WPI

Department of Biomedical Engineering

Spring Open House

Kristen Billiar, Ph.D.
Professor and Department Head
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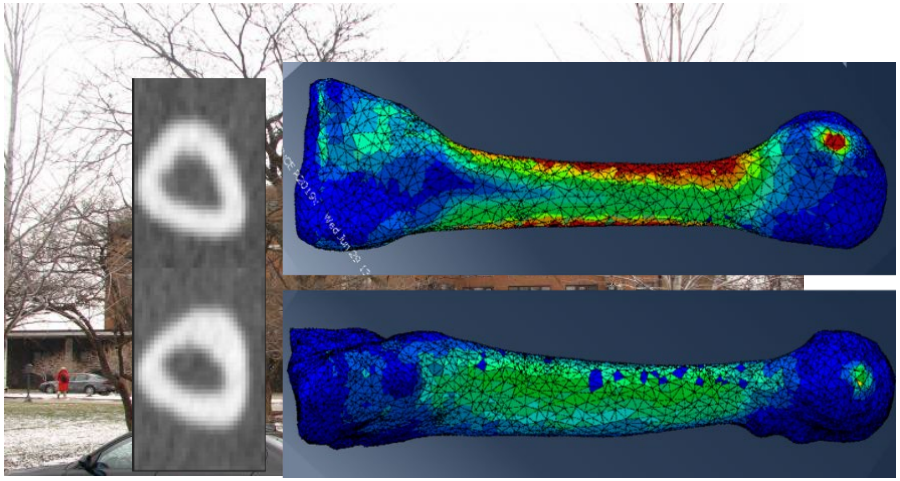
Karen L. Troy, Ph.D.
Professor and Associate Head
ktroy@wpi.edu

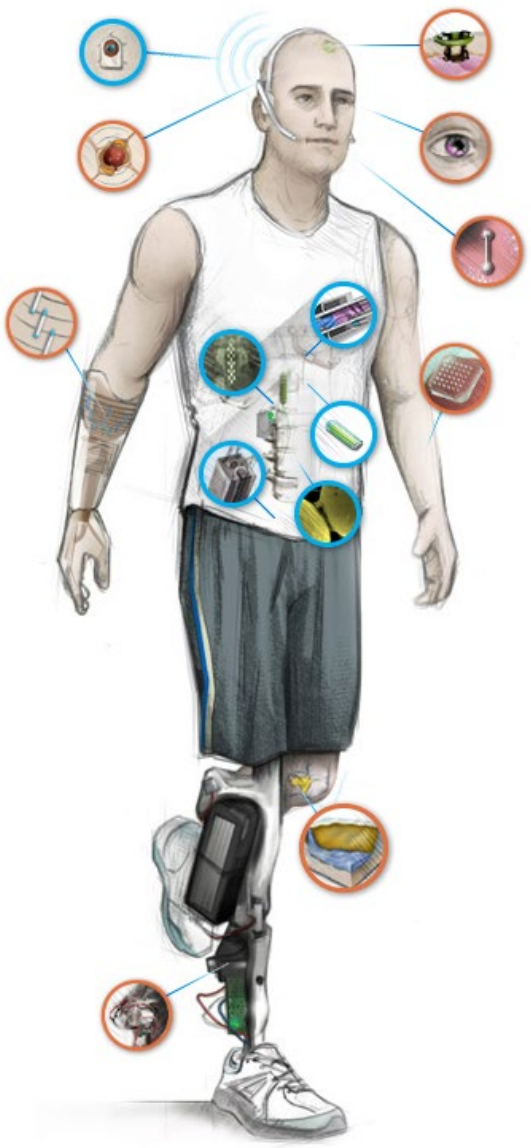
wpi.edu/academics/bme

@WPI_BME

Prof. Karen Troy– Professor and Associate Head



What is Biomedical Engineering?



*"The application of **engineering** principles to the solution of problems in **biology and medicine** for the enhancement of health care"*

https://www.nibib.nih.gov/science-education/bionic-man

BME Departmental Mission

To prepare students for rewarding careers in the health care industry or professional programs in biomedical research or medicine applying critical systems thinking and engineering rigor to create value at the challenging interface of engineering and medicine, through multidisciplinary student-centered project-based experiences.

ABET Accredited Program: 2001, 2009, 2015, 2021

About Biomedical Engineering @ WPI

Statement on Diversity, Equality and Inclusion

The WPI community and the BME Department value diversity. We are a community that stands for civility and respect. We stand for acceptance of others and champion those who may need compassion and understanding. We are an inclusive community that respects peaceful discord and upholds a fundamental belief that all members of our community deserve to feel safe.

For more on WPI's values statement, please see:
https://www.wpi.edu/about/diversity-inclusion

Biomedical Engineering Faculty

Kristen Billiar*
Dept. Head & Professor
Research Interests:

- Mechanobiology and Tissue Mechanics
- Functional Tissue Engineering
- Wound Healing & Regeneration
- Biomaterials Characterization

Karen Troy*
Professor & Assoc. Dept. Head
Research Interests:

- Biomechanics
- Orthopedics
- Finite Element
- Modeling
- Osteoporosis
- Musculoskeletal Injury

Songbai Ji*
Professor
Research Interests:

- Biomechanics and Computational Modeling
- Sports-related Concussion
- Medical Imaging
- Surgical Image Guidance

George Pins*
Professor
Research Interests:

- Mechanobiology and Tissue Mechanics
- Functional Tissue Engineering
- Wound Healing & Regeneration
- Biomaterials Characterization

Raymond Page*
Professor of Practice
Research Interests:

- Tissue Regeneration
- Cell Dedifferentiation and Differentiation
- Natural Biopolymers
- Cell Therapy

Brenton Faber
Professor of Writing
Research Interests:

- Social Determinants of Health
- Scientific and Medical Writing
- Health Systems and Pre-hospital Medicine
- Ethics and Biomedical Technologies

Dirk Albrecht*
Associate Professor
Research Interests:

- BioMEMS/Microfluidics
- Neural Dynamics and Behavior
- Automated Microscopy
- High-throughput Screening

Jeannine Coburn*
Associate Professor
Research Interests:

- Biomaterials
- Tissue Engineering
- In vitro Disease Models
- Drug Delivery

Diana Alatalo*
Assistant Professor
Research Interests:

- Biomechanics
- Women's Health and Maternal-Child Health
- Rheology
- Biofluids/BioTransport

* *Research faculty*

Biomedical Engineering Faculty

Adam Lammert*
Assistant Professor
Research Interests:
- Neuroengineering and Brain Health
- Computational Modeling
- Signal Processing
- Sensorimotor Control

Solomon Mensah*
Assistant Professor
Research Interests:
- Vascular Engineering
- Mechanobiology
- Medical Device Development
- Global Health

Catherine Whittington*
Assistant Professor
Research Interests:
- In vitro disease models
- Pancreatic cancer and Fibrosis
- Lymphatic Growth and Function
- Vascularization and Tissue Engineering

Haichong "Kai" Zhang*
Assistant Professor
Research Interests:
- Bioinstrumentation and Signal Processing
- Medical Robotics
- Medical Ultrasound and Photoacoustic Imaging
- Brain and Cancer Imaging

Sakthikumar Ambady
Assoc. Teaching Professor
Research Interests:
- Regenerative Medicine
- Cell and Tissue Engineering
- DNA and Protein Transfers
- Molecular Biology

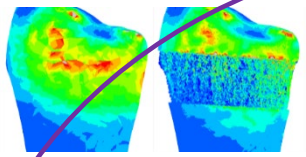
Zoe Reidinger
Assoc. Teaching Professor
Research Interests:
- Tissue Engineering
- Biomaterials
- Design

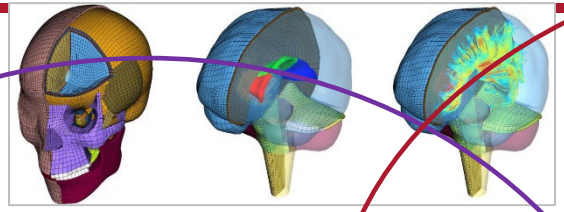
Taimoor Afzal
Assistant Teaching Professor
Research Interests:
- Neural Engineering
- Machine Learning
- Pattern Recognition
- Movement Control

Funmi Ayobami
Assistant Teaching Professor
Research Interests:
- Biomechanics
- Orthopedics
- Engineering Education
- Diversity, Equity, and Inclusion

* *Research faculty*

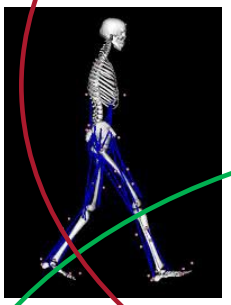
BME Research/Teaching Clusters

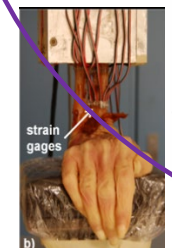


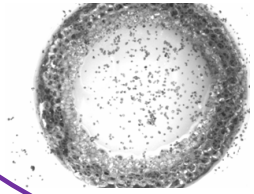


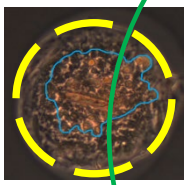
Biomechanics and Mechanobiology

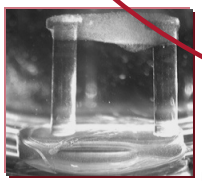
- Computational Biomech
- Tissue Biomechanics
- Image-guided surgery
- Rehabilitative Engineering

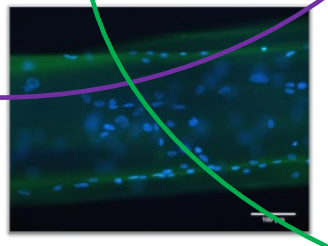






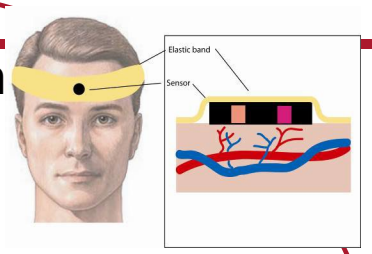


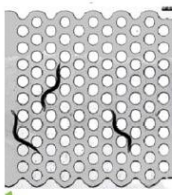


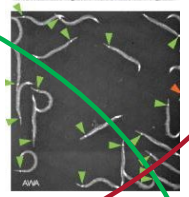


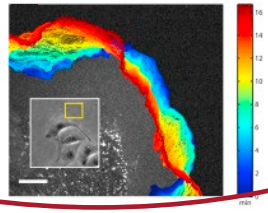
Bioinstrumentation & Quantitative Imaging

- Wearable Sensors
- Signal Analysis
- Neurobiology
- Cellular imaging
- Machine learning/ bioinformatics



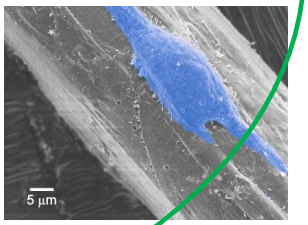




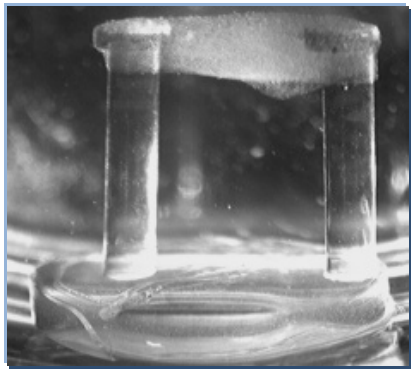
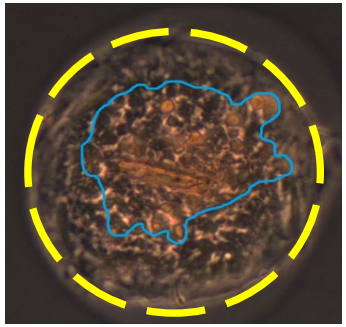


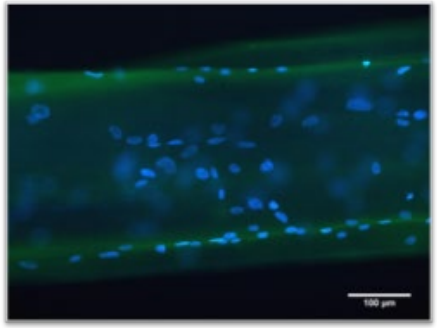
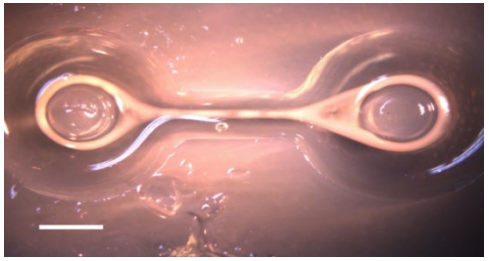
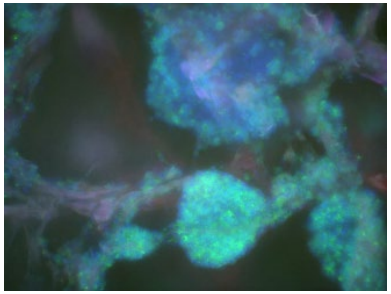
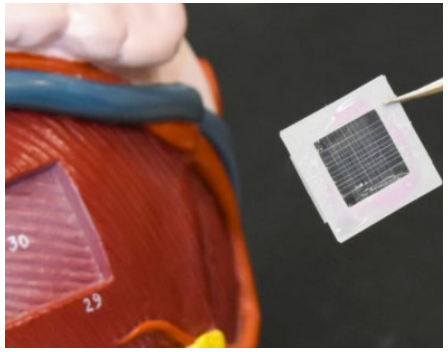
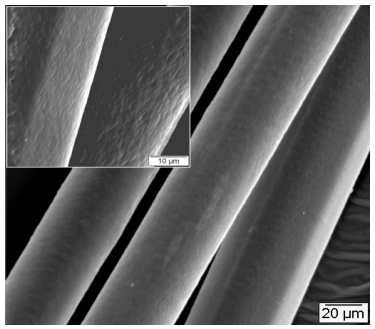
Biomaterials and Tissue Engineering

- Regenerative Medicine
- Drug Delivery
- Biomanufacturing
- In vitro Tissue Models
- Cell Delivery



Biomaterials and Tissue Engineering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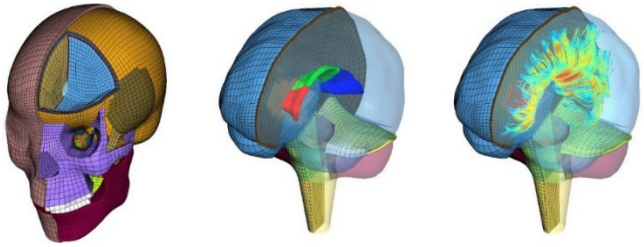
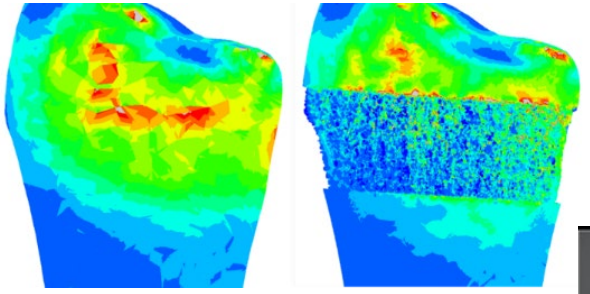
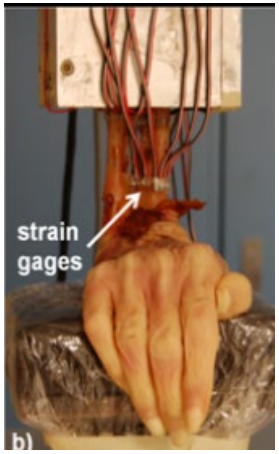
Marsha Rolle

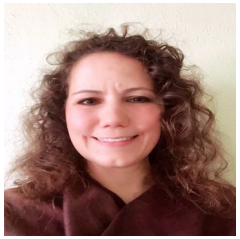

Catherine Whittington

Biomechanics and Medical Robotics









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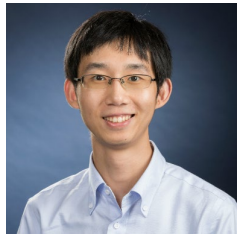
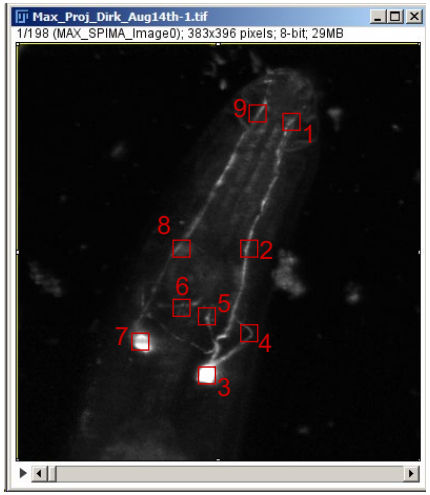
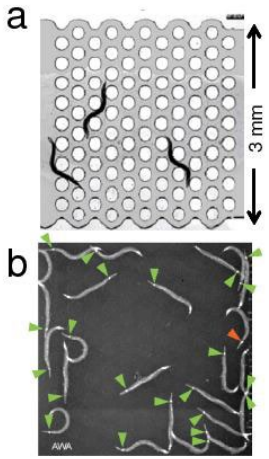
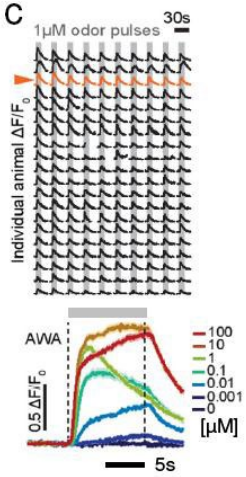


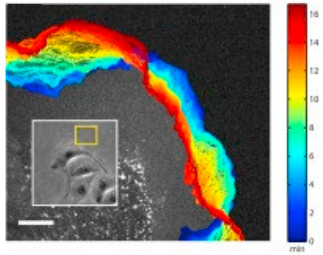
Haichong (Kai) Zhang

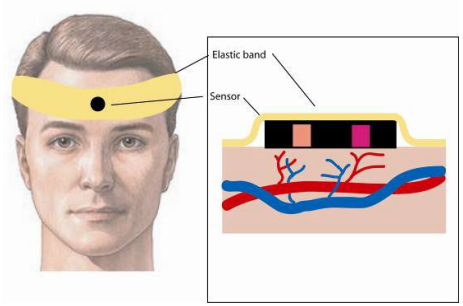
Bioinstrumentation and Signal Processing

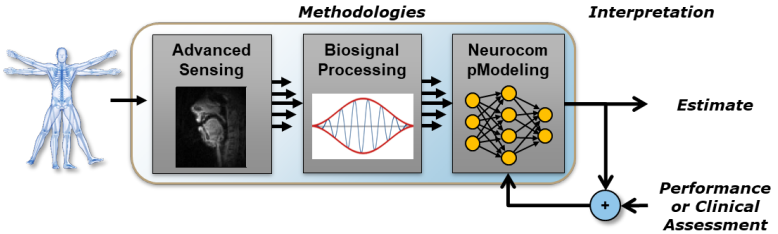






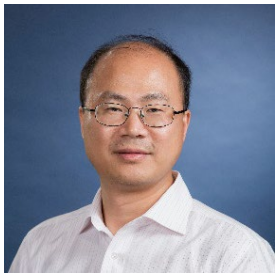







Taimoor Afzal


Dirk Albrecht


Songbai Ji


Adam Lammert

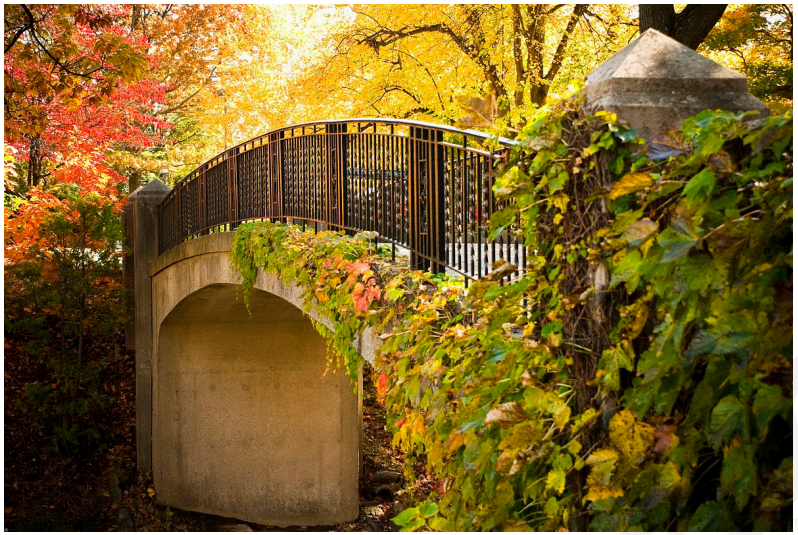

Solomon Mensah


Karen Troy

Worcester Polytechnic Institute

BME Curriculum

Freshman Courses



Upper-Level Courses in Specialization

Sophomore Level Bridge Courses (*Transition to Specialization*)

BME Curriculum (Courses)

Balanced, Multidisciplinary, Focused

- ✓ **Fundamental Freshman Courses:**
  - Mathematics, Physics, Chemistry, Biology
- ✓ **Sophomore Bridge Courses:**
  - Foundations in Bioprocess Engineering
  - Foundations of Bioinstrumentation, Signals, Data Analysis
  - Foundations of Biomechanics & Biotransport
  - Foundations of Biomaterials & Tissue Engineering
- ✓ **Junior Year – (4) Challenge-based Labs in Core Areas:**
  - Skeletal Biomechanics Lab
  - Biomaterials Lab
  - Cellular Engineering Lab
  - Bioinstrumentation Lab
- ✓ **Biomedical Engineering Specialization Areas:**
  - Bioinstrumentation, Biosignals & Image Processing
  - Biomechanics
  - Biomaterials & Tissue Engineering

WPI/BME Curriculum (Projects)

Strong emphasis on Professional Skills

- ✓ **Students work in diverse, multidisciplinary groups and address open-ended problems**
- ✓ **Projects teach and promote:**
  - **Critical thinking**
  - **Research methodologies**
- ✓ **Communications Skills:**
  - **Writing intensive**
  - **Requires oral presentations**
- ✓ **Teaches students to:**
  - **Set goals/priorities**
  - **Manage time**
  - **Work within practical constraints**
- ✓ **Entrepreneurial minded learning (EML) / Value Creation**

BME Teaching and Project Labs

Instrumentation and Design Lab

Mechanical Testing Lab

Cell Culture Lab

Surgical Training Lab

Imaging Lab

Chemical Wet Lab

WPI/BME Curriculum (Projects)

"*Lehr und Kunst*", Theory and Practice

Great Problems Seminar: Team-based research and project work focused on global importance

Project-Enriched Hands-On Learning:

- **Humanities and Arts**

(*Project in a non-technical discipline*)

- **Interactive Qualifying Project (IQP)**

(*Project relating science and technology to society*)

- **Major Qualifying Project (MQP)**

(*Technical capstone project and design experience in the student's major*)

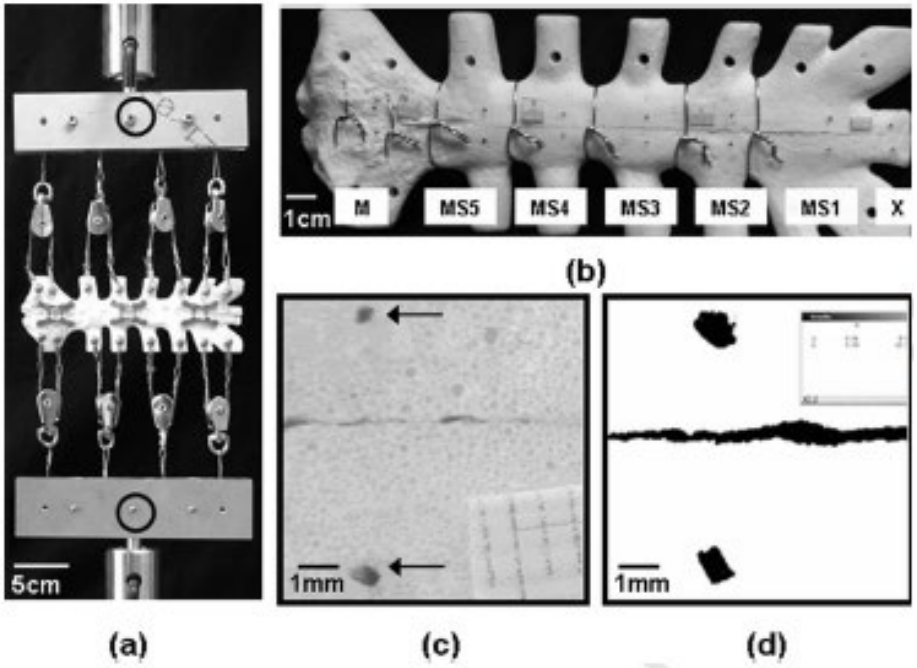
Entrepreneurial Mindset Learning and Value Creation – across curriculum

WPI/BME Curriculum

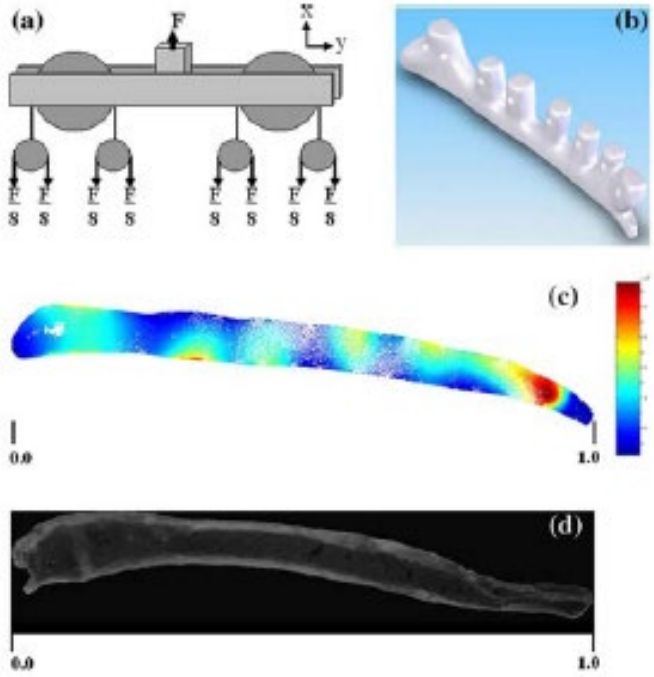
"*Lehr und Kunst*", Theory and Practice - Design

MQP: Optimization of a Sternal Fixation Technique

Experimental Set-Up (published in ATS)



FEA (published in ABME)



Students - Erin Dupak, Najmuddin Gunja, Nicole McMahon, Shruti Pai
Advisors - Professors Kristen Billiar, George Pins, Raymond Dunn

FAQs

Job Prospects in Biomedical Engineering

BME 2021 Post-Graduation Survey of UG Class:

Employed	**67%**
Graduate School	**21%**
Other	**9%**
Unknown	**3%**

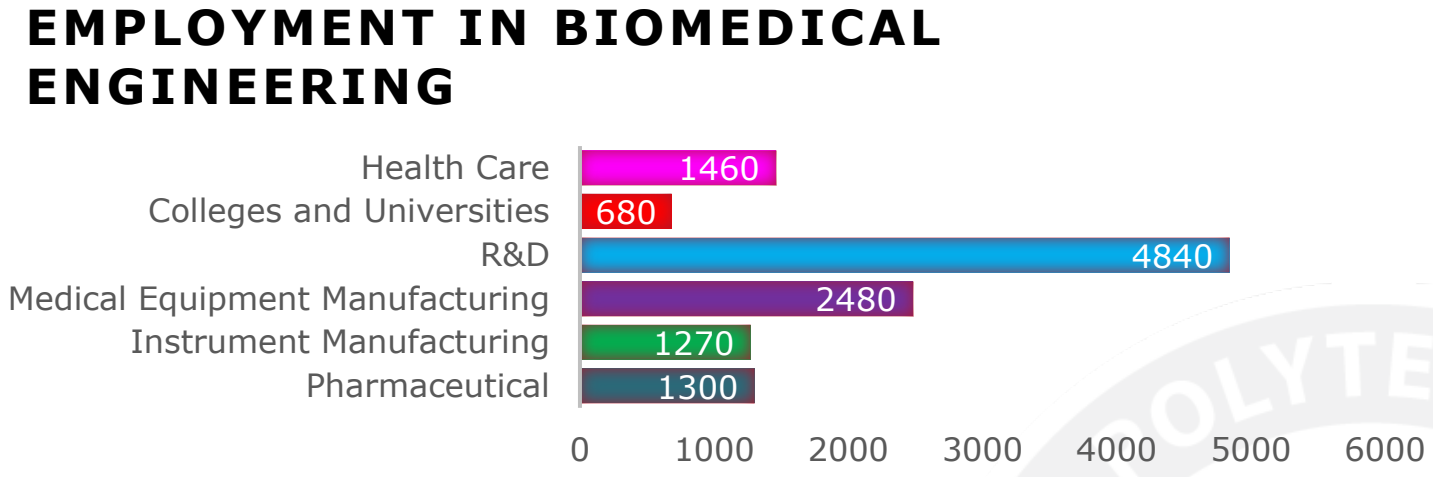
BME Average Starting Salaries with BS:

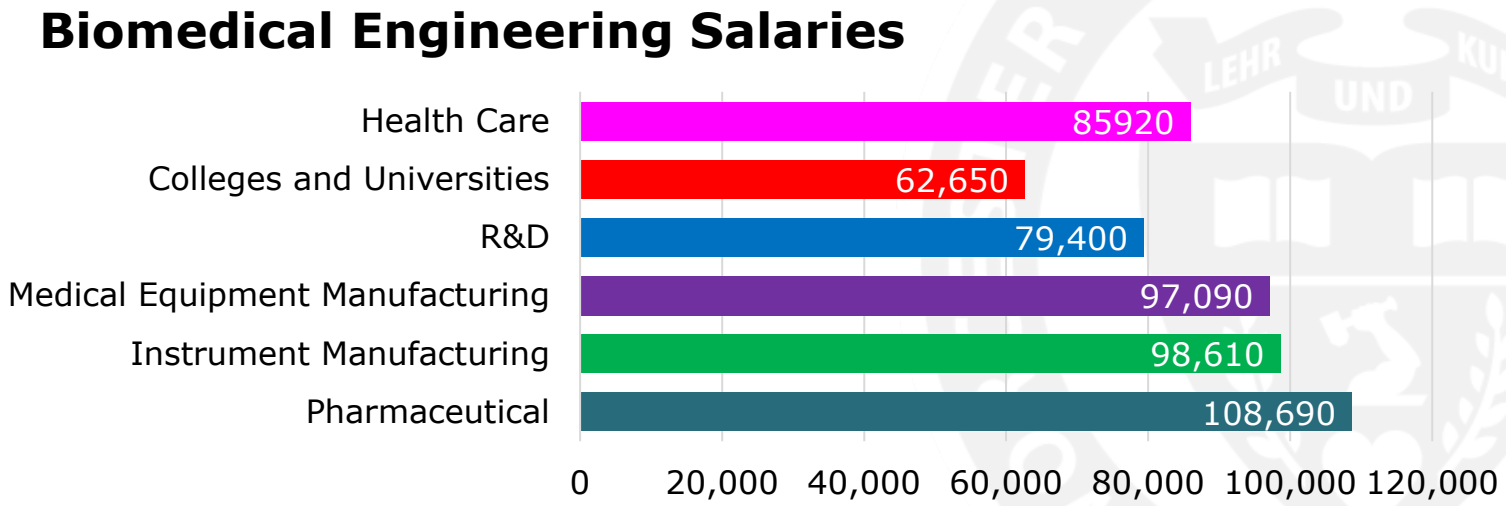
2020: **$65,006**

(WPI, CDC Survey; #10 Princeton Review)

Job Prospects in Biomedical Engineering

- **BME ranked #1 for Best Engineering jobs (US News 2023)**





https://www.bls.gov/ooh/architecture-and-engineering/biomedical-engineers.htm

Where are WPI BMEs Employed?

- **Medical Device Development**
  - Research and Development
  - Engineering Design and Analysis
  - Manufacturing
  - Regulatory Affairs
- **Biomedical Research**
- **Corporate Management**
  - Project Management
  - New Business Development

Work Environment for BMEs

Biomedical engineers work in a variety of settings, depending on what they do:

- ✓ **Hospitals where therapy occurs**
- ✓ **Laboratories conducting research**
- ✓ **Manufacturing settings where they design and test medical products**
- ✓ **Commercial enterprises where they make or support business decisions**
- ✓ **Entrepreneurs / start-up companies**
- ✓ **Federal government agencies (e.g. FDA, NIH, EPA, PTO).**

Continuing Graduate Education

- MS/ME Programs in BME
- PhD Programs in BME
- Professional Programs
  - Medical Schools
  - Dental Schools
  - Veterinary Schools
  - Law Schools

Continuing Graduate Education

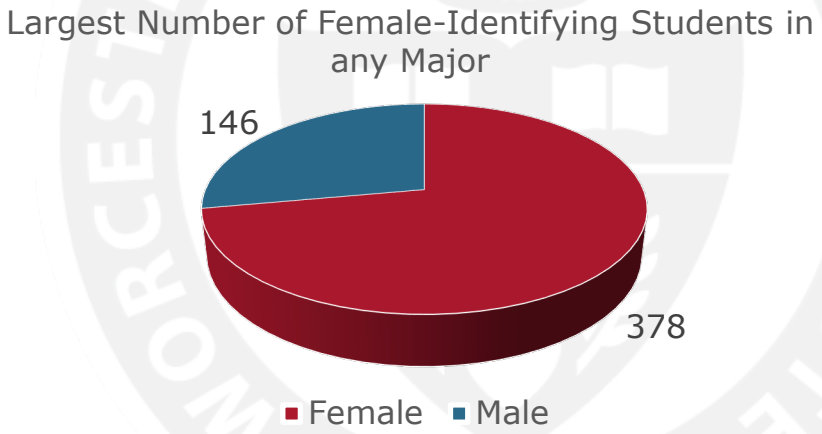
Graduate schools attended by our BME graduates (*Partial List*):

- Brown University
- Rutgers University
- Rice University
- University of California (Berkeley/SF)
- Boston University
- Tufts University
- Clemson University
- Georgia Tech
- Harvard University
- Cornell University
- MIT
- Columbia University
- Johns Hopkins University
- University of Pittsburgh
- WPI
- Imperial College (UK)
- University of London (UK)
- University of Cambridge (UK)

WPI BME Undergraduate Students

Award-winning students:

- 5 Goldwater Scholars
- 6 Tau Beta Pi Scholarships,
- 7 NSF GRFPs (13 NSF GRFP Hon. Mentions)
- 2 AHA Summer Fellowships
- Marshall Scholar
- 2 NIH-Oxford/Cambridge Biomedical Scholar
- Rotary Ambassadorial Scholarship
- SWE Scholarship



The BME Department is AWESOME!

Faculty vs. student athletic events!

The faculty/grad students always win ☺

Pie eating is an "athletic" event