RIT | Kate Gleason College of Engineering

Department of Biomedical Engineering

RIT

Rochester Institute of Technology

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Welcome to the fifth annual newsletter of the RIT Department of Biomedical Engineering.

Wow, what a year! One year ago, this letter focused on how we'd already felt the effects of COVID-19. As I wrote that letter we simply had no idea of how many different ways and times the pandemic would affect our department.

We were forced to revisit how we do nearly everything. But we persevered, like many other organizations where the work didn't stop, but just became more challenging. We figured out how to do everything from a graduation ceremony to open houses to advising, online. We restructured all of our lecture and lab-based courses in formats that allowed for in person or online delivery, and we closed and then reopened research labs to continue and start new projects. Our student body, the largest to date, figured out how to learn, survive, and even thrive in this environment. It would be impossible to overstate my gratitude for the professionalism, grace, and "can-do" attitude that students, faculty, and staff embraced to pull through this period.

I am not surprised that our biomedical engineering faculty and students did so well during this period. As engineers, we're quantitative problem solvers comfortable using technology to find solutions to hard problems. We are also comfortable working with the large uncertainty of biological systems. This mindset prepared us to find and create a variety of workarounds to keep things moving forward while safely avoiding exposure to the virus. And despite all of this, we really didn't just survive, but moved forward. Our research output and submitted and funded proposals were all higher than ever this year. Students found Co-ops and contributed to solutions related to the pandemic.

I hope that 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 class, 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 on to the top graduate programs in the country. I'm particularly proud of all of our students and alum that were contributing to solutions addressing the pandemic. Two of the three vaccine manufacturers were already top employers of our co-op students and we feature additional student contributions in this newsletter.

Thank you for your interest in the department and this newsletter. Best wishes for a healthy and productive upcoming year that allows for more in person interaction.

-Dr. Steven Day

RIT BME Faculty & Staff

2019

Faculty Scholarship

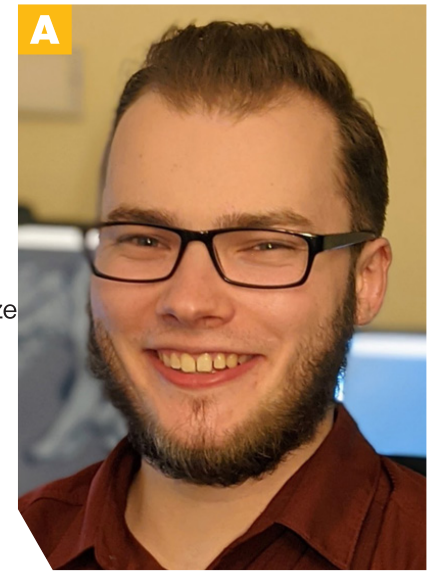
In the past year, our faculty received grant awards in excess of $670,000 from the National Institutes of Health, National Science Foundation, industry, and private foundations. In addition, our faculty published over 40 works of scholarship. More information can be found at www.researchgate.net

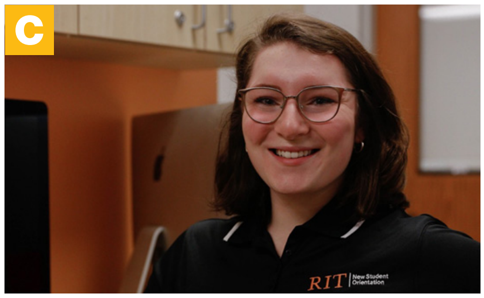
Dr. Karin Wuertz was featured in the 2020 Provost's Faculty Scholarship Report.

Dr. Blanca Lapizo-Encinas was awarded the prestigious Trustees Scholarship Award for her sustained accomplishments in academic scholarship.

Student Achievements

A Will Byron received a Student Achievement Award from TechRochester, an organization comprised of professionals and companies that are working together to strengthen the local technology community. The “Greater Rochester Excellence and Achievement in Technology” (GREAT) Award recognize individuals and organizations. The Student Achievement Award is awarded to a student, or team of students, who showed leadership and skill in applying or advancing innovative technology for the betterment of themselves, their educational institution, and/or the greater Rochester Community.





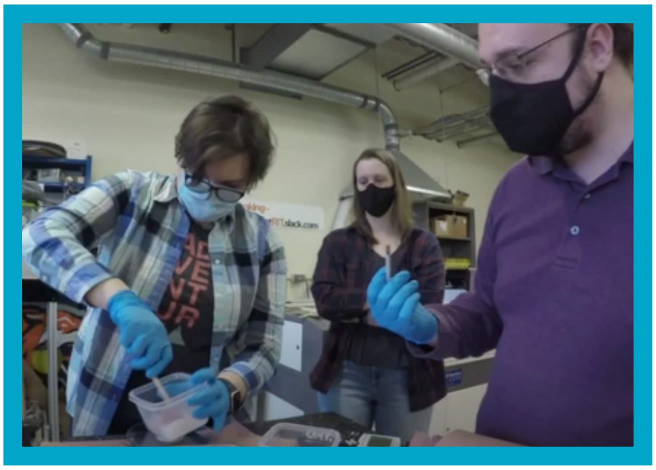
B Sam Hebbar has been awarded a Research Internship in Science and Engineering (RISE) grant from DAAD (Deutscher Akademischer Austauschdienst) to carry out research in Germany during the summer of 2021. Sam’s research at Technische Universität Kaiserslautern in Germany will focus on developing a simple, easy-to-use, and portable electric photometer to measure the quality of wine in an industrial setting. “As a Biomedical engineer, I am interested in one day designing and manufacturing biomedical devices that can make healthcare more accessible to people all over the world. While the product I’ll be working on during this experience isn’t related to the biomedical device industry, it will give me the tools and experience I need to one day reach that goal,” Sam says.

C The Patrick Lee Foundation has selected Chiara Young as one of their 2021 Distinguished Lee Scholars. RIT has been a partner school of the Lee Foundation since the Fall of 2017, and they have been growing their support of engineering and engineering technology students through $10,000/year scholarships for up to 4 engineering students who are near graduation. The Distinguished Lee Scholar award is given to an exceptional Lee Scholar who has successfully integrated the Foundation’s values of integrity, leadership and service to others into their personal and academic endeavors. The Distinguished Lee Scholar is a leader in and out of the classroom, helps foster the community of Lee Scholars, and finds meaningful ways to give back to others.

Rachel Strader, Anne Byerley, John Czukkermann and Catherine Musumeci (Top left clockwise) were recognized as 2021 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.

Multidisciplinary Senior Design

Multidisciplinary Senior Design (MSD) Projects prepare students for modern engineering practice through a structured 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.



Megan Rittiing (BME), Mike Sandway (BME)

Dissectable brain model (BME students: Megan Ritting, Mike Sandway): Susan Farnand and Elena Fedorovskaya, professors of "Introduction to Cognitive Neuroscience," were interested in models to increase student knowledge of neuroanatomy early in the program. A key component of learning neuroscience is maintaining a strong understanding of major structures of the brain and their relative locations. The instructors wanted to incorporate a tactile, laboratory component to the course that allowS students to dissect a model of the brain and visualize key structures in 3D. Currently, there are no readily available brain models on the market that explore the intricate anatomy of the human brain in a college level course. The goal of this project is to produce an anatomically correct model that can be disassembled into smaller components for students to visualize key brain structures and their locations, and facilitate their understanding of neuroanatomy.

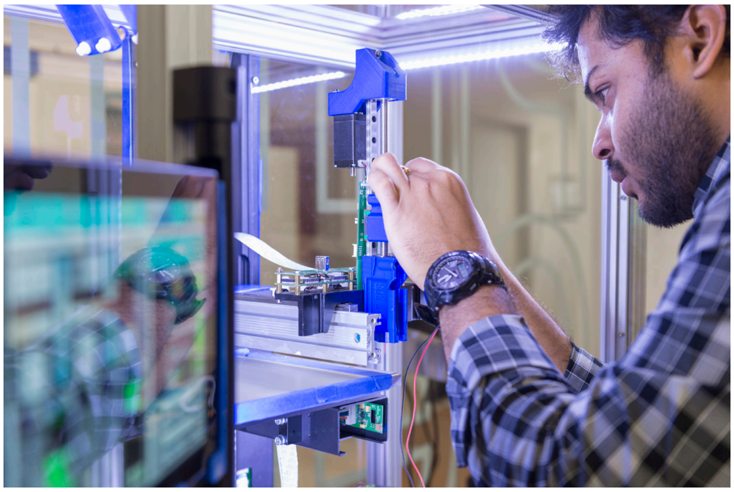
From left to right: Scott Lemay (BME), Thomas Gogos (Industrial Engineer), Aaron Kesner (Mechanical Engineer), Susan Lane (Mechanical Engineer), Hope DiVello (BME), and Maggie Brooks (BME).

Adjustable Pediatric Prosthesis (BME students Hope DiVello, Scott Lemay, Maggie Brooks): Prostheses are critical in rehabilitation of patients. A prosthesis can improve a patient's mobility and help them perform daily tasks. However, fitting and manufacturing a prosthesis is costly and as much as 50% of this is paid for by the client. In young patients who are still growing, prostheses must typically be remade annually. Our project aims to develop an adjustable, passive upper limb prosthesis which can "grow" with the child during their formative years. In this way, the financial burden to the family can be reduced. To develop this prosthetic design, we are working closely with Amy Pete, a Pediatric Physical Therapist from Nazareth College, Sean Zeller, the Chief of the Orthotics and Prosthetics Program at the University of Rochester, and Jade Myers, an RIT adjunct BME professor. This project started in our Medical Devices class and we enjoyed it so much we proposed it as an MSD project. Here, we aim to develop a comfortable, lightweight, and durable prototype prosthesis that is versatile enough to be worn from ages 2 to 10. We are also in the process of filing a provisional patent.

BME Doctoral Program

The Biomedical and Chemical Engineering Ph.D. program was added to our existing doctoral programs in 2021

Students in the Biomedical and Chemical Engineering Ph.D. program will complete a number of classes in their first two years of study, including foundational courses with other engineering graduate students, discipline-specific courses within biomedical and chemical engineering, and elective courses they select with their research advisor. They will complete a research thesis project and may have the opportunity to complete a complementary industrial co-op or internship. Graduates completing the degree will be highly skilled researchers, well-positioned to be leaders in the next generation of engineers who help tackle the challenging and complex problems facing our society.



Research Areas

Biofluid Mechanics

Bioseparations

Microfluidics

Nanomaterials

Medical Devices

Tissue Engineering

Medical Imaging

Image-Guided Navigation

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

Nicole Hill

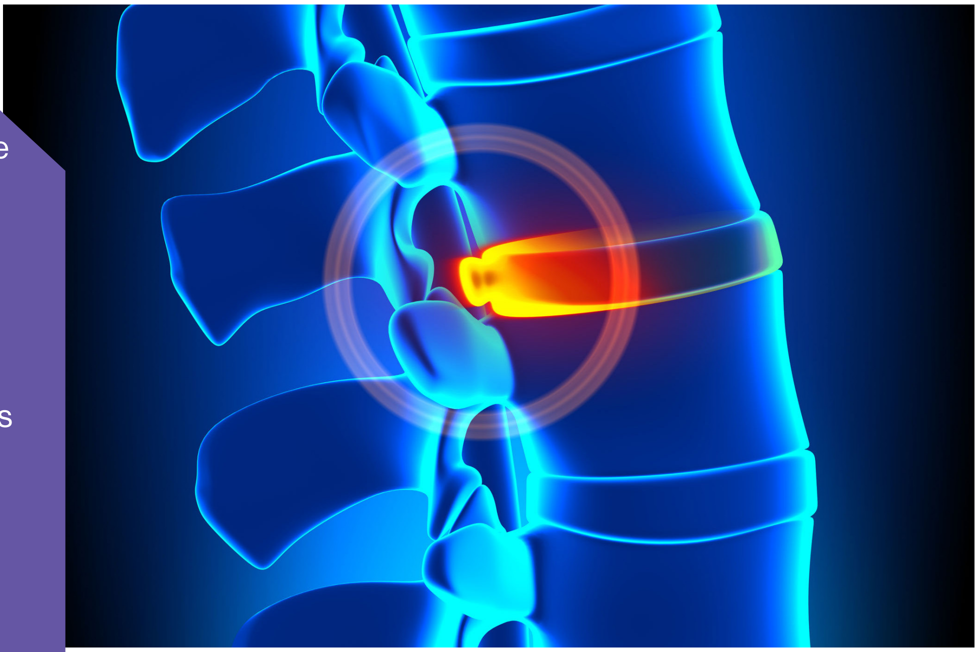
Ph.D. Candidate
Microparticle separation and purifications using insulator-based electrokinetic chromatography and insulator-based electrokinetic cascades.

Research Projects

Tissue Regeneration and Mechanobiology Lab

Numerous prevalent chronic diseases have a pathophysiological inflammatory component. However, the associated molecular receptors and pathways leading to dysregulated inflammation are often unknown. In degenerative disc disease - one of the main causes of back pain - Toll-like receptors (TLRs) have emerged as important mediators of inflammation. Due to the fundamental role of TLR activity in the intervertebral disc, their tight control is crucial. In this project, we hope to identify microRNAs that modulate TLR signaling in the intervertebral disc, and thus identify new, miRNA-based treatment options.

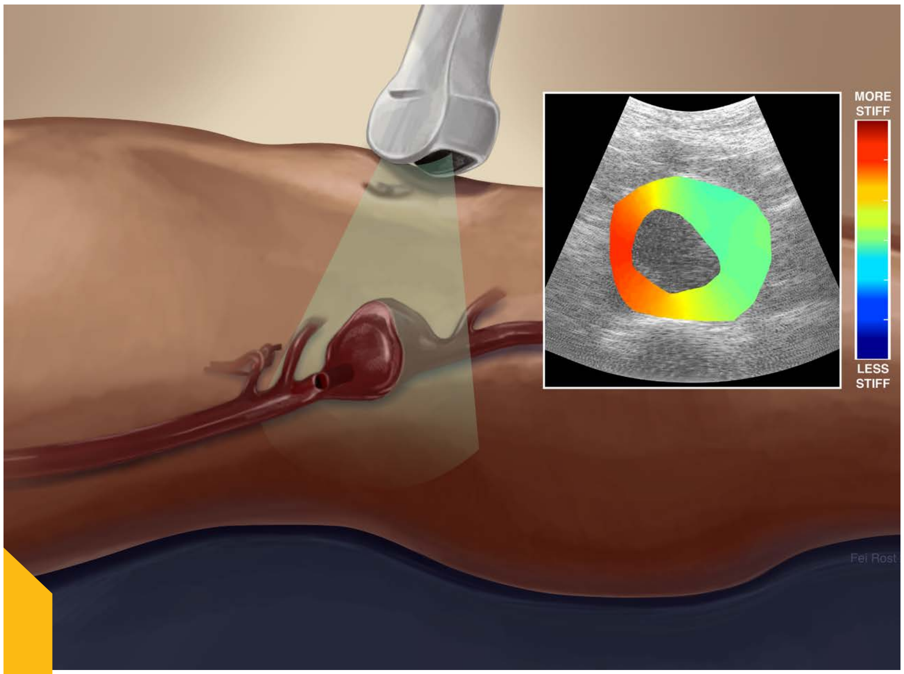
The Tissue Regeneration and Mechanobiology Lab is headed by Dr. Karin Wuertz-Kozak.



Biomechanical Imaging Lab

Our research is focused on the study of soft tissue biomechanics, using medical imaging systems, as it relates to a variety of pathologies. Biomechanical Imaging (BMI) is a technique that expands upon the medical imaging practice of elastography to solve the inverse problem in solid mechanics. This technique takes displacement measurement as input and produces an estimate of a mechanical property field as an output. BMI provides a non-invasive means of characterizing tissue structure and function based on quantitative two or three-dimensional material property maps. Potential areas of application span both clinical (e.g. detection and diagnosis of cancerous tumors, atherosclerotic plaques, aneurysms, musculoskeletal disorders etc.) and laboratory settings (e.g. research tools for physiology and mechanobiology).

The Biomechanical Imaging Lab is headed by Dr. Michael Richards.



BME Co-op Superstars

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


















Moderna

Johnson & Johnson

Rhēonix



ABIOMED
Recovering hearts. Saving lives.

Welch Allyn

UNDER ARMOUR

BMW

Harmac
MEDICAL PRODUCTS

CORNING

fisherscientific
by Thermo Fisher Scientific

HEXCEL

INVACARE
Yes, you can.

CLERIO VISION

DePuy Synthes
PART OF THE Johnson & Johnson FAMILY OF COMPANIES

BD

Wake Forest
School of Medicine

CSA MEDICAL

hikma.

ROCHESTER
REGIONAL HEALTH

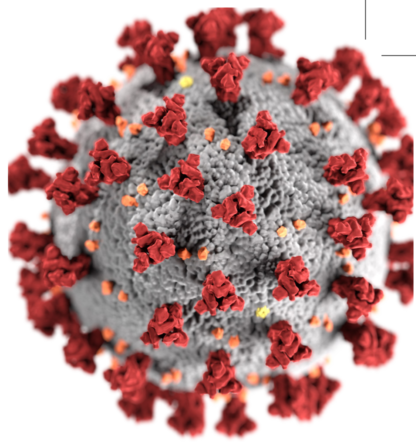
BOSE

Kaleidoscope
Innovation
Insights | Design | Development

SiMPore Inc.
Precision Membrane Technologies

Bristol Myers Squibb

SILKROAD
MEDICAL



Co-ops in COVID-19

What our students were doing to help end this pandemic.

Eleanor O'Gorman
Abbot, Westbrook ME
Eleanorworked with the lamination machines that create the individual strips that are used to create the rapid COVID-19 test currently used in Tiger Testing at RIT.

Kel Hakim
Rheonix, Ithaca NY
Kel is working on COVID-19 detection assays which are being used all around the Northeast. Kel is also involved in developing test assays for listeria, beer spoilage, and flu / respiratory viruses.

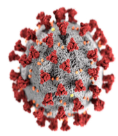
Maya Vanderhorst
Regeneron Pharmaceuticals, Tarrytown NY
Maya supported a project that created an FDA Briefing Book for approval of the production floor, facility, and production process of the COVID-19 antibody cocktail to help rapidly increase production of the drug.

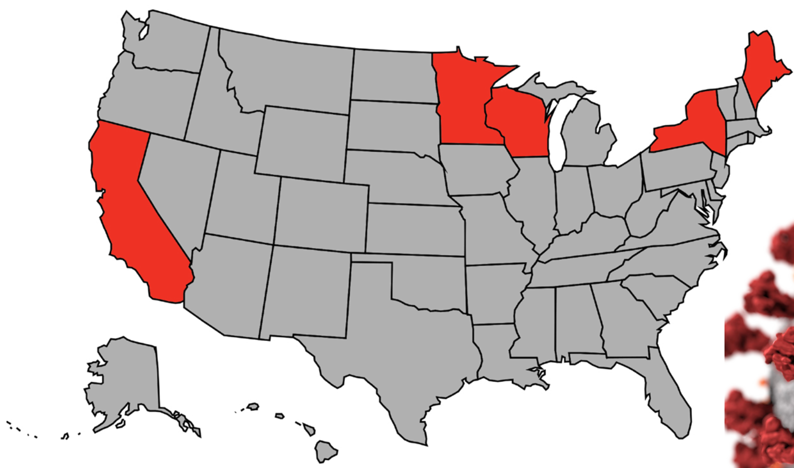
Austin Head
Entegris, Minneapolis MN
Austin's department manufactures single-use fluoropolymer bag assemblies that are being used in vaccine manufacturing and distribution efforts.

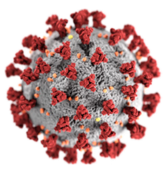
Marisa Cohen
GE Healthcare, Madison, WI
Moderna Therapeutics in Cambridge, MA
At GE Marisa, acted as a manufacturing engineer and helped with critical care ventilator COVID-19 production. At Moderna, she worked on the Molecular Biology team to help optimize 5' UTR of mRNA.

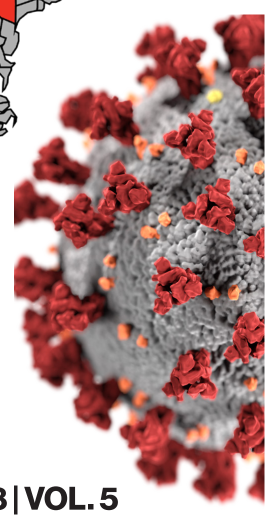
Julia Vaillancourt
GE Healthcare, Madison, WI
Julia worked with production lines and other engineers to help reduce the time and cost of producing ventilators for the pandemic.

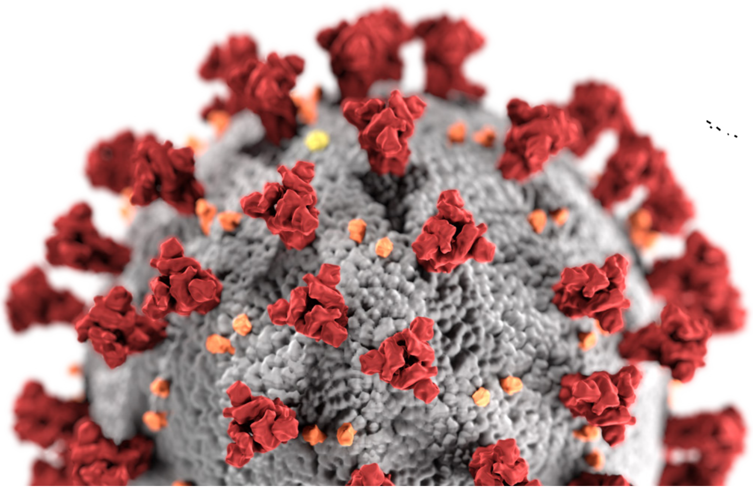
Andrew Short
AMDX BioSystems, Victor, NY
Over the last few months, Andrew has been working on the research and development of a novel, low cost, easy to use diagnostic device to test for COVID-19 and other infectious diseases.

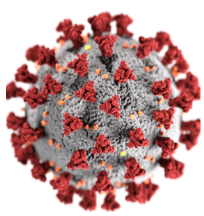












Where are they going?

Industry

A **Nicole VanOstrand** will be working at Ultragenyx Pharmaceuticals in Woburn, MA. She will be a research associate in cell culture process development where she will be helping to develop treatments for rare and ultra rare diseases.

B **Nate Piazza** is working at Regeneron Pharmaceuticals as a Process Development Associate II. He works in preclinical manufacturing and process development (as a member of the cell culture development group.)

C **Emma Kurz** has accepted a position with Bristol Myers Squibb in Devens, MA as an Assistant Engineer/Scientist in their Kickstart Rotational Program. Over the next two years, she will rotate through three different functional roles before landing in a final position.

A


B


C


Graduate School

A **Katarina Lichak** will be attending graduate school at the University of Rochester in the Medical Technology and Innovation Master's Program. This one year program is aimed at providing an education in clinical care and bioengineering design to prepare for a career in medical device design.

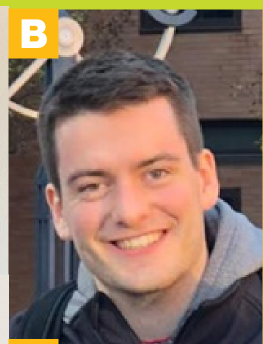
B **Felix Chamberland** will be pursuing a master's in electrical engineering at Laval University in Québec, Canada. For his research project, he will be working in the Biomedical Microsystems Laboratory on a real-time forearm myoelectric sensor. The sensor utilizes artificial intelligence algorithms to classify hand gestures. The goal is to eventually integrate it into commercial prosthetics.

C **Christina Kaszuba** will be attending graduate school at The University of Rochester as a Ph.D. candidate in their Biomedical Engineering program. Her plans are to use tissue engineering to create models to better understand diseases and work towards solutions.

D **Megan Ritting** will be starting the Molecular Pharmacology and Experimental Therapeutics Ph.D. program at the Mayo Clinic in Rochester, Minnesota.

E **Diana Kulawiec** will be pursuing a Ph.D. in Bioengineering at the University of Pittsburgh. She will be working in the Tumor Microenvironment Engineering Laboratory focused on using microfluidics, systems biology modeling, and in vivo experiments to study the interactions between tumor cells and their microenvironments.

A


B


C


D


E

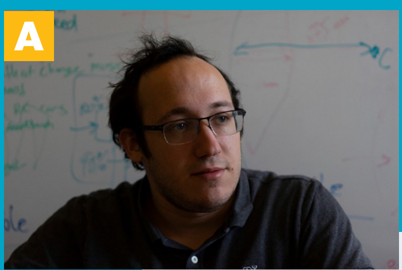

Where are they now?

Industry

Nicole Mazzola has been working for Abbott as a clinical specialist in electrophysiology. She travles to hospitals around Massachusetts and Rhode Island to map people's hearts for ablation procedures. She also assists with signal analysis of both EKGs and internal electrograms collected by electrodes that are placed inside of the heart. "This field is super exciting to be a part of because the technology and research is constantly changing, and there is always so much to learn!" says Nicole.

Medical School

Ellie Lefkovich is nearing the end of her first year of medical school at Albany Medical College, where she will be putting her engineering degree to good use in the Physical Medicine and Rehabilitation specialty.



Graduate School

A **Forrest Shooster** will join the University of Pittsburgh / Carnegie Mellon's Joint Medical Scientist Training Program (NIH Funded MD/PhD). He will be moving to Pittsburgh, PA in late May to start his first lab rotation to study neural engineering in early June.

B **Charles Hem** is in the second semester of his first year in Harvard's Speech and Hearing Bioscience and Technology PhD program. His classes cover all stages of the auditory system from acoustics and the outer ear, to higher central processing in the brain. He is working in Dr. Julie Arenberg's lab on projects related to measuring cochlear implant user variance through audiological methods.

Congratulations Class of 2021!

Mohammad Abdullah
** Donna Aiken
** Margaret Ann Brooks
*§ Lorna Burdick
** Erin Claire Butler
** William Byron
Isabella Caico
**§ Alexandra Rebecca Capodicasa
*** Felix Chamberland
*** Sierra Valerie Chimene
Kali H. Cook
Hope Elizabeth DiVello
Ramsey Martin Doolittle
Rachel Kellie Douglas
** Raquel Beatriz Feliz
*§ Cristina Guzman-Moumtzis
Nicole Patricia Hachmann Freundt
* Christina Marie Kaszuba
* Desmond Chin Ying Kuan
*** Diana Grace Kulawiec
***§ Emma Catharine Kurz
** Kevin Lee
Alexander Robert Micket
*** Abbi Lin Miller

Scott Robert Lemay
** Katarina Lichak
* Richelle Marie Mason
Kaylie Michelle McEntire
***§ Hayley Nicole Miller
*** Eleanor Jane O'Gorman
Charles Jordan Okehie
Leia Anne Peffer
*** Abigail Pfentner
** Nathan Samuel Piazza
*** Megan Lea Ritting
** Michael David Sandway
Jacob Richard Schnaufer
** Matthew Leo Sullivan
Courtney Lynn Swinehart
* Lauren Elizabeth Switalski
** Anna Grace Taylor
§ Anna Christine Tilstra-Smith
** Mark Truskinovsky
Sai Karan Reddy Uppugalla
***§ Nicole VanOstrand
* Sara Pearl Whitney
**§ Braedon Parker Williams
*** Chiara Santina Young

* cum laude **magna cum laude *** Summa Cum Laude § Honors Program