



# WPI

## Department of Biomedical Engineering

### Accepted Student Days

Kristen Billiar, Ph.D.  
Professor and Department Head  
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#### Biomedical Engineering

George Pins, Ph.D.  
Professor and Associate Head  
[gpins@wpi.edu](mailto:gpins@wpi.edu)

[wpi.edu/academics/bme](http://wpi.edu/academics/bme)



@WPI\_BME

# BME Virtual Outreach

- **Week of April 6:** Email from Prof. Billiar detailing information about chat sessions with faculty and students
- **WPI BME YouTube Channel:** Search for “WPI Biomedical Engineering”  
<https://www.youtube.com/channel/UCsNtUG112YBk9TjKO3ZiVhw/>
- **April 16:** 1:00 – 3:00 PM online Q & A with Prof. Pins and Elzani van Zyl '17 '19





# BME Departmental Mission

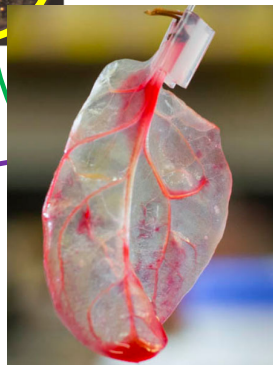
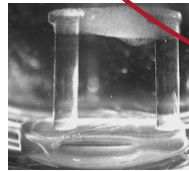
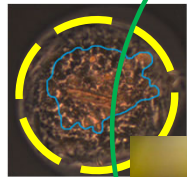
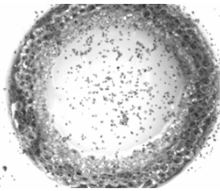
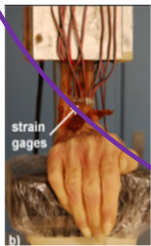
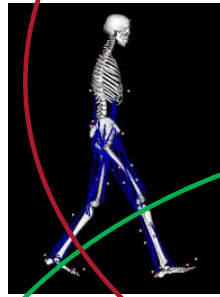
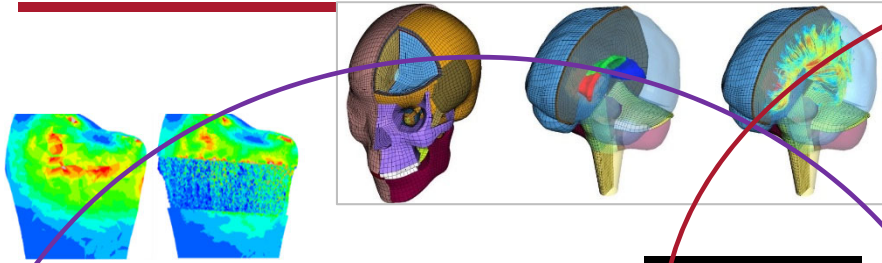
*To prepare students for rewarding careers in the health care industry or professional programs in biomedical research or medicine applying critical systems thinking and engineering rigor to create value at the challenging interface of engineering and medicine, through multidisciplinary student-centered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

*ABET Accredited Program: 2002, 2008, 2014*

# BME Research/Teaching Clusters

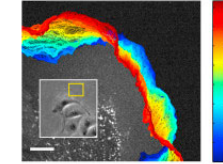
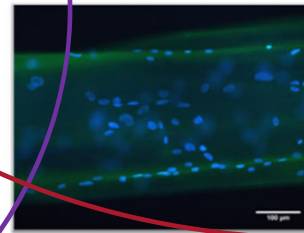
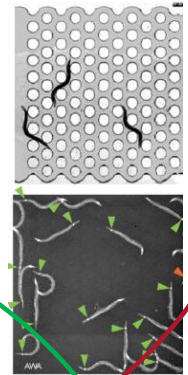
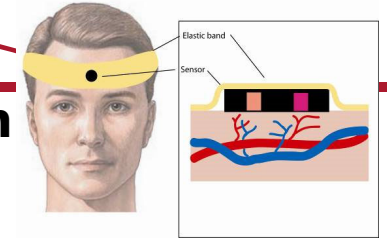
## Biomechanics and Mechanobiology

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



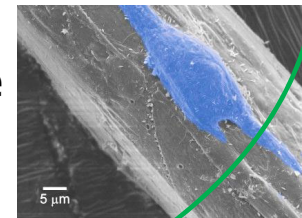
## Bioinstrumentation & Quantitative Imaging

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



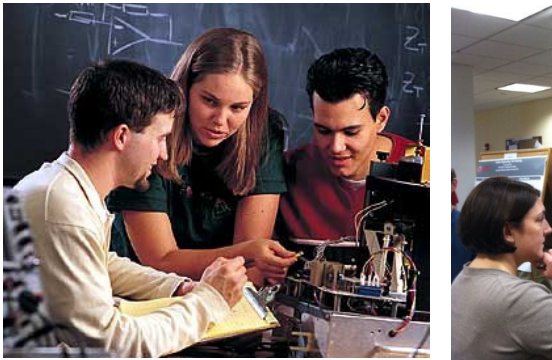
## Biomaterials and Tissue Engineering

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



# WPI/BME

“Lehr und



**Great Problems Served**  
 focused on global impact  
**Project-**

(Project)

- **Interdisciplinary**  
 (Project re)

- **Major**  
 (Technical capstone project)

\$2M+ Kern Foundation grant



## THE TOP FACULTIES

Schools that do the best in combining scholarly research with classroom instruction

1. Worcester Polytechnic Institute
2. Colorado School of Mines
3. Pomona College
4. Stanford University
5. Haverford College
6. Trinity University
7. Bowdoin College
8. University of Richmond
9. Lafayette College
10. North Carolina A & T State University

Source: Wall Street Journal/Times Higher Education College Ranking  
 THE WALL STREET JOURNAL.

# m (Projects)

and Practice



research and project work

**Learning:**

**arts**

*discipline)*

**ject (IQP)**

*nology to society)*

**ct (MQP)**

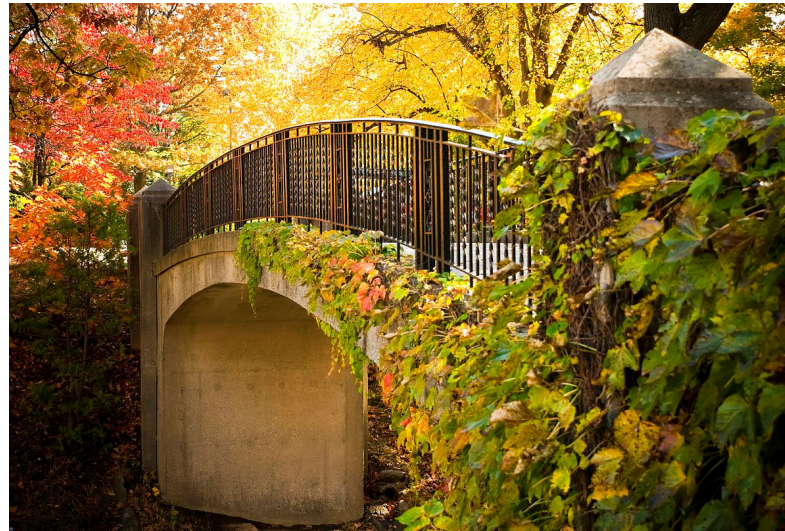
*nce in the student's major)*

cross curriculum – **BME LEAD 6**



# 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 – (9) Challenge-based Labs in Core Areas:**

- Skeletal Biomechanics Lab
- Biomaterials Lab
- Cellular Engineering Lab
- Bioinstrumentation Lab

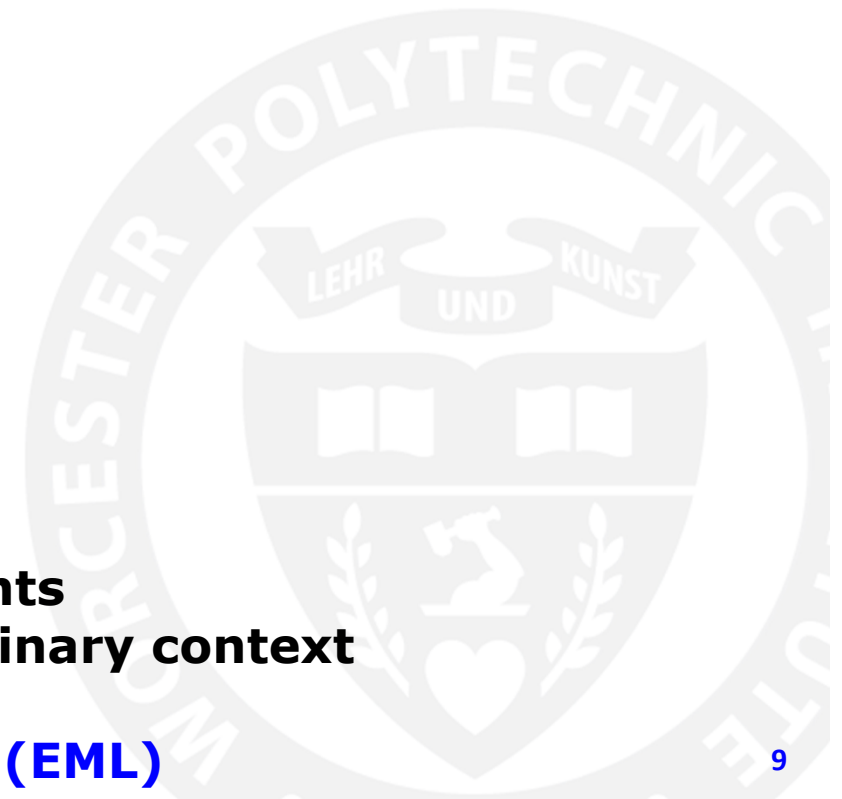
### ✓ **Biomedical Engineering Specialization Areas:**

- Bioinstrumentation, Biosignals & Image Processing
- Biomechanics
- Biomaterials & Tissue Engineering



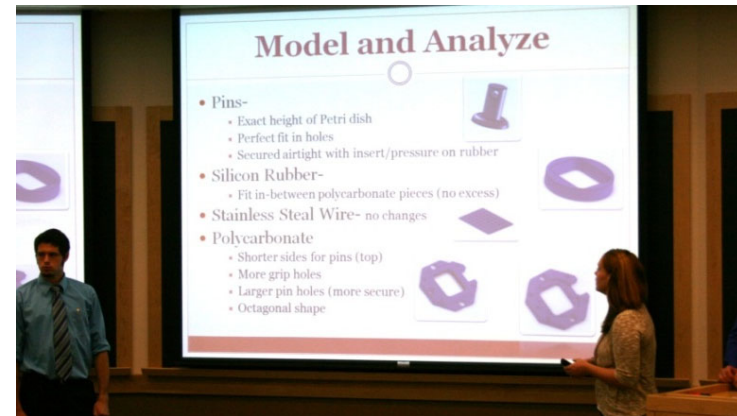
# WPI/BME Curriculum (Projects)

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



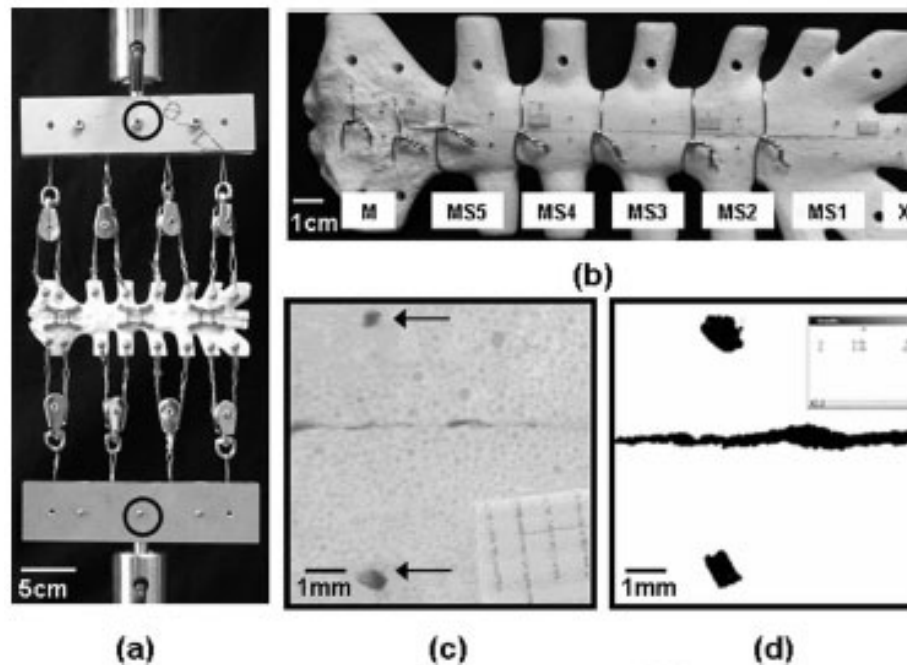
# WPI/BME Curriculum

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

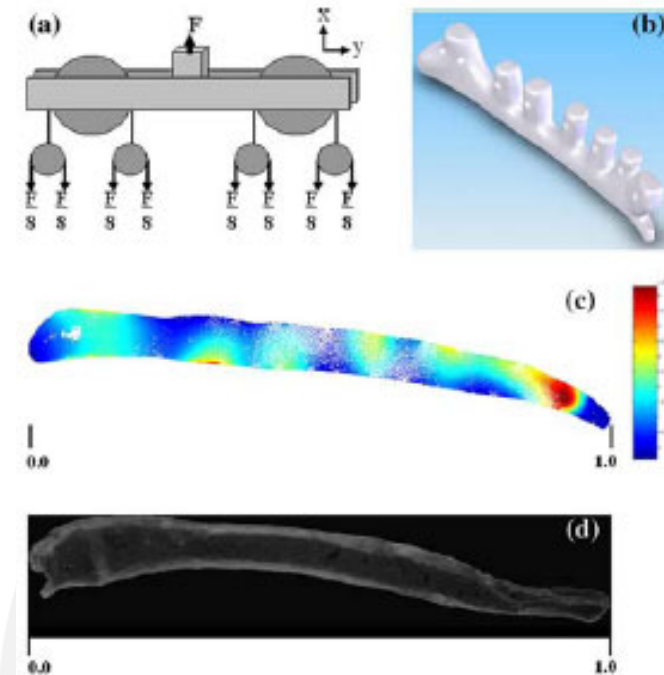


# MQP: Optimization of a Sternal Fixation Technique

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

# MQP: Pressure Ulcer Prevention System

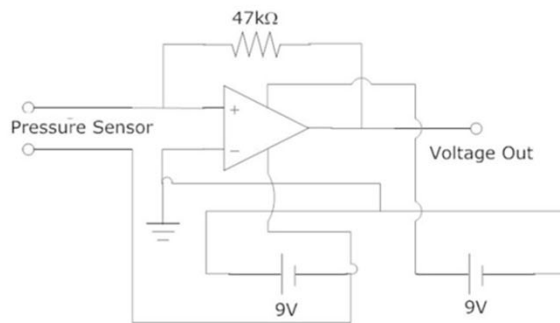
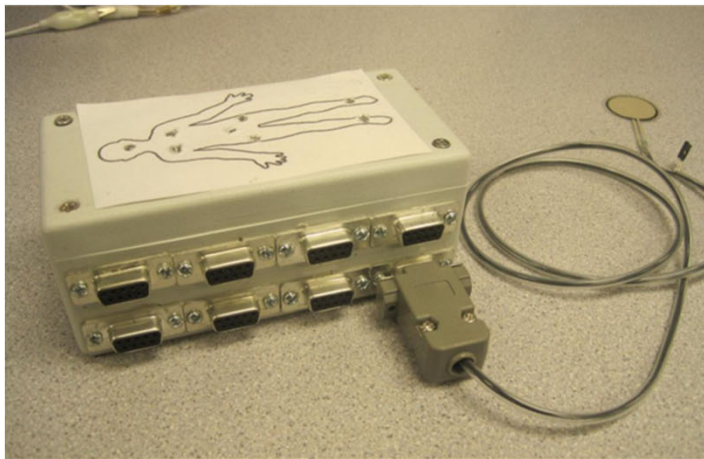


Figure 24: Pressure Sensor Circuit Used in Device



- RH sensor
- Pressure sensor
- Blood volume sensor

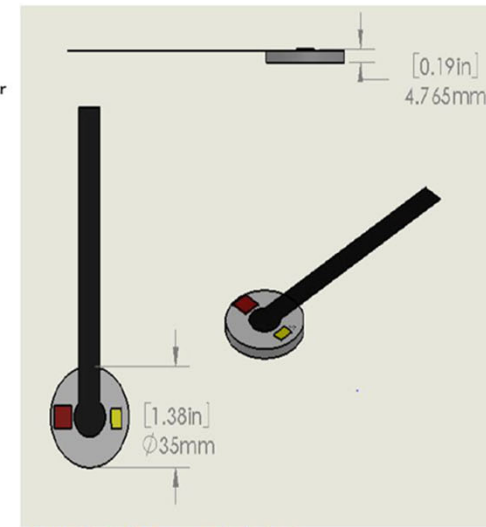


Figure 18: Preliminary patch design 1.

**Students** - Beatriz Gutierrez, Shanice Jones, Melissa Morianos

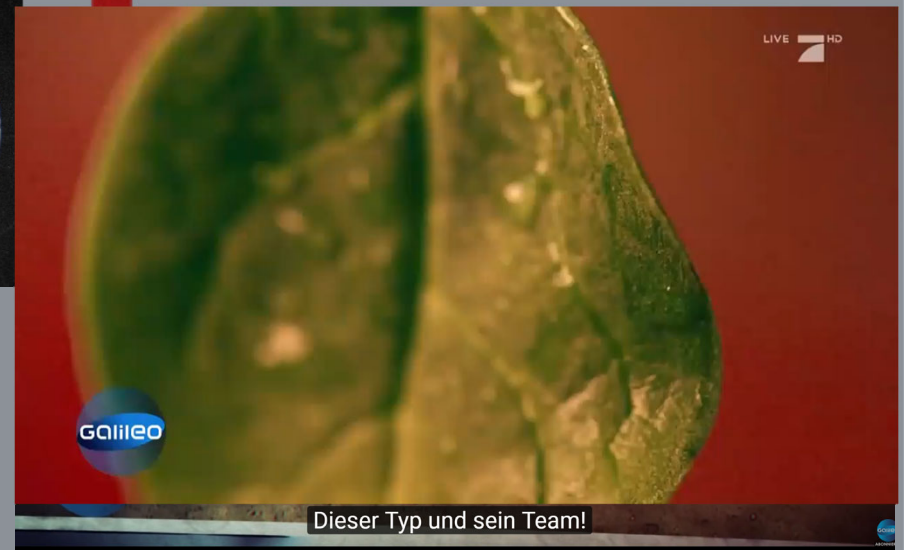
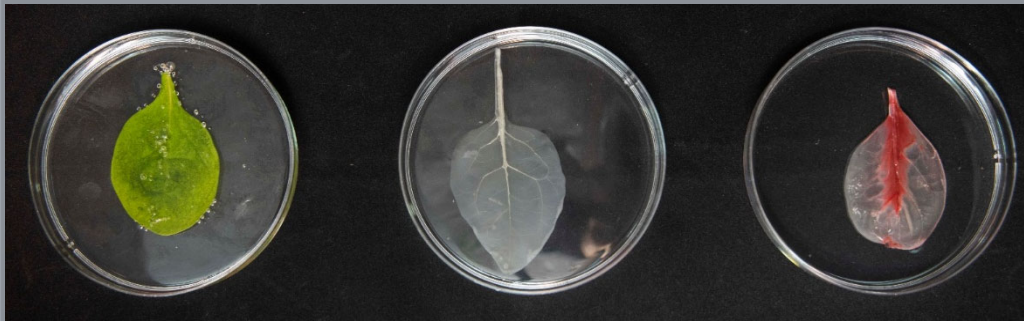
**Advisors** - Professor Yitzhak Mendelson (WPI), Dr. Raymond Dunn (UMass)

Tony Raymond, Advisor, New Harbor SQA

# Late Breaking News.....



# Crossing Kingdoms: Using decellularized plants as perfusable tissue engineering scaffolds



**CURIOSITY**



**CONNECTIONS**



**CREATING VALUE**



The background features a large, faded seal of Worcester Polytechnic Institute. The seal is circular and contains the text "WORCESTER POLYTECHNIC INSTITUTE" around the top edge and "1865" at the bottom. In the center of the seal is a shield with a heart, flanked by laurel branches, and a banner above it with the words "LEHR" and "KUNST".

# FAQs

# Job Prospects in Biomedical Engineering

## **BME 2019 Post-Graduation Survey of UG Class** (100% response):

<b>Employed</b>	<b>49.4%</b>
<b>Graduate School</b>	<b>36.7%</b>
<b>Military/Volunteer</b>	<b>1.2%</b>
<b>Other</b>	<b>12.7%</b>

## **BME Average Starting Salaries with BS:**

**2019: \$63, 985**

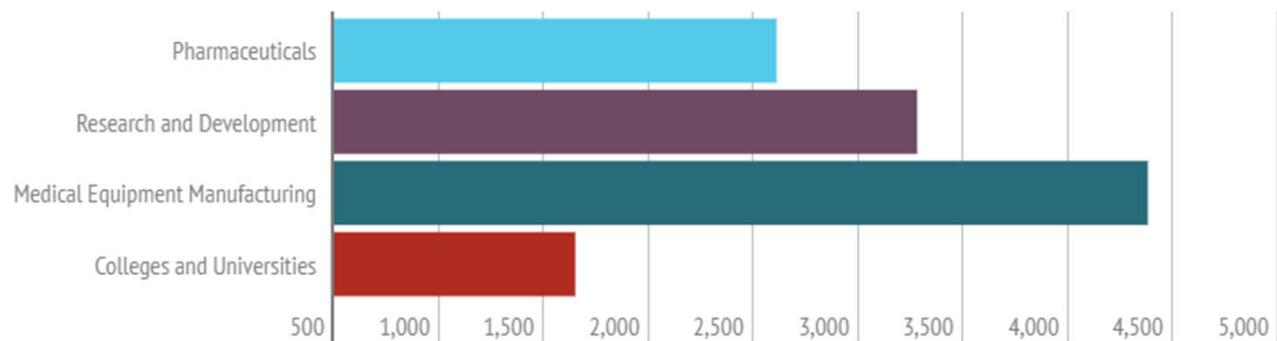
**(WPI, CDC Survey; #10 Princeton Review)**



# Job Prospects in Biomedical Engineering

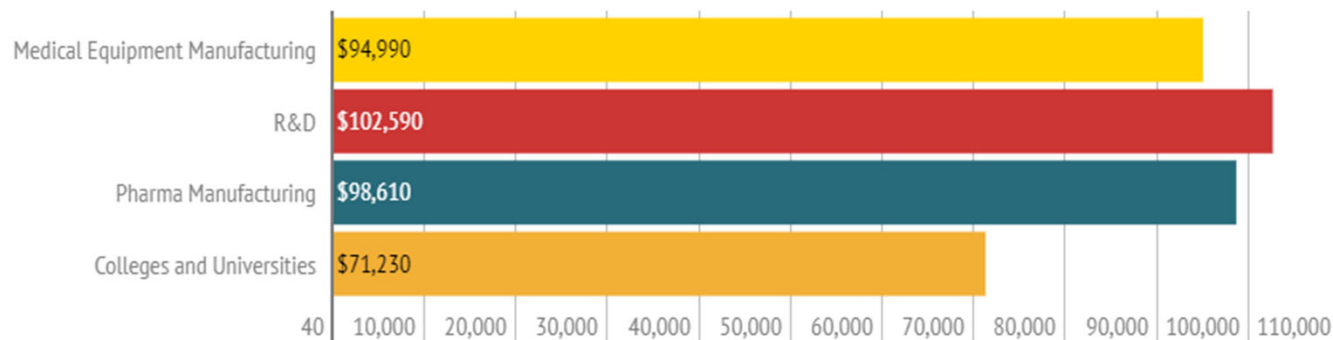
- **BME ranked #5 for Best Engineering jobs (US News 2017)**

## Employment in Bioengineering



Employment in selected Biomedical Engineering industries, May 2017

## Biomedical Engineering Salaries



Annual mean wage of selected Biomedical Engineering occupations/industries, May 2017

<https://navigate.aimbe.org/find-your-dream-job/career-outlook/>

# 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



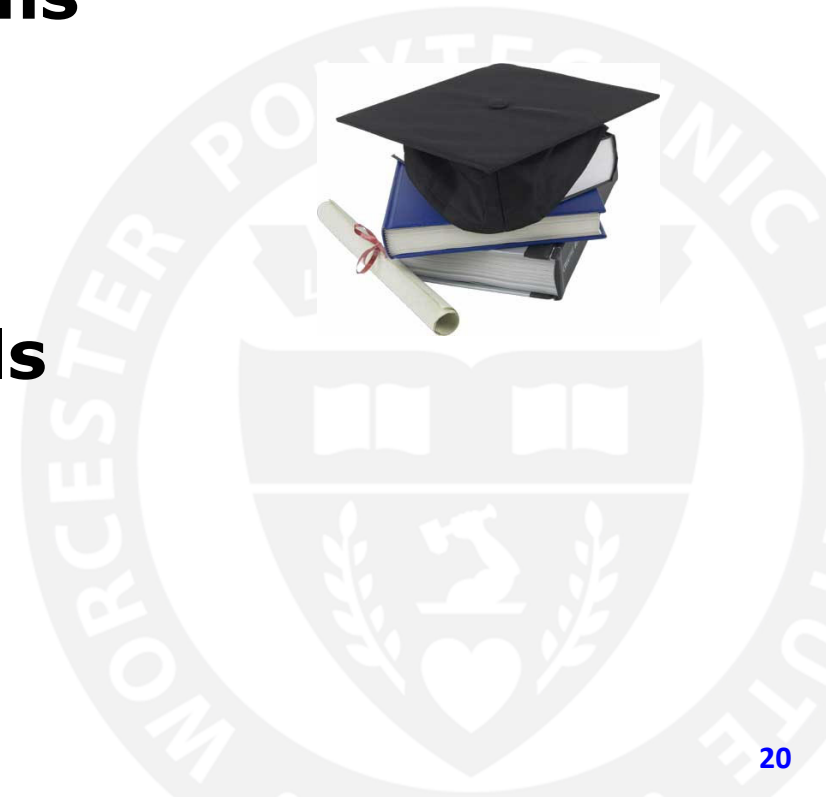
# Work Environment for BMEs

**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)

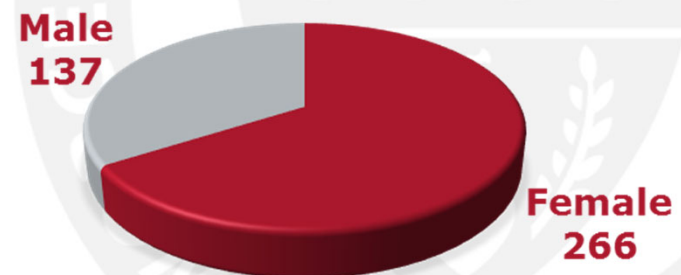


# WPI BME Undergraduate Students

## ***Award-winning students (past 12 years):***

- 8 Goldwater Scholars
- 4 Tau Beta Pi Scholarships,
- 5 NSF GRFs (4 NSF GRF Hon Mentions)
- 2 AHA Summer Fellowships
- Marshall Scholar
- 2 NIH-Oxford/Cambridge Biomedical Scholar
- Rotary Ambassadorial Scholarship
- SWE Scholarship

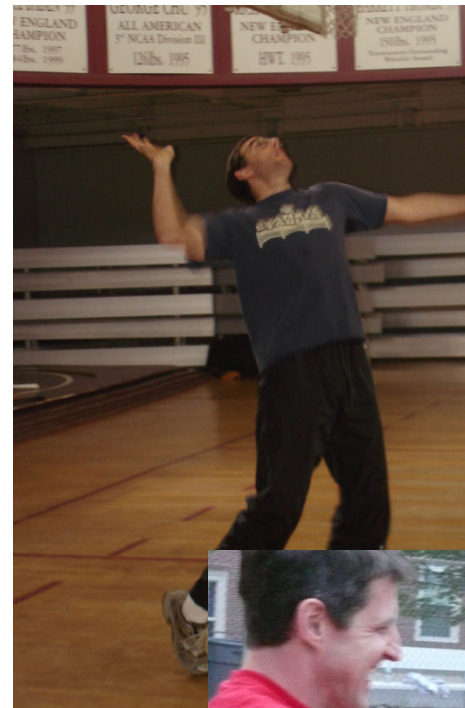
**LARGEST NUMBER OF FEMALES  
OF ANY MAJOR**



# The BME Department is AWESOME!

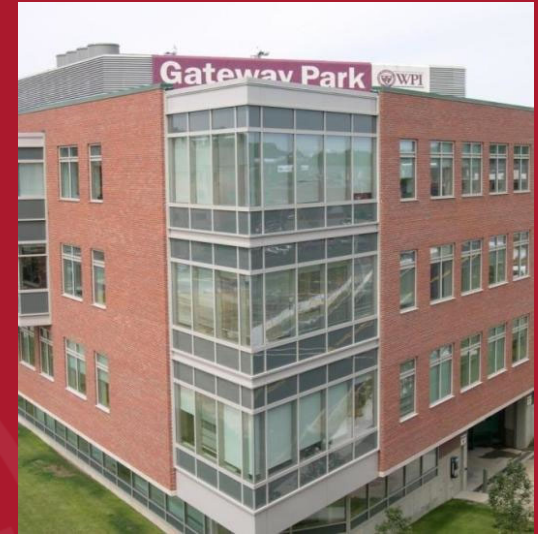
Faculty vs. student athletic events!

The faculty/grad students always win 😊



Pie eating is an "athletic" event if you're Professor Gaudette!





# Questions?





**Accepted Student Days**

# **Supplemental Slides**

**Teaching Labs and Research Clusters**



# BME Teaching and Project Labs



Instrumentation and Design Lab



Mechanical Testing Lab



Cell Culture Lab



Surgical Training Lab

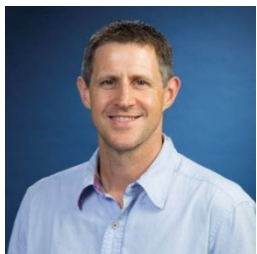
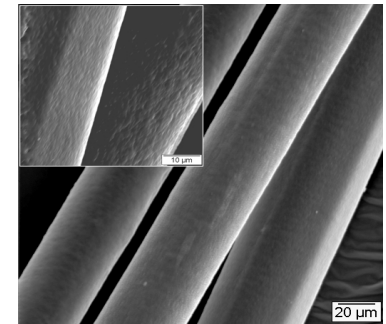
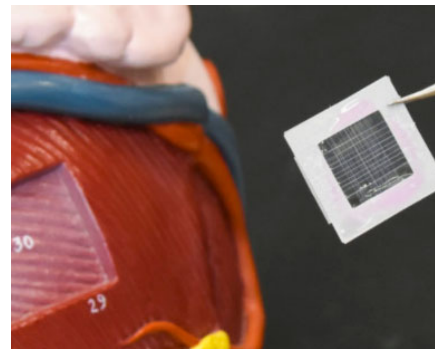
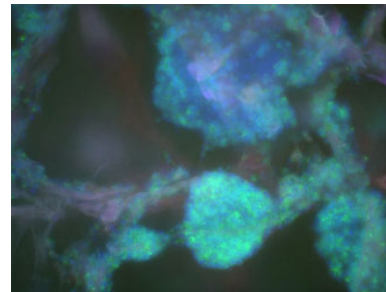
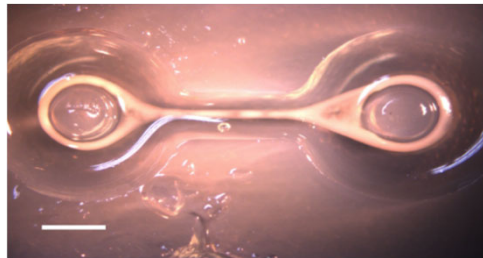
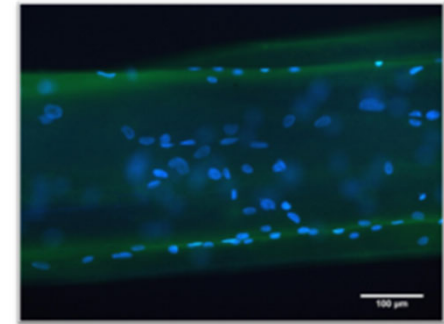
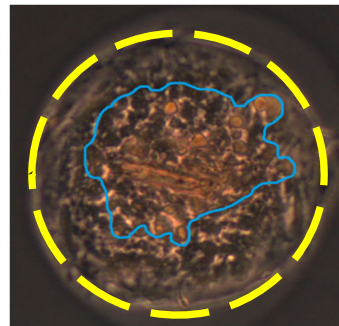
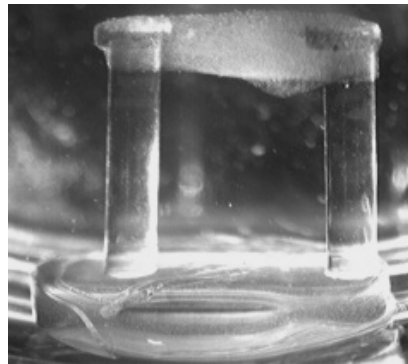


Imaging Lab



Chemical Wet Lab

# Biomaterials and Tissue Engineering



Kristen  
Billiar



Jeannine  
Coburn



Glenn  
Gaudette



Raymond  
Page



George  
Pins



Catherine  
Whittington

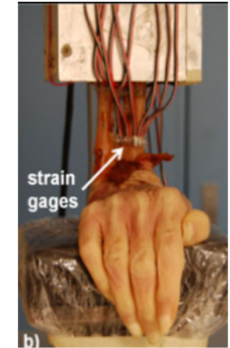
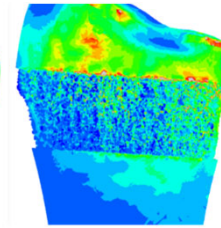
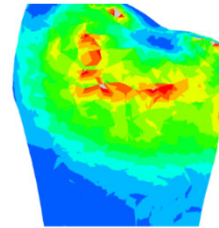
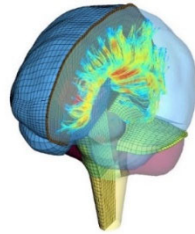
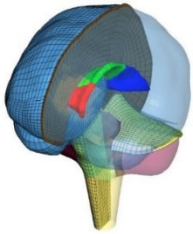
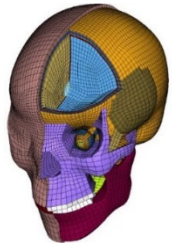


Marsha  
Rolle

Worcester Polytechnic Institute

# Biomechanics and Mechanobiology

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Kristen Billiar



Tiffany Butler



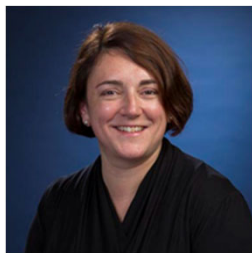
Glenn Gaudette



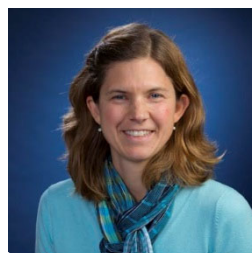
Songbai Ji



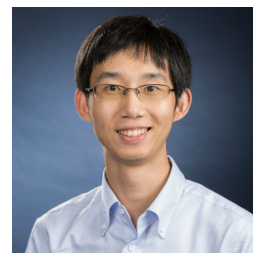
Kwonmoo Lee



Marsha Rolle

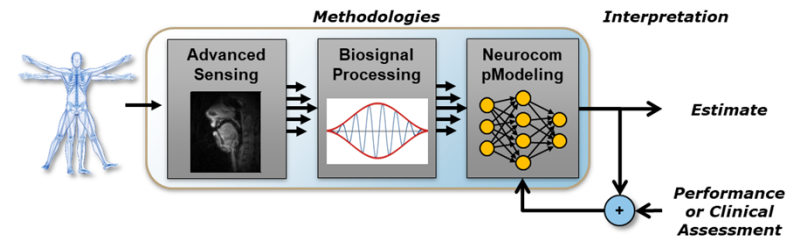
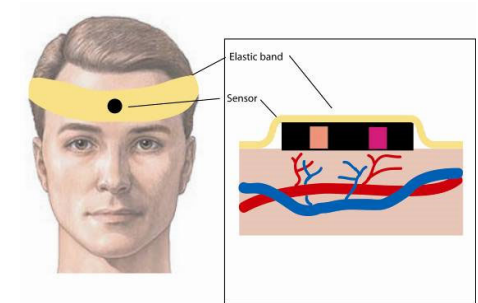
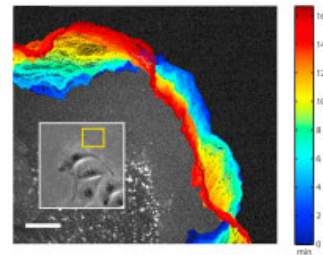
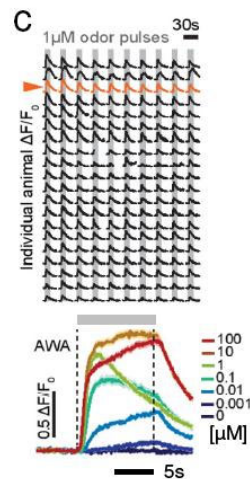
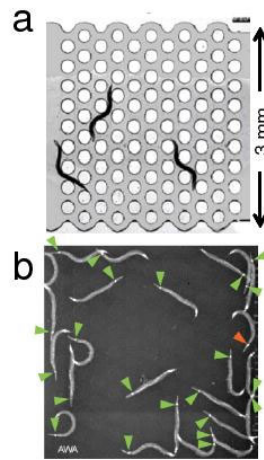
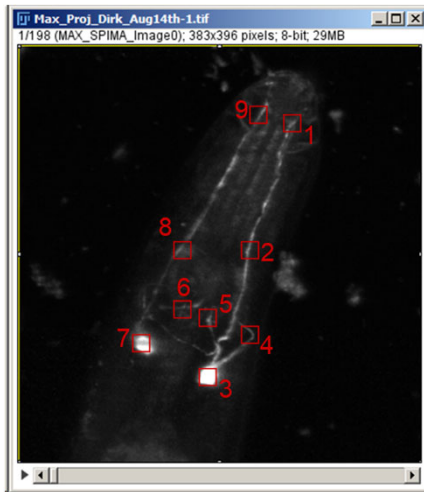


Karen Troy



Haichong (Kai) Zhang

# Bioinstrumentation and Signal Processing



Dirk Albrecht



Kwonmoo Lee



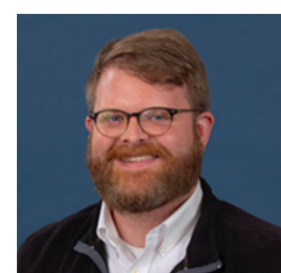
Yitzhak Mendelson



Karen Troy



Songbai Ji



Adam Lammert

Worcester Polytechnic Institute

