

# RIT

Rochester Institute of Technology

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Cover designed by Qianhui Shi RIT Medical Illustration



Welcome to the fourth annual newsletter of the RIT Department of Biomedical Engineering. It was quite a year. The fall was generally filled with a sense of stability and accomplishment. This academic year represented the 10<sup>th</sup> academic year of the program, our 11<sup>th</sup> and 12<sup>th</sup> full-time faculty joined our ranks, we surpassed 100 total graduates, and welcomed our largest cohort of first year students yet. As we were heading into the Spring, we were all really enjoying the continued successes of our students, faculty, and staff.

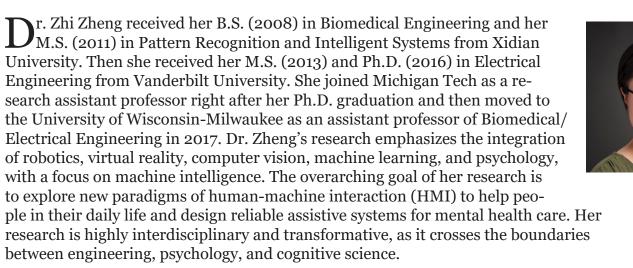
As happened for the rest of the world, everything changed in March and we were forced to revisit how we do nearly everything. Although not the focus of this newsletter, it would be impossible to overstate the effect that COVID-19 has had on our program as we depend on seeing students. It would be impossible to overstate my gratitude for the professionalism, grace, and "can-do" attitude that students, faculty, and staff demonstrated to pull through this period. With one week to clear out of Institute Hall and move all of our teaching, learning, and research online, we all embraced technology and creativity to address a new problem, just like any group of good engineers! And we all made it. The seniors are graduating, the underclassmen are making progress, and faculty and graduate students are looking forward to getting back into their research laboratories.

I hope this annual publication gives you a sense of the range of activities and accomplishments of our students and faculty during the past year. I couldn't be more proud of the success of our students within classes, labs, jobs, and clubs and have featured a few of these as examples. More than two hundred companies have hired students for co-op and full-time placement and our alum continue to go on to top graduate programs in the country.

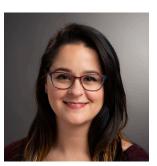
Thank you for your interest in the department. Best wishes for a healthy and productive upcoming year!

## **New Faculty and Staff**

Dr. Wuertz-Kozak is a pharmacist by training, and holds a Ph.D. in Human Biology from the University of Ulm in Germany and an MBA in Leadership and Sustainability from the University of Cumbria in the UK. After being a Postdoc at the University of Vermont, she was a group leader at the University of Zurich and the ETH Zurich in Switzerland, where she was the recipient of the Swiss National Science Foundation Professorship Award. Currently, Dr. Wuertz-Kozak holds the position of Kate Gleason Endowed Full Professor of Biomedical Engineering and leads the Tissue Regeneration and Mechanobiology (TRAM) Laboratory. Her laboratory aims to understand the cellular mechanisms underlying specific pathologies, with a focus on inflammation, and utilizes this knowledge for the development of novel treatment options that allow for tissue regeneration and pain reduction. Specifically, the group uses cells, biomaterials, biologics, genome engineering and mechanical cues to promote tissue regeneration.



Shannon LaJuett received her A.S. degree in Science from MCC in 2005 and her B.S. degree in Biomedical Sciences from RIT in 2015. Shannon began her career at Wegmans Food Markets (2012) as a Quality Microbiology Lab Technician for ready-to-eat/cook products where she was responsible for testing food pathogens and determining expiration dates for consumer goods. She then moved to Dupont as a Quality Control Lab Manager before joining the Biomedical Engineering Department as a Laboratory Manager in 2019. Shannon is certified in Hazard Analysis Control/Prevention and is a Preventative Controls Qualified Individual (PCQI) with experience in audits, food safety/quality, bacterial & viral food pathogens, GMPs, FDA/USDA regulations.



## **Grants and Scholarship**

In the past year, our faculty received grant awards in excess of \$685,000 from the National Institutes of Health, National Science Foundation, and Swiss National Science Foundation. In addition, our faculty published over 60 works of scholarship. See link below for details.

www.researchgate.net/institution/Rochester\_Institute\_of\_Technology

# **Student Achievements**









#### A

Fifth-year students Marcus D'Aguiar and Brandon Buscaglia developed a motorized stage and tracking prototype that works in conjunction with digital microscopes. The students ideas are being incorporated into a company's technology offerings, providing the potential to make an impact in health care applications tomorrow. Their contributions came about through engineering coursework and co-op experiences in a medical research laboratory.

В

Felix Chamberland, Abbi Miller, and Abbey Pfentner were recognized as Outstanding Undergraduate Scholars. All have completed at least 83 credit hours of study while maintaining a minimum grade-point average of 3.85 out of a 4.0. In addition, these students had other factors complementing academic achievement, including creative work, service on student committees, civic activities, employment, and independent research.

C

Graduate student Nicole Hill presented three posters at the 2019 Scix Conference. She won two distinct awards: the FACSS 1<sup>st</sup> place Poster Award and the Wiley Innovation Award. Her posters described her work on the design of electric field-driven microfluidic devices for the separation and enrichment of microparticles and cells. Her research was conducted through the Microscale BioSeparations Lab which is headed by Dr. Blanca Lapizco-Encinas.

#### D

Fourth-year student Will Byron and fifth-year student Sean Bellefeuille jumped at the opportunity to help Saler, a minature donkey. The animal had tendons in his front limbs that did not develop at the same rate as those in the back. The students helped create 3D printed prosthetics for Saler using the experience they gained from the campus club they established called BioPrint.



# Multidisciplinary Senior Design

Multidisciplinary Senior Design (MSD) Projects prepare students for modern engineering practice through a multidisciplinary, team based design experience. Students apply the skills and knowledge acquired in earlier coursework to implement solutions to engineering problems while adhering to customer requirements and recognized engineering standards.

## X-Ray Imaging to 3D Printed Diagnostic Models

A recent trend in orthopedic surgery is the use of preoperative bone models to practice and plan for these procedures. Use of these models has shown a decrease in operation time, which in turn decreases risk. To further improve the clinical relevance of these 3D models, materials need to be identified that replicate the mechanical properties and feeling of bone when being operated on. The team is creating a system that can convert two-dimensional data from technologies such as x-ray to a three-dimensional digital model that can be printed with materials to simulate bone properties. These approaches will allow physicians greater flexibility in diagnosing and treating their patients, as well as providing more advanced visualization technology to hospital systems that cannot afford CT or MRI technologies.



BME Members: Shannon Gulvin, Keyana Fariello, Leah Felker



BME Members: Sami Ali, Marshall Rioux, Sean Bellefeuille

# **Innovative Gynecological Speculum Redesign**

The standard speculum used by medical personnel in obstetrics and gynecology is the duckbill metal speculum. Uncomfortable and intrusive, the device induces patient stress which ultimately makes any procedure difficult for the examiner to perform. An OB/GYN with Rochester Regional Health Systems has identified a new speculum design concept, and this MSD team is working with him to refine the design concept further. The newly designed speculum will address the issues of the unnecessary distention of the pelvic floor musculature along with the associated discomfort and sense of intrusion. The new design will minimize anxiety for the patient, and provide better visibility for the practitioner to conduct exams.

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# **BME Doctoral Programs**

Students have the opportunity to work with BME core faculty on multidisciplinary research projects through several Ph.D. programs: Engineering, Microsystems Engineering, Imaging Science, and Mathematical Modeling, while an additional Ph.D. program named Biomedical and Chemical Engineering is developed. Students complete three research rotations in their first year to identify a good match with a research advisor and laboratory. Our recent graduates have gone on to positions in both industry and academia.



### **Research Areas**

Biofluid Mechanics Bioseparations Microfluidics

Nanomaterials
Medical Devices
Tissue Engineering

**Medical Imaging Image-Guided Navigation** 

Ph.D. students have the opportunity to complete practical and relevant industry co-ops that align with their research.



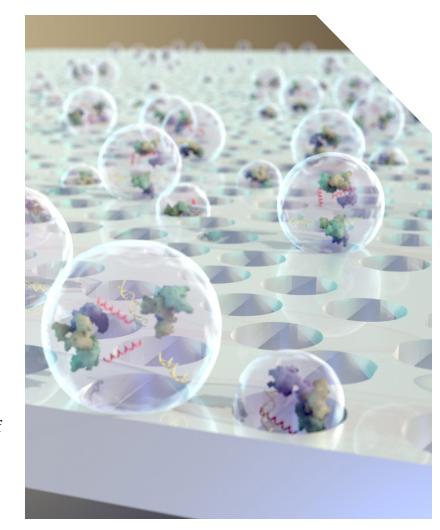
Ph.D. Candidate
Purification of
extracellular vesicles
and the characterization
of their role in wound
healing.

# Research Projects

### **NanoBio Materials Lab**

Extracellular vesicles (EVs) have attracted significant interest within the scientific community because of their role in cell-cell communication. EVs are secreted from all cells into bodily fluids and are generally just 50-500 nm in diameter. Efficient purification of these nanoscale particles from complex biofluids remains a challenge. Here, we introduce a new purification method where EVs are gently captured on the surface of a porous nanomembrane, while contaminants are washed away. This process is more rapid and tunable than existing solutions and could aid development of EV diagnostics for cancer detection as well as EV purification for therapeutics.

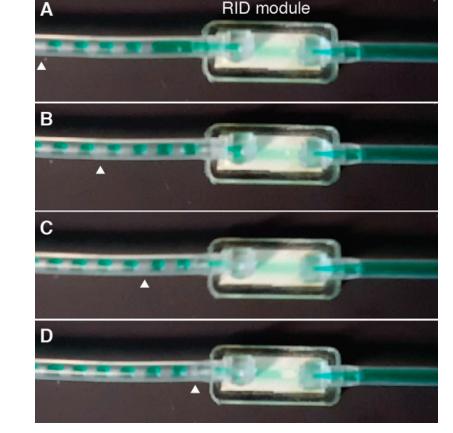
The NanoBio Materials Lab is headed by Dr. Thomas Gaborski.



## Biological Microsystems Lab

In vitro microfluidic cell culture platforms use fluid flows to mimic biophysical and biochemical environments found inside the human body. The introduction of air bubbles can cause damage to cultured cells and thus bubble-free flows are critical in microfluidic systems. Here, we present a rapid integrated debubbler (RID) module that can remove bubbles that range in volume from nanoliters to hundreds of microliters before they interact with cells cultured within a microfluidic channel network. Our technique has a larger bubble removal range than existing approaches and can be easily fabricated in any laboratory using our open-source design.

The Biological Microsystems Lab is headed by Dr. Vinay Abhyankar.



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## **2020 BME**

# **Co-op Superstars**

Our program requires students to complete 48 total weeks of co-op to graduate. These co-op stars have completed 65+ hours of co-op.







**Alexis** 

**Freeland** 



Gosselin



Hem



**Emilie** 

Mackinnon





**Mylott** 

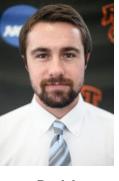




Wright



Wright









Rioux















**TOYOTA** 







Thermo Fisher SCIENTIFIC



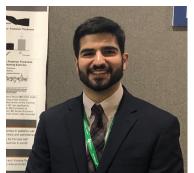


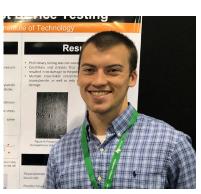




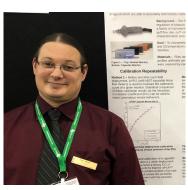
## **BMES Conference 2019**

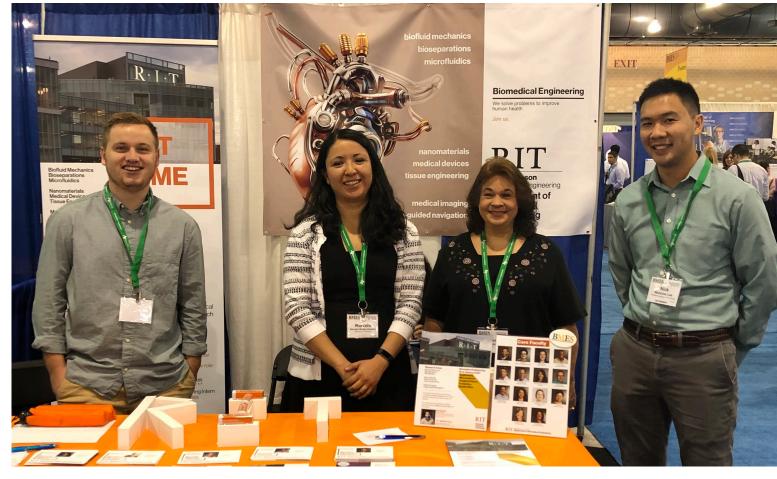
In October, the department traveled with faculty, staff, and more than 30 students to the Biomedical Engineering Society (BMES) Fall meeting in Philadelphia, PA. In addition to presenting our latest research work, we hosted a booth to recruit new students into RIT graduate programs. We also enjoyed reconnecting with our Philadelphia-area alumni during an evening networking event.

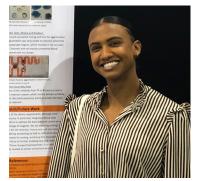




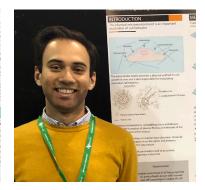














# Where are they going? and Where are they now?



#### Sean Bellefeuille

Sean joins the ranks of several Biomedical Engineering alum that have continued on to excellent health professional programs (MD, PA, Veterinary). Sean will be attending the veterinary medicine program at Cornell University in Ithaca, New York. He is interested in small animal medicine, specifically in surgery and rehabilitation.



#### **Maria Romero-Creel**

Maria started working at Ortho Clinical Diagnostics after graduation as a Scientist I in Research and Development. She worked on the FDA approval and launch of a new type of microslide. Currently, she works as a Quality Assurance Analyst II for the Performance and Assignment Release Team. She also started a MSc in Analytics at Georgia Tech with a concentration on big data and analytical tools.



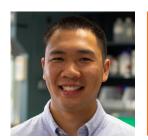
#### **Hannah Tennis**

Hannah is a part of the Air Force ROTC program and will graduate as a 2<sup>nd</sup> Lieutenant. She will be an air battle manager, which involves mission planning, looking at radars, and communication. Prior alum have also served in military and civil service. We are thankful for their service.



### **Brandon Hayes**

Brandon is now at University of Colorado Boulder for the PhD program in Mechanical Engineering. He received an NSF GRFP fellowship that allows him to study the interface between 3D printing and microfluidics. Aside from academic life, Hayes participated in the Ulman Foundation's 4K for Cancer and biked across the U.S. to raise funds and awareness for young adults with cancer.



#### **Nicholas Lee**

Nicholas will be joining the BME Ph.D. program at Carnegie Mellon University in Pittsburgh, PA. He is interested in researching bioprinting approaches that engineer the extracellular matrix to control cell fate and function. Nicholas is one of several students continuing on to top graduate programs (Harvard, Syracuse, Wake Forest).



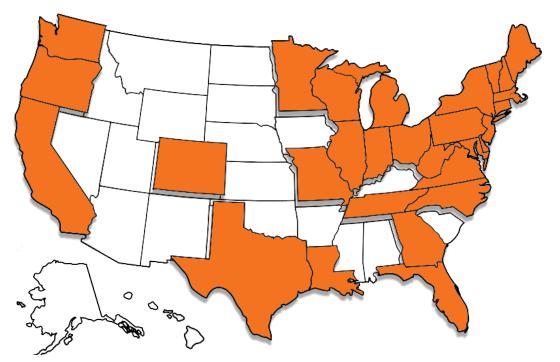
#### **Kyla Driver**

Kyla currently works for the U.S. Army Research Institute of Environmental Medicine as a researcher in the Biophysics & Biomedical Modeling Division. Her research work uses real-time physiological monitoring to identify risks of exertional heat injury. Her work will help to prevent heat injuries and casualties in the future.

# **Co-op & Employment**

#### **Across the country**

A part of pursuing a BME undergraduate degree here at RIT, students have the opportunity to complete co-ops for a duration of a summer and an academic semester. Many students have taken up positions across the U.S. They gain skills and experience from working in a new professional environment. Students are often offered a full time position after graduation.



**Top Employers** 



Johnson Johnson



<sup>80</sup>ABIOMED



BME Program Statistics

299

**Employers** of Co-ops

246

**Graduates** 

118

**Employers** of Graduates

**15**<sup>th</sup>



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Jeremy James Abbey \* Anil Adharapurapu Anthony Nicholas Aggouras \*\*\* Adam Peter Aldrow Sami Ali Elizabeth Ann Belfast Sean Donald Bellefeuille \*\* Tinuola Ifedamola Bolarin § Erik A. Brown Brandon Scott Buscaglia Jahmique Akilah Caines Alexandra Mary Celin \*\* Erik Johann Christian Cowell Marcus Luis D'Aguiar \*\* Stacy Nicel Diaz Perez \* Andrew P. Doran \* Sarah Angeline Ehrhardt Christina Kathaleen Eker \*\* § Keyana Evan Fariello Leah Felker \*

Alexis Leah Freeland \* Zachary Joseph Geffert \* § Amanda May Goodhines Andrew Gosselin Shannon Mary Gulvin \* Eva Hall \*\* Charles Beal Hem \*\* § Erica June Kabat \* Elizabeth Sarah Kuhl \*\* § Maya Lara \*\*\* Emily Lazarus \*\* Nicholas Lee \*\*\* Ellie Marie Lefkovich \*\* § Brandon Tyler Lindaman \* Karen Yasmin Linde-Garelli \* Emilie Mackinnon \*\*\* Elizabeth Rose Maeder Erin Claire Mastaj Mara Elizabeth McKain-Pitts Patrick Jepsen McPherson \*

Cole Johnson Miller \* Joseph Anthony Mylott \*\*\* Shriji Patel \*\* Erin Elizabeth Petrillose \*\* Lucas Tyler Quesnel \*\*\* William John Reid Hernandez \*\* Marshall Thomas Rioux Derek Alden Rothrock \*\* Dakota Rayne Sabotka \*\* Benjamin Jacob Sacco \*\*\* § Eric John Scharf Krista Ann Stanislow \*\*\* Hannah Tennis Hannah Elizabeth Thompson Peter Joseph Todoro II Melissa Grace Sanchez Valdez \*\* Tara Beth Williams \*\* § Catherine Rae Wright \*\*\* Sara Louise Wright \* Daniel William Zeglen \*\*

\* cum laude

\*\*magna cum laude

\*\*\*summa cum laude

§ Honors Program