August 2018

- Proposed improvement plan to execute manufacturing changes by suppliers and reduce project rework.
- Improved method of analyzing and obtaining monthly operations metrics for production planning.

Systems Engineer Intern: Medtronic – Mounds View, MN

May 2017 – August 2017

- Developed and implemented test protocol to compare cardiovascular device algorithms.
- Created a response tool to address physician inquiries from implant surgeries using data and clinical expertise.
- Generated a concept analysis for an algorithm to detect component malfunction.
- Responded to queries from physicians by designing tests to simulate device performance in the field.

Manufacturing Engineer Intern: Medtronic – Brooklyn Center, MN

May 2016 – May 2017

- Tested and provided recommendations on alternative design and material options for applying bend to capacitor wire to prevent component damage.
- Implemented Lean/Sigma to identify primary causes of scrap; and use the DMAIC process to analyze fixture improvements.
- Designed a manufacturing line that is in use, using expertise and leadership of operators to maximize efficiency.
- Managed production line by responding to calls, analyzing scrap trends, and investigating potential non-conformances by applying root cause analysis techniques.

Process Engineer Intern: Heraeus Medical Components – St. Paul, MN

May 2015 – September 2015

- Increased yield by 5% in a welded electrode assembly by solving laser setting and visual acceptance criteria.
- Developed hypotheses regarding low yield, ran tests to determine root cause, and recommended solutions.
- Designed production cells by executing time studies and generating Standard Work sheets.

VOLUNTEER EXPERIENCE

Leader: We Can Ride Volunteer Program

March 2011 – August 2016

- Led small teams of volunteers to assist both physically and mentally disabled clients in learning how to ride and care for horses. Developed leadership, communication, and skill working with diverse colleagues.

MEMBERSHIPS

Society of Women Engineers

Fall 2014 - Present

- Vice President: Led a group of 60 Directors and Committee members. (2017 - 2018)
- Secretary: Communicated with University section via email and monthly newsletters and organizes events. (2016 - 2017)
- Career Fair Director: Organized a two-day career fair to promote networking for students and 270 companies (2015 - 2016)

Biomedical Engineering Society

Fall 2014 – Spring 2017

- Officer of Development: Formed relationships with other organizations, applied for grants, and planned events. (2015 - 2017)

University of Minnesota Nordic Skiing Club

Fall 2014 – Spring 2018

- Officer of Apparel: Designed new racing suits and apparel for the team and coordinated orders. (2015 – 2016)

RELEVANT COURSE WORK

- Organic Chemistry
 - Biomedical Thermodynamics
 - Cellular Biology
 - Biomedical Transport Processes
 - Bioelectricity and Bioinstrumentation
 - CAD of Biomechanical/Transport Devices
 - Biomaterials
 - Biomechanics
 - Advanced Biomechanics
 - Biomedical Systems Analysis
 - Microfluidics in Biology and Medicine
 - Principles of Physiology
 - Advanced Physiology and Bioengineering
 - Applied Linear Algebra
 - Programming for Biomedical Engineers
 - Topics in Cardiovascular Devices
 - Fundamentals of Design and Manufacturing
 - Deformable Body Mechanics
 - Continuum Mechanics
 - Directed Research (2 credits Fall 2017)
 - Biomedical Engineering Design I & II
 - Programs: MatLab, Solidworks (Certified Developer), Mathematica, COMSOL, LABVIEW
- Senior Design Project: Wearable Device for Parkinson's Disease Symptom Tracking and Tremor Detection Algorithm*