Department of Biomedical Engineering

Accepted Student Days

Biomedical Engineering

Kristen Billiar, Ph.D.
Professor and Department Head
kbilliar@wpi.edu

George Pins, Ph.D.
Professor and Associate Head
gpins@wpi.edu

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
What is Biomedical Engineering?

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

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.

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

Worcester Polytechnic Institute
WPI/BME Curriculum (Projects)

"Lehr und Kunst

Theory and Practice

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)

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

$2M+ Kern Foundation grant to teach EML across curriculum – BME LEAD
BME Curriculum

Freshman Courses

Sophomore Level Bridge Courses (Transition to Specialization)

Upper-Level Courses in Specialization
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
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

Biomedical Engineering  wpi.edu/academics/bme
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

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

... AND I TAWT DAT SPINACH WAS ONLY GOOD FOR ME ARM MUSCLES!

THE SPINACH LEAF HEART

Researchers grow heart tissue on spinach leaves

WHAT IS THIS? A NATURE-INSPIRED HEART?

The spinach is a Leaf Heart, which is a human heart made by researchers from heart tissue that was grown inside a leaf of spinach. The leaf is a natural source of nutrients and energy that helps the heart to function and beat. The Leaf Heart is a new and innovative approach to heart research and treatment, which could lead to new therapies for heart disease.
Crossing Kingdoms: Using decellularized plants as perfusable tissue engineering scaffolds
Job Prospects in Biomedical Engineering

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

- Employed: 49.4%
- Graduate School: 36.7%
- Military/Volunteer: 1.2%
- Other: 12.7%

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**

<table>
<thead>
<tr>
<th>Industry</th>
<th>Employment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pharmaceuticals</td>
<td>2,500</td>
</tr>
<tr>
<td>Research and Development</td>
<td>3,000</td>
</tr>
<tr>
<td>Medical Equipment Manufacturing</td>
<td>4,000</td>
</tr>
<tr>
<td>Colleges and Universities</td>
<td>5,000</td>
</tr>
</tbody>
</table>

**Biomedical Engineering Salaries**

<table>
<thead>
<tr>
<th>Industry</th>
<th>Salary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medical Equipment Manufacturing</td>
<td>$94,990</td>
</tr>
<tr>
<td>R&amp;D</td>
<td>$102,590</td>
</tr>
<tr>
<td>Pharma Manufacturing</td>
<td>$98,610</td>
</tr>
<tr>
<td>Colleges and Universities</td>
<td>$71,230</td>
</tr>
</tbody>
</table>

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
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)
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
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

WPI
BME Teaching and Project Labs

Instrumentation and Design Lab

Mechanical Testing Lab

Surgical Training Lab

Cell Culture Lab

Imaging Lab

Chemical Wet Lab

Worcester Polytechnic Institute
Biomaterials and Tissue Engineering

Kristen Billiar
Jeannine Coburn
Glenn Gaudette
Raymond Page
George Pins
Catherine Whittington
Marsha Rolle

Worcester Polytechnic Institute
Biomechanics and Mechanobiology

Kristen Billiar
Tiffany Butler
Glenn Gaudette
Songbai Ji
Kwonmoo Lee

Marsha Rolle
Karen Troy
Haichong (Kai) Zhang

Worcester Polytechnic Institute
Bioinstrumentation and Signal Processing

Dirk Albrecht
Kwonmoo Lee
Yitzhak Mendelson
Karen Troy
Songbai Ji
Adam Lammert
Worcester Polytechnic Institute