

A MIGHTY FORCE

The Biomedical Engineering Alliance between Case Western Reserve University and Cleveland Clinic will bolster relationships already thriving at the two powerhouse institutions.

FULL STORY, p. 8

A LOOK INSIDE

Biomedical Engineering at Case Western Reserve University

50th Anniversary Edition

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FROM THE CHAIRS

If you have a keen eye, you'll notice this issue's message comes to you from two of us – chairs of biomedical engineering at both Case Western Reserve University and Cleveland Clinic's Lerner Research Institute. The co-written message is in recognition and celebration of the Biomedical Engineering Alliance between the two institutions forged last year.

We've worked very hard over the last several years along with our faculty, staff, administrators and key leaders to make the alliance a reality. When two distinguished institutions join forces, the sum is always greater than its individual parts. That certainly is true with the Biomedical Engineering Alliance. Together, we had more than \$40 million in research awards in fiscal 2018 and hold more than 700 patents.

We know first-hand the advantages of collaboration. Dr. Vince worked with two Case Western Reserve students, Jon Klingensmith and Anuja Nair, to develop a technology called Virtual Histology (VH-IVUS) that provides a colorized tissue map of plaque composition for complete lesion assessment. It was purchased by Volcano Corp. in 2002, and more than 7,000 units are now available worldwide. Other examples of joint efforts can be found in the article "A Mighty Force" on page 8.

While there are many benefits to the alliance, here are four key areas that will be bolstered through collaboration:

Basic and Clinical Research

We have a combined 56 faculty members conducting biomedical research in 11 areas at Case Western Reserve and Cleveland Clinic. While some of the areas overlap, there are others where expertise resides at one particular institution. That provides opportunities to team up on mutually beneficial programs, as well as grow into new areas.

Technology Translation

The alliance features two centers for technology translation and commercialization: the NIH Center for Accelerated Innovations at Cleveland Clinic and the Case-Coulter Translational Research Partnership. Both are committed to moving discoveries from the lab to the clinical setting to help tackle some of our biggest healthcare issues.

Core Facilities

Together, the institutions have dozens of facilities that support research by providing state-of-the-art equipment, technology and services that would be too costly or simply impractical for individual labs to provide. These cover a wide range of areas, from additive manufacturing and cellular therapy to digital imaging and molecular screening.

Student Opportunities

Students of all levels, from undergraduates to postdoctoral scholars, will have expanded opportunities within the alliance for education, research and internships. Most notably, graduate students will be able to complete their coursework at Case Western Reserve and perform research studies at Cleveland Clinic, as well as on the university campus.

We are excited by the future of the Biomedical Engineering Alliance and look forward to sharing success stories in upcoming issues of the newsletter.



Robert F. Kirsch

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



Geoffrey Vince

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

FACULTY HIGHLIGHTS



Dominique Durand

A team of researchers led by Dominique Durand, the Elmer Lincoln Lindseth Professor in Biomedical Engineering and director of the Neural Engineering Center

at the Case School of Engineering, believe they have identified a previously unidentified form of neural communication, a discovery that could help scientists better understand neural activity surrounding specific brain processes and brain disorders.

The team's paper, "Slow periodic activity in the longitudinal hippocampal slice can self-propagate non-synaptically by a mechanism consistent with ephaptic coupling," was published in the October 2018 issue of *The Journal of Physiology*.



Chaitali Ghosh

Chaitali Ghosh, staff scientist in the Lerner Research Institute Department of Biomedical Engineering, recently published findings in the journal *Epilepsia*

demonstrating that glucocorticoid receptors are involved with drug penetration across the blood-brain barrier (BBB) in pharmacoresistant epilepsy. Using human endothelial cells from patients with epilepsy, the team created a physiologically relevant, flow-based in vitro BBB model for the study. They found that downregulating GR expression increased BBB permeability to antiepileptic drugs and improved bioavailability of the drug oxcarbazepine. These findings suggest that GR are potential therapeutic targets in severe, drug-resistant epilepsy.



Xiaojuan Li

Xiaojuan Li, staff member in the Lerner Research Institute Department of Biomedical Engineering and founding director of the Program of Musculoskeletal Imaging, has been

appointed the inaugural Bonutti Family Endowed Chair for Musculoskeletal Research at Cleveland Clinic. This gift was generously established to support advanced imaging programs within Cleveland Clinic's Musculoskeletal Research Center. As a center member, Li's research focuses on the use of biomedical imaging to diagnose disease and study treatment approaches, with particular interest in osteoarthritis, rheumatoid arthritis and osteoporosis. She also holds joint appointments in Cleveland Clinic's Imaging and Orthopaedics & Rheumatology Institutes. Li was recruited to Cleveland Clinic in 2017 from the University of California, San Francisco.



Hunter Peckham and Megan Moynahan

The Institute for Functional Restoration (IFR) received the 2018 Gold Electrode Award from *Neurotech Reports* for being the most valuable non-profit. The award was presented at the 2018 Neurotech Leaders Forum in San Francisco.

The mission of the IFR is to restore function to people with paralysis by creating a sustainable commercial enterprise for neuromodulation systems. Hunter Peckham is founder of IFR, and Megan Moynahan serves as executive director.



Andrew Rollins

A team of U.S.-based researchers has demonstrated how cutting-edge catheter technology can help improve the accuracy of radiofrequency ablation (RFA), often used to treat cardiac arrhythmias. "We showed that the prototype can ablate normally and can image the tissue in order to confirm good catheter contact with the heart wall, and monitor that the tissue is ablated as the RF energy is delivered," says co-author Andrew Rollins, a professor of biomedical engineering. Rollins prepared the paper in partnership with fellow academics at the university, as well as clinicians based at Rainbow Babies and Children's Hospital and University Hospitals Cleveland Medical Center.



Anirban Sen Gupta

Anirban Sen Gupta, a professor of biomedical engineering, was awarded two new NIH R01 grants, one as primary investigator in a multi-PI team and one as co-investigator. In collaboration between University of Pittsburgh (Prithu Sundd and Matthew Neal) and Case Western Reserve, the multi-PI team with Sen Gupta was awarded the R01 award for the research: Platelet Exosome-dependent Acute Chest Syndrome in Sickle Cell Disease. In collaboration with Evi Stavrou (PI) and Marvin Nieman (Co-I) at Case Western Reserve School of Medicine, Sen Gupta is a co-investigator on the R01 award for the research: Targeted Abrogation of the FXII-uPAR-pAkt2 axis in Neutrophils for the Treatment of Chronic Wounds.



Pallavi Tiwari

Glioblastoma multiforme (GBM) is the most common malignant tumor diagnosed in adults. With her FY17 Career Development Award, Pallavi Tiwari, an assistant professor of biomedical engineering, will conduct a retrospective study to "train" and develop artificial intelligence (AI) tools to identify predictive biomarkers for response to chemoradiation in brain tumors. If the biomarkers are validated, then the AI tools may be used to segregate chemoradiation therapy responders from those who will not respond. This would allow those identified as non-responders to pursue other avenues of treatment. Additionally, Tiwari hopes to identify biomarkers that would allow clinicians to effectively differentiate benign radiation necrosis on an MRI from cancer recurrence, thus preventing unnecessary biopsies in patients with the benign condition.



Ronald Triolo

Ronald Triolo, the executive director of the APT Center at the Cleveland VA Medical Center and professor of biomedical engineering, is the recipient of the 2019 Paul B. Magnuson Award, the highest honor for VA rehabilitation investigators.

Triolo also presented at Hanger Inc.'s 2019 Education Fair on neurally-integrated assistive technology, specifically prostheses that restore motor and sensory function after paralysis or limb loss. The fair featured a full day of keynote sessions focusing on patient care and clinical outcomes, delivered by physicians, scientists and therapists from major medical institutions across the U.S.



Satish Viswanath

Satish Viswanath, an assistant professor of biomedical engineering, is helping clinicians predict treatment for Crohn's patients.

University Hospitals Digestive Health Institute and Case Western Reserve University's Center for Computational Imaging and Personalized Diagnostics are developing a radiographic enterographic treatment score that can help clinicians distinguish between mild and severe Crohn's.

If clinicians can determine whether medications are unlikely to work for a particular patient with Crohn's disease, they can recommend going directly to surgery instead and avoiding the major side effects associated with immunosuppressive medications.



Karl West

Karl West, director of Medical Device Solutions in the Lerner Research Institute and staff member in the Department of Biomedical Engineering, developed an application of Microsoft HoloLens technology to enhance visualization of minimally invasive thermal therapy (microwave ablation) for liver tumors. The technology is being used in a clinical trial comparing 2D standard-of-care images with 3D holographic images, layering virtual projections on top of the surgeon's real-world view. The surgeon uses head-mounted glasses to see the patient's internal anatomical structures and verify tumor location with the technology's mini-global positioning (GPS)-like system.



A MIGHTY FORCE

The Biomedical Engineering Alliance between Case Western Reserve University and Cleveland Clinic will bolster relationships already thriving at the two powerhouse institutions.





Case Western Reserve University and Cleveland Clinic Lerner Research Institute launched an alliance last year to advance research and education in biomedical engineering, but partnerships among researchers at both institutions have been ongoing for years. While it didn't require a formal agreement among the organizations for great minds to work together, the newly-forged alliance will increase opportunities for collaboration.

"The alliance builds an invisible bridge between the two places," says James Basilion, a professor of biomedical engineering in Case Western Reserve University's School of Medicine. "It makes it easier to collaborate, and it makes it feel like you're working for one entity rather than at different places." For several years, he co-chaired a biannual meeting on nanomedicine that brought together experts from Case Western Reserve, Cleveland Clinic and around the world. The other co-chairs were Alexis Abramson, an associate professor in the Department of Mechanical & Aerospace Engineering at Case Western Reserve, and Vinod Labhsetwar, a staff member in the Biomedical Engineering Department at Lerner Research Institute.

"It was a prime example of the cutting-edge nanomedicine efforts at both institutions," says Basilion. "When we combined forces, we could pull something together that was greater than its parts." Nanomedicine is just one field that will benefit from the alliance between nationally renowned biomedical

engineering departments at Case Western Reserve University and Lerner Research Institute. Areas of expertise among scientists, physicians and engineers within the alliance range from neural engineering and imaging to biomaterials and regenerative medicine. New projects in those areas, as well as ongoing research, will flourish under the alliance.

A Boon to Ongoing Research Projects

David Wilson is an expert in minimally-invasive, interventional medical imaging who is vocal about the alliance. "We are creating one of the largest biomedical engineering concerns in the world," he boasts.

Wilson knows first-hand the benefits of combining forces with researchers within easy walking distance from the Biomedical Imaging Laboratory he leads at Case Western Reserve University. For nearly a year, he has collaborated with Aaron Fleischman, director of the BioMEMS and Nanotech Laboratory at Lerner Research Institute, to develop a new intravascular ultrasound system (IVUS) to allow cardiologists to better understand, diagnose and treat coronary artery disease. They submitted a joint \$4 million R01 research grant to the National Institutes of Health soon after the announcement of the alliance.

The partnership is synergistic. "David has experience with image processing through machine learning and image evaluation. I have experience with miniature high-resolution ultrasound that has all the benefits of IVUS and has nearly the resolution of intravascular



“The alliance will make it easier to initiate joint projects and share students to take full advantage of the expanded pool of cutting-edge research and thought that our programs bring together.”

— Aaron Fleischman

Director of the BioMEMS and Nanotech Laboratory at Lerner Research Institute

optical coherence tomography,” says Fleischman. “The strengths of each imaging modality compensates for the weakness of the other.” Equally important to teaming up, adds Fleischman, is Wilson’s “reputation for outstanding collegiality.”

Efstathios (Stathis) Karathanasis, associate chair of the School of Medicine Biomedical Engineering at Case Western Reserve and an associate professor, also understands the need for collegiality. For the past five years or so, he has teamed with researchers at Lerner Research Institute to develop a multi-component drug carrier system based on nanoparticles that delivers potent drugs to brain tumors. His collaboration began with Jeremy Rich, who is now at the University of California San Diego. Rich created stem cell inhibiting agents, while Karathanasis designed a drug delivery system.

“Our overarching approach was to develop an effective drug carrier system that incorporates delivery across the blood-brain barrier, minimal toxicity to the normal brain and consideration of resistant glioma stem cell populations that don’t respond to standard of care, which is chemotherapy and radiation,” says Karathanasis.

Karathanasis has since begun working with Christopher Hubert, a research associate and staff member at

Lerner Research Institute who conducted his post-doctoral work in Rich’s lab. Hubert is developing the first glioblastoma (GBM) organoids – 3D cultured tissue structures that contain diverse and interacting tumor cell populations similar to clinical tumors. The researchers hope to use the GBM organoids to test the effectiveness of therapeutics developed by Rich and the drug delivery system made by Karathanasis.

“Stathis and I are both interested in developing therapies that have the maximum chance of success when translated from the laboratory to the clinic, and we are approaching this from two different, yet highly complementary directions,” says Hubert.

Abundant Advantages of the Alliance

The possibility of teaming on congruent projects is appealing to researchers from both institutions. “Work being done at Cleveland Clinic in biomedical engineering complements some of the work that we are doing on computational imaging and personalized diagnostics,” says Pallavi Tiwari, an assistant professor of biomedical engineering in the Case Western Reserve University School of Medicine. “It only makes sense that we join forces and work together.”

In their research, Tiwari and her colleague Satish Viswanath, also an assistant professor of biomedical

engineering in the School of Medicine, utilize standard-of-care imaging data to extract information, quantify it and apply it to predictive modeling. One of Tiwari's primary collaborators at Cleveland Clinic is Jennifer Yu, in the Radiation Oncology Department, with whom she serves as co-principal investigator on a grant from the Dana Foundation. By also teaming with Cleveland Clinic researchers who are developing new targeted imaging technologies, the process of predictive modeling can be further improved.

Enhancing opportunities for clinical translation is another major advantage of the alliance. The university's Case-Coulter Translational Research Partnership has supported more than 80 technologies, and a third of those projects have been licensed. Cleveland Clinic biomedical engineering researchers are instrumental in the NIH Center for Accelerated Innovation at Cleveland Clinic, one of three nationwide centers created by the NIH to develop best practices in translating academic innovations into new drugs, devices and diagnostics. "Putting people together [from both institutions] who think in different ways may actually speed up translation from basic discovery to the clinic," says Basilion.

Students also will benefit from the alliance. "They will have more access to faculty members across both institutions, which means more research opportunities, more mentorship possibilities and access to more resources in terms of funding, conferences to attend and experts to consult with," says Sam Senyo, an assistant professor in Case Western Reserve's Department of Biomedical Engineering whose research focuses on therapeutic cardiac regeneration.

Fleischman is also excited at the prospect of having access to a larger group of students. "The alliance will make it easier to initiate joint projects and share students to take full advantage of the expanded pool of cutting-edge research and thought that our programs bring together," he says.

Perhaps the greatest advantage of the alliance is a serendipitous one. "The formal partnership has an informal but powerful side benefit," says Hubert. "It gets together groups of extremely smart and collaborative scientists who may otherwise have never ended up in the same room together." He has pursued ongoing conversations and initial collaborative experiments with other Case Western Reserve University biomedical engineering faculty aside from Karathanasis whom he may not have met and worked with prior to the alliance.

"The alliance is building a closer community," echoes Karathanasis. And that, he says, will impact the most important thing of all – science itself.

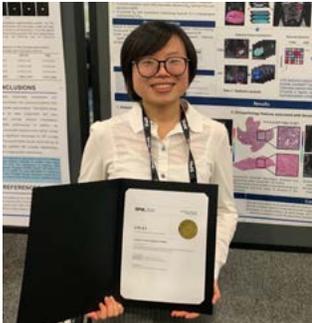
"I want to work with the best talent that can move our science forward," he says. "It just so happens that Cleveland Clinic has plenty of those." So does Case Western Reserve University. Together, they are a mighty force in biomedical engineering.

"The alliance is building a closer community, and that will impact the most important thing of all – science itself."

— Efstathios (Stathis) Karathanasis
Associate Chair of Biomedical Engineering, Case Western Reserve University School of Medicine

GRADUATE STUDENT SPOTLIGHT

Lin Li



Lin Li, PhD candidate, was awarded an honorable mention for the paper, "Radiomic Features derived from Pre-operative Multi-parametric MRI of Prostate Cancer are associated with Decipher Risk Score." It was presented as part of the computer aided diagnosis

track at the 2019 SPIE Medical Imaging meeting.

This was a collaboration with the Cleveland Clinic, Glickman Urological and Kidney Institute and supports the new Biomedical Engineering Alliance.

Authors: Lin Li, (Case Western Reserve University), Rakesh Shiradkar (Case Western Reserve University), Ahmad Algohary (Case Western Reserve University), Patrick Leo (Case Western Reserve University), Cristina Magi-Galluzzi (University of Alabama), Eric Klein (Cleveland Clinic, Glickman Urological and Kidney Institute), Andrei Purysko (Cleveland Clinic), Anant Madabhushi (Case Western Reserve University, Louis Stokes Cleveland VA Medical Center).

Ujjal Sekhon



Ujjal Sekhon, a doctoral researcher in Anirban Sen Gupta's laboratory, was invited to give a podium and a poster presentation on modular design of synthetic platelet nanotechnologies at the "Cell Biology of Megakaryocytes and Platelets" Gordon Research Conference in Galveston

Texas, Feb. 24-March 1, 2019.

Kihwan Kim



Kihwan Kim, a former MS student in Miklos Gratzl's lab, won first place in PITCH U, the Burton D. Morgan Foundation's Elevator Pitch Competition for students and recent

alums of northeast Ohio colleges and universities, conducted in conjunction with the Youngstown Business Incubator.

Kim delivered a 90-second elevator pitch on developing an early diagnostic device for cystic fibrosis, a project that he developed during his MS program with Gratzl.

Nathaniel Braman



Nathaniel Braman, a graduate student in the Center for Computational Imaging and Personalized Diagnostics, had his Radiological Society of North America (RSNA) abstract "Novel Radiomic Descriptor of Tumor Vascular

Morphology Identifies Responders to Neo-Adjuvant Chemotherapy on Pre-Treatment Breast MRI" selected to receive the RSNA Trainee Research Prize. His prize was also specially chosen for Dr. Tapan K. Chaudhuri in memory of Tandra R. Chaudhuri, PhD, and Tamasa R. Mallik, BA.

Graduate Students Win Top Prizes at the Cleveland Medical Hackathon Event

The 4th annual Cleveland Medical Hackathon delivered an innovative jolt to the health care industry. Students from the Department of Biomedical Engineering at Case Western Reserve University took the top three awards, each with a cash prize.

Students, developers, designers, investors, engineers, researchers and community members gathered at the HIMSS Innovation Center at the Global Center for Health Innovation Oct. 20-21, 2018, for a high-energy, all-night, problem-solving session to imagine and develop health IT solutions that directly respond to a variety of specific healthcare challenges. The hackathon is organized by Cleveland Clinic, Metro Health, University Hospitals, Case Western Reserve University, BioEnterprise, HIMSS and FlashStarts, with support from presenting sponsor, Ashland University MBA Programs.



Left to right: Amogh Hiremath, Gabriel Labbad, Tahseen Minhaz, Sukanya Raj Iyer and Joe O'Donnell

First Prize

Amogh Hiremath, PhD candidate, Anant Madabhushi's lab; Sukanya Raj Iyer, MS candidate, Pallavi Tiwari's lab; Tahseen Minhaz (PhD candidate, David Wilson's lab; Gabriel Labbad, gynecologist, MetroHealth; Joe O'Donnell, AI Consultant

The team pitched an idea of 'Early Warning System for Postpartum Depression' using speech and sentiment analysis. The present state of assessing postpartum depression (PPD) is that the physicians do a standard questionnaire three to four weeks after the delivery, and it is done only once. The team presented a quantitative method for measuring the PPD risk score by combining the socio-economic factors, patient's response during conversation with the physician and vitals to predict PPD risk and alert physicians.

Second Prize

Chaitanya Kolluru, PhD candidate, David Wilson's lab; Binit Panda, MS candidate, Soumyajit Mandal's lab in EECS; Peter Dietz, OnShift Inc. and Vadivelan Palaniswamy, Siemens Healthineers

The team developed an app for on-demand home health care.

Third Prize

Kihwan Kim, PhD candidate, Xin Yu's lab, and undergraduates Alex Neyman, Steven Dirjayanto and Silas Ifeanyi

The third prize was won by a team entirely of Case Western Reserve students for developing a wearable ECG monitoring solution for diabetic patients going through hypoglycemia during sleep.



Student-Led MedWish Team Refurbishes Pulse Oximeters for Use in Ghana



Members of CWRU MedWish, from left: Jennifer Buck, Leandra Bowsman, Jonathan Chen and Shyam Polaconda.

On Feb. 2, 2019, the student organization Case Western Reserve University MedWish delivered four pulse oximeters to a clinician from Nadowli District Hospital, who took the much-needed devices more than 5,300 miles away to an agricultural community in northwest Ghana. Transfer of the pulse oximeters, which measure oxygen saturation of the blood, was the culmination of a months-long project to refurbish the medical devices.

CWRU MedWish is a student arm of MedWish International, a not-for-profit organization that repurposes discarded medical supplies and equipment to provide humanitarian aid in developing countries. "Many lower-to-middle income countries do not have access to basic medical supplies and critical devices," says Leandra Bowsman, an undergraduate student at Case Western Reserve University double majoring in biomedical and mechanical engineering and the packaging and logistics coordinator of CWRU MedWish. "Our job is to triage incoming donated devices. After we



The international charitable organization Ghana Medical Help states the Spot Vital Signs® devices are one of the most requested items, allowing clinicians such as William Gudu (shown above) to efficiently monitor the vital signs of new mothers and other patients at Bongo Hospital and other health care facilities throughout Ghana.



Nadowli Hospital, Ghana, 2014

determine which devices are worth pursuing, we test each device, document and package them for MedWish to send to countries that have requested critical devices, such as pulse oximeters."

Refurbishment of the pulse oximeters involved adding an on/off switch so the battery won't drain when the system is turned off. Pulse oximeters are designed to be plugged in all of the time, but this won't be the case at Nadowli District Hospital, so the modification was necessary. CWRU MedWish students handled the switch installation and rewiring of the device under the guidance of Colin Drummond, a professor in the Department of Biomedical Engineering, and Alex Massiello, a retired senior principal research engineer from Cleveland Clinic. "Alex has been a great resource for mentoring students and explaining the way equipment works," says Drummond.

Now that the pulse oximeter project has ended, students are testing and repairing electrocardiogram

machines and neonatal incubators for donation. In 2017, MedWish sent 140 shipments of life-saving medical supplies and equipment around the world. The organization was founded in 1993 by Lee Ponsky, MD, chief of the Division of Urologic Oncology at University Hospitals and a graduate of the Case Western Reserve University School of Medicine.

Current Case Western Reserve students are excited at the opportunity to contribute to a philanthropic organization founded by one of the school's alumnus. "MedWish has given me hands-on experience working with medical devices," says Bowsman. "I am able to see the applicability and real-life context of some of these devices, which we discuss in class. Furthermore, working with these devices has made me realize some potential areas for design improvement and has elicited an interest in product design and life cycle."

CHECKING IN WITH ALUMNI

Adriana Velazquez Berumen

Adriana Velazquez Berumen (GRS '86, biomedical engineering), lead engineer for medical devices at the World Health Organization (WHO), returned to Case Western Reserve University on Feb. 28 as the keynote speaker for the 2019 Engineers Week Reception at Tinkham Veale University Center. More than 400 people listened as Velazquez Berumen shared her unique perspective from witnessing healthcare challenges around the world during her 11-year career at the WHO.

As lead engineer for medical devices, Velazquez Berumen has a global view of medical instruments and how they can be used most effectively in different communities and cultures. During her keynote speech, she noted that medical innovations such as X-rays, dialysis and pacemakers have changed the lives of millions of people, but so have simple tools like stethoscopes and syringes. She stressed that medical devices need not be technological marvels to work wonders: It's often enough that they are simple, safe and effective.

"Always put yourself in the place of the patient and the place of the healthcare worker who is trying to help the patient," she told an audience sprinkled with biomedical engineering majors. "First listen, then help." She added that engineering knowledge must be sharpened with personal passion to bring about change, especially when the challenges are tall.

Velazquez Berumen's personal passion is clear. She founded the World Health Organization's Global Forum on Medical Devices, which annually convenes health ministers and biomedical engineers from around the world to share technology and discuss best practices. In 2017, the Association for the Advancement of Medical Instrumentation honored her with its Humanitarian Award in recognition of her efforts to promote biomedical engineering and broad access to quality health care.



Adriana Velazquez Berumen was excited to address students who are as energized about the power of engineering as she is.



Robert Kirsch, chair of the Biomedical Engineering Department, welcomes Adriana Velazquez Berumen to the podium as the keynote speaker at the 2019 Engineers Week Reception.

IN MEMORIAM



Robert Aiken

Robert "Bob" Aiken (1930-2018) and his wife, Brenda, committed \$20 million in 2017 to support the Department of Biomedical Engineering.

"Our hearts go out to Brenda and the entire Aiken family during this difficult time," Case Western Reserve University President Barbara R. Snyder said. "Bob was a warm and wise man who appreciated innovation for the ways it could help people reclaim

parts of themselves lost to illness or injury. We are grateful for his support, insight and – most of all – recognition of the power of learning and discovery to transform lives."

A 1952 mechanical engineering graduate, Aiken credited his professional success to his alma mater – both because of the excellent education his academic program provided and also the social skills his fraternity allowed him to develop.

REMEMBERING OUR FOUNDING FATHERS

As we celebrate the 50th anniversary of Case Western Reserve University's Biomedical Engineering Department this academic year, we remember those who helped launch the department and build it into a leader in the field.



David Fleming

David "Dave" Fleming (1926-2013) received his MD from Case Western Reserve University School of Medicine in 1973 and was a professor emeritus in the Case School of Engineering. He

was a member of the American Physiological Society, American Academy of Pediatrics, Society for Biomedical Engineering, IEEE and the American Thoracic Society. He was co-patent holder/co-inventor of the Continuous Positive Airway Pressure (CPAP), a treatment for obstructive sleep apnea. He also served on the U.S. National Committee on Engineering in Medicine and Biology of the National Academy of Science, was chairman of the IEEE Group on Engineering in Medicine and Biology, chairman of the ASEE's Group on Bio-and-Medical Engineering Committee, a member of the NIH Study Sections in Anesthesia & Biomedical Engineering and a consultant to the National Science Foundation.



Donald Gibbons

Donald "Don" F. Gibbons (1926-2018) was director of the Center for the Study of Materials and saw the future of biomaterials and biocompatibility.

He was a founder of the Department of Biomedical Engineering at Case Western Reserve University and the Society for Biomaterials. He

understood the nature of science and saw the need for being meticulous at a basic level, whether it was the structure properties of materials, how they influenced biological pathways, or the need for understanding histopathologic interactions. He encouraged his students to work closely with pathologists to properly understand biologic reactions



Robert Plonsey

Robert "Bob" Plonsey (1925-2015), former chair of the Department of Biomedical Engineering at Case Western Reserve University from 1976-1980 will be

remembered for his leadership in the establishment of the field of biomedical engineering. He served as president of the IEEE Engineering in Medicine and Biology Society (EMBS) from 1973-1974 and the Biomedical Engineering Society from 1981-1982.

Plonsey became an assistant professor of Electrical Engineering at Case Institute of Technology. His deep interest for biomedical engineering led him to complete the first year-and-a-half of the medical school curriculum at Case Western Reserve University School of Medicine while a faculty member. Plonsey was one of the founding members of the Bioengineering Group, Systems Research Center, which eventually led to the formation of the Department of Biomedical Engineering at Case Western Reserve University in 1969.



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