Welcome to the class of 2018!

Across The University of Akron campus, the entering class has already distinguished itself with the highest average GPA, the largest entering Honors freshman class, the largest Honors College enrollment overall, and the highest number of minority entering freshman Honors students.

Within Biomedical Engineering, the incoming class of 140 students includes 49 Honors students. Both of these numbers reflect the largest totals over the past 30-year history of the department. There is likely no single “engine” driving this growth — factors such as the growth of biomedical device industries and biomaterials opportunities in NE Ohio, coupled with initiatives such as the Austen BioInnovation Institute in Akron, and the Cleveland-to-Akron biomedical corridor are all important. Moreover, engineering faculty are extremely active participants in College Visit Days, UA on Display and numerous other activities involving prospective students and their families.

The “Austen BioInnovation Academy” is an event hosted by ABIA that includes classes in computer-aided design. These classes are held in the Department of Biomedical Engineering at The University of Akron. Seen on the left is Nyna Sayarath, a junior at the STEM High School who spent time this summer working on designing a device to prevent concussion. Her future plans are to become a biomedical engineer.

This should be an exciting year for the department! We have a new BME Design Team, our department is hosting a welcome reception for alumni at the annual Biomedical Engineering Society meeting in San Antonio, we have new projects that will be part of the NSF I-corps program and our faculty and students are being recognized nationally and internationally. These stories are highlighted in the pages ahead!

Brian L. Davis, Ph.D
Professor and Department Chair
bdavis3@uakron.edu

Factoid

The College of Engineering has seen a 40% increase In the number of incoming Honors students in the fall of 2014!
**BME Recognition**

**Paul Bishop** — doctoral student in BME — received the 2014 Alex Chao MD Young Investigator’s award from the Society for Vascular Ultrasound. This award is sponsored by Philips Healthcare.

**Dr. Mary Verstraete** was recognized by the American Society for Engineering Education (North Central Section) as the “2014 ASEE NCS Outstanding Teacher”. This award and title was conferred upon Dr. Verstraete during the 2014 ASEE NCS conference at Oakland University.

**Dr. Hossein Tavana** has been selected as one of 13 Young Innovators in Cellular and Molecular Bioengineering by the Biomedical Engineering Society. As a result, he will present a paper on his biphasic tumor spheroid microtechnology for anti-cancer drug testing at the upcoming BMES meeting.

**Dr. Brian Davis** received the 2014 “Student Supervisor of the Year” award from The University of Akron.

**Calia Battista** received an award from the Ohio Space Grant Consortium and will present her research at the 2015 Annual student research symposium at the Ohio Aerospace Institute.

Best student presentations at the 10th Annual UA Student Innovation Symposium (UASIS) include: **Stephanie Lemmo, Ehsan Atefi, Abrar AlNiemi and Jessica Stukel** (Best Poster), **Michael Majcher** and **Spencer York** (Best Oral presentations).

**Sarah Snyder** received UASIS Outstanding Student Research Award for undergraduates. **Spencer York** received Outstanding Student Research Award for graduate students.

**Dr. Yang Yun** received the UASIS Faculty Mentor of the Year Award.

**Dimitria Kontoveros** received the Njus Family Scholarship for 2014.

**Jessica Stukel** received an Honorable Mention on her NSF Graduate Research Fellowship Application and was in the top 28% of the 14,000 applications submitted.

At the World Congress of Biomechanics meeting this summer, **Michael Majcher** won 3rd place in the undergraduate student competition sponsored by the American Society of Mechanical Engineers. He was one of 1,000 students participating at this event! His project was “Quantification of neural tissue deformation in Type 1 Chiari malformation patients pre- and post spinal decompression surgery and comparison to controls.”

**Biomedical engineering student Michael Majcher at the World Congress of Biomechanics meeting.**
Career Fair

Our annual Fall Engineering & Science Career Fair will be held Tuesday, October 7 from 10 a.m. to 3 p.m. at the Student Union. Students attending are looking for an internship, co-op or full-time position. If you are an employer and want to be added to our mailing list, please e-mail Erin Elosh at elosh1@uakron.edu.

Career fair registration information for employers can be found at:
http://www.uakron.edu/engineering/academics/undergraduate/cooperative-education/career-fair.dot

New BME Grants


Dr. Yang Liu and Chris Mela (NASA): A Miniature Multimodal Imaging System for Medical Diagnostics and Interventions in Space.

Dr. Bing Yu (UA Firestone grant): Optical spectroscopy for noninvasive evaluation of the efficacy of anti-hypoxia drugs in cancer therapy.

Drs. Marnie Saunders and Jutta Luettmer-Strathman (Biomimicry Research and Innovation Center): The soluble effects of microgravity-exposed osteocytes on osteoclastic bone resorption.

Drs. Erik Engeberg, Rebecca Willits, and Jordan Renna (Biomimicry Research and Innovation Center): Towards the development of living robots.

INVITATION TO ALUMNI, EXTERNAL ADVISORY BOARD MEMBERS, FACULTY, STUDENTS AND GUESTS:

Join us for a reception at the 2014 BMES conference!
This will be held on Thursday, October 23, 2014 between 8:00-9:30pm at the Marriott Rivercenter in San Antonio.
New Biomedical Engineering Design Team

This year the department has created a BME Design Team. The purpose is to give students the opportunity to work on new and innovative medical device ideas. These developed devices will be entered into design competitions as well as potentially commercialized into real world devices.

Students who are interested in participating and/or companies in the region that could assist with prototyping or sponsoring student travel to national BME design competitions should contact Dr. Brian Davis by email at bdavis3@uakron.edu.

BME students work with physicians at ABIA

A number of Biomedical Engineering students from The University of Akron recently participated in multiple training programs hosted by the Austen BioInnovation Institute in Akron (ABIA). One of these was an all-day Summa Orthopedic workshop focusing on forearm and elbow surgery. During this workshop, resident physicians were split into groups that included students who were able to assist with routine aspects of the “surgery” on cadaver specimens.

Another workshop, entitled “Trauma Boot Camp,” took place this past summer. Physicians were placed in a trauma simulation that was video and audio recorded while BME students and fellow physicians observed. The medical specialists were then split into four groups and spent an hour in each trauma skill focus session.

Two engineering students followed each group and observed as the physicians trained in different procedures. Feedback from the students taking part in these training sessions included statements such as “I truly learned a great deal of information, and enjoyed observing the many trauma simulations and skill stations” and “I loved the experience and I really just wanted to let you know how much I appreciate that you extended this offer to the students! I learned so much and got some hands on time this was just an amazing opportunity!”
BME Provisional Patents (filed in the previous 12 months)

Note: Questions related to licensing these technologies should be directed to Sue Dollinger (sed@uakron.edu).

<table>
<thead>
<tr>
<th>Lead Inventor</th>
<th>Title</th>
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<tbody>
<tr>
<td>Dr. Matthew L. Becker</td>
<td>Modular Device for Preventing Compression and Instability in a Segmen-</td>
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<td></td>
<td>tal Defect Repair Scaffold</td>
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<tr>
<td>Dr. Matthew L. Becker</td>
<td>Metal Free, Degradable Radiopaque Poly(ester ureas)</td>
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<tr>
<td>Dr. Matthew L. Becker</td>
<td>Resorbable, Amino Acid-Based Poly(ester ureas) Scaffold for Vascular</td>
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<td>Graft Tissue Engineering</td>
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<tr>
<td>Dr. Matthew L. Becker</td>
<td>Methods for Post-Fabrication Functionalization of Poly(ester ureas)</td>
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<tr>
<td>Dr. Brian L. Davis</td>
<td>Algorithm for Optimal Placement of ACL and PCL Grafts During Knee</td>
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<td>Reconstruction Surgery</td>
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<td>Dr. Yang Liu</td>
<td>Convertible Goggle Systems for Defense and Medical Applications</td>
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<tr>
<td>Dr. Yang Liu</td>
<td>Wearable Apparatus for Guiding Medical Interventions and Method for</td>
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<td>Making the Same</td>
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<td>Dr. Ajay Mahajan</td>
<td>Retraction force sensor for medical retrieval baskets</td>
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<td>Dr. Marnie M. Saunders</td>
<td>Point-of-Care Osteoporosis Screening Kit</td>
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<tr>
<td>Dr. Becky Willits</td>
<td>Fluorescence Assisted Portable Cell Counting System</td>
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<tr>
<td>Dr. Bing Yu</td>
<td>A Robotic Fiber Optic Instrument (RFOI) for Detecting Tissue Damage</td>
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<td>During Electrosurgical or Ultrasonic Surgery</td>
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<tr>
<td>Dr. Bing Yu</td>
<td>A Multimodality Microendoscope (M3E) for High Resolution Imaging of</td>
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<td>Internal Organs</td>
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<tr>
<td>Dr. Bing Yu</td>
<td>Smartphone Endoscopy for High Resolution Imaging of Internal Organs</td>
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<tr>
<td>Dr. Jiang J. Zhe</td>
<td>Label-Free Biomarker Detection Based on Immunoaggregation and</td>
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<td></td>
<td>Electrical Pulse Sensing</td>
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<tr>
<td>Dr. Jiang J. Zhe</td>
<td>Design of Vacuum Pump for Wound Healing</td>
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The 2014 Midwest American Society of Biomechanics Conference was held at Quaker Station on The University of Akron campus in Akron, Ohio. There were 133 attendees from 16 different universities, 13 companies and federal organizations across 6 states. A total of 82 students attended the conference: 22 undergraduate students and 60 graduate students. All of these students registered for free --- thanks largely to the generous support from the American Society of Biomechanics.

The two-day conference allowed attendees to learn and ask questions about research being done at universities and companies all across the Midwest. Highlights of the meeting included keynotes by Drs. Loth and van den Bogert on the topics of “Experimental and Numerical Simulation of Biological Flows” and “Model-based strategies for analysis and prediction of human movement,” respectively. The closing reception was held at The Football Hall of Fame in Canton.

### Quick Statistics
- 61 presentations
- 33 posters
- 2 keynotes – delivered by Drs. Loth and van den Bogert
- 1 workshop – presented by Dr. Carin Helfer
- 1 tutorial – presented by Dr. Jason Moore and Obinna Nwanna on the topic of Python programming
- 13 companies/organizations
- 16 universities
- 3 corporate sponsors – Bertec, Simpleware and Great Lakes Neurotechnologies
- 22 undergraduate students
- 60 graduates students
- 82 total students

### Fall Seminar Series

Note: Seminars are held in the Auburn Science and Engineering Center, Room 223/224. Questions should be directed to Dr. Bing Yu (byu@uakron.edu).

<table>
<thead>
<tr>
<th>Date</th>
<th>Speaker</th>
<th>Topic</th>
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<tbody>
<tr>
<td>9/12/2014</td>
<td>Dr. Steve Fening, ABIA</td>
<td>Out on a Limb: Designing to Solve a Need</td>
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<td>9/19/2014</td>
<td>Dr. Rich Hart, Ohio State</td>
<td>Computational Biomechanics: Bones and Eyes</td>
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<td>10/3/2014</td>
<td>Dr. Michael Vogelbaum, Cleveland Clinic</td>
<td>Chemothepy for Brain Tumors: Is Delivery Included?”</td>
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<tr>
<td>10/17/2014</td>
<td>Dr. Barry Edwards, Univ. of Pittsburg</td>
<td>Development of molecular imaging agents from an single-chain variable fragment library based on a binary code</td>
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<tr>
<td>10/31/2014</td>
<td>Dr. Yong Wang, Penn State University</td>
<td>Programmable materials for drug delivery and regenerative medicine</td>
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<tr>
<td>11/14/2014</td>
<td>Dr. Michael Sacks, UT-Austin</td>
<td>Cardiac valve mechanics</td>
</tr>
<tr>
<td>11/21/2014</td>
<td>Dr. Christopher Kelly, Wayne State</td>
<td>The interplay of molecular organization, lipid phases, and curvature in biological membranes</td>
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Biomedical Engineer Dr Marnie Saunders discusses the exciting investigations into cellular interactions her lab is currently engaged in and the profound importance of conducting biomimetic research.

What is the overall goal of your research into biomimicry? Why is this study area so fundamentally important?

Our research is aimed at developing laboratory models that accurately mimic the in vivo bone environment and as such enable us to study bone multicellular interactions in reproducible and meaningful ways. Given a major research area of the laboratory is mechanics, our group builds devices that allow us to examine the effects and alterations of mechanical loading on bone structure and function. In addition to understanding the basic science mechanisms and pathways by which bone cells coordinate their activity in response to altered loading environments, our work has applications to fracture fixation, implant design, spaceflight, bioreactor development and osteoporosis.

How have your skills, experiences and career path led you to this field of research?

My BS degree is in Mechanical Engineering and my graduate degrees are in engineering with a concentration in biomechanics. My interest in orthopaedic implant design taught me that until we understand how bone cells respond to altered loading environments, such as those that occur with implant introduction, attempts to improve implants will be unsuccessful. Given this concern, I completed a postdoctoral fellowship and was introduced to the field of bone cell mechanotransduction. My current research continues to combine mechanics and biology.

Could you define the mechanotransduction process?

Bone mechanobiology is a field of study focused upon understanding the role that mechanical loading plays in bone development, growth, function and disease. It acknowledges that bone is a highly dynamic structure that adapts throughout the lifetime of an individual. This tissue level adaptation is the result of activity at the cellular level. Within this field, mechanotransduction research is aimed at understanding how bone cells sense and respond to mechanical loading. The response of the bone cells will ultimately determine if bone is created, destroyed or constant.

Bone is able to adapt to changing mechanical demands. What significance does this ability have to your research?

Our cellular work is centred on the fact that bone adapts to its mechanical loading environment. This ability to adapt results in an increase in bone with exercise and a decrease in bone with paralysis, long-term spaceflight and osteoporosis. In addition, implant design and bioreactor development for functional tissue engineering are also tremendously impacted by bone's ability to adapt. However, before we can successfully address these issues, we need to understand how normal bone adapts to its mechanical environment during growth, development and function. It is critical that we understand normal bone adaptation to successfully address these abnormal loading environments.

Could you detail the activities currently taking place at your laboratory to study standard testing systems to determine mechanical properties of bone and evaluate fracture fixation systems?

Currently, we are developing loading platforms that allow us to impart physiologically-relevant levels of mechanical loading to bone cells and study the cellular responses. Given our mechanical focus, we also utilise these loading devices to perform a variety of small-scale biomechanical tests to evaluate transgenic rodent limb mechanical properties, pre- and post-fracture rodent bone strength, decellularised tissue grafts and novel biomaterials. When determining the mechanical properties of small tissues, unique challenges often arise and so our laboratory works to develop fixtures and systems that provide accurate, reproducible and reliable data.

Do you have any exciting projects planned for the future? Where would you next like to focus your research efforts?

We continue to focus our efforts on developing biomimetic models that accurately simulate the bone environment. While much of our work to date has focused upon microdamage, we are currently using our models to address the effects of microgravity on bone multicellular activity. Combining our data with mathematical modelling will help us move closer to the end goal of predicting bone's response to its mechanical environment. Finally, we are beginning to pursue point-of-care systems stemming from this work.
235 Carroll Street  
Auburn Science and Engineering Center  
West Tower Room 275  
Phone: 330-972-6650  
Fax: 330-972-3939  
Website: bme.uakron.edu

BME Out and About

Drs. Ton van den Bogert and Brian Davis at the International Society of Biomechanics’ “Presidents Symposium” in Boston. July 9th.

(Left) Dr. Frank Loth delivering a podium presentation at the World Congress of Biomechanics, Boston, July 6th.

(Right) Dr. Rouzbeh Amini chairing a session at the same conference.

(Above) BME External Advisory Board members, Don Styblo from Valtronic and Pete Buca from Parker Hannifin at the 100th Anniversary dinner of the College of Engineering.

(Above) Bob Bowman, Deputy Mayor of Akron, Nicole Kasischke (New Business Development for Bytec Medizintechnik GmbH) and Dr. Ajay Mahajan at the 2014 Biomedica meeting in Maastricht.

(Right) The Akron delegation meeting with medical device companies in Germany.