

# MAPPING BRAIN CIRCUITS TO BETTER MANAGE PAIN



**"I want to transform the landscape  
of pain management using  
innovation and scientific discovery."**

- Carl Saab, director of the Pain Science Technology And  
Research (STAR) Lab in the Cleveland Clinic Department of  
Biomedical Engineering

FULL STORY, p. 14

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## #BMEalliance

 CWRU, Department of  
Biomedical Engineering

 @CWRUBME

[bme.case.edu](http://bme.case.edu)

[lerner.ccf.org/bme](http://lerner.ccf.org/bme)

# OPPORTUNITIES

## Full- and Part-Time Research Positions in Computational Imaging and Machine Learning

*Departments of Biomedical Engineering  
and Computer & Data Sciences*

The Center for Computational Imaging and Personalized Diagnostics (CCIPD) at CWRU is hiring for positions including postdoctoral research associates, predoctoral research scientists, and undergraduate and graduate student researchers.

[ccipd.case.edu](http://ccipd.case.edu)

## Summer 2021 Virtual Internship for Undergraduates

In 2020, approximately 500 engineering undergrads from top universities around the world participated in the 10-week Virtual Summer Internship, which culminated in a small group-based design challenge to develop, design and test a solution to address the need for enhanced use of personal protective equipment (PPE) – particularly on college campuses – to help mitigate the coronavirus pandemic.

The design challenge is just one component of the internship. The program also features live one-hour online sessions led several times a week by professors, researchers, professional staff, entrepreneurs and others on a host of topics related to biomedical engineering careers, research and technology.

[bme.case.edu/Summer2021VSI](http://bme.case.edu/Summer2021VSI)

# FROM THE CHAIRS



## Robert F. Kirsch

Allen H. and Constance T. Ford Professor  
Chair of Biomedical Engineering  
Case Western Reserve University



@RKirschCWRU



## Geoffrey Vince

The Virginia Lois Kennedy Endowed  
Chair in Biomedical Engineering and  
Applied Therapeutics  
Lerner Research Institute  
Cleveland Clinic



@DGeoffreyVince

We are very pleased to present the activities and accomplishments of the BME Alliance from Case Western Reserve University and Cleveland Clinic in this Spring 2021 BME Alliance newsletter! Throughout the coronavirus pandemic, we have continued most of our activities, delivering our courses (primarily online but with some in-person when safety measures could be implemented) and maintaining most research activities. Very promising signs point to an emergence from the pandemic, and Case Western Reserve University intends to return to full on-campus activities in July.

We are very proud of our students, faculty and staff for maintaining our activities under challenging circumstances over the past year, and we are evaluating how to integrate innovative new processes learned over the past year into our operations as the situation allows. For example, we are discussing how to incorporate the successful aspects of online courses with in-person activities to improve our courses beyond their pre-pandemic quality while enhancing flexibility for our students. Also, the BME Alliance will again offer a Virtual Internship this summer, a program that was swiftly assembled last summer to provide professional opportunities for our own students, but quickly grew to an international student cohort of more than 500 students!

The next few months will bring some important transitions. The CWRU Board of Trustees announced last fall that Eric W. Kaler, the former University of Minnesota president, was selected to succeed Barbara Snyder as president as of July 1, 2021. Dr. Kaler is a chemical engineer who had significant success in his eight years as president at the University of Minnesota, so expectations are high. Dr. Gerald Saidel, an original faculty member and previous chair of the Case BME Department, will retire and transition to professor emeritus this summer.

Jerry has been a stalwart of our department and of biomedical engineering throughout his 54-year faculty career, and his seemingly tireless contributions will be sorely missed.

At Cleveland Clinic, Serpil Erzurum, MD, chair of the Lerner Research Institute, has been appointed to the newly created position of chief research and academic officer, where she will integrate clinical, basic and translational research efforts across Cleveland Clinic.

Cleveland Clinic has also created the Global Center for Pathogen Research & Human Health to help protect against future public health threats by increasing research efforts into viral pathogens and the human immune response. The center is directed by Jae Jung, PhD, an internationally renowned expert in virology and virus-induced cancers.

This spring's newsletter is literally overflowing with the accomplishments of our students and faculty. Highlights include Q&As with Ciera McCrary, a Navy lieutenant and online engineering master's program student, and Yuliang "Bill" Ding, who studied abroad in Uganda; a retrospective on Dr. Saidel's career; the amazing progress of Dr. Anant Madabhushi and his Center for Computational Imaging and Personalized Diagnostics; the Open BME seminar series, a seven university BME collaboration organized by Case BME; Dr. Anirban Sen Gupta's groundbreaking research in the area of trauma and other platelet-related therapeutics; the arrival of Dr. Carl Saab and his prominent Pain Science Technology and Research (STAR) Lab to the Cleveland Clinic Department of Biomedical Engineering; and an update on BME alumnus Paritosh Dhawale (MS '91, PhD '94), who was appointed senior vice president and general manager of GE's Edison Health Services Platform. We hope that you enjoy catching up on these accomplishments and many other updates included in the newsletter.

# STUDENT SPOTLIGHT

## Outstanding Performance as a Reviewer



**Jacob Antunes**, a newly-minted PhD from the Center for Computational Imaging and Personalized Diagnostics (CCIPD), was awarded for his outstanding performance as a reviewer at the 23rd International Conference on Medical Image Computing & Computer Assisted Intervention (MICCAI) hosted Oct. 4 – 8, 2020. Jacob Antunes was mentored by Satish Viswanath, assistant professor of biomedical engineering at CWRU.

## Clothing Drive Warms Cleveland

Cleveland Clinic Lerner Research Institute had a very successful winter clothing drive for Bolton Elementary School, coordinated by BME's Robin Crotty, Hannah Simmons and Cleveland Clinic undergraduate student **Edward Carson**. As Robin Crotty reports, "We were able to provide the school with 200 coats, 330+ pairs of gloves, 300 hats, 70+ scarves and numerous other winter items like sweaters, snow pants and boots. Because of these donations, every child will receive at least a hat and gloves this winter, and over 70% of the students will be given a coat."



## ISMRM Trainee Competition

**Amogh Hiremath**, a PhD student in the Center for Computational Imaging and Personalized Diagnostics (CCIPD), was runner-up in the trainee competition held by the International Society of Magnetic

Resonance in Medicine (ISMRM) MR of Cancer Study Group. The mission of the MR of Cancer Study Group is to foster education and research in the field of cancer imaging using MRI/MRS and to ultimately improve scientific knowledge and patient care. The group nominated five finalists as part of the trainee competition, including Hiremath. The competition included abstract presentations and two-minute Q&A sessions, and the results were based on an audience poll of 90 people. Hiremath's abstract was titled "Test-retest repeatability of convolutional neural networks in detecting malignant regions on apparent diffusion coefficient maps in 112 prostate cancer patients." Hiremath is mentored by Anant Madabhushi, director of CCIPD and Donnell Institute Professor of Biomedical Engineering.

## Published Papers on Wearable Technology



**Dhruv Seshadri**, a PhD student in the Department of Biomedical Engineering, recently published a paper entitled, "[Wearable Technology and Analytics as a Complementary Toolkit to Optimize Workload and to Reduce Injury Burden](#)"

in collaboration with University Hospitals, University of Southern Queensland, UCLA and Atrium Health. Another multi-institutional paper led by Seshadri and published in 2020 achieved the metric of having more views than 99% of all articles published by Frontiers, a leading open-access publication: "[Wearable Sensors for COVID-19: A Call to Action to Harness Our Digital Infrastructure for Remote Patient Monitoring and Virtual Assessments.](#)"

## Students Receive Prestigious Graduate Research Fellowships



The National Science Foundation Graduate Research Fellowship Program (NSF GRFP)

recognizes and supports outstanding graduate students in NSF-supported STEM disciplines who are pursuing research-based master's and doctoral degrees at accredited U.S. institutions. Five Case Western Reserve University engineering students received a graduate fellowship in 2021: **Olivia Krebs (BME)**, **Oluka Okia (Mech Eng)**, **Justin Kim (BME)**, **Clayton Alan Cooper (Mech Eng)** and **Alan Zhou-Yi Chen (BME)**.



**NDSEG**

In addition, **Natalie Mueller (BME)** received the 2021 Department of Defense National Defense Science

and Engineering Graduate (DOD NDSEG) Fellowship Award. The DoD NDSEG Fellowship Program, established in 1989 by direction of Congress and sponsored by the Army, Navy, and Air Force, serves to increase the number of United States citizens trained in science and engineering disciplines of military importance.

# 5 questions with Ciera McCrary, Navy lieutenant and online engineering master's program student



When Case Western Reserve University made the switch to virtual learning in the spring as a result of the COVID-19 pandemic, students, faculty and staff had to make rapid adjustments. But Ciera McCrary had uniquely challenging circumstances: The Navy lieutenant and graduate student in the online master's in biomedical engineering program at Case School of Engineering was aboard a ship at sea.

McCrary, who is stationed on the USS Howard out of San Diego, was aboard the ship and unable to come ashore for months – all while still trying to continue her online program. On the ship, internet connections can be unstable and there is limited access, but McCrary was grateful for her instructors' support.

"The professors are extremely helpful in being lenient and working with me on what to do," McCrary says. "They're very understanding and help me a lot."

McCrary earned her undergraduate degree in mechanical engineering from the U.S. Naval Academy, following in her older brother's footsteps by attending the institution.

"I always knew I wanted to serve. I wanted something bigger and I love to travel, so the Naval Academy seemed like a competitive place that would drive me and push me to get better," she says.

During her undergraduate experience, McCrary had internships with NASA and MIT.

As a surface warfare officer in the Navy, McCrary's experience has largely involved program management and maintenance and also offered her the chance to develop her leadership skills, both in helping others through humanitarian acts and leading those who work under her.

Case Western Reserve's master's program offered an opportunity to return to the more technical side of engineering and to study biomedical applications, a field she had been drawn to since first reading about cell-grown organs outside of the human body.

McCrary looks to enter the civilian workforce following her anticipated spring graduation, at which time she hopes to explore the research and development side of engineering.

"The military has given me a great amount of opportunities and I don't regret it whatsoever, but I think it's time for me to transition," McCrary says.

Learn more about McCrary in these five questions.

## 1. WHAT WAS THE LAST BOOK YOU READ?

The last book I read was actually *Moonwalking with Einstein* [by Joshua Foer]. It's a way of understanding a new form of how to learn properly.

## 2. WHEN YOU WERE YOUNGER, WHAT DID YOU WANT TO BE WHEN YOU GREW UP?

When I was younger, I always wanted to be an engineer, some sort of scientist. I always wanted to be involved in something with cancer research or deadly diseases, infectious diseases ... anything of that nature – or work on cars.

## 3. IF YOU COULD HAVE A SUPERPOWER, WHAT WOULD IT BE?

My superpower would definitely be something like being able to transport anywhere. I love traveling, so being able to just one day be in one country and the next minute, be somewhere else would be great.

## 4. WHO HAS HAD THE GREATEST INFLUENCE ON YOU?

The person who has had the greatest influence on me is my grandmother because she was one of the first few people to encourage me to go into a field that – at the time – wasn't very female-heavy, especially when I started showing interest in cars. She ran with it, buying me little toy sets and car sets, so she was definitely the biggest influence and driver for me to go where I am.

## 5. WHAT'S YOUR FAVORITE THING ABOUT CASE WESTERN RESERVE?

My favorite thing is the teachers, as a whole, just being willing to help. From the TAs all the way to the professors. If you have problems like I have in that I can't finish things on time or I have to finish them early, they are always willing to be open and understand and talk through thoughtful options.

# BME Student from China Studies Abroad in Uganda



Yuliang "Bill" Ding is a biomedical engineering major from China. He has made the most of his time at Case Western Reserve University by getting involved in campus organizations and becoming an orientation leader. During his second year in Spring Break 2019, Bill expanded his global perspective even further by studying abroad in Uganda. He shares how his experiences have impacted his career plans and offers advice for other international students and those interested in studying abroad.

## HOW DID YOU DECIDE TO STUDY AT CWRU?

Before coming to the U.S., I was often fascinated by the studying atmosphere at medium-to-small size universities and the American college life. CWRU's size was a great fit for me. It allowed me to network across the entire campus and make sustainable connections.

Besides the awesome academic environment at CWRU (as a research university), I also like the city of Cleveland. Born and raised in Shanghai, China, I was so used to living in a crowded city that I wanted to try something new and have my college experience in a relatively smaller and quieter city. Cleveland is a good fit - I love this forest city! The smaller city size (compared to Shanghai) also enabled me to get civically engaged and learn more about the community.

## WHY DID YOU DECIDE TO STUDY ABROAD?

People might ask, since I am already studying abroad as an international student, why do I "study abroad" again? In my opinion, the passion of wanting to experience a different culture and live my life from another perspective should never wane, regardless of how many countries I travelled to. With this enthusiasm, plus my initial goal of utilizing biomedical engineering technologies to help people across the world, I decided to join a CWRU study abroad program on "Global Health Issues in Uganda" (ENGR 350U / ANTH 300), where I worked in an 8-student team and brought design prototypes to Uganda to help address global health issues.

## WHAT WAS THE BEST PART OF YOUR STUDY ABROAD EXPERIENCE?

There are so many... I think one of my favorite experiences was the safari trip to Uganda national park. The view was fantastic. I was able to see places that I would have only seen on a TV show before. From hippos to zebras, I had the privilege of watching them only meters away in the safari car, and enjoyed the lowest gravity on the Earth - at the equator!

## DID YOUR EXPERIENCE ADJUSTING TO STUDYING IN THE U.S. AS AN INTERNATIONAL STUDENT HELP YOU ADJUST TO YOUR STUDY ABROAD EXPERIENCE?

I believe so! Studying in the U.S. as an international student opened my eyes to the cultural diversity, which helped me become more open-minded when travelling in Uganda. It is also interesting to learn about how both China and the U.S. collaborates with Uganda. Sometimes, people from different countries might have varying opinions on international policies, which was also fascinating to learn about.

## YOUR STUDY ABROAD PROGRAM FOCUSED ON CREATING SUSTAINABLE SOLUTIONS TO HEALTHCARE CHALLENGES IN UGANDA. WHAT WAS IT LIKE TO HAVE THE OPPORTUNITY TO MEET AND WORK WITH THE END USERS AND PEOPLE WHO WOULD BENEFIT FROM THE WORK YOU DID HERE AT CWRU?

The spring break trip to Uganda has taught me how to evaluate feedback and analyze data critically. My most important "take home message" is to think carefully about the positions of people who give feedback. It is important to note that Ugandan administrators' comments may weigh less than healthcare workers'

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## "Traveling to the U.S. and Uganda taught me to not rely on single stories, and opened my eyes to the diversity."

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advice, as the latter are the ones who do the outreach and use our prototypes. In addition, working with end users in Uganda taught me to be an active listener and critical thinker. When interviewing local healthcare workers for feedback, I realized that they tended to be polite and gave compliments, but a positive comment did not always mean our design was the best fit for their clinical settings. Carefully analyzing interviewees' responses, we learned to tailor our design based on local manufacturability. Serving in a different country, I learned to appreciate cultural variances and not to have experience-based pre-assumptions.

### **HOW HAS YOUR EXPERIENCE AS AN INTERNATIONAL STUDENT IN TWO LOCATIONS CHANGED THE WAY YOU THINK ABOUT THE WORLD?**

Traveling to the U.S. and Uganda taught me to not rely on single stories and opened my eyes to the diversity. When in China and the U.S., I sometimes learn about the shortages in resources in Uganda, which made me think that Ugandan people might have always been living a challenging and sad life. However, it was not until I travelled to Uganda did I notice that my assumptions were biased: Ugandan friends had their own enthusiastic culture, and with close connections with WHO and UNESCO, Uganda is also rapidly developing its healthcare system, aiming to achieve herd immunity. People's passions are contagious. Reflecting on my international student experience, I learned to avoid implicit biases and to keep a positive mindset when viewing the world.

### **WHAT ARE YOUR CAREER PLANS, AND HOW DO YOU THINK THESE INTERNATIONAL EXPERIENCES WILL HELP YOU IN YOUR CAREER?**

In the future, I want to become a healthcare worker in the U.S., and possibly help the world through medical mission trips. This international experience in Uganda has influenced how I think about global health collaborations. Having the opportunity to bring engineering designs to address health issues on the other side of the world, I learned more about the culture and healthcare system in a country other than China and the U.S., and developed a long lasting relationship with Uganda college students. On the other hand, I also saw the negative aspects of global health work. In Uganda, lack of medical resources

and not enough international support still lead to potential harm and infections. As travelers, our visits could have disrupted patients' privacies, while we might have only focused on getting our results for the class. We could have brought some additional medical supplies for these hospitals, so we can at least do something for them in return.

### **WHAT ADVICE WOULD YOU GIVE TO OTHER INTERNATIONAL STUDENTS CONSIDERING STUDYING AT CWRU?**

CWRU is an unsung champion. People might think that CWRU is a small campus in a relatively small city, compared to other metropolitans. However, as an old Chinese saying goes, a sparrow might be small, but it has all its vital organs. CWRU might be smaller (and maybe hence less popular) than other large universities, but it has all the resources you need. A small-to-medium campus size also makes CWRU like a big family. The individuals you met in classes in the morning might also be your teammates in running practice in the afternoon. Such extensive connections are not easily found in large universities, and as a Shanghainese guy, I truly enjoy the time at CWRU.

One more thing to (always) advocate for: CWRU is also one of the greatest places to study biomedical engineering and get hands-on healthcare experiences. Throughout the past few years at CWRU, I was able to find my passion in healthcare, and to prepare for my graduate/professional education post college.

### **WHAT ADVICE WOULD YOU GIVE TO STUDENTS CONSIDERING STUDYING ABROAD?**

Be well-prepared for the study abroad trips, but also, be open to the culture and everything new! As a biomedical engineering student, I thought the trip to Uganda was simply a way to help populations in another country through global health designs, but through friendship building and fieldwork interviews, I gained much more in return.



## Center Makes Inroads on AI in Medicine

In February, Anant Madabhushi was one of several presenters at the virtual event Think Showcase: The Next Generation of Healthcare. Sponsored by Case Western Reserve University, the three-day program highlighted new research and discoveries from university faculty members. Madabhushi shared how artificial intelligence can be a game changer for cancer diagnosis and treatment.



### Anant Madabhushi

Donnell Institute Professor of Biomedical Engineering  
Director of the Center for Computational Imaging and Personalized Diagnostics  
Case Western Reserve University

“It was an honor to discuss ground-breaking research and innovations from our center members, showing tangible examples of how AI could move the needle forward in the area of precision oncology,” says Madabhushi, Donnell Institute Professor of Biomedical Engineering.

As director of the [Center for Computational Imaging and Personalized Diagnostics](#) (CCIPD), Madabhushi leads a team of more than 65 researchers who are developing and applying novel AI and machine learning approaches for the diagnosis, prognosis

and prediction of therapy response for a variety of cancer indications, including breast, prostate, lung, head and neck, brain, colorectal, gynecologic and skin, as well as other diseases such as kidney, eye and cardiovascular disease. CCIPD’s clinical network and collaborations span six continents, with a strong foundation in Cleveland’s unique medical ecosystem.

The center’s impact and scope have grown exponentially since the first [article](#) on CCIPD appeared in the Biomedical Engineering Department newsletter in 2017. With 68 patents awarded – nearly one quarter of them in 2020 alone – the center actively seeks partners to translate its inventions from the lab to the clinical setting. Last year, CCIPD signed three [research agreements](#) with leading biopharmaceutical companies: AstraZeneca, Bristol Myers Squibb and Boehringer Ingelheim. “The partnership with these pharmaceutical

companies validates the work we do isn’t simply cutting-edge research in the area of computational imaging, but is truly relevant to pharmaceutical applications,” says Madabhushi.

In addition, the center recently appointed Christina Buzzy as director of research operations. Buzzy earned her doctorate degree in the Department of Pathology at Case Western Reserve University and served as assistant director of research programs at the Case Comprehensive Cancer Center prior to joining CCIPD. In her new role, Buzzy will facilitate the synchronization of research efforts and resources in applying AI techniques to radiology and pathology imaging. “This unique role allows me to apply the translational research skills I have developed over the past 12 years at Case Western Reserve University to pave the path toward the design of AI clinical trials, which is an important next step for the center,” she says. “In order to demonstrate that CCIPD’s computer-aided decision support tools and image-based algorithms provide added value to the physician end users, we’ll need to do that in a prospective clinical setting.”

The expertise of CCIPD and Madabhushi is sought after throughout industry and government agencies. Earlier this year, Madabhushi was appointed to two [scientific panels](#), joining the Food and Drug Administration’s Network of Digital Health Experts and the recently formed Scientific Advisory Panel for AI-based software company Aiforia.

While such appointments are rewarding, Madabhushi’s commitment to his life’s work doesn’t stem from a desire to boost his curriculum vitae. He is passionate about reducing health disparities by using AI to reveal population differences in biomarkers at the cellular level. For instance, there are differences in disease characteristics of Black men and white men with prostate cancer and differences between breast cancer appearance in South Asian women and white women in North America.

“Cleveland has an amazing medical ecosystem, which is prime for the AI in medicine research that our center members are involved in. Unfortunately, the city also has a very poor record in terms of addressing health disparities,” says Madabhushi. “A major focus for CCIPD going forward will be the innovative use of AI to help directly address challenges in health disparities.”



## CCIPD Research Garner Attention

In the past several months, the array of research conducted by the team at the Center for Personalized Imaging and Diagnostics has been presented in academic journals, industry publications and mainstream media. Here are a few highlights:

### Consult QD

[Cleveland Clinic Consult QD](#)

Retinal Leakage Pattern and Vascular Tortuosity May Predict Durability of Anti-VEGF Therapy

CRAIN'S

Cleveland Business

[Crain's Cleveland Business](#)

Artificial intelligence's role in pandemic resource management



[Health Beauty Daily](#)

Blood Vessels Within the Eye Might Diagnose Parkinson's Illness



[Journal for ImmunoTherapy of Cancer](#)

Novel, non-invasive imaging approach to identify patients with advanced non-small cell lung cancer at risk of hyperprogressive disease with immune checkpoint blockade



[The Lancet's EBioMedicine Journal](#)

A novel imaging based Nomogram for predicting post-surgical biochemical recurrence and adverse pathology of prostate cancer from pre-operative bi-parametric MRI

TOI

[The Times of India](#)

How Indian researchers in US are developing AI tools to cut down on cancer surgeries

## SAVE THE DATE

### ARTIFICIAL INTELLIGENCE IN ONCOLOGY SYMPOSIUM PRECISION MEDICINE AND CANCER DISPARITIES

November 8-9, 2021 | Virtual

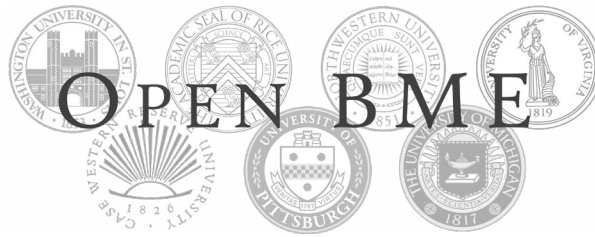
[case.edu/cancer/events/AIO](http://case.edu/cancer/events/AIO)



CASE  
COMPREHENSIVE  
CANCER CENTER



CENTER FOR  
COMPUTATIONAL IMAGING  
AND PERSONALIZED DIAGNOSTICS



# Top BME Departments Present Seminar Series

On Feb. 4, several hundred people tuned into a live video conference seminar led by Bruce Tromberg, director of the National Institute of Biomedical Imaging and Bioengineering (NIBIB). He shared information on NIBIB's RADx<sup>SM</sup> Initiative to increase testing capacity and accessibility for SARS-CoV-2, the virus that causes COVID. Tromberg's presentation was the first of eight in the [Open BME](#) collaborative seminar series being coordinated by seven leading biomedical engineering departments across the country.

The goal of the series is to expose graduate students to cutting-edge ideas in biomedical engineering by attracting a group of high-quality speakers that would be difficult for any single department to host on its own. The participating universities include Case Western Reserve University, Northwestern University, Rice University, the University of Michigan, the University of Pittsburgh, the University of Virginia and Washington University.

The seminars, which are hosted on Zoom and live-streamed on [YouTube](#), cover an array of topics, including biomedical engineering's impact on global health, systems neuroscience, synthetic biology, gene targeting of stem cells to create medicine and more.

## Upcoming Speakers

April 1st, 4-5pm EST



### SYNTHETIC GENOME REGULATION FOR CELL AND TISSUE ENGINEERING

Dr. Tim Downing

**University of California Irvine**

Assistant Professor in Biomedical Engineering

*Hosted by Dr. Sriram Chandrasekaran | University of Michigan*

April 8th, 4-5pm EST



### SYNTHETIC BIOLOGY: LIFE REDESIGNED

Dr. James Collins

**Massachusetts Institute of Technology**

Termeer Professor of Medical Engineering and Science

*Hosted by Dr. Sanjeev Shroff | University of Pittsburgh*

OpenBME.org



# Cleveland NeuroDesign Innovation Fellowship

*Training the next generation of entrepreneurs in neurotechnology  
and care based on the proven BioDesign model*

The Cleveland NeuroDesign Innovation Fellowship is a 10-month educational opportunity at Cleveland Clinic and Case Western Reserve University. The fellowship aims to develop a generation of trained experts to efficiently bring clinically-impactful products successfully to market by equipping fellows with a proven, repeatable process to identify healthcare needs, invent novel health technologies to address them and prepare to implement those products into patient care.

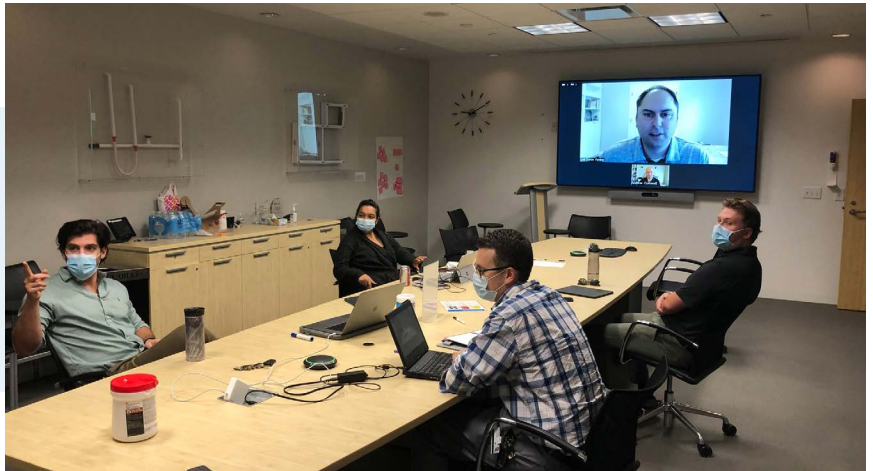
Apply for the 2021-2022

*Cleveland NeuroDesign Innovation Fellowship Cohort*

by April 30, 2021

*2020-21 Cohort meets virtually  
with executive faculty members  
Steve Fening and Andrew Cornwell.*

*From left: Efstathios 'Stathis'  
Kondylis, Swarna Solanki, Nicholas  
Couturier and Patrick Smith.*



Watch the recently held informational webinar at [ClevelandNeurodesign.org](https://ClevelandNeurodesign.org)

# PIONEERING BLEEDING-EDGE RESEARCH

The BEAT Lab leads initiatives to create bioinspired therapeutics and diagnostics for transfusion medicine and critical care.



*ICU*



*MedEvac*



*EMS*



*Battlefield*

Motor vehicle crashes are a leading cause of civilian deaths in the United States, with more than [36,000 fatalities](#) in 2019, according to the National Highway Traffic and Safety Administration. For the U.S. military, 90% of fatalities occur due to [combat-associated severe injuries](#). A contributing factor for such civilian and military fatalities is trauma-induced coagulopathy (TIC), which is a complex imbalance in bleeding, clotting and clot lysis in the early stages of trauma.

"If somebody gets injured in a car accident or in the battlefield, by the time an emergency medic can access, evaluate and stabilize the patient and take him or her to a well-equipped medical facility, perhaps an hour or more has passed," says [Anirban Sen Gupta](#), professor of biomedical engineering at Case Western Reserve University. "Whatever the patient's blood status was

in the early phases after injury may have changed by the time the patient reaches the hospital. So, what the hospital may assess may be less effective in guiding how the patient should be treated."

Diagnosing, monitoring and adequately treating trauma-induced coagulopathy as early as possible after injury is critical in saving lives at the roadside and in the battlefield. "But such approaches are not possible right now for two primary reasons. First, the machines required to evaluate and monitor TIC are printer-sized and not easily portable. In addition, the treatment of TIC often requires transfusion of blood products, which are also not readily available pre-hospital," says Sen Gupta. He and his colleagues hope to address these limitations by creating artificial blood surrogates for emergency transfusion, as well as developing portable,



# "The long-term vision is advancing toward a fully artificial whole blood surrogate."

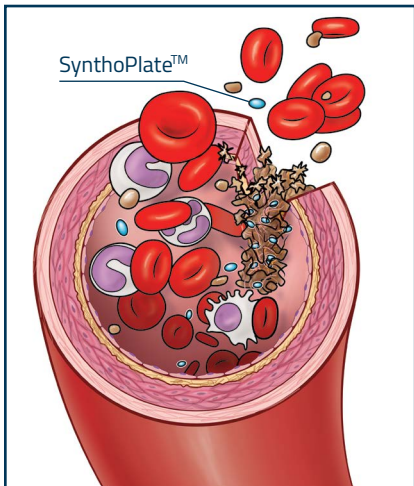
**Anirban Sen Gupta**

Professor of Biomedical Engineering, Case Western Reserve University  
Director, Bio-inspired Engineering for Advanced Therapies (BEAT) Laboratory

hand-held diagnostic systems for point-of-injury and en route comprehensive assessment of TIC to guide early treatment.

## Tackling Clot Stability

Sen Gupta and his Bio-inspired Engineering for Advanced Therapies ([BEAT](#)) Laboratory began their work in 2007 on the therapeutic side, developing platelet-inspired technologies for hemorrhage control, targeted thrombolysis and drug delivery. One of the lab's inventions is [SynthoPlate™](#), an artificial platelet



nanotechnology. These synthetic platelets use a combination of bioactive peptides decorated on nanoparticles to mimic the functional aspects of how natural platelets form clots to stop bleeding. SynthoPlate has subsequently been

licensed to [Haima Therapeutics LLC](#), a biotechnology company that Sen Gupta co-founded in 2016, for further research and development.

"The long-term vision is advancing toward a fully artificial whole blood surrogate (WBS), not just a platelet surrogate," says Sen Gupta, who is chair of Haima's scientific advisory board and serves as a consultant to the company. To this end, Haima is partnering with experts at the University of Pittsburgh, the University of Maryland, the U.S. Army Institute of Surgical Research and the company [Teleflex](#).

In July 2020, Sen Gupta received a \$3.8 million, 3-year grant from the Department of Defense (DoD), which includes collaboration with Haima Therapeutics and the University of Pittsburgh to develop and evaluate

freeze-dried SynthoPlate that can be potentially carried by emergency medics for point-of-injury hemorrhage treatment in battlefield and civilian settings. Haima Therapeutics also received additional awards from the National Science Foundation (NSF) and DoD totaling approximately \$4 million over the next three years to scale up SynthoPlate manufacture and study the combination of SynthoPlate with freeze-dried plasma made by Teleflex, and with Erythromer™, a red blood cell surrogate developed by the University of Maryland and the company [Kalocyte](#).

Meanwhile, the BEAT Lab continues work on other therapeutic technologies, most notably in two areas – advancement of synthetic platelet systems that enhance clot stability and creation of nanoparticle-based platforms that target harmful clots by leveraging the interactions between platelets, blood proteins and white blood cells. "SynthoPlate captures a critical subset of platelet function – initiating blood clotting," says Sen Gupta. "But there are other parts of platelet involvement and functions that provide cues for additional technologies."

One of those functions is to facilitate the formation of the protein fibrin to provide clot stability. Sen Gupta compares the role of platelets to that of sandbags used to prevent flooding. Stacking sandbags is an important barrier against flooding, but the sandbags are often secured with netting so the force of the flood doesn't topple them over. Fibrin is a net-like protein that secures the platelet plug to stabilize the clot. "We've gone back to the drawing board in the lab and created a new synthetic platelet design that can enhance the production and stabilization of fibrin at the site of injury," says Sen Gupta. "This is important for treating patients who suffer from fibrin instability in the clot." This includes acutely injured patients with hyperfibrinolysis, as well as people with certain kinds of liver disease, vascular disease and infections.

In 2019, the BEAT Lab partnered with researchers at the University of Michigan and the University of North

Carolina at Chapel Hill to study the new synthetic platelet design. Led by Sen Gupta, the team received a \$2.1 million, 4-year R01 grant from the National Institutes of Health in January 2021 to advance these studies.

## Studying Platelet-Leukocyte Interactions in Diseases

In addition, Sen Gupta works with multiple collaborators to investigate the interaction of platelets with other blood proteins and leukocytes, then leverage these interactions to create nanomedicine platforms for targeted therapeutics. These include partnerships with the University of Pittsburgh, the Case Western Reserve School of Medicine and the Louis Stokes Cleveland VA Medical Center. Leukocytes like neutrophils act as the body's first line of defense against infection, but their aberrant interactions with platelets can drive many pathologies. Research in this area could benefit patients with a wide array of conditions, ranging from diabetic ulcers and deep vein thrombosis to lupus and atherosclerosis.

"The diseases are all different but they have specific underlying pathology framework of platelet interactions with certain kinds of leukocytes," says Sen Gupta. The overarching aim of his collaborations is to create therapeutic systems that treat an array of medical conditions without affecting the beneficial immune functions of leukocytes.

One of Sen Gupta's collaborators in this area is Evi Stavrou, MD, an associate professor in the Case Western Reserve University School of Medicine and a member of the Molecular Oncology Program at the Case Comprehensive Cancer Center. Stavrou is the primary investigator on an \$1.8 million, 5-year NIH R01 grant with Sen Gupta to research therapeutic systems for chronic wounds. The team has also subsequently received a 4-year, \$700,000 VA Merit Award, as well as \$200,000 in research funding from the Case-Coulter Translational Research Partnership ([CCTRP](#)), the Clinical and Translational Science Collaborative of Cleveland ([CTSC](#)) and the NIH Center for Accelerated Innovations at Cleveland Clinic ([NCAI-CC](#)) to advance neutrophil-modulating nanomedicine systems to treat thrombo-inflammatory pathologies.

"We have worked closely in developing nanoparticle platforms that selectively interact in disease microenvironments with primed, activated neutrophils and neutrophil-platelet aggregates," says Dr. Stavrou. "We have generated exciting results that demonstrate

specificity of targeting, but also therapeutic effect in sterile inflammatory diseases."

These results are important, she adds, because other efforts to develop therapeutic approaches that modulate neutrophils have presented obstacles, such as impairment of the patient's ability to fight infections and limited penetration of drugs in tissues. "Presently, a major unmet clinical need is the development of new treatments with enhanced efficacy and an improved safety profile," says Dr. Stavrou. "Our nanomedicine approach fills this vacuum."

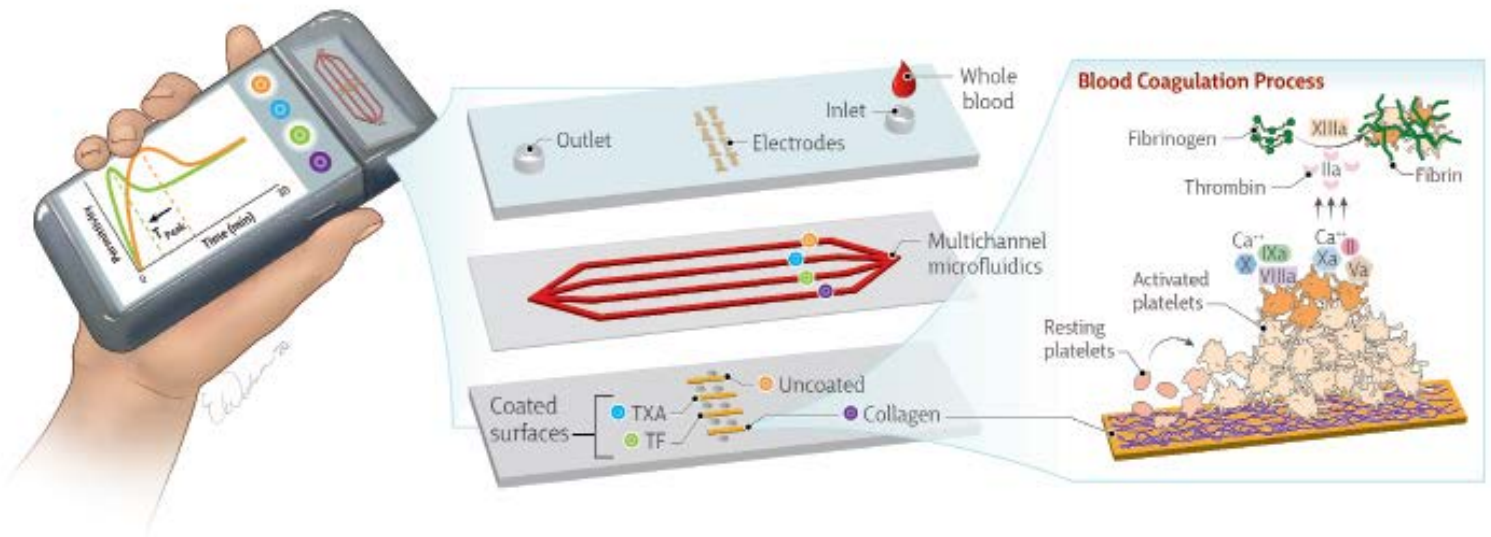
In the same vein, Sen Gupta is also advancing collaborative research as a co-principal investigator with several faculty members at the University of Pittsburgh supported by a 5-year NIH R01 award totaling approximately \$4 million to develop targeted nanomedicine systems to treat thrombo-inflammatory mechanisms in trauma and sickle cell disease.

## Creating Point-of-Injury Diagnostic Systems

Sen Gupta's move into diagnostics for transfusion medicine and critical care also aims to fill a void in healthcare. Smaller hospitals and pre-hospital settings – point-of-injury locations, such as accident scenes and military battlefields – don't have access to sophisticated labs to diagnose bleeding and clotting problems. "There is a big need to create diagnostic systems that go to the patient rather than waiting for the patient to come to the diagnostic system," says Sen Gupta. To that end, he has teamed up with colleagues to design and evaluate TraumaChek, a field-deployable dielectric coagulometer for comprehensive assessment of TIC.

Development of TraumaChek began serendipitously when Sen Gupta had a chance conversation at an on-campus meeting with Pedram Mohseni, chair of the Department of Electrical, Computer and Systems Engineering at Case Western Reserve University, and Michael Suster, senior research associate in the BioMicroSystems Laboratory directed by Mohseni. Mohseni and Suster previously led development of the ClotChip™ system, a hand-held, point-of-care device to evaluate the hemostatic status of patients in minutes. The technology has since been licensed to [XaTek](#), which is pursuing commercialization of the system for anticoagulation therapy and hemophilia care management.

In discussions with Mohseni and Suster about ClotChip, Sen Gupta recognized the potential for refining the instrument's design to make it more sensitive and



TraumaChek, a field-deployable dielectric coagulometer for comprehensive assessment of TIC.

applicable in trauma. Together, the researchers conceptualized the TraumaChek system in 2019 and began working on hardware and electrode components of the device.

“Anirban has a lot of experience on the therapeutic side to stem bleeding and control hemorrhage, and we have experience on the diagnostic side,” says Mohseni. “The marriage of the two approaches can ultimately create a closed loop system in which the information we gain in real time at the point of injury using TraumaChek can act as decision support to inform the nature of the therapy that needs to be administered to the injured patient on site. A large percentage of fatalities from hemorrhage and TIC is preventable if guidance and treatment actions can be taken in the golden hour after injury.”

Experimentation on ClotChip and TraumaChek use in TIC began in 2020, and the team recently received funding totaling \$4.8 million over the next two to four years from the DoD, as well as \$200,000 in funding from CCTRP and NCAI-CC to advance the technologies in collaboration with University Hospitals in Cleveland and the University of Pittsburgh.

Sanjay Ahuja, MD, director of the hemophilia program at University Hospitals Cleveland Medical Center and a professor in the Case School of Medicine, is involved in both the ClotChip and TraumaChek development. His role in the multidisciplinary development of TraumaChek is to validate and optimize the tool by testing it in TIC-relevant deficiencies and disorders. Matthew Neal, MD, professor of surgery and trauma expert at the University

of Pittsburgh, is also collaborating to test TraumaChek with patient samples. “The crux [of the project] is to take a leap from a complex measurement to a simple point-of-care testing measurement,” says Ahuja. “That leap truly requires a meeting of the minds, and that’s what this project brings forward.”

If the team succeeds, the impact will be profound. “Imagine taking all of that expertise [in TIC], putting it into a hand-held device and making it available at the community level in small hospitals and in the battlefield?” says Ahuja. “That is a game-changer in terms of saving lives.”

## Looking Ahead

The potential to save lives through therapeutic and diagnostic systems has garnered the BEAT Lab, its collaborators and Haima Therapeutics nearly \$22 million in grants in the past two years – and counting. Sen Gupta envisions the activities growing into a full-fledged research center.

“Our lab has been very fortunate to work on our own technologies, as well as establish highly productive collaborations within Case Western Reserve University and elsewhere, that have helped move the needle toward creating therapeutics and diagnostics that can hopefully save lives someday soon,” says Sen Gupta. “Looking at the big picture, so many impactful technologies can be developed and clinically translated under the umbrella of trauma, emergency medicine and critical care. This is just the beginning.”

# MAPPING BRAIN CIRCUITS TO BETTER MANAGE PAIN

**“I want to transform the landscape of pain management using innovation and scientific discovery.”**

- Carl Saab, director of the Pain Science Technology And Research (STAR) Lab in the Cleveland Clinic Department of Biomedical Engineering





Carl Saab, director of the Pain Science Technology And Research (STAR) Lab in the Cleveland Clinic Department of Biomedical Engineering (BME, part of the Lerner Research Institute), states his goal very plainly: "I want to transform the landscape of pain management, using innovation and scientific discovery."

For Saab, the transformation begins with the way we approach the concept of pain. "We don't have to be passive in dealing with pain," he says. "We can be active participants. We can shape our pain experience."

### **First in His Field**

Saab received his Bachelor of Science degree in Public Health from the American University of Beirut, Lebanon, where he also got a Master's degree in neuroscience (the study of the nervous system and the structure of the human brain). The field was so new that, at the time (mid-90s), Saab's was the first such degree at the University.

From the beginning of his career, Saab has been interested in the study of pain, not just as a physical

experience, but also as a mental and emotional phenomenon. "I've always sought to understand the basis of emotions," he says. "In that sense, pain is a window to the mind."

It is also a universal, and very expensive, syndrome. In the United States, more than \$600 billion a year is spent on pain management — \$100 billion on chronic low back pain alone. Complicating its diagnosis and treatment: pain is also a subjective experience, so what's painful for one person may only be an inconvenience for another.

"Because pain is so prevalent, it's a bottleneck for the healthcare system," Saab notes. "Many resources are tied up in dealing with it. In addition, misdiagnosing pain can make treatment difficult and has contributed to the overprescription and abuse of opioids."

### **A Brain-Centric Approach to Pain**

Before coming to Cleveland Clinic, Saab was director of the Center for Pain and Neural Circuits at Rhode Island Hospital and Brown University, where his research revolved around traffic patterns between networks in the

## Pain Science Technology And Research (STAR) Lab

Cleveland Clinic Department of Biomedical Engineering



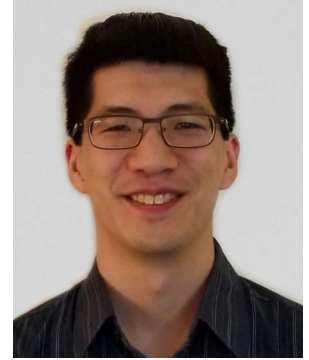
**Carl Saab**  
*Director*



**Mehammad Edhi**  
*Postdoctoral Research Fellow*

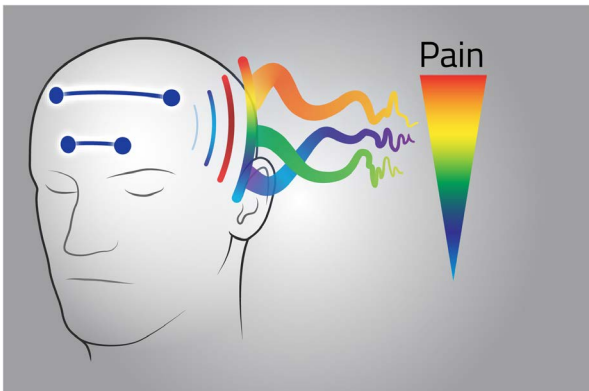


**Ki-See Jeong**  
*Predoctoral Research Fellow*



**Jason Leung**  
*Project Manager*

brain and machine learning. Using artificial intelligence (AI) and electroencephalography (EEG), in which electrodes are attached to the scalp (non-invasively) to measure electrical activity in the brain, his lab developed computer algorithms to help phenotype patients with chronic back pain and migraine — work which continues in his position at Cleveland Clinic.



*In the Pain STAR lab, electrodes are attached to the scalp (non-invasively) to measure electrical activity in the brain.*

The Cleveland Clinic BME Pain STAR lab has at its heart a collaboration between researchers and clinicians that will lead to translational discovery. Saab and his Cleveland Clinic scientific team (Muhammad Edhi, MD, Ki-Soo Jeong and Jason Leung) are mapping the brain networks that control sensory and emotional states in people —

including pain. “The brain is fundamental in mediating the experience of pain,” he notes. “The brain is making up your pain experience — not in the sense of hallucination, but more like actively generating your experience. So we need to understand the mechanisms of the brain as it relates to pain.”

As Saab notes, this is a new approach that will take some time to catch on. One of his goals is to enable clinicians to move beyond the visual analogue scale (the “smiley face” — a frown for pain, a smiley face for no pain) in assessing a patient’s level of pain.

### AI: The Wave of the Future

Saab’s research has posited that, through the use of AI, machines could be “taught” to detect and measure pain. At Cleveland Clinic, Saab and his team continue to use AI and EEG to define with crystal clarity the networks that control pain.

In a recent study, Saab created and tested an AI software platform to objectively classify pain based on EEG scans in three groups of subjects: healthy patients, patients with radiculopathy (pinched nerve) and patients with chronic back pain who were scheduled to have a device implanted to relieve pain. The researchers trained the computer algorithm to compare and correctly distinguish patterns among the EEGs of the different subject groups. The AI algorithm not only distinguished between healthy

patients and those with pain, it was also able to identify those patients who were due to have surgery.

According to Saab, AI is the new frontier for diagnosing pain. "AI gives you an extra edge when you reach the limits of conventional statistics and human interpretation of complex data. You can capture patterns that aren't noticeable to the naked eye. AI has the additional advantage of being able to cross over into clinical use, free of bias."

This kind of algorithm can take the guesswork out of diagnosing pain, Saab adds. "With this platform, we can make pain diagnosis an automated procedure — an objective, rather than subjective, process that also mitigates health disparities." Saab adds that this algorithm could be expanded to assess other conditions, such as depression and anxiety.

## The BRAIN Initiative Grant

The need to get a better handle on pain management, and to reduce the overprescription of opioids, is so critical that the National Institutes of Health (NIH) has established two programs toward that end: the Helping to End Addiction Long-term<sup>SM</sup> (HEAL) Initiative, a multi-agency endeavor "to speed scientific solutions to stem the national opioid public health crisis," which is funding projects to better understand and treat pain; and the Brain Research through Advancing Innovative Neurotechnologies® (BRAIN) Initiative, which calls for "innovative approaches and new paradigms for identifying and understanding brain disorders."

The BRAIN Initiative also solicited applications related to nociception (the ability to feel pain) and pain in the context of circuit mechanics of the central nervous system. Saab's lab was awarded a grant from the BRAIN Initiative to elucidate the mechanisms of pain in the spinal cord and brain. The goal is to approach the mechanisms of pain in the nervous system as a

"continuum" between the spine and the brain, in order to have a comprehensive understanding of how pain signals are relayed through the spine and processed in the brain.

"Receiving the NIH BRAIN initiative grant was an honor," Saab says. "These new models and pain circuits in the brain will guide us toward pain diagnostics and more effective non-opioid therapies. The aims in this grant can be summarized as elucidating the mechanisms of pain with unprecedented cellular precision, ultra-fast temporal resolution and high-density neural recordings, simultaneously."

## Leading the Way from Research to Treatment

"Dr. Saab's work in pain research, especially in the growing field of defining brain networks, is groundbreaking," notes D. Geoffrey Vince, chair of the Cleveland Clinic Department of Biomedical Engineering. "His grant from the NIH Brain Initiative is confirmation of the value of his team's efforts. Their work in mapping neural circuits, and sharing that research with our clinicians, will go a long way not only toward helping our patients, but also to making Cleveland Clinic a leader in pain management."

Saab is confident that Cleveland Clinic can be a pioneer for transferring this scientific knowledge to a clinical setting. "We've had a very positive response to our work from Cleveland Clinic physicians," he says. "When they're treating a patient who has chronic pain, they want to use innovative tools backed up by rigorous science. We are adding tools to the toolbox. This can have several benefits: reducing opioid dependence, improving patients' quality of life and, ultimately, lowering healthcare costs. In the process, we will better understand how the brain works and how the physical in our environment is internally represented in our minds."

# A TRIBUTE TO GERALD SAIDEL



A founding father of the Department of Biomedical Engineering retires after 54 years of service.

## Gerald Saidel

Professor, Biomedical Engineering  
Case Western Reserve University

When Gerald Saidel arrived at the Case Institute of Technology in the spring of 1967 as an assistant professor in engineering, there were no departments dedicated to specific fields. "At the time, everything was wide open," recalls Saidel. "The field of biomedical engineering didn't really exist, but there were two small research groups involved with bioengineering systems and medical engineering."

Neither of the groups matched Saidel's area of interest, but that didn't deter the young researcher from pursuing partnerships to apply mathematical modeling of chemical and particle population processes with biological applications. "Since my formal education was in chemical engineering with no biological background, my plan was to learn primarily through research collaborations," says Saidel. "Within a year, I started research projects in collaboration with faculty in the School of Medicine involving yeast population dynamics, pulmonary function analysis and urea concentration development in the kidney."

In 1968, Case Western Reserve University was formed and Saidel was named one of the original faculty members of the Department of Biomedical Engineering. Through the years, he became a tenured professor and served as chair of the department from 1987 to 1998. Saidel will retire at the end of June 2021 having left his mark on his students, the university and the field of biomedical engineering.

## Advancing Research in Mathematical Modeling and Analysis

While Saidel had expertise in mathematical modeling and quantitative analysis, he credits his collaborators with helping advance his research. "Through the research collaborations, I learned the biological and physiological aspects and was able to do something with them in terms of diagnostics and therapeutics," he says.

During the first decade of his career, Saidel teamed with Edward Chester, MD, at the Cleveland VA Medical Center to develop a better way of performing diagnostic evaluations of the respiratory system. He also partnered with students to analyze kidney function. "The anatomical aspects of the kidney are very complicated, and there are many countercurrent exchange processes," says Saidel. "The idea was to model the development so we could then predict what would happen under certain conditions."

Saidel's areas of research changed over the years as various faculty and students sought out his knowledge and collaboration. His research interests included, but were not limited to, tumor growth and metastatic processes, iron kinetics and metabolism, macromolecular transport in the arterial wall, cellular metabolic dynamics in exercise and ischemia, drug delivery in cancerous tissues, tissue engineering for bone defects, quantifying key cell receptors with positron emission tomography (PET), chronic heating of tissue, and thermal ablation of tissue guided by magnetic resonance imaging (MRI).

"I was fortunate to attract many outstanding graduate students who were interested in mathematical modeling for quantitative analysis of experimental

My most important product during my modest career has been the students that I've taught and worked with who have been particularly successful.

— Gerald Saidel

data," says Saidel. "Gradually, I developed courses using more sophisticated mathematical models and nonlinear parameter estimation."

## Putting Students First

The courses Saidel taught were invaluable to students like Kenneth Lutchen (PhD '83), now Dean of the College of Engineering at Boston University. "Jerry introduced me to the power and danger of fitting models to real data and the deep need to drill down into the results via sensitivity analysis and the statistical soundness of estimated parameters," he says.

Saidel served as Lutchen's PhD advisor, and together they developed and validated some of the first models that combined lung mechanical function with ventilation distribution of the lung. Lutchen acknowledges that Saidel was demanding and sometimes struck students as gruff. "But I learned early on that under all that is a deeply committed, caring, wonderful person who wanted his students to succeed more than anything," says Lutchen.

Throughout his career, Saidel was committed to making students a top priority. As chair of the biomedical engineering department, he organized undergraduate and graduate committees so students would have a voice in the department. He also helped establish undergraduate sub-fields. "We wanted students to have different opportunities – to make sure they had options for minors in traditional engineering fields," he says.

Saidel was equally committed to advancing the field of biomedical engineering outside of campus. "As chair of the department, I worked with other faculty and BME departments across the country on educational aspects of the field, trying to find common ground," he says. Saidel also served as president of the Biomedical Engineering Society from 1986 to 1987 and was chair of the Council of Chairs of Bioengineering and Biomedical Engineering from 1992 to 1993.

While he had a vision for biomedical engineering, Saidel remained open minded to new ideas. When Ravi Bellamkonda was an assistant professor at Case Western Reserve University in the late 1990s, he recalls Saidel sliding an undergraduate paper under his door with the note, "How is this engineering?" The paper was on genetic engineering, and it was a time when the field was actively considering what the role of biology and bioengineering methods meant to BME, says Bellamkonda, currently Vinik Dean of Engineering at Duke University.

"To his credit, Jerry went on to not only support such research, but hire more faculty with non-traditional engineering backgrounds," says Bellamkonda, who will join Emory University as provost and executive vice president of academic affairs in July. "This ability to ask questions, truly listen, and

adapt and do what's best for Case and the department is what exemplifies Jerry Saidel and his service to Case."

### Leaving Behind a Strong Legacy

Saidel has had many high notes during his career. His work on cellular metabolic dynamics in exercise led to creation of the Center for Modeling Integrated Metabolic Systems (MIMS), which received initial funding from an \$11.8 million grant from the National Institutes of Health. Saidel served as director of MIMS from 2002 to 2015.

Saidel co-authored the textbook "Biomedical Mass Transport and Chemical Reaction," authored or co-authored more than 150 peer-reviewed journal articles

and was an associate editor of the Annals of Biomedical Engineering from 1998 to 2013. He has received numerous awards and honors, including being named a Founding Fellow in the American Institute of Medical and Biomedical Engineers in 1992 and an Inaugural Class Fellow of the Biomedical Engineering Society in 2005.

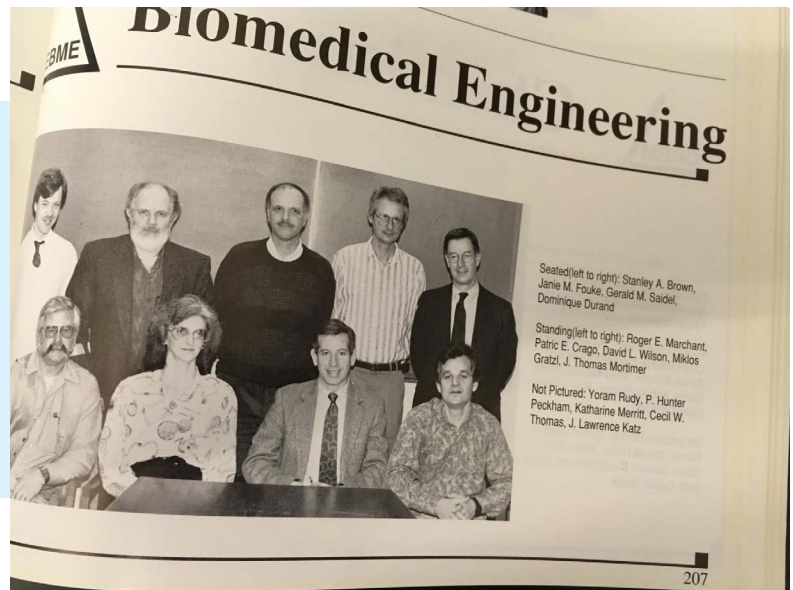
Though proud of the individual accolades, Saidel points to his students as his crowning achievement. "My most important product during my modest career has been the students that I've taught and worked with who have been particularly successful," he says.

Echoing the sentiments of students spanning seven decades, Lutchen says, "Thank you, Jerry, for more than you can ever imagine."

Case Western Reserve University  
Department of Biomedical Engineering  
faculty circa 1990.

Seated (left to right): Stanley A. Brown, Janie M. Fouke, Gerald M. Saidel, Dominique Durand

Standing (left to right): Roger E. Marchant, Patrick E. Crago, David L. Wilson, Miklos Gratzl, J. Thomas Mortimer



From left: Shown here in 2009, Marco Cabrera (deceased) and Nicola Lai were long-time research collaborators in analysis of metabolism and dear friends of Gerald Saidel.



# SPHERES OF INFLUENCE

During his 54 years as a faculty member at Case Western Reserve University, Gerald Saidel influenced two generations of students, post-doctoral fellows and professors who went on to illustrious careers in biomedical engineering. Four of them share the impact Saidel had on their lives:

"Jerry and the rest of the faculty took a chance on a young, not very experienced assistant professor [in 1995]. Jerry was instrumental in putting me in situations – with my teaching load, my advising load, my research space and access to other resources – for me to be successful."

*Ravi V. Bellamkonda, Vinik Dean of Engineering, Duke University*

"I arrived for my graduate studies at CWRU in 1970 with the dream of leveraging a new invention – the mainframe computer – to model the transport function of the kidney. Luckily, Jerry Saidel had just joined the faculty, and I realized he was just the guy to guide my work. I am now a principal investigator at NIH in the National Heart, Lung and Blood Institute's Systems Biology Center, working on projects that derived from my dissertation work. The field of systems biology is now in vogue. However, Jerry and I were doing systems biology 30 years before it became a popular endeavor."

*Mark A. Knepper (PhD '75, MD '76), Principal Investigator, Epithelial Systems Biology Laboratory, Systems Biology Center, National Heart, Lung and Blood Institute*

"Jerry Saidel was a fantastic, caring mentor who taught me that a successful scientist must forecast the next big questions and develop the technology to answer those questions instead of just joining in on the topics currently in vogue. I use the engineering and mathematics principles he taught me throughout my current work. The publications we worked on together more than 30 years ago are still highly cited."

*Lance A. Liotta (PhD '74, MD '76), University Professor and Co-Director and Medical Director of the Center for Applied Proteomics and Molecular Medicine, George Mason University*

"Jerry's influence on me was immeasurable. First, of course, was his extraordinary knowledge in mathematical modeling of lumped and distributed systems, of transport phenomena and of how to think of modeling in the context of real data, not just simulated data. ... On a different axis, Jerry, more than anyone else by far, taught me technical and scientific writing and communication. No matter how busy, Jerry would rigorously pour his red pencil into making sure the next version was better."

*Kenneth R. Lutchen (PhD '83), Dean of the College of Engineering, Boston University*

# NEW LEADERS TO SHAPE CWRU AND BME



Eric W. Kaler | Appointed President, Case Western Reserve University

On July 1, 2021, a new leader will take the helm as president of Case Western Reserve University. The university's board of trustees selected Eric W. Kaler, former University of Minnesota president and an accomplished chemical engineer known for his affinity for metrics.

The presidential search committee included a team of 11 trustees and two faculty members, including Anant Madabhushi, Donnell Institute Professor of Biomedical Engineering. "The search committee was struck by Eric's phenomenal background as an engineer, researcher and leader with a stellar track record," says Madabhushi. "In addition, Eric demonstrated a clear vision to enhance Case Western Reserve University's rankings, especially by focusing and prioritizing biomedical research, which he understands is the jewel in CWRU's crown."

In an [article](#) announcing the appointment in The Daily, an internal university communication outlet, Kaler noted he is a "tremendous fit" for the role of president because of his work in elevating research, collaborating with hospital systems and encouraging entrepreneurship. During his time as president of the University of Minnesota, research expenditures increased 35% and business and industry research funding climbed from \$55.2 million to \$81.6 million.

In addition to Madabhushi, two other biomedical engineering faculty members played key roles in the selection of the new president. A. Bolu Ajiboye, Elmer Lincoln Lindseth Associate Professor of Biomedical Engineering, and Agata Exner, professor in the School of Medicine, served on the presidential search advisory committee, which gathered perspectives from all





**Serpil Erzurum, MD**

Chief Research and Academic Officer,  
Cleveland Clinic Lerner Research Institute



**Stan Gerson**

Interim Dean, Case Western Reserve  
University School of Medicine

university stakeholders to assist the search committee. (Madabhushi co-chaired the advisory committee.)

“It is encouraging that the university continues to look to biomedical engineering to help shape the future leadership and priorities of the university,” says Ajiboye. “I look forward to learning more about Dr. Kaler’s vision – in regards to the role of the Biomedical Engineering Department in particular and biomedical research in general – in moving CWRU into continued national and international prominence.”

Other leadership changes impacting the Biomedical Alliance include the extension of [Stan Gerson](#) as interim dean of the School of Medicine and the appointment of Serpil Erzurum, MD, chair of the Cleveland Clinic Lerner Research Institute (LRI), to the newly created position of chief research and academic officer.

A Distinguished University Professor and longtime director of the Case Comprehensive Cancer Center, Gerson accepted the interim role after now President Emerita Barbara R. Snyder announced she would step down to lead the Association of American Universities.

Gerson’s appointment was extended until June 30, 2022, to allow Kaler the opportunity to select the School of Medicine’s next permanent dean.

Dr. Erzurum’s role as chief research and academic officer, which is an expansion of her role as chair of the LRI, will focus on enterprise-wide clinical, basic and translational research, and will integrate research efforts across Cleveland Clinic. Dr. Erzurum, who also serves as a staff physician in the Respiratory Institute, joined Cleveland Clinic in 1993.

# FACULTY HIGHLIGHTS



## Jay Alberts

Jay Alberts and Stephen Rao with Cleveland Clinic's Luo Ruvo Center for Brain Health received a five-year, \$6.7 million grant from the National Institute of Aging to evaluate the effect of high-intensity exercise – using a home-based, internet-connected indoor cycle – on preventing Alzheimer's disease in people at high genetic risk of the disease. Alberts is also working with the National Football League Players Association to use artificial intelligence to help identify, treat and prevent brain disorders. In addition, he received the Outstanding Innovation in HIT Award, one of Cleveland Clinic Innovations' Celebrating Innovation Program awards.



## Scott Bruder and Anant Madabhushi

Scott Bruder and Anant Madabhushi, a pair of biomedical engineering innovators and leaders in their respective fields over the last two decades, were honored as fellows of the National Academy of Inventors (NAI). Bruder and Madabhushi join a list of eight others who were named fellows or senior members of the NAI while at Case Western Reserve University. Madabhushi also was named the Donnell Institute Professor of Biomedical Engineering at Case Western Reserve University. Bruder serves as chair of the advisory board for the Department of Biomedical Engineering at Case.



## Jeffrey Capadona

Jeffrey Capadona was named the Leonard Case Jr. Professor of Engineering in November 2020 and appointed a Dean's Research Fellow at Case Western Reserve University. In addition, Capadona's National Institutes of Health T32 grant was renewed in September and he was awarded a T32 training grant by the National Institute of Biomedical Imaging and Bioengineering (NIBIB), which will allow for continued funding of a previously awarded NIBIB T23 project titled "Integrated Neural Engineering and Rehabilitation Training."



## Muhammad M. Edhi

Muhammad M. Edhi, postdoctoral research fellow, Lerner Research Institute Department of Biomedical Engineering, won a travel

award to attend the Neurocritical Care Society Annual Meeting in Scottsdale, Ariz. The meeting was held virtually because of the pandemic.



## Ahmet Erdemir

Ahmet Erdemir, associate staff, Lerner Research Institute Department of Biomedical Engineering, was first author of an article in the *Journal of Translation Medicine* on "10 rules for credible practice of modeling and simulation in healthcare."



## Kiyotaka Fukamachi and Jamshid Karimov

Kiyotaka Fukamachi, staff, and Jamshid Karimov, project staff, Lerner Research Institute Department of Biomedical Engineering, are co-editors along with Randall Starling, MD, of the book "Mechanical Support for Heart Failure: Current Solutions and New Technologies" published by Springer. They also contributed four chapters in the book: Options for modeling and simulation used in mechanical circulatory support development, the development of advanced ventricular assist device as a next generation ventricular assist device, Cleveland Clinic total artificial heart and progress on total artificial heart for pediatric patients.



## Chaitali Ghosh

Chaitali Ghosh, staff scientist, Lerner Research Institute Department of Biomedical Engineering, was invited by the editor-in-chief and the editorial board of the journal *Cells* to join their board as a topic editor. In this role, she will lead special issues related to her research field every one or two years. Ghosh's laboratory investigates the role of the blood-brain barrier in health and disease, with a focus on cerebrovascular research to better understand brain physiology and function in neurological disorders.



## Efstathios Karathanasis

Efstathios Karathanasis, associate professor in the Department of Biomedical Engineering, received a \$3 million grant from the National Cancer Institute to fight deadly metastatic breast cancer by combining nanotechnology with immunotherapy. The team, which also includes researchers from Cleveland Clinic and Duke University, says the combination shows

therapeutic promise for the most difficult-to-treat metastatic cancers. "Our work has been to design a nanoparticle that triggers an activation of antigen-presenting cells in the tumor," says Karathanasis. "Within a few weeks, the patient can have adapted T-cells that recognize and fight cancer."



### Jae Jung

Cleveland Clinic has created the Global Center for Pathogen Research & Human Health as part of its continuing commitment to infectious disease research and translational programs. The new center will help protect against future public health threats by increasing research efforts into viral pathogens and the human immune response. The center is directed by Jae Jung, PhD, an internationally renowned expert in virology and virus-induced cancers, and consists of six programs: Virus & Immune Discovery; Personalized Medicine; People & Population Studies; Diagnostic Tests; Technology Development, Treatments & Vaccines; and Clinical Application & Healthcare Deliverables.



### Vinod Labhasetwar

Vinod Labhasetwar, staff, Lerner Research Institute Department of Biomedical Engineering, received the Outstanding Innovation I Medical Device Award, one of Cleveland Clinic Innovations' Celebrating Innovation Program awards. In addition, his work with Advanced NanoTherapies Inc. in creating biodegradable functionalized nanoparticles has enabled the company to raise \$5.3 million in seed-round financing.



### Debra McGivney

Debra McGivney, assistant professor in the Department of Biomedical Engineering, won the 2021 Srinivasa P. Gutti Memorial Teaching Award. The award is presented annually by the engineering honor society Tau Beta Pi to honor members of the engineering faculty that show an exemplary commitment to undergraduate teaching. She teaches junior-level core BME classes, including Biomedical Signals and Systems and Models of Biomedical Systems.



### Ron Midura

Ron Midura, emeritus staff, Lerner Research Institute Department of Biomedical Engineering, won the 2020 Lerner Research Institute Award for Excellence in Medical Education.



### Ela Plow

The paper "Stratifying chronic stroke patients based on the influence of contralesional motor cortices: An inter-hemispheric inhibition study" by Ela Plow, assistant staff, Lerner Research Institute Department of Biomedical Engineering, was an Editor's Choice for October in the journal *Clinical Neurophysiology*.



### Carl Saab

Carl Saab, staff, Lerner Research Institute Department of Biomedical Engineering, is co-author of a chapter on AI in spinal cord injury in the new book *Spinal Cord Injury Pain* published by Elsevier.



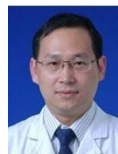
### Anirban Sen Gupta

Anirban Sen Gupta, a professor of biomedical engineering, was elected to the College of Fellows by the American Institute for Medical and Biological Engineering (AIMBE). Sen Gupta was nominated, reviewed and elected by peers and members of the College of Fellows for outstanding contributions in biomaterials science research and education with a focus on hemostasis, hemocompatibility, wound healing and point-of-care devices.



### Dustin Tyler

Dustin Tyler, the Kent H. Smith Professor II of Biomedical Engineering at Case Western Reserve University, was published in the Nov. 23, 2020, edition of *Nature Biomedical Engineering*. The article, "Restoration of sensory information via bionic hands," describes non-invasive and invasive technologies for conveying artificial sensory feedback through bionic hands and evaluates long-term prospects for the technologies. The article is ranked in the 97<sup>th</sup> percentile of the nearly 400,000 articles accessed in *Nature*.



### Yan Wang

Yan Wang, research associate, Lerner Research Institute Department of Biomedical Engineering, received a three-year, \$150,000 grant from the Scleroderma Foundation for the project "The role of hyaluronan and O-GlcNAcylation in fibroblast turnover and function in scleroderma."

# CHECKING IN WITH ALUMNI

## GE Leader Recalls Grad School as a Magical Time



### Paritosh Dhawale

Paritosh Dhawale (MS '91, PhD '94) was appointed senior vice president and general manager of GE's Edison Health Services Platform, where he leads a team of more than 500 engineers and

product managers who build, host and manage AI-enabled digital applications for GE and third-party ecosystems. "We are on a journey to digitally transform how we develop and sell medical software," he says.

Dhawale began his career with GE in 1997 at the company's research center in Schenectady, N.Y. Aside from a two-year stint with Johnson & Johnson in strategic marketing and health economics, he has remained at GE since then. Through the years, Dhawale has held several roles, including general manager for the company's imaging contrast media business and general manager for GE's Lifesciences business in southeast Asia. "I've done the gamut, from sales to R&D," he says.

Dhawale credits much of his success to his time as a graduate student in Case Western Reserve University's Department of Biomedical Engineering. "Case had a very lasting effect on me," says Dhawale, who headed to Cleveland after completing undergraduate studies in engineering physics from the Indian Institute of Technology, Bombay. He completed his master's thesis on respiratory physiology-related signal processing with advisor Eugene Bruce, former associate professor of biomedical engineering.

"Dr. Bruce was so patient with me," recalls Dhawale. "You are not a polished researcher when you finish your undergrad studies. I knew nothing about research!" He learned quickly working in the cardiac catheterization lab at University Hospitals during his PhD studies.

David Wilson, who is the Robert Herbold Professor of Biomedical Engineering & Radiology at Case Western Reserve University, served as Dhawale's PhD thesis advisor. "Paritosh was an exceptional graduate student," says Wilson. "Not only did he do good technical work, but he was very diplomatic and worked closely with others, including cardiologists at University Hospitals."

Dhawale says his time spent in the clinical setting was invaluable. "You learn so much about real life – patient care, the clinical pathway, the real-time decisions that physicians make," he says. "It taught me a lot that I still share to this day about how little technology matters in the large scheme of things. It's humbling. As an engineer, you think the equipment you design is central to the work. But it's only one piece of the puzzle."

Dhawale says that making the human connection between engineering activities and end results was reinforced by faculty at Case for whom he has great respect, including Wilson, Patrick Crago (emeritus) and Dominique Durand (Elmer Lincoln Professor in Biomedical Engineering). "I learned as much about EQ as IQ at Case," he says. "Graduate school is a special time in your life. Couple that with a special environment like Case, and it's magic."

After earning his PhD, Dhawale spent one year in a post-doctoral fellowship at Washington University before realizing he wanted a career in business, not academia. He returned to Cleveland and co-founded a start-up funded by the Small Business Innovation Research (SBIR) program with a former cardiology advisor from University Hospitals to develop and commercialize software for intravascular ultrasound image analysis. Three years later, they licensed the technology and Dhawale began his illustrious career at GE.

"I remember Paritosh telling me one time that his family were all business people, and he would like to follow in their footsteps," says Wilson. "He absolutely has done that with a meteoric career combining biomedical engineering with business acumen."

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