Ronald E. McNair
Postbaccalaureate Achievement Program
20th Summer Research Symposium (Virtual)
July 23, 2020

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NJIT New Jersey's Science & Technology University

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Ronald E. McNair
Postbaccalaureate Achievement Program

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Welcome to New Jersey Institute of Technology's Summer Research Symposium. At this difficult time that the world is facing because of COVID19 pandemic it has been an honor and privilege to be part of this year's Undergraduate Summer Research Symposium solely by the participants of Ronald E. McNair Postbaccalaureate Achievement Program. Because of the pandemic many other summer programs including the National Science Foundation REU and India's Heritage Institute of Technology were canceled because of campus restrictions. Under this difficult situation the Ronald E. McNair Program students worked very hard remotely to carry out their research projects with literature review, data analysis and simulation. This year's success comes because of Ms. Zara Williams, Assistant Director of the Ronald E. McNair Program, for her efforts in coordinating the programs associated with virtual McNair student research and not allowing these students to waste an entire summer without doing anything. Efforts of Mr. Nazeem Patel, of the Ronald E. McNair Program is recognized for his valuable input in producing this program's brochure.

The students in the Ronald E. McNair Program have the opportunity to virtually present their research accomplishments via WebEx that was completed under the supervision of dedicated NJIT faculty. Without the time and effort of NJIT faculty and graduate student mentors the outstanding achievement of the students would not have been possible. Some of the students also met their advisors in the labs with social distancing to move their research forward.

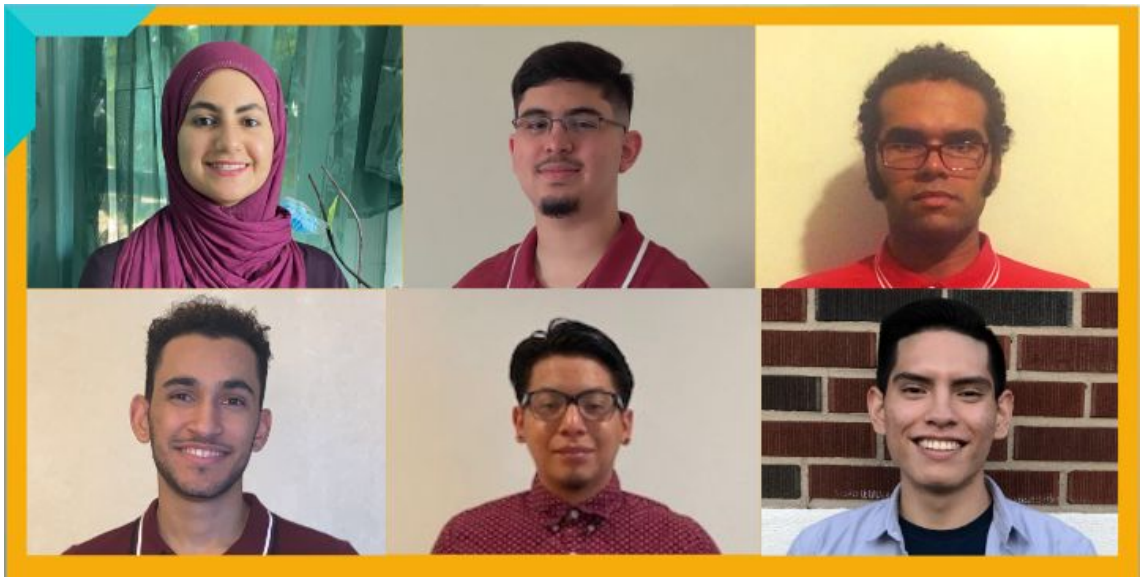
In a sad note, we miss Prof. Angelo Perna, the long-time Director of the Ronald E. McNair Program for 20 years. This summer he lost his fight against cancer and is no longer with us. His contributions to this program will be cherished by all the students he touched and the entire NJIT community.

We are extremely proud of the research efforts of all the students, the quality of the research presentations and grateful for the support of the NJIT administration, faculty, and staff in contributing to the success of today's event despite all the difficulties of the worldwide pandemic.

Sincerely,

Durgamahab Misra, PhD
Symposium Chair and McNair Program Interim Director
Professor and Associate Chair for Graduate Programs
Department of Electrical and Computer Engineering

Ronald E. McNair Postbaccalaureate Achievement Program 2020 Scholars



L to R:

Jehan Shalabi || Tyler Rodriguez || Edgar Canario
George Ulerio II || Kelvin Azcatl || Ricky Palaguachi

L to R:

Oladimeji Sobanjo || Tatiana Excellent
Ilham Chahla || Brian Trivinos

Kelvin Azcatl - (Electrical Engineering), NJIT
Research: *Electronic Synapse Devised Based on Metal Oxide*
Faculty Adviser: Dr. Durgamadhab Misra**,** Department of Electrical Engineering

Edgar Canario - (Biomedical Engineering), NJIT
Research: *Measuring Entropy in Sleep EEG to Examine Complexity and Level of Biological Activity in Different Sleep Stages*
Faculty Adviser: Dr. Bharat Biswal**,** Department of Biomedical Engineering

Ilham Chahla - (Biomedical Engineering), NJIT
Research: *A Lower-Limb Exoskeleton for Cerebral Palsy Children with Stiff Knee Gait*
Faculty Adviser: Dr. Saikat Pal**,** Department of Biomedical Engineering

Tatiana Excellent - (Biochemistry), NJIT
Research: *Inflammatory Interactions of induced pluripotent stem cells derived cardiomyocytes with induced pluripotent stem cells derived macrophages*
Faculty Adviser: Dr. Eun Jung (Alice) Lee, Department of Biomedical Engineering

Ricky Palaguachi - (Computer Science), NJIT
Research: *Measuring the Level of Concern of Twitter Users during the COVID-19 Pandemic*
Faculty Adviser: Dr. James Geller, Department of Computer Science

Tyler Rodriguez - (Biomedical Engineering), NJIT
Research: *Using Finite Element Modelling to Infer Bone Health After Spinal injury*
Faculty Adviser: Dr. Saikat Pal, Department of Biomedical Engineering

Jehan Shalabi - (Electrical Engineering), NJIT
Research: *Drone-Assisted Mobile Networking*
Faculty Adviser: Dr. Nirwan Ansari, Department of Electrical and Computer Engineering

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Research: *Design and Characterization of III-Nitride Ultraviolet Nanowire Light Emitting Diodes*
Faculty Adviser: Dr. Hieu Nguyen, Department of Electrical and Computer Engineering

Brian Trivinos - (Mechanical Engineering), NJIT
Research: *Using Creo to Model Complex Mechanisms: Sarrus Linkage Mechanisms*
Faculty Adviser: Prof. Mani, Department of Mechanical Engineering

George Ulerio II - (Civil Engineering), NJIT
Research: *Impact of Chemical Admixtures on Workability, setting time, and heat evolution of Calcium Aluminate Cement Systems*
Faculty Adviser: Prof. Matthew Adams, Department of Civil and Environmental Engineering

Electronic Synapse Devised Based on Metal Oxide Resistive Switching Memory

Scholar: Kelvin Azcatl, Advisor: Dr. Durgamadhab Misra
Department of Electrical and Computer Engineering
New Jersey Institute of Technology, Newark, NJ 07102

The metal oxide resistive switching memory device was inspected to be a promising candidate to act as an electronic synapse device. This device is desirable for better neuromorphic computation than the traditional method in creating an electronic synapse which raised problems undesirable in heavy neuromorphic computation. The metal oxide resistive switching memory device has a switch functionality where a positive voltage is applied to the device and the device begins conducting and enters a low resistive state. When a negative voltage is applied to the device, it will stop conducting and will enter a high resistive state. The device also has a great endurance cycle of 10^5 cycles of continues low to high and high to low transition resistive states. The device is also very energy efficient where the largest energy measured consumed by the device is 6pJ which is necessary in large scale hardware implementation of neuromorphic computing and brain simulation. This device is formed in a Metal Insulator Metal (MIM) structure. Different configuration and fabrication of the metal oxide resistive switching memory device demonstrated which configuration resulted in better power consumption. The results showed that when the buffer layer (part of the insulator) is closer to the top electrode (metal), the power requirement of the device decreases dramatically compared to the other configurations tested. These results suggested that the metal oxide memory device can potentially be used as an electronic synapse device for neuromorphic computation systems.

Measuring Entropy in Sleep EEG to Examine Complexity and Level of Biological Activity in Different Sleep Stages

Scholar: Edgar Canario, Advisor: Bharat Biswal
Department of Biomedical Engineering
New Jersey Institute of Technology, Newark, NJ, 07102

Abstract: Sleep scoring is done to help diagnose disorders like sleep apnea, where breathing stops and starts during sleep, or insomnia. Sleep scoring is a difficult and tedious process, usually taking several hours. However, by identifying characteristics that can be fed into a computer for it to identify sleep stages, it is possible to automate the process. Sleep scoring is done using electroencephalogram (EEG) to measure a person's brain waves during sleep. The data obtained from this reading can help split a person's sleep into six different sleep stages where the body and brain function differently. These sleep stages are wakefulness (W), N1, N2, N3, N4, and rem sleep (R), with each N stage representing a deeper level of sleep and rem sleep being a time of intensive dreaming. One of the characteristics that can be used to classify sleep stages is entropy. Entropy in biological systems can be thought of as a measure of order or disorder. It is often, although not always, correlated with complexity in biological systems. Higher entropy often means a higher level of complexity. This has been seen before in human hearts, where a low level of entropy was seen in unhealthy hearts compared to a healthy one. We will examine this phenomenon in regards to sleep stages to identify whether a deeper level of sleep correlates to a lower level of entropy. EEGLAB, a plugin for matlab, was used to read and process EEG data from a public sleep database. A total of 153 datasets were used. Each dataset was then run through a script that would calculate approximate entropy and multiscale entropy. The former calculates entropy based on the number of times a data point was repeated in a dataset. The latter repeats the experiment over multiple time scales (created by averaging a series of data points over the original time series). Results show a decrease in entropy as subjects fall farther into deep sleep. For mse, entropy decreases by an average of 50% from N1 to N4. For approximate entropy, entropy decreases by an average of 48% from N1 to N4. Both cases support the theory of lowered entropy with a lower amount of biological complexity. By understanding the entropy traits inherent in sleep stages it is possible to automate the process of sleep scoring, making it faster and easier to do, enough so that a patient may obtain an accurate sleep scoring at home.

A LOWER-LIMB EXOSKELETON FOR CEREBRAL PALSY CHILDREN WITH STIFF KNEE GAIT

Scholar: Ilham Chahla, Advisor: Saikat Pal
Department of Biomedical Engineering
New Jersey Institute of Technology, Newark, NJ 07102

Abstract: Stiff knee gait (SKG) is one of the most common gait disorders manifested in children with cerebral palsy. SKG is mainly characterized by reduced peak knee flexion during the swing phase of the gait cycle due to high tone and/or spasticity in the rectus femoris muscle. Although cerebral palsy is not a degenerative disorder many studies suggest that motor control in patients with cerebral palsy diminishes with age. However, patients may benefit from physical therapy if implemented early on in life. Exoskeleton devices have been introduced in recent years as early intervention devices for children. The aim of this study is to develop a lower-limb exoskeleton for children with SKG. The design of this device is passive (no electrical components) and adjustable to ensure that it is accessible to low-income families and can be continually used by the patient for a reasonable time frame. The current design consists of three 3D printed parts located respectively at the back of the thigh, around the calf, and on the forefoot (metatarsal location). A resistance band is threaded through these parts coupling the degree of freedom at the ankle (dorsiflexion-plantar flexion) and the knee (flexion-extension). Studies investigating knee and ankle kinematics for patients afflicted particularly with stiff knee gait are scarce and present inconsistent findings. Thus, we have identified the need to perform a gait lab analysis on a pediatric SKG population to observe the consequent reactions and determine the best course of action for the exoskeleton design.

Inflammatory interactions of induced pluripotent stem cells derived cardiomyocytes with induced pluripotent stem cells derived macrophages

Scholar: Tatiana Excellent, Advisor: Dr. Alice Lee
Department of Biomedical Engineering
New Jersey Institute of Technology, Newark, NJ 07102

Abstract: Most deaths in patients who suffer a heart attack are due to restrictive cardiomyopathy, a type of cardiomyopathy in which the heart tissue becomes stiff because of the abnormal presence of tissue, such as scar tissue. Scar tissue is a result of extracellular matrix (ECM) proteins being deposited by the work of myofibroblasts. Myofibroblasts, responsible for wound healing, are induced by anti-inflammatory macrophages, called M2, and they are mediated by cytokines secreted by these macrophages. Unfortunately, there is limited knowledge of the interaction between these macrophages and myofibroblasts during the proliferative phase of myocardial injury. This study aims to examine the response of M2 macrophages to infarcted cardiac cells and their interaction with myofibroblasts, pushing the response for ECM remodeling. To examine this, I will perform an in-vitro study using healthy mice cardiomyocytes, and an endotoxin to incite an inflammatory response focusing on the anti-inflammatory phase. Using an enzyme immunosorbent assay, I will quantity the secretion of cytokines by M2 macrophages to determine which types are important for fibroblasts. Then, I will determine if cytokine-specific mediation in cardiac cells increases the activity of myofibroblasts. Understanding the interrelating function of M2 macrophages and myofibroblasts during the cardiac inflammatory response will yield insights into how their functions can be exploited in favor of improving cardiac remodeling.

Measuring the Level of Concern of Twitter Users during the COVID-19 Pandemic

Ricky Palaguachi, Advisor: Dr. James Geller and Dr. Soon Ae Chun
Department of Computer Science
New Jersey Institute of Technology, Newark, NJ USA

Abstract: On March 11, 2020, the World Health Organization (WHO) declared the novel coronavirus outbreak a pandemic. Within weeks, normal life transitioned to a mostly virtual one. Many gathering events, including normal business and school operations, were ordered to be shut down and moved virtually for an indefinite period of time. Social policies were put in place by local and state governments to help slow the spread COVID-19. Stay-at-home orders, social distancing practices, and face covering mandates were commonplace across the US. Citizens, unsure of the outcome of the pandemic, are experiencing different emotions with respect to these policies. These emotions can include disbelief, shock, health concerns, fear, anxiety, and panic. This research presents an approach to measure the level of concern of Twitter users for US States. Our approach allows for the visualization of these data changes temporally and geographically on choropleth maps.

Keywords: COVID-19, Sentiment analysis, Government policy, Health policy, Public health, Twitter mining, Degree of concern

Using Finite Element Modeling to Infer Bone Health After Spinal Cord Injury

Scholar: Tyler Rodriguez, Advisor: Dr. Saikat Pal
Department of Biomedical Engineering
New Jersey Institute of Technology, Newark, NJ 07102

Abstract: Only 0.8 % of those suffering spinal cord injury come out of the ordeal without any complications. The majority of patients incur incomplete tetraplegia, severely damaging their quality of life in all regards. Paired with its neurological consequences, spinal cord injury (SCI) results in mechanical complications as well, often needing therapy and treatment to recover, although never fully. Although the mechanism is unknown, SCI is most prominently characterized by bone mineral degradation in the general knee area, causing weakened internal structure, reduced strength, decreased remodeling capability, and low-energy fracture. These problems amount to general degradation of biomechanics for approximately 288,000 people in the United States as of 2018. Finite Element (FE) modeling and analysis provides unique insight into SCI diagnosis and prognosis, as it is more accurate and explains wide variances in clinical data with more detail than standard clinical procedures. However, FE modeling is inefficient in a clinical setting due to its reliance on patient-specific data rather than large populace generalizations. Due to this, the objectives of this research are: 1) to identify consistent biomarkers that can assist with the diagnosis of SCI and; 2) to increase the scale high-fidelity FE modeling to diagnose SCI. Thus, in this study, FE modeling and analysis was carried out on segmented computer tomography (CT) data to determine possible markers of SCI-related bone degradation across large populations. Using MATLAB to segment CT scan data into layers of cross-sectional images, a 3-dimensional model of the bone was formed, using a modeling and meshing software called Geomagic. Modeling in Geomagic was be performed using Non-Uniform Rational Basis Spline (NURBS) technique. Once modeled, the bone was meshed in HyperMesh, to better define surface and internal structure. This mesh was placed within a bone material property software called Bonemat, which maps material properties on the external and internal structure of the bone mesh. Finally, mathematical FE analysis was performed in Abaqus and post-processing of data was performed using a Python script. Based on reviewed literature, it is expected that the most prominent biomarkers will be observed in decreasing strength and changing internal structure due to increased osteoclastic activities. Should these predictions be correct, it would mean that FE modeling would become clinically viable, improving the diagnosis and treatment of spinal cord injury.

Drone-Assisted Mobile Networking

Scholar: Jehan Shalabi, Advisor: Nirwan Ansari
Department of Electrical and Computer Engineering
New Jersey Institute of Technology, Newark, NJ 07102

Abstract: With the growing need to wirelessly connect billions of mobile devices globally, the resulting massive connectivity will increase wireless data traffic. Drone-assisted mobile networks deploy drones to assist communication networks and act as flying base stations to increase the coverage and capacity to mobile devices. These Drone-Mounted Base Stations (DBSs) provide users with various mobile services. DBSs are deployed over hotspot areas to help the macro base stations (MBSs/cell towers) in delivering traffic to user equipment in the hotspot and speed up the delivery of contents to users in that area. This research will use AIRSim, an open source drone simulator for AI research to develop autonomous solutions without the risk of deployment damage. Drones facilitate wireless communications, high maneuverability, and flexible deployment. The simulated drone was able to fly in Unreal Engine's simulation environment. By familiarizing with AIRSim's GitHub software, setup, Python/C++ APIs, and capabilities, constraints will be programmed into AIRSim's Python APIs. Constraints include drone energy consumption, battery life, speed, size, payload, connectivity, communication capabilities and incorporating DBSs. This determines how drone payload affects speed, how speed affects battery drainage/lifetime, ensuring minimal power used by drones. Future research will concentrate on programming the constraints into AIRSim's software to view its effects on drone performance. This is cost effective because this simulator allows us to investigate the performance of drone-assisted networking that is close to actual physical deployment.

Design and Characterization of III-Nitride Ultraviolet Nanowire Light Emitting Diodes

Scholar: Oladimeji Sobanjo, Advisor: Dr. Hieu Nguyen, Mentor: Jain Barsha, Ravi Velpula

Department of Electrical and Computer Engineering
New Jersey Institute of Technology, Newark, NJ 07102

Abstract: The use of light emitting diodes (LEDs) is being incorporated into more devices today more than the tradition filament light bulbs due to their longer life span and lower power usage, brighter and sharper light emitted, and miniscule sizes. Traditional planar ultraviolet LEDs have low light extraction efficiency which is the amount of light being emitted from the device to the air. Nanowire ultraviolet LEDs show potential to increase Light extraction efficiency. This project aims to develop optimized nanowire LEDs operating in the 210 nm – 340 nm wavelength regime. The application of ultraviolet LEDs in this wavelength range include DNA sensing, food sterilization, water/surface/air purification and more. The design of the material composition and calculation of the light extraction efficiency will be performed using the Finite-Difference Time-Domain (FDTD) software. We have studied the light extraction properties of the nanowires using photonic crystal structures with square and random arrangements while varying the radius of the nanowires as well as the spacing between each nanowire. The light extraction efficiency of the random and square lattice nanowires was found to be 25%-30%, and 55.60% respectively.

Using Creo to Model Complex Mechanisms: Sarrus Linkage Mechanism

Scholar: Brian Trivinos, Advisor: Balraj Mani
Department of Mechanical and Industrial Engineering
New Jersey Institute of Technology, Newark, NJ 07102

Abstract: The study's focus is using Creo to assembly complex mechanisms as it will allow users to efficiently model, assemble and animate various mechanisms. Creo is a computing aid design (CAD) program that offers various tools to model parts, assemblies, and simulations it's essential as it makes sketches and ideas of innovations come to live. For the study once the mechanism is completed, it would then be uploaded onto an open source website. The site would serve as a database for faculty and students of other institutions to view complex mechanisms that were made within Creo; helping aid with research, projects or training purposes. A Sarrus mechanism linkage would serve as the test mechanism to measure how Creo could efficiently be used to construct a complex mechanism and later be uploaded onto the site. A Sarrus mechanism consists of six spatial linkages with two sets of parallel adjacent axes which was created by Pierre Frederic Sarrus in 1853. It's the earliest mechanism to produce linear motion from revolving motion without using guide references. The Sarrus mechanism would serve as an example of a unique spatial configuration that serves as an over-constraint mechanism that's most desirable to help students understand its behavior and functionality. The results included the completed Sarrus mechanism as it would be one of the 100 mechanisms available on the site for others to access. As a handful of students are constructing the mechanisms; the site is currently available but requires some maintenance and reworking. Once completed, the site will serve as a resource for others to view animations, assemblies, and models of various complex mechanisms.

Impact of Chemical Admixtures on Workability, setting time, and heat evolution of Calcium Aluminate Cement Systems

Scholar: George Ulerio II, Advisor: Dr. Matthew P. Adams
Department of Civil and Environmental Engineering, Materials and Structures Laboratory
New Jersey Institute of Technology, Newark, NJ 07102

Abstract: Alternative cements, such as calcium aluminate cement (CAC), are an important tool in rapid repair situations for concrete structures and roadways. CAC has the unique property of being able to gain strength in a few days whereas commonly used cements gain strength over the span of up to 30 days. CAC is also particularly useful in cold weather environments with its ability to set and harden at nearly freezing temperatures. CAC systems come with the obstacle of setting and hardening before the cement can be molded and put into place. This can lead to poor repair quality and even the necessity to restart the entire repair in a short period of time. Chemical admixtures can help to improve the fresh properties of concrete to improve the workability. Very little information is provided to guide the specification of these chemicals in practice. The proposed work will examine the role of chemical admixtures in providing better workability during the initial fresh period of working with CAC systems, what dosage rates are appropriate, and if combining admixtures can help improve the workability of CAC concrete systems.

Kelvin Azcatl,
Electrical Engineering

Dr. Durgamadhab Misra,
Department of Electrical Engineering

Edgar Canario,
Biomedical
Engineering

Dr. Bharat Biswal,
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Tyler Rodriguez

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Department of Computer Science

Jehan Shalabi,
Electrical Engineering

Dr. Nirwan Ansari,
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Oladimeji Sobanjo,
Electrical Engineering

Dr. Hieu Nguyen,
Department of Electrical
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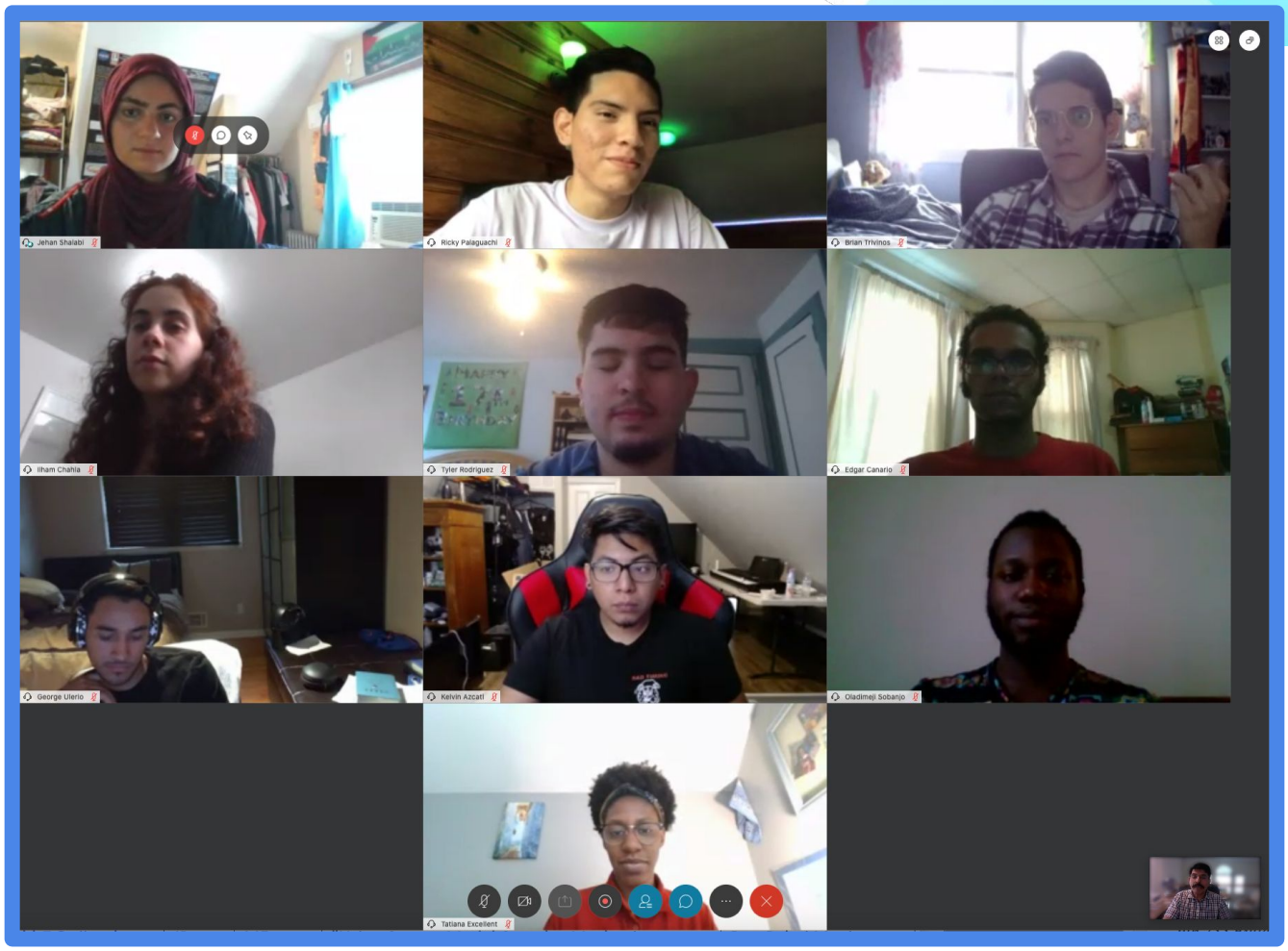
Brian Trivanos,
Mechanical Engineering

Prof. Balraj Mani,
Department of Mechanical Engineering

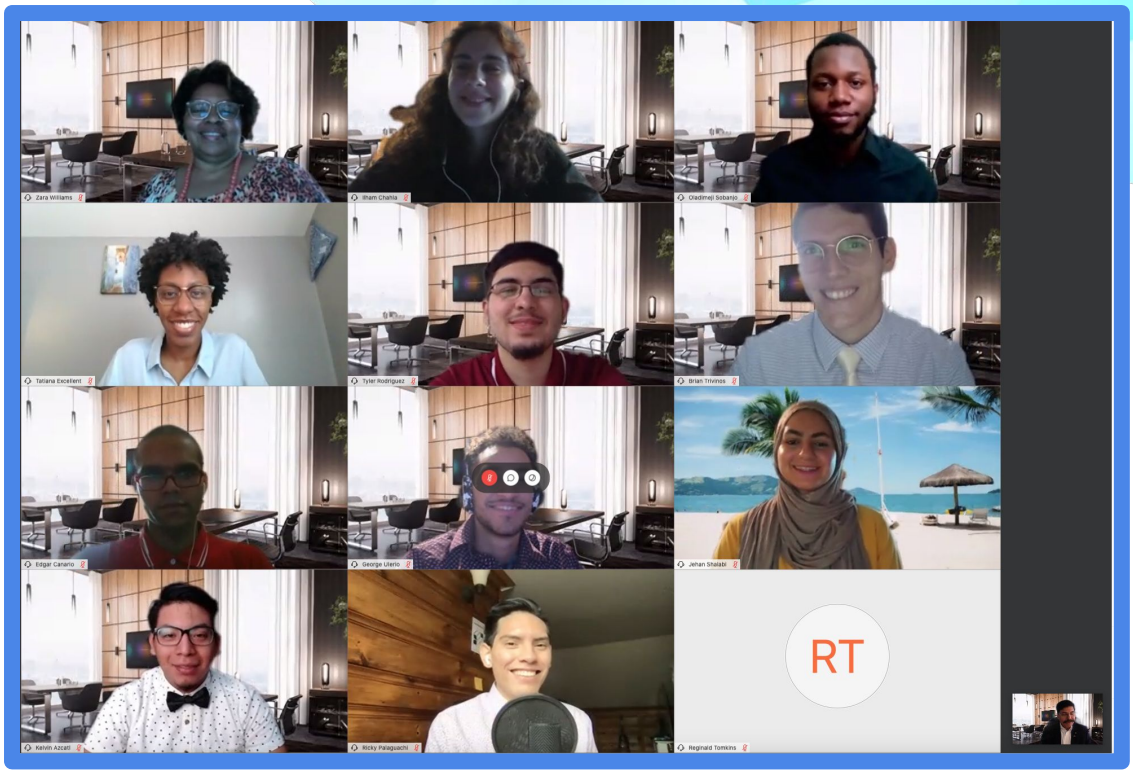
George Ulerio II, Civil Engineering

Prof. Matthew Adams,
Department of Civil and Environmental Engineering

Research Update Meeting

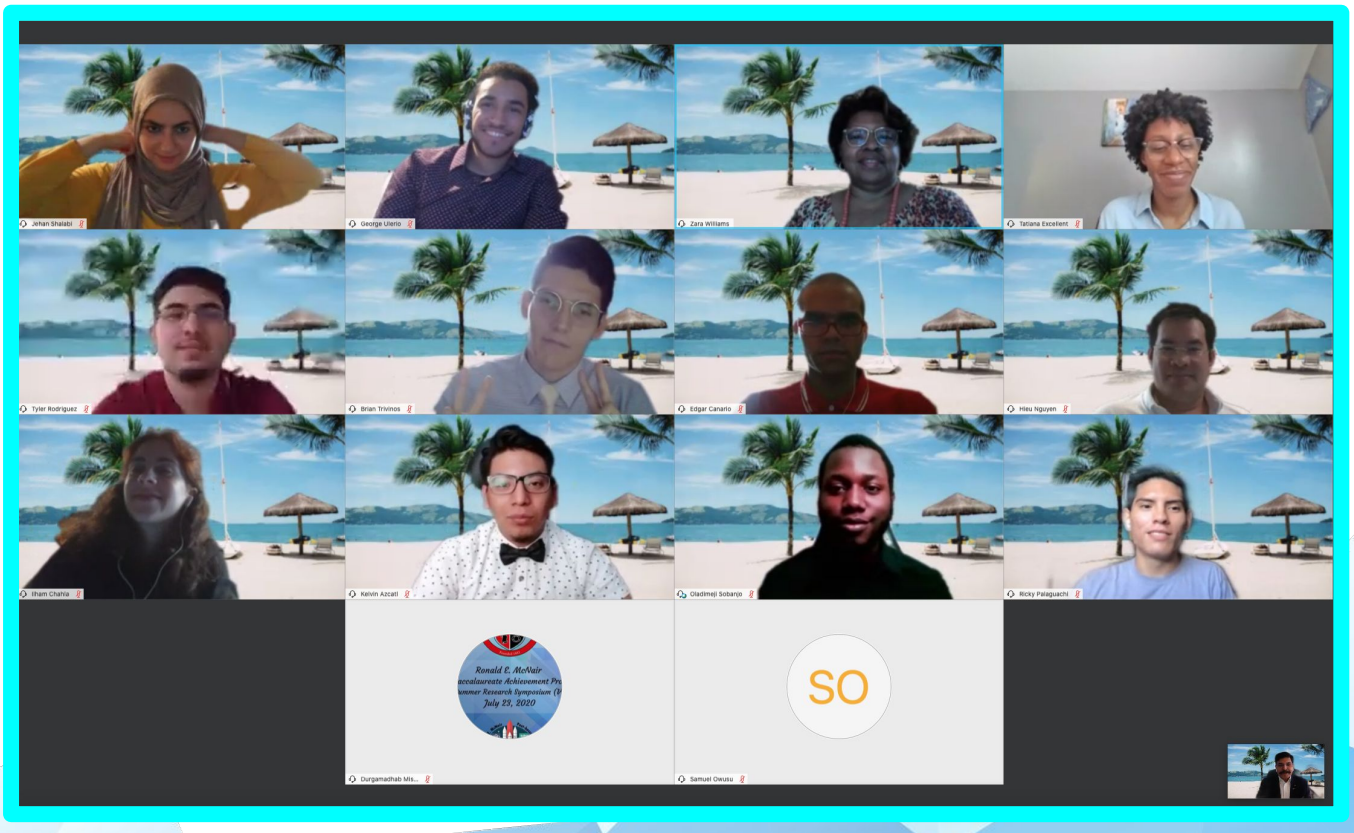


Scholars preparing for upcoming Research Presentations



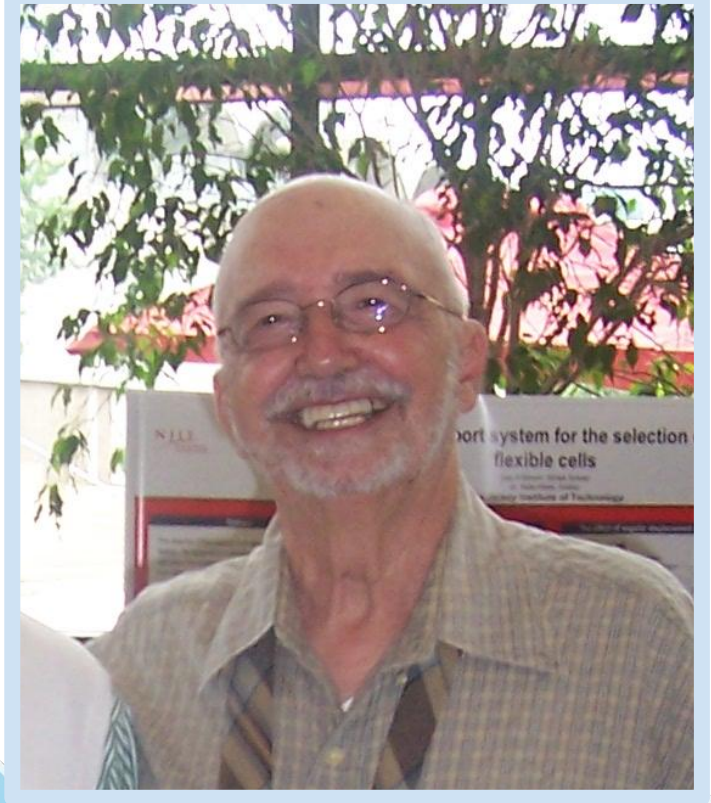
Scholars **Before** their Research Presentations

Scholars **After** their Research Presentations



In Loving Memory for Dr. Angelo J. Perna
1931 - 2020

With a big heart, he shared his Intellect, Guidance, & Friendship



In Memory of Dr. Angelo J. Perna

Angelo Perna was a Professor of Chemical Engineering, serving as educator, researcher and mentor at NJIT for more than 50 years. Among his recent duties he was Director of the Ronald E. McNair Post-Baccalaureate Achievement Program and advisor to the chemical engineering honor society, Omega Chi Epsilon. He served for many years as the advisor to the Student Chapter of the American Institute of Chemical Engineers (AIChE) and taught many courses to undergraduate and graduate students.

Professor Perna was widely recognized in his field. A Fellow of AIChE, he was highly active in this professional society and was the recipient of its highest service awards. Most recently, he earned the distinction of a *Lifetime of Service to AIChE*, presented to him in February 2020. Earlier, he was the recipient of the AIChE's *Shining Star Award* (2015), recognizing significant contributions and exceptional volunteerism.

Professor Perna joined NJIT in 1967 after graduating with a doctorate from the University of Connecticut. He earned his Master of Science and Bachelor of Science degrees in Chemical Engineering from Clemson University. Among his many contributions to the education of Chemical Engineers at NJIT, Professor Perna was the developer of the NJIT pilot-scale Unit Operations Laboratory, designed and implemented with his long-time collaborator and friend Professor Deran Hanesian. This remarkable facility continues to serve NJIT's chemical engineering students to this day, providing realistic hands-on experiences and preparing our students to tackle the complex challenges of the industry and the marketplace.

Professor Perna was highly active until his last days at NJIT, involved in all aspects of NJIT life – education, research, retention, recruitment, governance, and long-term planning. He had a large group of followers among NJIT's alumni, many of whom kept professional ties with him, sometimes many decades after graduation. Alumni often came looking for him at annual reunions, and mentioned him in letters and articles as a key influencer who helped them prepare for professional success. Indeed, Professor Perna's legacy is the generations of NJIT students who owe him the training and careful preparation that launched their rewarding careers and positioned them to make a mark in a highly competitive environment. Moreover, with his long-time service and dedicated involvement, Angelo Perna often served as our living institutional memory. He carried our collective knowledge and learned experiences, and provided insight and advice from decades of experience and careful observation. His colleagues and students will miss his intelligence, guidance, counsel and friendship.

Provost and Senior Executive Vice President Fadi P. Deek noted, "During his long career at NJIT, Professor Perna was an inspirational and award-winning teacher and mentor to thousands of students at all levels of university education. Most importantly, he touched the lives of many undergraduates through the McNair Scholars Program. Deep sadness for Angie's loss will be felt among the NJIT community and beyond."

President Joel S. Bloom added, "Angie Perna will be deeply missed, but his impact upon NJIT and its students will endure because the passion he brought to his work made an indelible impression upon so many."

U.S. (DOE) Management and Program Analyst, Carmen Gordon: Dr. Perna was a great pleasure to work with and devoted immeasurable concern, support and commitment to the McNair Program and students throughout his tenure as Project Director.

Assistant Director McNair Program, Zara Williams: Dr. Perna will be greatly missed by the McNair community as well as NJIT. He was a force to contend with especially when it involved students succeeding in academics, research and in their career goals. Dr. Perna was passionate in his commitment to teaching and to the goals and mission of the McNair program. For twenty years it has been my pleasure working together with him, maintaining a successful McNair program. Dr. Perna and his "Let me tell you a story" phrase will always be remembered by faculty, staff and students.

NJIT McNair Office Assistant Nazeem Patel: Dr. Perna was someone who made sure he could help any individual that needed him, and the number of people he has helped is numerous throughout his many years at NJIT. He was and will always be a one-of-a-kind role model, professor, and friend.

Rutgers Newark McNair Director, Rex Nobles: Dr. Perna leaves a long legacy. He was so inspirational. He and my boss were the ones who first encouraged me to chair our conference. He will be greatly missed.

Rider University McNair Director, Angelica A. Benitez: Dr. Perna. He was a person genuinely dedicated to student advancement and to the TRIO programs, especially McNair.

NJIT McNair Alumni David Diaz: Dr. Perna was like a father to many of us and had an immeasurable positive impact in my life and that of many others.

NJIT McNair Alumni Jillian Tarlowe: Dr. Perna's legacy will live on and I will never forget him "telling" us a story.

NJIT McNair Alumni Ayad Hussain: Dr. Perna. was a great mentor and he had a great personality.

NJIT McNair Alumni Shu Tham: If it was not for Dr. Perna and his efforts for the McNair program. I would not be where I am today.

NJIT McNair Alumni Marie Phillips: Dr. Perna was a great mentor during my time with the research program.

NJIT McNair Scholar Cruz Donato: Dr. Perna was an excellent mentor and educator, and we will sincerely miss him.

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