FULTON UNDERGRADUATE RESEARCH INITIATIVE
FURI
FALL SYMPOSIUM 2013
The Fulton Undergraduate Research Initiative (FURI) is designed to enhance and enrich a student's engineering education by providing hands-on lab experience, independent and thesis-based research and travel to national conferences. At this semiannual symposium, students present their research and share their findings with peers, Fulton Engineering, the ASU community and the community at large.
November 22, 2013

Thank you for joining us for the Fall 2013 FURI Symposium.

This year we celebrate the 10th anniversary of Ira and Mary Lou Fulton’s gift to the engineering schools—an investment that has enabled many things for our students, including this undergraduate research program that has become one of our signature experiential opportunities.

In 2005, the first year of the Fulton Undergraduate Research Initiative, 35 students participated. Today you will have the opportunity to meet with more than 100 students who are working on advances in health, energy, education, security and sustainability.

When our impressive group of students work alongside our renowned faculty, exciting projects and concepts are inevitable. The research projects you will see today are graduate-level efforts with real-world impact.

We are very proud of our students’ accomplishments this semester. We are also grateful for everyone who helps make this program such a success. We extend congratulations to all and look forward to their continued success.

Sincerely,

Paul C. Johnson, Ph.D.

Amy Sever
Professor, Civil, Environmental and Sustainable Engineering
Associate Director
Undergraduate Student Engagement


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Students in the FURI research program develop an idea under the mentorship of an engineering faculty member, then apply for funding. Once accepted, they perform research, attend workshops and prepare research summaries. Participants receive stipends and research supply budgets.

Engineering students in the thesis program at Barrett, The Honors College have an opportunity to fund their thesis work through FURI.

The travel grant program helps students participate in national conferences by providing financial assistance with travel expenses.

Aman Aberra 4  
Angela Adams 4  
Andrew Barkan 4  
Trevor Barker 4  
Jared Becker 5  
Nicholas Berk 5  
Amy Blatt 5  
Jeremy Blazer 5  
Emily Bondank 6  
Chaley Boreland 6  
Kristen Brown 6  
David Bull 6  
Lee Burke 7  
Dillon Card 7  
Joe Carpenter 7  
Aaron Carrillo 7  
Santhi Priya Challa 8  
George Chen 8  
Katelyn Conrad 8  
Andrew Creighton 8  
Tara De Vries 9  
Abhishek Dharan 9  
Ibrahimia Diop 9  
Taylor Dolberg 9  
Kathleen Duggan 10  
John Ernzen 10  
Francis Eusebio 10  
Sabrina Freeman 10  
Patrick Gaines 11  
Matthew Geres 11  
Alison Gibson 11  
Zachary Gordon 11  
Mackenzie Hagan 12  
Ibrahim Halloum 12  
Joseph Hanson 12  
Peter Harper 12  
Benjamin Havens 13  
Emily Herring 13  
Trent Hoffman 13  
Conrad Hom 13  
Chelsea Howard 14  
Khatheeb Hussain 14  
Lisa Irimata 14  
James Jensen 14  
Jeremy Johnson 15  
Jessica Johnson 15  
Scott Jones 15  
Paul Juneau 15  
Jason Kam 16  
Ajay Karpur 16  
Morgan Kelley 16  
Lilian Kim 16  
Michael Kim 17  
Kody Klimes 17  
Luis Laitano 17  
Alexandria Lam 17  
Jenessa Lancaster 18  
Brett Larsen 18  
Ching Yan Lau 18  
Brady Laughlin 18  
Long Le 19  
Mathew Lee 19  
Lydia Letham 19  
Alexander Links 19  
Philip Logan 20  
Gabrielle Maestas 20  
Chelsea Mann 20  
Elan Markov 20  
Jonathan Martin 21  
Stephanie Maxwell 21  
Sanya Mehta 21  
Sami Mian 21  
Jennifer Minchieli 22  
Amanda Moore 22  
Jeffery Morgan 22  
Miranda Ngan 22  
Jeffrey Nguyen 23  
Gerald O’Neill 23  
Shih-Ling Phuong 23  
Ellen Qin 23  
Noelle Rabiah 24  
Paul Rayes 24  
Kitt Roney 24  
Julie Rorrer 24  
Michael Rozowski 25  
Max Ruiz 25  
Kailey Rumbo 25  
Francesco Ruta 25  
Dagan Sassarini 26  
John Schrilla 26  
Andrew Shabilla 26  
Ankush Sharma 26  
Logan Smith 27  
Victoria Smith 27  
Amanda Snodgrass 27  
Daniel Stehlik 27  
Matthew Swann 28  
Giresse Tchegho 28  
Claire Tilton 28  
Xavier Vargas 28  
Johnathan Vo 29  
Sandeep Vora 29  
Zixuan Wang 29  
Stephen Warren 29  
Joseph Williams 30  
Louis Wilson 30  
Christopher Wong 30  
Weidong Ye 30
Financial support for FURI programs is made possible by Mr. Ira A. Fulton and Barrett, The Honors College, which contributes to the FURI Honors Thesis Program.

Special thanks to all of the mentors, family and friends for supporting our students through this program.

We appreciate the efforts of all who helped make this program a success, especially:

Delilah Alirez, business operations specialist
Sabrina Beck, administrative associate
Kevin Buck, academic financial specialist
Tamera Cameron, business operations specialist
Hasan Davulcu, associate professor
Jhanaye Glynn, administrative associate
Michael Goryll, assistant professor
Karmella Haynes, assistant professor
Stephen Krause, professor
Mary Laura Lind, assistant professor
Cortney Loui, coordinator, undergraduate student engagement
Jenna Marturano, administrative assistant
Barbara Minich, business operations manager
Beverly Naig, business operations manager
Narayanan Neithalanth, associate professor
Jay Oswald, assistant professor
Trudy Perez, administrative associate
Shaunna Price, business operations specialist
Stephen Rippon, assistant dean
Katrina Roalson, manager, fiscal and business services
Amy Sever, associate director undergraduate student engagement, FURI director
Shevonda Shields, research advancement administrator
Sarah Stabenfeldt, assistant professor
Tomi St. John, business operations manager
Alicia Stiers, business operations manager
Brent Vernon, associate professor
Nellie Voise, academic financial specialist
TARGETED FUNCTIONAL GENE SILENCING IN NEURONS USING MICROELECTROPORATION

Mentor: Jitendran Muthuswamy, associate professor, School of Biological and Health Systems Engineering
Research Theme: Health

The delivery of genetic payloads to neuronal cell lines has a wide range of applications in both medicine and basic research, from potentially treating Alzheimer’s Disease and Parkinson’s to contributing to drug discovery and functional genomics. Electroporation, the use of electric fields to create transient pores in the cell membrane allowing the uptake of exogenous materials, is a current technology that has the potential for high-throughput, high-efficiency transfection. The researchers developed a protocol for successful electroporation of neurons, demonstrating functional silencing using small-interfering RNA (siRNA). Further work will focus on improving transfection efficiencies and viabilities.

AMAN ABERRA, Biomedical Engineering
Graduation: May 2015
Hometown: Chandler, Arizona

DIABETES BIOSENSOR UTILIZING CAPILLARY ACTION THROUGH A HYDROPHILIC MICROFLUIDIC

Mentor: Jeffrey LaBelle, assistant professor, School of Biological and Health Systems Engineering
Research Theme: Health

There are over 25 million diabetics in the United States, and they lack an effective, painless method of quickly measuring glucose levels. The TOUCH tear glucose-sensing device is a noninvasive and uses tear fluid instead of blood. To get this device to market, liquid reagents must be dried. To dry the reagents various methods, such as desiccation, incubation and exposure to drying agents, were used. While incubation dried the reagents the fastest, the high temperatures denatured the sensitive enzyme. It was determined that desiccation in proximity to a drying reagent was the most effective method. Future devices will implement dried reagents.

ANNGELA ADAMS, Biomedical Engineering
Graduation: May 2015
Hometown: Phoenix, Arizona

DEVELOPING SAMPLE PREPARATION TECHNIQUES FOR OPERANDO TRANSMISSION ELECTRON MICROSCOPY OF CATALYSTS

Mentor: Peter Crozier, associate professor, School for Engineering of Matter, Transport and Energy
Research Themes: Energy

Operando Electron Microscopy is an emerging field of research that allows for both quantitative and qualitative observations in the microscope. However, one significant obstacle in this area of research is the lack of a catalyst available in the microscope. In order to overcome this problem a fiber glass pellet was fabricated out of pyrex and quartz wool fibers. These pellets can be impregnated with a Ruthenium catalyst, which is an important catalyst for fuel cells because it ensures an environment of CO2. With the assistance of a RIG-150 reactor, CO oxidation reactions were run in order to characterize the reactivity pellets and the catalyst.

ANDREW BARKAN, Mechanical Engineering
Graduation: May 2015
Hometown: Phoenix, Arizona

A NOVEL TREADMILL FOR GAIT REHABILITATION: DESIGN AND IMPLEMENTATION OF THE VARIABLE STIFFNESS MECHANISM

Mentor: Panagiotis Artemiadis, assistant professor, School for Engineering of Matter, Transport and Energy
Research Themes: Health

The objective of this research project was to investigate the effect of force stimulus on the gait pattern of individuals by using a novel treadmill mechanism that employs variable stiffness control. A unique treadmill system with the ability to impose surface stiffness control was designed and fabricated for implementation in gait research and rehabilitation. Using this device, experiments were conducted on healthy individuals in order to gauge the influence of force stimulus on gait kinematics. Future work will consist of further experimentation with both healthy and gait-impaired individuals using the variable stiffness treadmill system.

TREVOR BARKER, Chemical Engineering
Graduation: May 2016
Hometown: Mesa, Arizona

The TOUCH tear glucose-sensing device is a method of quickly measuring glucose levels. There are over 25 million diabetics in the United States, and they lack an effective, painless method of quickly measuring glucose levels. The TOUCH tear glucose-sensing device is a noninvasive and uses tear fluid instead of blood. To get this device to market, liquid reagents must be dried. To dry the reagents various methods, such as desiccation, incubation and exposure to drying agents, were used. While incubation dried the reagents the fastest, the high temperatures denatured the sensitive enzyme. It was determined that desiccation in proximity to a drying reagent was the most effective method. Future devices will implement dried reagents.

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TREVOR BARKER, Chemical Engineering
Graduation: May 2016
Hometown: Mesa, Arizona
The recent emergence of DNA-based diagnostics increases the need for rapid DNA sequencing technologies. One method to achieve this is to pass DNA through a nanopore, recording the trans-membrane current with a low-noise current amplifier. This amplifier that offers a wider bandwidth than typical mammalian cells contain picogram polymerase chain reaction (qRT-PCR). Since a microfluidic quantitative reverse transcription-polymerase chain reaction (qRT-PCR) improved detection sensitivity of qRT-PCR conditions is necessary to analyze gene expression at the single cell level. To date, the researchers have successfully detected nanogram concentrations of RNA and will continue to identify more sensitive approaches to achieve single-cell sensitivity. Future work will also include optimization for single-cell analysis from intact tissues.

**Developing a Broadband Amplifier for Analysis of DNA Structural and Molecular Characteristics**

**Mentor:** Michael Goryll, associate professor, School of Electrical, Computer and Energy Engineering

**Research Theme:** Health

The recent emergence of DNA-based diagnostics increases the need for rapid DNA sequencing technologies. One method to achieve this is to pass DNA through a nanopore, recording the trans-membrane current with a low-noise current amplifier. This research will demonstrate a design of a custom amplifier that offers a wider bandwidth than the current designs, enabling the study of DNA translocation without the need to limit the speed of translocation. The amplifier will be designed to allow direct integration of a nanopore sensing area on the same physical substrate, eliminating the need for external electrode wiring, forming a single device.

**Using Robotics to Aid Geometry Education**

**Mentor:** Erin Walker, assistant professor, School of Computing, Informatics, and Decision Systems Engineering

**Research Theme:** Education

This project aims to discover how robotics can be used to reinforce geometric concepts in education. This project works under the GaLLaG program (Game as Life, Life as Game), which encourages the fusion of technology and daily living. Through a combination of psychological and technological research, the project is evaluating the effects of using virtual and physical agents which students teach. This project is currently being tested and improved incrementally.

**In Situ mRNA Expression Analysis Using Two-Photon Laser Cell Lysis and Microfluidic qRT-PCR**

**Mentor:** Deirdre Meldrum, professor, School of Electrical, Computer and Energy Engineering

**Research Theme:** Health

The goal is to design a diagnostic tool detecting novel esophageal adenocarcinoma biosignatures at the single-cell level using the combined Two-Photon Laser Lysis system and a microfluidic quantitative reverse transcription-polymerase chain reaction (qRT-PCR). Since typical mammalian cells contain picogram concentrations of RNA, improved detection sensitivity of qRT-PCR conditions is necessary to analyze gene expression at the single cell level. To date, the researchers have successfully detected nanogram concentrations of RNA and will continue to identify more sensitive approaches to achieve single-cell sensitivity. Future work will also include optimization for single-cell analysis from intact tissues.

**Analyzing the Effects of Ultrasonic Tissue Stimulation on Neural Signaling with Applications in Non-Invasive Therapies**

**Mentor:** Jeffrey Kleim, associate professor, School of Biomedical and Health Systems Engineering

**Research Theme:** Health

Recent work has suggested that ultrasonic stimulation is a potentially viable method for driving neural activity. However, the exact mechanism by which ultrasound interacts with neural tissue remains unknown. A freshly excised section of rodent brain was subjected to ultrasound while tissue impedance was monitored. Any underlying bioelectric phenomena resulting from the ultrasonic stimulation were unable to be separated from thermal effects. Taking this study to an animal model would provide additional clinical relevance and perhaps reveal an effect of ultrasonic stimulation undetectable by our model.
**OPTIMIZATION OF ELECTRON DONORS AND BUFFERS FOR GROWTH OF TRICHLOROETHENE BIOAUGMENTATION CULTURES CONTAINING DEHALOCOCCOIDES**

Mentor: Rosa Krajmalnik-Brown, associate professor, School of Sustainable Engineering and the Built Environment  
Research Theme: Sustainability  
While bioremediation of trichloroethene polluted groundwater using microbial cultures containing Dehalococcoides has proven to be a successful remediation method, the process has the potential to become more cost effective. The current chemical compounds being used as electron donors for these microbial communities are expensive for field-scale use. Two alternative electron donors (molasses and ethanol) have been tested for their ability to support dechlorination. Preliminary results show that molasses, the cheapest alternative being tested, supports the fastest rate of dechlorination. Further work could include using the successful alternative in a continuous bioreactor currently being run.

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**ANEURYSM MODEL DATABASE DEVELOPMENT**

Mentor: David Frakes, assistant professor, School of Biological and Health Systems Engineering  
Research Theme: Health  
Ruptured intracranial aneurysm is a cerebrovascular disorder that causes thousands of casualties each year. Aneurysm models are created at ASU IPALab using 3-D printing to perform test treatments utilizing coil embolization with the goal of preventing aneurysmal rupture. Due to a constant need for the treatment results and information updates, an effective database was created to contain data from different ongoing simulation and experimental treatments performed on idealized models. Not only will the database effectively organize information collected from experiments, but it will also speed up average searching time when finding models that meet specific characteristics and potentially increase productivity.

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**CHEMICAL COMPOSITION AND LIPID QUANTIFICATION OF ALGAE STRAINS SUBJECT TO BIOFUEL INTEREST**

Mentors: David Nielsen, assistant professor, School for Engineering of Matter, Transport and Energy  
Research Themes: Energy and Sustainability  
With the push for biofuels growing steadily every day, algae (microalgae) are a sustainable choice for a green fuel source because they outperform other bio-based alternatives in their energy density to produce biodiesel precursors. The goal of the project is to optimize parameters to overproduce lipids in Aurantiochytrium sp. T66, a relatively uncharacterized strain. Lipids characterized in the cyanobacterial strain, Synechocystis sp. PCC 6803 and the high lipid-producing algae strain Chlorella sp. were used as a basis to determine parameters to successfully optimize, extract and characterize Aurantiochytrium sp. T66.

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**CONTROLLED DOPING OF ZINC OXIDE NANOWIRES**

Mentor: Hongbin Yu, associate professor, School of Electrical, Computer and Energy Engineering  
Research Theme: Energy  
One of the major engineering challenges of today is energy. This project aims to solve this by developing transparent solar panels that could replace windows. However, development of transparent zinc oxide solar panels in the future require a better material to conduct electricity to create an ideal p/n type relationship for power generation, so this project focuses on altering the electrical properties of zinc oxide nanowires through doping that will allow more energy to be generated from the solar panels than current zinc oxide solar panels. The researcher currently works with an undergraduate student, Ali Azhar, while doing research.
Lee Burke, Mechanical Engineering
Graduation: December 2015
Hometown: Tucson, Arizona

MULTISCALE MODELING OF A SELF-HEALING NANOCOMPOSITE

Mentor: Aditi Chattopadhyay, professor, School for Engineering of Matter, Transport and Energy
Research Theme: Security
Self-healing composites are a promising frontier in the science of materials, but there are few analytical models that can take into account the many scales inherent in these systems. This project instead applies a numerical molecular dynamics simulator to one such composite, an epoxy-resin system containing tris(cinnamoyloxymethyl) ethane. From this nanoscale model, macro-scale properties such as the glass transition point are extrapolated. Other mechanical properties including both elastic and inelastic behavior could be extrapolated from further simulations, and much work remains in the development of numerical tools for the multiscale modeling of composite materials.

Dillon Card, Mechanical Engineering
Graduation: May 2014
Hometown: Montrose, Colorado

BIO-INSPIRED ROBOT GRASPING AND CATCHING

Mentor: Panagiotis Artemiadis, assistant professor, School for Engineering of Matter, Transport and Energy
Research Theme: Health
This research project focused on successful bio-inspired control of a robotic prosthesis. Through the investigation of human grasping trends during object-catching experiments, a bio-inspired kinematic model was applied to the prosthesis with a goal of mimicking human grasp patterns with the device. By implementing optical analysis, the kinematic properties of the object under consideration were recorded and calculated. Based on these resulting kinematic characteristics, the bio-inspired model determined the appropriate response and control of the prosthesis.

TRAVEL GRANT

Joe Carpenter, Chemical Engineering
Graduation: May 2014
Hometown: Gilbert, Arizona

NANOCRYSTALLINE SI GROWTH ON SI NANOPARTICLES FOR SI HETEROJUNCTION SOLAR CELLS

Mentor: Zachary Holman, assistant professor, School of Electrical, Computer and Energy Engineering
Research Theme: Energy, Sustainability
Nanocrystalline silicon (nc-Si) can replace the amorphous Si layer of Si heterojunction solar cells. This could improve the efficiency of the solar cell by increasing doping, conductivity and increase transparency. This improvement in efficiency would come at little additional cost. The thickness of the layer is around 18nm. The crystallinity has been maximized at 50.8% using industry standard equipment. Next step work will involve deposition of a monolayer of Si nanoparticles to promote nc-Si growth.

Aaron Carrillo, Mechanical Engineering
Graduation: December 2013
Hometown: Chandler, Arizona

PRESSURE SENSING LINE LEAKAGE DIAGNOSTICS

Mentor: Keith Holbert, associate professor School of Electrical, Computer and Energy Engineering
Research Theme: Energy
Pressure sensing lines convey the pressure of a large pipe to a less harsh environment for a pressure sensor. The pressure harmonics registered by the sensor can be used to monitor the line for leaks. This research applied previous research to diagnose leaks in sensing lines. A computational method was developed to pinpoint the size and the position of the leak, using the pressure harmonic characteristics. To test the code an experiment was built that replicated the conditions in a power plant. The experiment produced a signal and the leaks were correctly diagnosed. Future research can be done on leak diagnostics in oil or gas lines.
PERFORMING ROTARY MOTION TASKS USING TACTILE SENSOR-DRIVEN FEEDBACK CONTROL

Mentor: Veronica Santos, assistant professor, School for Engineering of Matter, Transport and Energy
Research Theme: Health
Humans use a variety of sensing techniques to determine various characteristics of an object, and these same techniques can be used to facilitate robotic perception. This study focuses on using the sense of touch to teach a robot how to recognize and interact with objects requiring rotary motion. Tactile sensors collect data about contact pressure and vibration, which is used to fine-tune a feedback control algorithm, enabling the robot to complete a task. This study involves interactions with haptic knobs. Future work can expand on this to include more interactions, such as turning a doorknob or opening a bottle.

ULTRAHIGH SENSITIVITY STRAIN SENSING IN SEMICONDUCTOR CHIP APPLICATIONS

Mentor: Hongbin Yu, associate professor, School of Electrical, Computer and Energy Engineering
Research Theme: Energy
The objective of this research is to introduce a new strain sensing technique that can detect very small amounts of localized strain across a large area. This new technique uses a grating in conjunction with an optical setup to measure strains on different substrates such as copper or silicon. There have been several advancements made since last semester, including the ability to directly fabricate the grating as well as improvements in the software so that a strain map can be produced by processing the data. The task now is to distinguish between multi-domain periodicities with the optical setup.

DEVELOPMENT AND APPLICATION OF BIOMUSCLES IN PROSTHETICS

Mentor: Jeffrey LaBelle, assistant professor, School of Biological and Health Systems Engineering
Research Theme: Health
The objective was to design a prosthetic hand, utilizing nitinol actuators that would allow for more dexterity than that of current prosthetics. To do so, a prototype was designed emulating the tendons of the hand, and the force generated by two different actuator prototypes was compared with the force necessary to both move an actual hand and the prosthetic prototype. The actuator prototypes were not found to individually generate sufficient force. Future studies include the investigation of combining the two different actuator designs to generate more force and improving dexterity of the prosthetic by designing a more anatomically correct prototype.

ANALYSIS OF CURRENT COMMERCIAL AIRCRAFT RUNWAY REGULATIONS

Mentor: Timothy Takahashi, professor of practice, School for Engineering Matter, Transport and Energy
Research Theme: Security
The objective of this research is to determine the best practice, in terms of both technique and equipment, for selecting appropriate landing runways for commercial aircraft. In assessing the current situation, research into past runway overruns as well as past and current FAA regulations is being conducted. In addition, interviews of individuals with a background in commercial aviation have been initiated. Upon conclusion of research and interviews, the obtained data will be analyzed to determine the best course of action for future policy.
GENDER DIFFERENCES IN K-12 STUDENT ENGINEERING OUTREACH EFFECTIVENESS

Mentor: Martin Reisslein, professor, School of Electrical, Computer and Energy Engineering
Research Theme: Education
Due to the underrepresentation of women in STEM fields, research is being conducted to determine how male and female students in grades K-12 respond differently to engineering outreach activities. Evaluation data from a sample of the existing engineering outreach activities held by Dr. Reisslein’s group has been collected and used as a basis for comparison. The activities are being modified to appeal better to the female students and data collected again to establish the effectiveness of “female friendly” aspects of the activities. This research aims to determine whether these efforts will encourage female students to pursue careers in STEM fields.

CHEMICAL CELL TO CELL COMMUNICATION ON BIOMINERALIZED NANOPORE SUBSTRATES FOR SINGLE CELL ANALYSIS

Mentor: Michael Goryll, associate professor, School of Electrical, Computer and Energy Engineering
Research Theme: Health
By analyzing communication between cells at the single-cell level, researchers can pinpoint the responses cells have to various chemical stimuli. It is envisioned that cells on biomineralized nanopore substrates can be chemically stimulated so that cell-to-cell chemical communication can be observed, allowing researchers studying diseases to understand interactions between cells. This research will demonstrate how cells can grow on biomineralized nanopore substrates that are mounted on silicon micropore chips. The cells will be grown using cell-culture methods common in similar cell-viability studies. Future work will be focused on collecting cell-to-cell communication data.

COMBINED GENERATION OF SOLAR AND WIND ELECTRICITY – A CASE STUDY FOR DAKAR, SENEGAL

Mentor: Meng Tao, professor, School of Electrical, Computer and Energy Engineering
Research Themes: Energy and Sustainability
While using solar and wind as the main sources of electricity, the goal of this research is to conduct technical studies that will produce more stable output power over a 24-hour period. Data on both solar intensity and wind speed have been collected for on the region of study, Dakar, Senegal, in order to demonstrate the concept. Using real efficiencies of both systems, different sizes of solar panels and wind generators will be combined to make the overall power output more stable over 24 hours. This study will provide advice for policy makers on effective deployment of sustainable energy sources.

PROTEIN RESEARCH TO DISCOVER DIAGNOSTICS AND THERAPEUTICS FOR ALZHEIMER’S DISEASE

Mentor: Michael Sierks, professor, School for Engineering of Matter, Transport and Energy
Research Theme: Health
Alzheimer’s disease is among the top 10 leading causes of death in the United States with no current cure or treatment. What can be done to combat this disease? Dr. Sierk’s lab is extensively studying Alzheimer’s to discover a diagnostic and therapeutic for this disease. The target of the research is beta-amyloid protein, which causes major problems in the brain when it misfolds and accumulates. The focus of this project is to research and determine the optimal method to produce the highest yield of functional antibody for the purpose of finding a diagnosis for Alzheimer’s disease.
ASSESSING THE RELATIONSHIP BETWEEN THERMAL COMFORT AND STUDENT ENGAGEMENT

Mentor: Kristen Parrish, assistant professor, School of Sustainable Engineering and the Built Environment
Research Theme: Engineering Education
This project explores the relationship between thermal comfort, that is, how comfortable a human is in their built environment, and student engagement in a higher education environment. Preliminary findings show a relationship between these two variables. Using assumed posterior distributions and prior research, this project models engagement and comfort mathematically, and combines these models using Bayesian analysis. The research will continue in Spring 2014, and the models will be validated using data collected from engineering students. Evidence of relationship between thermal comfort and student engagement can provide an argument for how green building designs can improve student success.

AN EXAMINATION OF THE BIOMEDICAL ENGINEERING CURRICULUM

Mentor: Jeffrey Kleim, associate professor, School of Biological and Health Systems Engineering
Research Theme: Engineering Education
This project studies the current undergraduate engineering education model employed by Arizona State's School of Biological and Health Systems Engineering. The research is based upon feedback provided by the program's alumni of skills they did or did not have upon graduation that they feel are critical to have in the workforce. After having compiled a list of suitable alumni to contact, the project now consists of collecting this feedback before analysis and possible recommendations to improve the program's efficacy can be made.

DEVELOPMENT OF A GLYCATED ALBUMIN MULTIMARKER SENSOR FOR DIABETES MANAGEMENT

Mentor: Jeffrey LaBelle, assistant professor, School of Biological and Health Systems Engineering
Research Theme: Health
A new sensor is being developed to provide more information for diabetics on a daily basis. Data was obtained to show that an electrochemical technique, EIS, could be used to measure concentrations of a protein, albumin, and its counterpart, glycated albumin. EIS was used to measure electrical impedance for different concentrations of the proteins and find the best frequency of alternating current to measure impedance. From this experiment, a best-fit line was found comparing concentration to impedance. Future work should be done to combine marker sensing on a single sensor and to develop the instrumentation of the device.

THE INFLUENCE OF INJURY SEVERITY ON ENDOGENOUS REGENERATION AFTER TRAUMATIC BRAIN INJURY

Mentor: Sarah Stabenfeldt, assistant professor, School of Biological and Health Systems Engineering
Research Theme: Health
The objective of this project was to evaluate chemotactic chemical signals that may influence the migration of neural stem cells after brain injury (TBI). A rodent TBI model was used to generate tissue samples that were homogenized to assess protein levels based on anatomical region. Specifically, the level of stromal cell derived factor-1α (SDF-1α) was investigated with respect to injury severity. In general, the level of SDF-1α increased with injury severity. The future work for this project is to utilize information on protein expression and other factors to develop therapeutic treatment for TBI.
TOWARDS THE DEVELOPMENT OF WEB AND MOBILE TOOLS FOR MODELING, ANALYSIS, SIMULATION, ANIMATION, DESIGN AND CONTROL OF COMPLEX UNCERTAIN DYNAMICAL SYSTEMS

Mentor: Armando Rodriguez, professor, School of Electrical, Computer and Energy Engineering
Research Theme: Education
This project proposes to develop web and mobile tools for Modeling, Analysis, Simulation, Animation, Design and Control of Complex Uncertain Dynamical Systems in order to benefit systems researchers, as well as students in controls. The tools are comprised of the mobile user interface on Android, PC user interface, data analysis backend using Golang and Revel, and Interactive Computer-Aided Lessons (ICALs). The system is capable of taking multiple input variables and computing results based on a MATLAB model design. Future research will implement support for video lectures, social media interaction and solicitation testing and feedback from systems researchers and students.

MOLECULE CHARACTERIZATION USING NANO-FLUIDIC TRANSISTORS

Mentor: Michael Goryll, associate professor, School of Electrical, Computer and Energy Engineering
Research Theme: Health
The objective of this project was to use existing MOSFET transistor manufacturing technologies to create a Nano-fluidic transistor device using bio-mineralized Nano-pore membranes. Samples were coated first with an electrically conductive aluminum layer using electron-beam evaporation, followed by an electrically insulating layer, deposited via Atomic Layer Deposition. This arrangement allowed an electrostatic bias to be applied to the Nano-pores to change their permeability for salt ions and molecules. It was proven experimentally that the Nano-pores remained open after layer deposition and that the conductive layer remained properly insulated in salt solutions. Future work will be aimed at electrical biasing for selective passing of nano-particles.

FORCE-SOUND COUPLING FOR HAPTIC FEEDBACK DURING ROBOTIC CONTROL

Mentor: Panagiotis Artemiadis, assistant professor, School of Engineering of Matter, Transport and Energy
Research Theme: Health
When using robotic end effectors to interact with environments, whether in neuro-prosthetics, exoskeletons or robotic teleoperation, it's crucial for the user to be able to receive feedback from the system. Current brain-machine interface systems rely heavily on visual feedback, which lacks details about the contact forces and weights involved in dexterous tasks. This project proposes a new cross-modal feedback method in which contact forces are perceived through sound. Using volume to represent force magnitude and frequency to represent force location, the feedback method has shown to be successful in providing tactile information while staying realistic and non-invasive to the user.

SYNTHESIS OF NANOSTRUCTURED MATERIALS FOR SOLID-STATE LITHIUM-ION BATTERY ELECTROLYTES

Mentor: Candace Chan, assistant professor, School for Engineering of Matter, Transport and Energy
Research Theme: Energy
Modern lithium-ion batteries contain a reactive electrolyte which can violently ignite at higher temperatures. The objective of this research is to decrease the risk posed by the liquid electrolyte by replacing it with a nanostructured metal oxide solid electrolyte. The focus has been to template a potential solid electrolyte, Li7La3Zr2O12 (LLZO), on various forms of metal oxide solid electrolyte. The focus has been to decrease the risk posed by the liquid electrolyte by replacing it with a nanostructured metal oxide solid electrolyte. The focus has been to template a potential solid electrolyte, Li7La3Zr2O12 (LLZO), on various forms of metal oxide solid electrolyte. The focus has been to template a potential solid electrolyte, Li7La3Zr2O12 (LLZO), on various forms of metal oxide solid electrolyte. The focus has been to template a potential solid electrolyte, Li7La3Zr2O12 (LLZO), on various forms of metal oxide solid electrolyte. The focus has been to template a potential solid electrolyte, Li7La3Zr2O12 (LLZO), on various forms of metal oxide solid electrolyte. The focus has been to template a potential solid electrolyte, Li7La3Zr2O12 (LLZO), on various forms of metal oxide solid electrolyte. The focus has been to template a potential solid electrolyte, Li7La3Zr2O12 (LLZO), on various forms of metal oxide solid electrolyte. The focus has been to template a potential solid electrolyte, Li7La3Zr2O12 (LLZO), on various forms of metal oxide solid electrolyte. The focus has been to template a potential solid electrolyte, Li7La3Zr2O12 (LLZO), on various forms of metal oxide solid electrolyte. The focus has been to template a potential solid electrolyte, Li7La3Zr2O12 (LLZO), on various forms of metal oxide solid electrolyte. The focus has been to template a potential solid electrolyte, Li7La3Zr2O12 (LLZO), on various forms of metal oxide solid electrolyte. The focus has been to template a potential solid electrolyte, Li7La3Zr2O12 (LLZO), on various forms of metal oxide solid electrolyte. The focus has been to template a potential solid electrolyte, Li7La3Zr2O12 (LLZO), on various forms of metal oxide solid electrolyte. The focus has been to(template process.

Scanning-electron microscopy (SEM) has been used to determine the effect of the LLZO structure in the template process. Future work will involve varying the parameters to determine the effect of the LLZO structure in the template process.
Desulfovibrio. DBP for debrominators, which most likely are Dehalococcoides. Future work involves enriching a culture of Dehalococcoides. 16S rRNA gene of Dehalococcoides indicated debromination, but qPCR tests targeting the enzyme in recombinant E. coli has been performed demonstrating its rapid action. Experiments yielded rapid dechlorination and potentially debrominating microbes. Experiments yielded rapid dechlorination and debromination, but qPCR tests targeting the 16S rRNA gene of Dehalococcoides indicated Dehalococcoides is not debrominating. Future work involves enriching a culture of DBP for debrominators, which most likely are Desulfovibrio.
Benjamin Havens, Civil Engineering
Graduation: December 2015
Hometown: Lewiston, Idaho

Emily Herring, Biomedical Engineering
Graduation: May 2016
Hometown: Litchfield Park, Arizona

Trent Hoffman, Aerospace Engineering
Graduation: May 2014
Hometown: Chandler, Arizona

Conrad Hom, Chemical Engineering
Graduation: May 2015
Hometown: Tucson, Arizona

THE TALL TOWER

Mentor: Keith Hjelmstad, professor, School of Sustainability and the Built Environment
Research Themes: Sustainability

The main intent of The Tall Tower project is to create a feasible model of a 20 km tall structure with the purpose of launching rockets to reduce cost. The basic concept was fostered on verifying the idea that it is possible to build something this extravagant using only the materials the researchers currently have access to today. From these initial steps, the project has become a cornerstone of breakthrough constructional and sustainable concepts such as welding in below negative sixty degree Fahrenheit temperatures and attempting to harness the jet stream’s wind energy blowing at speeds of more than 250 mph.

NEURAL CORRELATES OF ATTENTION AND CONTROL DURING DRIVING USING A RAT MODEL

Mentor: Jennie Si, professor, School of Electrical, Computer and Energy Engineering
Research Theme: Health

The research question investigated was “How do high-order cognitive functions take place in a rat's cortical neural network for performing tasks such as driving that require attention and control at the same time?” This was investigated by implanting behaviorally prepared rats with electrodes in the medial and lateral agranular areas. This was done to broadly sample a large frontal area. The recorded data was extracted for distinct neural spikes. It appeared that the recorded neurons were task factor selective. It has been decided that research will be continued in order to specify the neural correlates with certain task factors.

ANALYSIS OF BLADE VORTEX INTERACTION (BVI) TO MITIGATE ROTOR AIRCRAFT NOISE LEVELS

Mentor: Valana Wells, associate professor, School for Engineering of Matter, Transport and Energy
Research Theme: Security

Excessive noise generated by rotor blades hampers both civilian and military helicopter operations. This project utilizes a NASA fluid-dynamics code, OVERFLOW, to simulate a 2-D model of rotor blade-vortex interaction (BVI), which is known to be a major source of impulsive rotor noise. The vortex is generated by quickly increasing the angle of attack of an upstream airfoil; the vortex travels downstream and interacts with the study airfoil. The vortex causes sudden changes in pressure on the downstream airfoil, thereby rapidly altering aerodynamic forces and generating strong acoustic signals. Variations in lift and drag due to BVI are illustrated and discussed.

SYNTHESIS OF CORE-SHELL COMPOSITE POLYMERIC IONIC LIQUID-SILICA MICROGELS VIA ONE-STEP PICKERING EMULSION POLYMERIZATION

Mentor: Lenore Dai, professor, School of Engineering of Matter, Transport and Energy
Research Theme: Energy, Health

Pickering emulsions (or solid stabilized emulsions) have received increased attention due to their differences comparing to conventional emulsions and their tremendous applications. Ionic liquids are unique liquid materials composed of large, sterically hindered ions; with polymeric ionic liquids (PILs) being their polymerized form. The researchers have successfully synthesized PILs and explored the development of polymeric ionic liquid-silica core-shell composite microparticles via a one-step Pickering emulsion polymerization route. These core-shell microparticles are anticipated to yield unique applications due to the charged nature of the polymeric liquid and the robustness of the silica shell.

Ira A. Fulton Schools of Engineering engineering.asu.edu
experimentation and characterization. 
of the membranes will continue, followed by 
been conducted on test membranes. Synthesis 
and characterized, and preliminary testing has 
to these membranes have been synthesized 
expenditures of production. The components 
which would thus reduce total energy 
current ethanol manufacturing techniques, 
These Mixed Matrix Membranes would enhance 
greenhouse gas emissions than other fuels. 
a biofuel that, when burned, produces fewer 
recover ethanol from water/ethanol solutions 
Inclusion Nano Composite (ZIFINC) 
The objective of this research is to develop 
Research Theme: Energy 
Mentor: Mary Laura Lind, assistant professor, 
School of Engineering of Matter, Transport and 
Energy 
Research Theme: Energy 
The objective of this research is to develop 
free-standing Zeolitic Imidazolate Framework 
Inclusion Nano Composite (ZIFINC) 
membranes and quantify their abilities to 
recover ethanol from water/ethanol solutions 
through pre evaporative processes. Ethanol is 
a biofuel that, when burned, produces fewer 
greenhouse gas emissions than other fuels. 
These Mixed Matrix Membranes would enhance 
current ethanol manufacturing techniques, 
which would thus reduce total energy 
expenditures of production. The components 
to these membranes have been synthesized 
and characterized, and preliminary testing has 
been conducted on test membranes. Synthesis 
of the membranes will continue, followed by 
experimentation and characterization. 

Cheslea Howard, Chemical Engineering 
Graduation: May 2015 
Hometown: Phoenix, Arizona 

Khateeb Hussain, Biomedical Engineering 
Graduation: May 2014 
Hometown: Scottsdale, Arizona 

Lisa Irinata, Biomedical Engineering 
Graduation: May 2015 
Hometown: Peoria, Arizona 

James Jensen, Aeronautical Engineering 
Graduation: May 2014 
Hometown: San Jose, Arizona 

ANALYSIS OF FREE STANDING 
ZEO LITIC IMIDAZOLATE FRAM EWORK 
INCLUSION NANO COMPOSITE (ZIFINC) 
MEMBRANES ON ETHANOL/WATER 
SEPARATIONS 
Mentor: Mary Laura Lind, assistant professor, 
School of Engineering of Matter, Transport and 
Energy 
Research Theme: Energy 
The objective of this research is to develop 
free-standing Zeolitic Imidazolate Framework 
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membranes and quantify their abilities to 
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to these membranes have been synthesized 
and characterized, and preliminary testing has 
been conducted on test membranes. Synthesis 
of the membranes will continue, followed by 
experimentation and characterization. 

DEVELOPMENT OF A NOVEL SMART 
CONTRAST AGENT FOR MAGNETIC 
RESONANCE IMAGING 
Mentor: Vikram D. Kodibagkar, assistant 
professor, School of Biological and Health 
Systems Engineering 
Research Theme: Health 
Currently, the most commonly used contrast 
agents for Magnetic Resonance Imaging are 
gadolinium-based agents. Patients with renal 
insufficiency or dysfunction are at risk of 
developing nephrogenic systemic fibrosis when 
exposed to gadolinium-based agents. The goal 
of this research is to develop a novel iron-based 
contrast agent that is safer than traditional 
gadolinium agents and can be selectively 
activated noninvasively. Transmission Electron 
Microscopy, Nuclear Magnetic Resonance 
and cell culture growth assays were used to 
characterize the physical, magnetic and 
cytotoxic properties of candidate nanoprobes. 
Future work will be focused on generating and 
characterizing photo-active “smart” analogues of 
the nanoprobes. 

THE EFFECTS OF BRAINSTEM 
NORADRENERGIC LESIONS OF 
CRANIAL MOTOR FUNCTION 
Mentor: Jeffrey Kleim, associate professor, 
School of Biological and Health Systems 
Engineering 
Research Theme: Health 
Crani al motor impairments associated 
with Parkinson Disease can be attributed 
to the depletion of the neurotransmitter 
norepinephrine in the locus coeruleus. A 
comprehensive animal model mimicking 
behavioral impairments is critical in advancing 
motor functionality treatments. A behavioral 
assay to measure cranial motor function in rats, 
including tests of tongue extension and chewing 
frequency was developed. The first task 
teaches tongue extension required to receive 
a water reward. The second task measures the 
frequency and amplitude of acoustic signals 
generated by the animal eating. These tasks aid 
in assessing damage to the locus coeruleus and 
consequent effects on cranial motor function. 

DEVELOPMENT OF MAXIMUM LIFT 
AIRFOIL DESIGN METHODOLOGY 
Mentor: Valana Wells, associate professor, 
School of Engineering of Matter, Transport and 
Energy 
Research Theme: Sustainability, Security and 
Education 
This research is aimed at developing a 
method for designing high lift airfoils based 
on maximizing the pressure difference across 
their upper and lower surfaces through the use 
of Liebeck’s method. It is possible to use the 
inverse airfoil design method outlined by Weber 
to obtain the airfoil geometry that produces 
the desired pressure distribution. Following the 
Liebeck and Weber methods will yield an airfoil 
with maximum lift for given conditions. The 
end goal of the research is to develop a robust 
design method that can be utilized for various 
levels of analysis.
**Jeremy Johnson**, Mechanical Engineering  
Graduation: December 2013  
Hometown: Kirchardt, Germany

**Perturbation of Lower Extremities**

Mentor: Panagiotis Artemiadis, assistant professor, School for Engineering of Matter, Transport and Energy  
Research Theme: Health  
The objective of this research is to increase the effectiveness of perturbation-based therapy on the lower extremities of gait-impaired patients. For this purpose a robotic arm is attached to the hip of a subject and conducts the perturbations as the subject walks on a treadmill. A Microsoft Kinect monitors the lower extremities of the subject in order to time the perturbations and acquire motion data. To date, this experiment has been conducted on four healthy subjects with inconclusive results. Further evaluation of the data collected needs to be conducted for a better evaluation.

**Jessica Johnson**, Chemical Engineering  
Graduation: May 2015  
Hometown: Anthem, Arizona

**Transport-Enhanced Thermogalvanic Energy Conversion**

Mentor: Patrick Phelan, professor, School of Engineering of Matter, Transport and Energy  
Research Theme: Sustainability  
Thermogalvanic cells have been largely explored because of their potential to convert low-temperature waste heat to electricity. The main complication with the fluid thermogalvanic cell is that it’s difficult to simultaneously maximize the ion transport, while minimizing thermal transport. Through recent experimentation, an electrode/electrolyte combination was found to produce a maximum power from the system; the combination consists of an electrode of Copper wire (Cu) with an electrolyte solution containing 5 mM PAA (Polymer). This has generated a Seebeck coefficient value ($\alpha$) of about 1.5 mV/K. Future exploration is to find whether or not using a higher quality of polymer will increase the Seebeck coefficient value, which in turn increases the overall power of the system.

**Scott Jones**, Electrical Engineering  
Graduation: May 2014  
Hometown: Tucson, Arizona

**Fourier Phase Recovery**

Mentor: Douglas Cochran, associate professor, School of Electrical, Computer and Energy Engineering  
Research Theme: Security  
Using iterative functional analytic methods, there is a very high probability that signal phase can be recovered from a set of magnitude-only measurements of the signal. Various recovery methods were implemented and compared on a basis of recovered signal fidelity and robustness in the presence of measurement noise. Recovery algorithms studied include iterative Fourier transformation of a set of zero padded measurements, compressive sensing motivated matching pursuit under the constraint of a sparse solution, and quadratic reduction via phase lifting. Future work will investigate applications to radar detection.

**Paul Juneau**, Biomedical Engineering  
Graduation: May 2014  
Hometown: Phoenix, Arizona

**Development of Calcium Alginate Hydrogel for Cardiac Stem Cell Delivery**

Mentor: Brent Vernon, associate professor, School of Biological and Health Systems Engineering  
Research Theme: Health  
Heart failure is one of the leading causes of death worldwide. An emerging less-invasive treatment is called cardiac stem cell therapy. The goal is to engineer calcium alginate hydrogels to become an optimal cardiac stem cell delivery agent for targeted damaged heart tissue. Hydrogels are promising cell delivery devices due to their high water content and favorable biocompatibility. Thus far, the gel has shown increased mechanical strength when encapsulating a surgical mesh along with successful binding of an amino acid to the gel’s polymer backbone; suggesting future cell migration success. Cell compatibility tests need to be done.
HIGH EFFICIENCY ELECTRONICS FOR SPACE APPLICATIONS

Mentor: Trevor Thornton, professor, School of Electrical, Computer and Energy Engineering
Research Theme: Security
Radiation tolerant electronics have been developed so that complex electrical systems, such as satellites, can function in space. Dr. Thornton’s research group develops radiation tolerant transistors, known as MESFETs that are fabricated at commercial semiconductor foundries. Once returned, the electrical characteristics of the devices are measured. These measurements have been performed on the latest devices from IBM’s 32-nanometer process. Future work includes plans to subject the transistors to radiation and temperature stresses and measure the resulting impact in performance.

IDENTIFYING ELECTROPHYSIOLOGICAL BIOMARKERS OF GENE MODULATION IN THE ALZHEIMER’S DISEASE PATHWAY

Mentor: Jitendra Muthuswamy, associate professor, School of Biological and Health Systems Engineering
Research Theme: Health
The potential contribution of genes to Alzheimer’s disease is typically determined using conventional protein measurements. Electrophysiology can be used instead as a real-time, non-invasive assessment. The objective of this project is to assess the electrophysiological impact of modulating the genes GAPDH and BACE1. Electrical signals were recorded from rat hippocampal neurons cultured on microelectrode devices. Either GAPDH or BACE1 was “switched off” in each culture and the electrical signals were again recorded and analyzed. Distinct changes in the signals were measured and quantified. Further research will involve more sophisticated signal analysis and an assessment of the gene S100B.

FEATURE SELECTION AND TIME-FREQUENCY PROCESSING OF BIOLOGICAL MICROARRAY DATA FOR CLASSIFYING DISEASES

Mentor: Antonia Papandreou-Suppappola, professor, School of Electrical, Computer and Energy Engineering
Research Theme: Health and Security
Immunosignature is a diagnostic medical tool that detects and identifies diseases. There are several immunosignaturing approaches to develop an individual’s antibody profile. A large microarray of peptide sequences bind to antibodies in a blood sample associated with a disease. The overall data of peptide intensities, based on the strength of the bindings, is reduced and randomly sampled through an adaptive algorithm and grouped into clusters by an unidentified disease. In this research, the processes and signal-processing techniques of the adaptive algorithm will be analyzed, where future work will be towards developing methods to identify diseases.
attraction of the antibody to the protein was the sample. Based off of the experiment, the intensity of the antigen and antibody to show conjunction with a spectrometer to quantify the enzyme-linked immunosorbent assay is used in purify the single-chain variable fragment before protein liquid chromatography are used to the purpose of Parkinson's disease diagnosis. used to identify alpha-synuclein antigen for chain variable fragment (scFv) that can be The project aims to target a specific single- Engineering of Matter, Transport and Energy Mentor: Michael Sierks, professor, School for Engineering of Matter, Transport and Energy Research Theme: Health The project aims to target a specific single-chain variable fragment (scFv) that can be used to identify alpha-synuclein antigen for the purpose of Parkinson's disease diagnosis. Processes like tangential filtration and fast protein liquid chromatography are used to purify the single-chain variable fragment before being tested with the Western blot. Finally, the enzyme-linked immunosorbent assay is used in conjunction with a spectrometer to quantify the intensity of the antigen and antibody to show how much of each target species is present in the sample. Based off of the experiment, the attraction of the antibody to the protein was confirmed.

Michael Kim, Chemical Engineering Graduation: May 2016 Hometown: Atlanta, Georgia

Kody Klimes, Mechanical Engineering Graduation: December 2013 Hometown: Phoenix, Arizona

Luis Laitano, Biomedical Engineering Graduation: May 2014 Hometown: Tegucigalpa, Honduras

Alexandria Lam, Biomedical Engineering Graduation: May 2016 Hometown: Glendale, Arizona

EXPRESSION AND PURIFICATION OF SINGLE-CHAIN VARIABLE FRAGMENT FOR THE DETECTION OF ALPHA SYNucleIN ANTIGEN VIA ENZYME-LINKED IMMUNOSORBENT ASSAY

Mentor: Michael Sierks, professor, School for Engineering of Matter, Transport and Energy Research Theme: Health

The project aims to target a specific single-chain variable fragment (scFv) that can be used to identify alpha-synuclein antigen for the purpose of Parkinson's disease diagnosis. Processes like tangential filtration and fast protein liquid chromatography are used to purify the single-chain variable fragment before being tested with the Western blot. Finally, the enzyme-linked immunosorbent assay is used in conjunction with a spectrometer to quantify the intensity of the antigen and antibody to show how much of each target species is present in the sample. Based off of the experiment, the attraction of the antibody to the protein was confirmed.

ENHANCED EXTERNAL QUANTUM EFFICIENCY EMPLOYING ORGANIC ANODE INTERFACIAL LAYERS

Mentor: Jian Li, associate professor, School for Engineering of Matter, Transport and Energy Research Theme: Energy

Research into the field of small molecular organic photovoltaics has experienced steady growth over the past decade due to their potential to be a cheap clean source of energy. In this presentation the researchers demonstrate the simultaneous enhancement in fill factor, open circuit voltage and short circuit current in planar heterojunction devices through the introduction of organic anode interfacial layers. By using these organic templating layers, the researchers observed enhancement in excitation diffusion, as well as improving the crystallinity and preferentially orienting the molecules of the donor material. These improvements result in an overall increase in power conversion efficiency.

CHARACTERIZATION OF GELATIN-HYALURONIC ACID HYDROGELS FOR THREE-DIMENSIONAL GLIOMA CELL CULTURE AND ISOLATION

Mentor: Brent Vernon, associate professor, School of Biological and Health Systems Engineering Research Theme: Health

Regarding brain cancer, the most frequent and deadly is Glioblastoma multiforme. In order to effectively test different treatments on these tumors, a 3-D cell culture platform that mimics the cerebral extra-cellular matrix (ECM) can be devised through Hyaluronic Acid (HA) and Gelatin hydrogels. To find the most appropriate hydrogel strength to mimic cerebral ECM, different parameters such as concentrations and pH must be modulated and the resulting hydrogels tested. The strength of the hydrogels increases as the concentration increases; these range from 5Pa to 15kPa. In the future, different treatments will be tested on tumor cells cultured in the hydrogels.

ELECTROCHEMICAL ASSESSMENT OF GLUTAMATE AS A TARGET FOR BIOSSENSOR DETECTION OF TRAUMATIC BRAIN INJURY

Mentor: Jeffrey LaBelle, assistant professor, School of Biological and Health Systems Engineering Research Theme: Health

Glutamate has been found in high levels within the brain following traumatic brain injury. A blood biosensor continuously monitoring concentrations of glutamate would allow physicians to more rapidly and accurately assess the degree of TBI without the expense or invasiveness of current tests. In this study, the electrochemical activity of glutamate was characterized through cyclic voltammetry, amperometric i-t and electrochemical impedance spectroscopy (EIS). The techniques were used to find specifications for the biosensor, the optimal frequency at which the binding occurs. Future work includes testing the sensor’s reactivity with non-targets and detection of glutamate in the presence of non-targets.
OPTIMIZING LEARNING AND BIOFEEDBACK IN AN EEG-BASED BRAIN-COMPUTER INTERFACE

Mentor: Stephen Helms Tillery, associate professor, School of Biological and Health Systems Engineering
Research Theme: Health
Brain-computer interface technology establishes communication between the brain and a computer, allowing users to control virtual objects using their thoughts. This study investigates optimal conditions to facilitate learning to operate this interface. It compares two biofeedback methods, which dictate the relationship between brain activity and the movement of a virtual ball in a target-hitting task. Preliminary results indicate that a method in which the position of the virtual object directly relates to the amplitude of brain signals is most conducive to success. Future BCI projects will be advised by these methods, to create the most intuitive and reliable BCI possible.

Jenessa Lancaster, Biomedical Engineering
Graduation: May 2014
Hometown: Phoenix, Arizona

Brett Larsen, Electrical Engineering
Graduation: May 2015
Hometown: Chandler, Arizona

HARDWARE IMPLEMENTATION OF DENOISING ALGORITHMS FOR NANOPORE SENSING

Mentor: Michael Goryll, associate professor, School of Electrical, Computer and Energy Engineering
Research Theme: Security
Effective biosensors continue to be a critical research area for both defense and medical applications. In particular, silicon pores with diameters in the range of micro/nanometers have demonstrated the ability to detect an array of analytes based on the amplitude and duration of the current flowing across the chamber. In order to effectively use such sensors, however, robust denoising and classification algorithms must also be developed. In this work, the NpGoDec algorithm was programmed onto a Field Programmable Gate Array (FPGA) for on-chip, biosensor processing. The system was carefully investigated for accuracy and processing time as compared to simulated data.

Ching Yan Lau, Chemical Engineering
Graduation: May 2015
Hometown: Hong Kong, China

CHARACTERIZATION OF THIN SUPPORTED FILMS OF ZEOLITE IMIDAZOLATE FRAMEWORK INCLUSION NANOCOMPOSITE MEMBRANES FOR PERVAPORATIVE RECOVERY OF BIOFUELS

Mentor: Mary Laura Lind, assistant professor, School for Engineering of Matter, Transport and Energy
Research Theme: Sustainability
Zeolite Imidazolate Framework Inclusion NanoComposite membranes show promising capabilities for the pervaporative recovery of biofuels. Pervaporation is a membrane process driven by chemical activity that separates a solution through a semi-permeable membrane layer. This membrane layer is synthesized from polydimethylsiloxane (PDMS) which allows thermal stability and chemical inertness and Zeolite Imidazolate Framework nanocrystals (ZIF-71) which allows precisely defined pore structures suitable for separations. The pervaporation system characterizes the membrane’s ability to separate ethanol from water and the flux permeating through the membrane to determine the overall success. Future work includes different methods for PDMS/ZIF-71 membrane synthesis.

Brady Laughlin, Biomedical Engineering
Graduation: Spring 2015
Hometown: Phoenix, Arizona

COMBINATORIAL LIBRARY OF SYNTHETIC TRANSCRIPTION FACTORS

Mentor: Karmella Haynes, assistant professor, School of Biological and Health Systems Engineering
Research Theme: Health
Pc-TF, a synthetic transcription factor developed by Dr. Haynes, regulates cell states by binding the trimethyl-histone H3 lysine 27 signal (H3K27me3) and switching silenced genes to an active state. DNA assembly will be used to build a combinatorial library of synthetic transcription factors (Pc-TFs) that will activate therapeutic genes in cancer cells. To produce purified Pc-TF, constructs were tagged with a 6-histidine peptide, inserted into a mammalian cell expression vector, and transfected into U2OS cells. Pc-TF expression was visualized by microscopy as a red fluorescent signal. Pc-TF will be purified from cell extracts and tested for H3K27me3 binding in vitro.
PASSIVATION OF SILICON USING NOVEL SPRAY PYROLYSIS OF ALUMINUM OXIDE

Mentor: Meng Tao, professor, School of Electrical, Computer and Energy Engineering
Research Theme: Energy
This project is to increase the efficiency of silicon solar cells by passivating the surface with aluminum oxide. The researchers will employ spray pyrolysis for this task, which is a low-cost simple process suitable for this purpose. Experiments have been set up to deposit aluminum oxide onto silicon; and the properties of the film will be measured. The chemicals for spray deposition and their concentrations in the spray solution have been determined. Experimental investigation will be performed on the effectiveness of these aluminum oxide films on passivation of silicon surface.

SIGNAL PROCESSING OF BIOLOGICAL MICROARRAY DATA FOR DISEASE DETECTION AND CLASSIFICATION

Mentor: Antonia Papandreou-Suppappola, professor, School of Electrical, Computer and Energy Engineering
Research Theme: Security, Health
The research project focuses on analyzing large biological data-sets such that disease can be identified from patient blood samples alone. Using signal processing techniques, diagnosis can be faster and more accurate than symptom-based methods. When blood is bonded to the peptides in a large micro-array, the type and intensity of that bond (features) indicates possible diseases. Thus far, the Bayesian algorithm the researchers use clusters each unknown data-set according to its most distinctive features. The clusters can then be identified as containing a specific disease. Future work will involve identifying individual stages within a disease and expanding identification methods.
Specroscopy (DRIFTS) analyses. Diffuse Reflectance Fourier Transform Infrared N2 fed over the catalyst was determined using formed from UV irradiation of CO2, H2O and the modified catalyst. The identity of products analyses were completed for characterization of (XRD) and Brunauer-Emmett-Teller (BET) was completed in this study. X-ray diffraction of a copper modified titanium dioxide catalyst of sustainably generated fuel, specifically a gas CO2 (in the presence of water vapor) the light-initiated conversion of the greenhouse The light-initiated conversion of the greenhouse gas CO2 (in the presence of water vapor) over a catalyst provides a potential source of hydrocarbon such as methane. The synthesis of a copper modified titanium dioxide catalyst was completed in this study. X-ray diffraction (XRD) and Brunauer-Emmett-Teller (BET) analyses were completed for characterization of the modified catalyst. The identity of products formed from UV irradiation of CO2, H2O and N2 fed over the catalyst was determined using Diffuse Reflectance Fourier Transform Infrared Spectroscopy (DRIFTS) analyses.

**COPPER-CONTAINING CATALYSTS FOR THE CONVERSION OF CO2 TO FUELS USING LIGHT**

Mentor: Jean Andino, associate professor, School of Engineering Matter, Transport and Energy
Research Themes: Energy and Sustainability
The light-initiated conversion of the greenhouse gas CO2 (in the presence of water vapor) over a catalyst provides a potential source of sustainably generated fuel, specifically a hydrocarbon such as methane. The synthesis of a copper modified titanium dioxide catalyst was completed in this study. X-ray diffraction (XRD) and Brunauer-Emmett-Teller (BET) analyses were completed for characterization of the modified catalyst. The identity of products formed from UV irradiation of CO2, H2O and N2 fed over the catalyst was determined using Diffuse Reflectance Fourier Transform Infrared Spectroscopy (DRIFTS) analyses.

**DIFFERENTIATING BETWEEN A HARDNESS GRADIENT GIVEN RESTRICTED FINGER MOBILITY**

Mentor: Stephen Helms Tillery, associate professor, School of Biological and Health Systems Engineering
Research Theme: Health
This project is intended to test an individual’s ability to differentiate hardness within a gradient, and determine where that perception originates from: the mechanics of the fingers or the fingertips. Participants were blindfolded and placed in an arm-immobilizing device, then asked to differentiate hardness levels between a randomized set of ballistic gelatin cubes (designed to represent an array of hardness levels). As anticipated, an individual’s ability to determine differences in hardness levels decreased greatly as the differences in hardness between two cubes decreased. Using this information, the project will be altered to analyze hardness differentiation between cubes ranging in size.

**ENERGY DASHBOARDS AND THEIR INFLUENCE ON HUMAN BEHAVIOR**

Mentor: Kristen Parrish, assistant professor, School of Sustainable Engineering and the Built Environment
Research Theme: Sustainability
An energy dashboard is an interactive display allowing viewers to see real-time energy use in a building. These dashboards are shown to affect human behavior; however, how influential are they? This research focuses on ASU’s energy dashboard, Campus Metabolism. Over 100 students were surveyed on the Tempe Campus, and were asked to rate the visual appeal and content of Campus Metabolism, as well as its related effort on certain energy-saving behaviors. This survey will ultimately provide insight to effective energy displays, and will highlight the importance of graphic design and content when using dashboards to promote more energy-efficient occupant behavior.

**USING OPTIMIZATION TECHNIQUES IN PROBABILISTIC BASED METHODS FOR SUSTAINABLE ENGINEERING DESIGNS**

Mentor: S.D. Rajan, professor, School of Sustainable Engineering and the Built Environment
Research Theme: Sustainability
For many engineering problems, a better structural design can be created by using computer models in order to mathematically find the optimal solution to best suit a certain set of criteria. Here, these models will be created using techniques from the mathematical branches of optimization and probability. This will be used to create more accurate tools for solving such problems in the future and for creating more effective engine-containment systems for commercial jets.
levels ($pO_2$). Future work will include the implementation of an in vivo experiment that were evaluated. The model yields a hypoxia-oxygenation ($O_{hypoxia}$) in the imaged tissue, a trait common to tumors. The model uses Magnetic Resonance (MR) image data for hypoxia-targeting contrast agent to quantify the presence of hypoxia (poor oxygenation) in the imaged tissue, a trait common to tumors. The model yields a hypoxia-dependent parameter that was used to analyze MR data for hypoxia-targeting contrast agent in tumor-bearing rats. Using solutions to this model, the responses of two different tumors in vivo to pure oxygen breathing conditions were evaluated. Future work will include the implementation of an in vivo experiment that will allow the direct calculation of tissue oxygen levels ($pO_2$).

**TRAVEL GRANT**

**Stephanie Maxwell**, Biomedical Engineering
Graduation: May 2014
Hometown: Chandler, Arizona

**IMPLEMENTING A FOUR-YEAR DESIGN SPINE CURRICULUM IN BIOMEDICAL ENGINEERING**

Mentor: Jeffrey LaBelle, assistant professor, School of Biological and Health Systems Engineering
Research Theme: Education

It has been determined that students in Biomedical Engineering (BME) need hands-on learning, early engagement, motivation to learn their field, exposure to entrepreneurship, global awareness, education in finding problems—not looking for solutions only, and interaction with BME faculty. To address this challenge, the school is incorporating the design method into the curriculum starting from day one and continuing all the way through senior year. This will allow BME students to become familiar with the field they are entering as well as what industry expects, promoting a deeper understanding of BME.

**Sanya Mehta**, Chemical Engineering
Graduation: May 2016
Hometown: San Jose, California

**ALGAL BIOFUELS: RECLAMATION OF EXCESS BIOMASS**

Mentor: Morteza Abbaszadegan, professor, School of Sustainable Engineering and the Built Environment
Research Theme: Energy

The goal to optimize algal biofuel production has led many research initiatives to unveil limiting factors and potential solutions. The purpose of this research is to identify and analyze the impact of virus infectivity on the phototrophic microorganisms, cyanobacteria and microalgae, which are biofuel feedstock candidates for use by energy companies. After confirmation of viral contamination, this research has gone further to identify the virus by molecular techniques, perform electron microscopy for visualization of virus attachment, test the infection rates and its significance on biofuel production, and to prevent infectivity under laboratory conditions through bioreactors and plaque assays.

**Sami Mian**, Computer Systems Engineering
Graduation: May 2016
Hometown: Phoenix, Arizona

**HARDWARE ACCELERATED LOW POWER VIDEO PROCESSING AND TRANSMISSION FOR REAL WORLD HUMAN SENSOR NETWORKS**

Mentor: Martin Reisslein, professor, School of Electrical, Computer and Energy Engineering
Research Themes: Energy

This research involves the evaluation and improvement of wireless video sensor networks, utilizing hardware acceleration and open source video processing libraries to improve wireless video transfer between devices. This semester’s work has been developing a network using the ZigBee network protocols and the GStreamer video processing library to stream video files from a server to an external client. Currently, this method seems to have the potential to integrate video elements into the Internet of Things ecosystem and to integrate video networks with traditional sensor networks. Future plans include utilizing other video processing libraries and testing server-side video capture/streaming software.
The objective of this research project is to create an automated process that performs intracellular recordings of single cells. Neurons from the abdominal ganglia of *aplysia* were dissected and used for this experiment. Different feedback signals were tested on these neurons to determine the best method for positioning the microelectrode inside a neuron. The next step will be to acquire successful intracellular recordings of single neurons. Future work involves automating the process of positioning a microelectrode inside a neuron.

The goal of this FURI research is to develop and evaluate a video player for streamed video segments, which will be a critical component of a comprehensive project for the WSNP Group. The web-based video player will function as a remote interface to the video surveillance network and will permit the remote monitoring of a wide range of critical infrastructure. In-depth research on various components has guided the design of the video player. The basic building blocks have been implemented as a client side application, which utilizes emerging technologies available on the most popular web browsers.

The objective is to investigate ethyl ammonium nitrate (EAN), an ionic liquid (IL), as a novel electrolyte solvent to replace traditional water in a seismic sensor to be used beyond earth. ILs provide superior thermal stability, which is critical for space applications. Potassium iodide (KI) was added to EAN to enhance its sensitivity. Thermogravimetric analysis shows that 31% KI in EAN has better thermal stability than the standard KI electrolyte solution (60% KI in water). Future work includes the investigation of other ionic liquids to optimize the sensitivity and to determine the existence of a more favorable ionic liquid than EAN to be used in seismometer development.
testing will determine a final product that yields high performance. In addition to these parameters, various other factors (e.g., particle size, temperature) controlling the carbonation reaction will be determined by manipulating these parameters. Optimization of the carbonization process and thermal stability of iron carbonate cement can replace current ordinary Portland cement (OPC) while reducing CO2 emissions to 70% of current levels. This research is an investigation into the mechanical properties of iron carbonate cement which OPC is a main contributor. Preliminary results showed an increase in gene expression from introducing calcium phosphate without compromising growth (measured with an MTT assay). Future work includes repeating the experiments with different polymers and/or cell lines.

Iron powder is abundant industrial waste. It has potential to produce iron-based concrete that can replace current ordinary Portland cement (OPC), meanwhile reducing CO2 emissions to which OPC is a main contributor. Preliminary physical iron composites have been formed and analyzed with X-Ray Diffraction whose results indicate effective chemical characteristics and thermal stability of iron carbonate cement product. Optimization of the carbonization reaction will be determined by manipulating different parameters (PCO2, temperature, particle size) controlling the carbonation process. In addition to these parameters, various aggregates compositions and mechanical testing will determine a final product that yields sustainable applications.

**IRON COMPOSITE CEMENT & APPLICATIONS FOR SUSTAINABILITY**

Mentor: Hamdallah Bearat, instructor, School for Engineering of Matter, Transport and Energy
Research Theme: Sustainability
Iron powder is abundant industrial waste. It has potential to produce iron-based concrete that can replace current ordinary Portland cement (OPC), meanwhile reducing CO2 emissions to which OPC is a main contributor. Preliminary physical iron composites have been formed and analyzed with X-Ray Diffraction whose results indicate effective chemical characteristics and thermal stability of iron carbonate cement product. Optimization of the carbonization reaction will be determined by manipulating different parameters (PCO2, temperature, particle size) controlling the carbonation process. In addition to these parameters, various aggregates compositions and mechanical testing will determine a final product that yields sustainable applications.

**TRAVEL GRANT**

**Gerald O’Neill**, Mechanical Engineering
Graduation: May 2013
Hometown: Tempe, Arizona

**IMPEDANCE IN THE HUMAN ARM WITH REGARDS TO EXOSKELETON CONTROL**

Mentor: Panagiotis K. Artemiadis, assistant professor, School for Engineering of Matter, Transport and Energy
Research Theme: Health
This research is an investigation into the mechanical properties (specifically impedance) of the human arm in an effort to improve exoskeleton control for rehabilitative and augmentative purposes. This involves conducting experiments with a human subject attached at the wrist to, and working with, a robotic arm. To this end, a wearable coupling has been developed, tested and evaluated to join together the human and robotic arm. Having found this coupling’s operational characteristics, it was employed in the planned experimentation. The results from these experiments are analyzed and used to improve exoskeleton control.

**Shih-Ling Phuong**, Mechanical Engineering
Graduation: May 2014
Hometown: Goodyear, Arizona

**CONSENSUS AND COORDINATED CONTROL OF MULTI-AGENT SYSTEMS**

Mentor: Douglas Cochran, associate professor, School of Electrical, Computer and Energy Engineering
Research Theme: Security
In recent years, networked systems have become prevalent in communications, computing, sensing and many other areas. In a network composed of spatially distributed agents, network-wide consensus about the physical environment and the network configuration must be maintained using information collected locally by the agents. This poses numerous challenges, particularly due to availability of direct communication only between neighboring agents. These are exacerbated by uncertainty in the measurements imperfect communication links. This research began with study and implementation of existing consensus algorithms. It is proceeding to pose and evaluate new algorithms that accommodate nonlinear state spaces and measurement and system noise.

**Ellen Qin**, Chemical Engineering
Graduation: May 2014
Hometown: Chandler, Arizona

**EFFECTS OF METAL CATIONS ON POLYMER-MEDIATED GENE DELIVERY**

Mentor: Kaushal Rege, associate professor, School for Engineering of Matter, Transport and Energy
Research Theme: Health
The objective of this research is to determine a method to increase gene delivery to human cancer cells by decreasing polymer:DNA (polyplex) size. Calcium phosphate has previously been shown to condense DNA for gene delivery. The DLS results show that adding cationic polymers to metal/DNA complexes further decreases their size. Prostate cancer cells were thus transfected with the metal-DNApolyplexes and gene delivery was quantified by measuring luciferase expression while viability was measured with an MTT assay. Preliminary results showed an increase in gene delivery for metal/polymer polyplexes relative to control polyplexes. Future work includes repeating the experiments with different polymers and/or cell lines.
Noelle Rabiah, Chemical Engineering  
Graduation: May 2014  
Hometown: Scottsdale, Arizona

**“SMART” ASYMMETRIC POLYSTYRENE/PNIPAM-GOLD NANOPARTICLES**

Mentor: Lenore Dai, professor, School for Engineering of Matter, Transport and Energy  
Research Themes: Energy and Health  
Asymmetric particles are particles that contain an irregularity which prevents them from having uniform characteristics across their surface. Due to their irregularity, these particles have interesting applications, such as the self-assembly of advanced materials, catalysis, stabilization of emulsions, and several others. This research project focuses on the synthesis of asymmetric particles that contain a “smart” polystyrene/PNIPAM core which allows the particles to change in size with temperature variance. The particles are organic-inorganic hybrid with a single gold nanoparticle serving as the irregularity on the particle, formed via one-step Pickering emulsion polymerization.

Paul Rayes, Electrical Engineering  
Graduation: May 2015  
Hometown: Phoenix, Arizona

**TECHNICAL GRAPHING TOOL WITH AUTOMATED ASSESSMENT CAPABILITY**

Mentor: Brian Skromme, professor, School of Electrical, Computer and Energy Engineering  
Research Theme: Education  
This project is to develop a graph entry and manipulation system that can be used in classes, and to test it to determine its potential advantages. A prototype of the graphical interface has been created and a few graph types can be drawn. The system can present a textbook-style problem, request a graph as an answer, and check whether that answer is correct. The testing phase of the project is in progress and initial results are pending. Future work will involve expanding the system, further testing in classes, and giving hints and feedback based on student answers.

Kitt Roney, Mechanical Engineering  
Graduation: May 2016  
Hometown: Scottsdale, Arizona

**DEVELOPING A LOW ENERGY PHOTOBIOREACTOR SYSTEM USING SHAPE MEMORY ALLOY MOTORS**

Mentor: David Nielsen, assistant professor, School for Engineering of Matter, Transport and Energy  
Research Theme: Energy  
While algae-derived lipids are a promising biofuel, their production requires the supply of ample light and carbon dioxide. Mixing aids in their delivery, but is energy intensive. As a lower energy alternative, a new photobioreactor will be developed using shape memory alloy motors to provide mixing while using very little energy. The motors are currently being programmed and their function optimized. In the future, larger models will be built to show the efficiency and effectiveness of the device.

Julie Rorrer, Chemical Engineering  
Graduation: May 2013  
Hometown: Corvallis, Oregon

**INVESTIGATION OF PHOTOCATALYTIC PROPERTIES OF AMORPHOUS SODIUM TANTALUM OXIDE**

Mentor: Candace Chan, assistant professor, School for Engineering of Matter, Transport and Energy  
Research Theme: Energy  
The focus of this project is to investigate the water splitting capabilities of sodium tantalum oxide and to investigate the effects of particle morphology on photocatalytic activity. Sodium tantalum oxide is of interest because of its stability and catalytic activity for water splitting, especially in the ultraviolet range. Amorphous sodium tantalum oxide nanoparticles were formed using a hydrothermal synthesis, characterized with X-Ray Diffraction (XRD), and compared to alternative morphologies of sodium tantalum oxide. Future work involves synthesizing various forms of nanocrystalline sodium tantalum oxide and bulk sodium tantalum oxide, and comparing the photocatalytic and physical properties of the materials.
THE EFFECT OF FAUJASITE CRYSTALLINITY AND PARTICLE SIZE IN THE THIN FILM NANOCOMPOSITE MEMBRANES PERFORMANCE FOR REVERSE OSMOSIS DESALINATION

Mentor: Mary Laura Lind, assistant professor, School for Engineering of Matter, Transport and Energy
Research Theme: Sustainability
Faujasite, a porous, crystalline material, was added as a filler to the active layer of polyamide interfacially polymerized onto porous polysulfone supports. The membranes' performance was tested for their capability to desalinate seawater through a reverse osmosis process. Performance was evaluated as function of the faujasite crystallinity, evaluated quantitatively via x-ray diffraction (XRD), as well particle size, as measured by dynamic light scattering (DLS).

LOW COST, SINGLE AXIS, AUTONOMOUS, HARDWARE SOLAR TRACKER

Mentor: Chao Wang, lecturer, School of Electrical Computer and Energy Engineering
Research Theme: Sustainability
In an attempt to facilitate renewable sources of energy, an inexpensive solar tracker adds incentive and increased power production for solar energy. A low cost solar tracker was designed for an all hardware system which maintains modularity, self-sustainability, and is just as robust as its digital counterpart. A novel mechanical design was also included to increase mechanical efficiency and results show tracking system operation with a minimum of 234 mW, a 5.2:1 mechanical torque advantage, and adjustable accuracy from less than one to ten degrees. Future aspirations include a product version to help increase the demand for solar energy.

UTILIZATION OF NANOPARTICLES FOR IDENTIFYING FIBRIN DEPOSITION IN NEURAL TISSUE

Mentor: Sarah Stabenfeldt, assistant professor, School of Biological and Health Systems Engineering
Research Theme: Health
The main objective of this research is to develop and characterize a targeted contrast agent that will recognize acute neural injury pathology (i.e. fibrin) after traumatic brain injury (TBI). Single chain fragment variable antibodies (scFv) that bind specifically to fibrin have been produced and purified. DSPE-PEG micelles have been produced and the scFv has been conjugated to the surface of the micelles; this nanoparticle system will be used to overcome limitations in diagnosing TBI. The binding and imaging properties will be analyzed in the future to determine functionality of the nanoparticle system.

WATER TREATMENT POTENTIAL OF CERAMICS AND CEMENT VARIANTS (ZEOLITE SYNTHESIS PHASE)

Mentor: Narayanan Neithalath, associate professor, School of Sustainable Engineering and the Built Environment
Research Theme: Sustainability
Three different types of FAU-type zeolite, labeled X, P and S were synthesized. Each was made from solution of various proportions of NaOH, NaCl and coal fly ash heated for 24 hours at various temperatures. Once out of the oven the precipitate in each of the heated solutions was washed and dried, then pulverized and placed in a sealed plastic tube. The prepared samples were each tested with an FTIR, and transmittance v. wave number plots were gathered. TGA testing remains. Continuation of the research will involve the application of the synthesized zeolite to cement systems for water filtration purposes.
CONCRETE PRODUCTION AND CO2 SEQUESTRATION VIA CARBONATION OF MECHANICALLY-ACTIVATED ALKALI EARTH SILICATES

Mentor: Hamdallah Bearat, instructor, School for Engineering of Matter, Transport and Energy
Research Theme: Sustainability
Engineers have been working to sequester CO2 from our atmosphere via mineral carbonation resulting in cement materials. The chemical reaction involving Olivine has been a research focal point. There action is enhanced by mechanical agitation of the reactants, XRD analysis is used to characterize samples of Olivine, Pre-mechanically activated samples are primarily characterized Forsterite, and Ferrous Forsterite. Mechanically activated samples are reacted with CO2 in order to produce concrete and sequester CO2. Efficacy of these tests will be determined by the characterization and strength of the final product of the reaction of CO2 and Olivine or Alkali Silicates.

ELECTROCHEMICAL PROPERTIES OF JAROSITE-BASED MATERIALS

Mentor: Candace Chan, assistant professor, School for Engineering of Matter, Transport and Energy
Research Theme: Energy
The electrochemical performance of lithium-ion batteries is currently limited by a lack of high capacity cathode materials. Jarosite $[\text{KFe}_{3+3}(\text{OH})_6(\text{SO}_4)_2]$ and its analogues have potential for high lithium insertion and diffusion and are therefore promising for this application. This research project investigates the potential of jarosite-based materials as cathodes through synthesis and electrochemical testing. Initial testing identified sodium-based vanadium analogue as the highest capacity variant, although its capacity still does not match current cathode materials. Future research will focus on improving synthesis techniques in order to further increase the observed capacity.

MODEL MEMBRANE SYSTEM TO DETERMINE WATER PERMEABILITY OF LTA ZEOLITES

Mentor: Mary Laura Lind, assistant professor, School for Engineering of Matter, Transport and Energy
Research Theme: Sustainability
Nanocomposite membranes hold promise in decreasing the costs associated with reverse osmosis purification of water through increased life and higher water flux. LTA zeolites have often been used in these membranes. However, a value for the water permeability of LTA zeolites has not yet been determined. This value is needed to establish a theoretical upper bound of permeability for nanocomposite reverse osmosis membranes utilizing zeolites. A model membrane system has been created which allows for the direct measurement of water flow through these zeolites. However, some fabrication issues remain before data can be collected.

EARLY DIAGNOSIS OF ALZHEIMER’S DISEASE: UTILIZATION OF MOLECULAR CLONING TO CORRECT A FAULTY ANTIBODY GENE REGION AND TO OPTIMIZE SINGLE CHAIN VARIABLE FRAGMENT YIELD AND FUNCTIONALITY

Mentor: Michael Sierks, professor, School for Engineering of Matter, Transport and Energy
Research Theme: Health
The objective of this research is to increase the output and performance of an antibody that has been linked to Alzheimer’s disease using molecular cloning techniques. Currently, the DNA vector correlating to the antibody has been cut from its donor plasmid via restriction enzymes, but has not successfully been ligated to its host vector. Upon, ligation of the two fragments, the resultant antibody will be harvested and tested in comparison to its predecessor. The DNA sequence for the antibody will be further modified or kept the same depending on if the improvement was of significance or not.
EMBEDDED WATER TRADE IN AGRICULTURAL PRODUCTS

Mentor: Thomas Seager, associate professor, School of Sustainable Engineering and the Built Environment
Research Theme: Sustainability

Much of the water produced in water treatment plants goes to grow crops, which are either consumed locally or traded with other locales. Embedded water is the input water for a product that travels to other places through trade. In Western states, like Arizona, water moves in and out of the state through the agricultural products the state imports and exports because irrigation water is embedded in crops. The goal of this research is to track the trade of water through agriculture between states in the Western United States to determine where water used to irrigate crops is consumed.

VALIDITY OF USING ANTI-ESTRADIOL AS THE BINDING AGENT FOR A FERTILITY BIOSensor

Mentor: Jeffrey LaBelle, assistant professor, School of Biological and Health Systems Engineering
Research Theme: Health

The peak ovulation range for a woman has a strong correlation to the concentration of the hormone estradiol. If the concentration of estradiol can be determined, a biosensor can be created to accurately predict a woman’s ovulation period. Estradiol was characterized by finding its optimal frequency, 37.46 Hertz, and creating a concentration gradient using electrochemical impedance spectroscopy via immobilization. Currently the possibilities in interferences with the hormone anti-body binding process are being tested and analyzed. This includes the testing of common blood components and other fertility hormones in purified conditions as well as testing in blood.

DEVELOPMENT OF A DYNAMIC THREE-DIMENSIONAL TACTILE DISPLAY

Mentors: Hongyu Yu, assistant professor, School of Electrical, Computer and Energy Engineering; Hanqing Jiang, associate professor, School of Engineering Matter, Transport and Energy
Research Theme: Health

This project focused on fabricating environmentally responsive—particularly visible light sensitive—hydrogels. Hydrogels have notable biocompatibility and responsiveness to environmental stimuli. Their stiffness and reactivity can be tweaked with formulation changes. Different formulations, materials and geometries were tested throughout the semester to fabricate an environmentally responsive material in a controlled fashion. More studies will be performed before this material can become a novel candidate for hard-soft material integration with semiconductors, sensors, or medical devices. Once fabricated, this material can serve as a cheaper and quicker means of manufacturing materials with intrinsic functionality.

GRAPHENE NANO COMPOSITES FOR THERMALLY SAFE LITHIUM-ION BATTERIES

Mentor: Candace Chan, assistant professor, School for Engineering of Matter, Transport and Energy
Research Theme: Energy

The project objective is to optimize internal heat transfer in lithium-ion batteries by utilizing nanocomposite materials. In pursuit of this, nanomaterial synthesis methods for graphite/graphene oxide have been surveyed and graphene oxide product. This oxide nanocomposites will also be performed.
**Matthew Swann**, Aerospace Engineering, Aeronautics

Graduation: May 2014
Hometown: Phoenix, Arizona

**MULTI-DISCIPLINARY DESIGN OPTIMIZATION TOOL FOR AIRCRAFT**

Mentor: Timothy Takahashi, professor of practice, School for Engineering of Matter, Transport and Energy
Research Theme: Security

The purpose of this project was to develop a design optimization tool which would evaluate the design criteria for aircraft. This design optimization tool is being created by integrating several software packages that will analyze the characteristics of an aircraft’s design. The aircraft’s components can then be varied and evaluated through the use of trade studies to find the best configuration for the aircraft. The design optimization tool is currently being used to create a high-speed aircraft design and can be used by other school organizations as well as for teaching.

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**Giresse Tchegho**, Chemical Engineering
Graduation: May 2015
Hometown: Yaoundé, Cameroon

**PREDICTION OF THE EFFECTS OF RESIDUES MUTATION ON PROTEIN STABILITY**

Mentor: Zoé Lacroix, associate research professor, School of Electrical Computer and Energy Engineering
Research Theme: Health

The mutation of an amino acid can potentially affect the protein’s structure. SPROUTS (Structural Prediction of Protein Folding Utility System) not only calculates the free energy change after mutation in order to determine the stability of the protein but it also computes other prediction methods such as the MIR (Most Interacting Residues) method and the TEF (Tightened End Fragment) method. An offline computational program such as MATLAB is being used to improve the results obtained from SPROUTS. Potential applications of this program to the identification of most interacting residues of several proteins are presented in this contribution.

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**Claire Tilton**, Civil (Environmental) Engineering
Graduation: December 2015
Hometown: Tempe, Arizona

**LEED VS. NON-LEED ENERGY CONSUMPTION OF BUILDINGS ON ASU’S TEMPE CAMPUS**

Mentor: Mounir El Asmar, assistant professor, School of Biological and Health Systems Engineering
Research Themes: Energy and Sustainability

The Leadership in Energy & Environmental Design (or LEED) rating system touts that these ratings accurately describe buildings that “save energy, use fewer resources and reduce pollution.” Therefore, LEED buildings on the Tempe campus of ASU should perform better (less energy consumption) than their non-LEED building counterparts. In order to calculate energy performance, heating, cooling and electricity data was collected and made uniform for an accurate comparison by means of EUI unit or energy unit intensity. Post-analysis, LEED buildings do not prove to have any specific advantage against their non-LEED counterparts.

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**Xavier Vargas**, Mechanical Engineering
Graduation: May 2014
Hometown: Mesa, Arizona

**ROBUST ACCURATE ARM POSITION TRACKING SYSTEM**

Mentor: Panagiotis Artemiadis, assistant professor, School for Engineering of Matter, Transport and Energy
Research Theme: Health

Limb position tracking systems are essential for studying human motion and designing robotic systems that can safely and effectively interact in a cooperative setting. Multiple Microsoft Kinects were used in conjunction with an Advanced NDI 3-D Infrared Camera System to design and improve a robust system for tracking limb orientation and positioning. The Microsoft Kinect provides a low cost substitute that can be utilized to reduce data loss caused by anomalous positioning. The methodologies developed will allow better development of systems for human-orientated control of robotics aimed at cooperative tasks, prosthetics and rehabilitation.
APPLICATION OF THE LEVEL SET METHOD TO MODELING DIESEL SPRAY INJECTOR NOZZLES

Mentor: Marcus Herrmann, associate professor, School for Engineering of Matter, Transport and Energy
Research Theme: Energy

The Engine Combustion Network is an open forum for international collaboration among experimental and computational researchers in engine combustion. This work contributes to the forum by providing computational models of a diesel spray injector nozzle for model validation. The computational models are produced by reconstructing the surface of the nozzle using the level set method. Mesh refinement is used to accelerate the computations necessary for reconstruction. The models produced in this work are intended to be used to create computational fluid dynamic simulations. Ultimately, the computational results will be compared to experimental results to improve predictive capabilities of spray/nozzle models.

ONCHIP INDUCTORS WITH FERROMAGNETIC MATERIAL

Mentor: Hongbin Yu, associate professor, School of Electrical, Computer and Energy Engineering
Research Theme: Energy

Miniaturization and energy saving in electronics devices require research into ways to create smaller inductors with a higher inductance and a higher ratio of stored energy to energy lost (Quality-Factor). Completed estimating what effect changing the distance of the magnetic coils from the copper coils would have on the Q-factor and inductance. Tests were performed on what changing the materials’ properties would have on the inductor. A slightly lower quality-factor and a higher inductance resulted the closer the magnetic-material was to the copper. Future research includes finding the maximum current and Q-factor based on various changeable properties.

PHOTOCATALYTIC REDUCTION OF CO2 TO FUEL USING NOVEL I-TIO2 COMPOSITE

Mentor: Jean Andino, associate professor, School for Engineering of Matter, Transport and Energy
Research Theme: Energy and Sustainability

The scope of this project entails converting CO2 into valuable compounds that can be used to create sustainable fuel sources such as methane (CH4), carbon monoxide (CO) and other products. Synthesis of the TiO2 composite was completed in this study, X-ray diffraction (XRD) was also used to determine the atomic and molecular structure of the crystals, thus characterizing the material. The products formed from UV irradiation were identified by using Diffused Infrared Fourier Transform Spectroscopy (DRIFTS).

ON THE CONTROL OF HUMAN-ROBOT BI-MANUAL MANIPULATION

Mentors: Panagiotis Artemiadis, assistant professor, School for Engineering of Matter, Transport and Energy
Research Theme: Health

This paper focuses on the introduction of bio-inspired control schemes for robots that coordinate with humans during dual arm object manipulation. Using experimental data from human subjects performing a variety of everyday bi-manual life tasks, the researchers purpose a bio-inspired controller for a robot arm, which is able to learn human inter- and intra-arm coordination during those tasks. This method is then tested using real experimental data across multiple bi-manual tasks with a comparison made between the bio-inspired and traditional inverse kinematic controllers. Using a robotic kinematic chain identical to the human arm, models are evaluated for anthropomorphic configuration.
**Joseph Williams**, Aerospace Engineering  
Graduation: May 2014  
Hometown: Casa Grande, Arizona

**THERMAL PROTECTION SYSTEMS OF HYPERSONIC VEHICLES**

Mentor: Armando Rodriguez, professor, School of Electrical, Computer and Energy Engineering  
Research Theme: Sustainability  
The objective of the research is to design a system for protecting a vehicle from high temperatures that result from traveling at velocities greater than five times the speed of sound. This work involves researching of the fundamental theories and principles and developing a model to describe the flow of heat through the system. By using models and varying the number of layers of the thermal protection system and the thickness of each layer, performance can be measured. Trade studies between the aerodynamic, structural and controllability effects are also critical. Future work will involve higher fidelity models.

**Louis Wilson**, Computer Science  
Graduation: May 2014  
Hometown: Madison, Wisconsin

**CONDITIONAL EXPECTATION ALGORITHMS FOR MATRICES**

Mentor: Charles Colbourn, professor, School of Computing, Informatics, and Decision Systems Engineering  
Research Theme: Security  
Covering arrays, matrices where every set of columns includes every combination of symbols, are useful in computer, network and communications security. Current techniques for finding them generate rows at random. New approaches for efficiently constructing and storing them were investigated, by reducing randomness and by storing only a few rows along with algorithms for generating related rows. Future research entails finding more efficient methods and improving algorithmic guarantees.

**Christopher Wong**, Materials Science and Engineering  
Graduation: May 2016  
Hometown: Tempe, Arizona

**ORGANIZATION OF INDIUM GALLIUM NITRIDE NANORINGS**

Mentor: Michael O’Connell, assistant professor, School for Engineering of Matter, Transport and Energy  
Research Theme: Energy  
The potential of indium gallium nitride (InGaN) nanorings as a semiconducting material is extensive. However, the practicality of applying these nanostructures is restricted by current growth methods that result in low yields. The objective of this research is to organize InGaN nanorings into an array to combat this restriction. This is done by patterning the substrate that the nanostructures grow on, causing the nanorings to be in a uniformed high density matrix, thus increasing its utility. Future work includes further substrate characterization and substrate patterning using soft lithography.

**Weidong Ye**, Electrical Engineering  
Graduation: May 2015  
Hometown: Fuzhou, China

**INAS NANOWIRE FIELD EFFECT TRANSISTORS**

Mentor: Hongbin Yu, associate professor, School of Electrical, Computer and Energy Engineering  
Research Theme: Energy  
The purpose of this project is to explore the potential of III-V compound semiconductors. Compared to silicon based transistors, transistors made with III-V compound semiconductors theoretically have higher performance and efficiency. There are many different types of III-V semiconductors, but this project focuses on one, Indium Arsenide. InAs nanowires were transferred from their vertical growth substrate to a planar silicon substrate to fabricate field effect transistors (FET). After Fabrication, the devices are characterized to evaluate performance.
where are they now?

**Teagan Adamson** (Biomedical '12 – FURI Fall '10-Spring '12) is performing antibody engineering research for cancer therapeutics at Academia Sincia’s Institute of Biomedical Sciences in Taipei, Taiwan through the support of a Fulbright and Whitaker Fellowship.

**Rachel Austin** (Biomedical '12 - FURI Fall '11-Spring '11) is a process engineer in the IC Test Systems group at Medtronic, where they manufacture the circuit boards for all of Medtronic’s implantable medical devices.

**Jaclyn Avellan** (Material Science ’12 – FURI Spring ’12) is pursuing a Ph.D. in materials at UC Santa Barbara.

**Celia Barker** (Biomedical ’13 – FURI Fall ’10-Fall ’11) is pursuing a master’s in management of a Fulbright and Whitaker Fellowship.

**Zack Berkson** (Chemical ’13 – FURI Summer ’11-Fall ’12) is a first-year Ph.D. student in chemical engineering at University of California, Santa Barbara, beginning to get involved in research in molecular interactions in organic solar cells.

**Katherine Cai** (Chemical and Statistics ’13 - FURI Spring ’10-Fall ’12) is in the Ph.D. program in Statistics at ASU.

**Amelia Celozza** (Civil ’13 – FURI Summer ’09; Fall ’11-Spring ’13) is pursuing a master’s in sustainable design and construction at Stanford University.

**Katherine Driggs-Campbell** (Electrical ’12 – FURI Summer ’10-Spring ’12) is currently a research associate and Ph.D. student at ASU and is continuing her FURI research working toward a point of care diagnostic biosensor based on nanotechnology for traumatic brain injury.

**Carly Hom** (Biomedical ’13 – FURI Spring ’12-Spring ’13) is currently employed as an associate advanced quality assurance engineer for Stryker Sustainability Solutions in Tempe, Arizona.

**Amit Jha** (Biomedical ’13 – FURI Fall ’11-Spring ’13) is currently pursuing a master’s in biomedical engineering at ASU and is also working at a start-up venture.

**Eric Kincaid** (Materials Science ’13 – FURI ’11-12) is pursuing an Erasmus Mundus master’s degree in the SERP-chem program (www.serpc-chem.eu) with a specialization in chemistry and materials science, it is a two year program (four semesters), with each semester spent at a different university in Europe.

**Darcy Frear** (Biomedical ’13 – FURI Spring ’11-Spring ’13) is currently pursuing a Ph.D. at Harvard University in the speech and hearing bionicscience and technology program.

**Robert Fruchtmann** (Computer Science ’12 – FURI Fall ’09-Spring ’12) is a full stack software engineer at YourMechanic, a YCombinator startup in Mountain View, CA, that lets people get their car fixed at home or at work by mechanics.

**Rachel Ginn** (Biomedical ’12 – FURI Fall ’11) is currently working toward a master of science in biomedical informatics at Arizona State University and Mayo Clinic Hospital.

**Tina Hakimi** (Biomedical ’12 – FURI Spring ’10-Spring ’12) is completing a Whitaker International Fellowship with the Brien Holden Vision Institute in Sydney, Australia, working to redefine the design of soft contact lenses using new information about the ocular surface shape.

**Brittney Haselwood** (Biomedical ’12 – FURI ’10-12) is currently a research associate and Ph.D. student at ASU and is continuing her FURI research working toward a point of care diagnostic biosensor based on nanotechnology for traumatic brain injury.

**Carly Hom** (Biomedical ’13 – FURI Spring ’12-Spring ’13) is currently employed as an associate advanced quality assurance engineer for Stryker Sustainability Solutions in Tempe, Arizona.

**Amrit Jha** (Biomedical ’13 – FURI Fall ’11-Spring ’13) is currently pursuing a master’s in biomedical engineering at ASU and is also working at a start-up venture.

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**John Kondziolka** (Civil/Environmental ’12 – FURI Fall ’10-Spring ’12) is graduating with a master of science in environmental fluid mechanics from MIT this spring.

**Dwight Lane** (Biomedical ’12 – FURI Summer ’11-Spring ’12) is currently a second-year Ph.D. student in bioengineering at the University of Utah.

**Kevin LaRosa** (Electrical ’12 – FURI Spring ’10-Spring ’12) is working toward a Ph.D. at the University of Texas in Dallas, where he is researching thin-film technologies.

**Xuan Liang** (Chemical ’13 - FURI Spring ’12) is starting a master’s in chemical engineering at University of Maryland this semester.

**Michael Machas** (Chemical ’13 – FURI Fall ’11-Spring ’13) is finishing a master’s in chemical engineering at Arizona State University in May 2014 and hopes to begin his career in industry in the summer.

**Beth Magerman** (Mechanical ’13 – FURI Fall ’11-Spring ’13) is pursuing a master’s in mechanical engineering at Arizona State University as a research assistant, studying remote measurement and modeling of wind development for wind turbine control.

**Michael Mast** (Aerospace/Aeronautics ’12 – FURI Spring ’11-Fall ’11) is currently a systems engineer at Honeywell Aerospace and am the lead focal for Auto-throttle and Flight Director for the Gulfstream program. Also pursing an M.S. in aerospace engineering at Honeywell.

**Isha Mehta** (Civil ’12 – FURI Fall ’11-Spring ’12) is currently working as a structural designer, creating engineering art structures, high rises and more.

**Divya Goetha Nair** (Materials Science ’12 - FURI Fall ’10-Spring ’12) is working as a Process Engineer in Intel Micron Flash Technologies, in Utah.

**Alisha Nanda** (Chemical/Biochemistry ’13 – FURI Summer ’10-Spring ’12) is currently a medical student pursuing an M.D. at University of Arizona – Phoenix.

**Meelad Nikpourian** (Mechanical ’12 - FURI Fall ’11-Spring ’12) finished a master’s in mechanical engineering at Arizona State University and will be working at Honeywell Aerospace.

**Gabe Oland** (Biomedical ’13 - FURI Summer ’11-Spring ’13) is a first-year medical student at the Medical College of Wisconsin, Milwaukee, WI.

**Guy Pickett** (Mechanical ’12 – FURI Summer ’11-Fall ’11) is currently pursuing a master’s of science in electrical engineering while conducting research on solar-cell fabrication processes at ASU’s Solar Power Lab.

**Spencer Prost** (Computer Science ’13 – FURI Fall ’11-Spring ’13) is currently a post bachelor’s research associate at Pacific Northwest National Laboratory, engineering robust acquisition software for Agilent Acquisir digitizers for use with ion mobility spectrometry.

**Tim Reblitz** (Electrical ’12 – FURI Summer ’11-Spring ’12) is a graduate research assistant and Ph.D. candidate studying silicon photovoltaics at Arizona State University in the OESTE Engineering Research Center, working to develop solar cells using only aluminum for metallization to minimize the use of costly and/ or toxic materials typically used.

**Mariela Robledo** (Chemical ’13 - FURI Summer ’11-Spring ’13) is getting ready to begin her new adventure as a manufacturing engineering associate with General Mills in 2014.

**Neil Saez** (Bioengineering ’13 – FURI Spring ’10-Spring ’12) is pursuing an M.D. at UC Irvine’s School of Medicine, and is also a member of the Program in Medical Education for the Latino Community (PRIME- LC).

**Rafael Santana** (Computer Science ’13 – FURI Spring ’12-Spring ’13) is currently a consultant for Avolve Software to develop electronic planning with a focus on planning and building plan reviews.
Jared Schoepf (Chemical '13 – FURI Spring '12-Spring '13) is currently pursuing a Ph.D. in chemical engineering at Arizona State University. He is also the co-founder and president at SafeSIPP, which both transports and purifies contaminated water in developing countries. He is also the president of Sustainable Storm Solutions, which works to remove trash from storm water before it contaminates fragile aquatic ecosystems.

Tyler Stannard (Materials Science '13 – FURI Summer '12-Fall '12) is a graduate student research assistant at Arizona State University, researching stress corrosion cracking in aluminum alloys.

Eric Stevens (Chemical '13 – FURI Summer '11-Spring '12) is a Ph.D. candidate in chemical engineering at North Carolina State University.

Luan Trinh (Aerospace '11 – FURI Fall '11) is finishing a master's in mechanical engineering at Arizona State University.

Logan Van Engelhoven (Mechanical '12 – FURI Fall '11-Fall '12) is an M.S./Ph.D. student at UC Berkeley working with the Human Engineering and Robotics Laboratory.

Reed Wittman (Material Science '13 – FURI Fall '12-Spring '13) is a Bredesen Scholar pursuing a Ph.D. at the University of Tennessee.

Diane Wu (Electrical '13 - FURI Spring '11-Spring '13) is currently a test engineer at Microchip.

Chuan Xu (Industrial '12 – FURI Fall '11-Spring '12) is a senior associate buyer/planner at Life Technologies, and graduated from UC Berkeley with a master of engineering degree in industrial engineering and operations research.
51 STUDENT ORGANIZATIONS
Ranging from honors and professional associations to groups creating underwater robots, concrete canoes and launching rockets, student organizations offer excellent opportunities to learn about career possibilities and network with industry professionals.
studentorgs.engineering.asu.edu

4+1 ACCELERATED PROGRAMS
4+1 programs provide students with the opportunity to combine advanced undergraduate course work with graduate course work to earn both bachelor’s and master’s degrees in five years.
engineering.asu.edu/accelerated

ENGINEERING CAREER CENTER
Serving as a central point of contact to connect students and employers, the Career Center connects employers with engineering students for full-time job opportunities and internships and provides comprehensive career coaching services for Fulton students and alumni.
engineering.asu.edu/career

STUDENT SUPPORT SERVICES
The Engineering Tutoring Center offers free tutoring in math, physics, chemistry and engineering courses.
tutoring.engineering.asu.edu

ENGINEERING PROJECTS IN COMMUNITY SERVICE
EPICS organizes teams of undergraduate students to design, build and deploy systems to solve engineering-based problems for not-for-profit organizations.
engineering.asu.edu/epics

GRAND CHALLENGE SCHOLARS PROGRAM
The Fulton Grand Challenge Scholars program combines innovative curriculum and cutting-edge research for an academic experience that spans disciplines and includes entrepreneurial and service-learning opportunities.
more.engineering.asu.edu/grandchallengescholars

STUDY ABROAD
Engineering students are encouraged to take full advantage of the study abroad opportunities offered by ASU and Fulton Engineering.
engineering.asu.edu/studyabroad

FURI is one of the innovative programs that make up the Fulton Difference
Celebrating 10 years as the Ira A. Fulton Schools of Engineering

At Arizona State University, we’ve been educating engineers for Arizona and the world for nearly 60 years. With over 10,000 students, we are building the engineers of the future and pursuing the discoveries and solutions to challenges facing society.

In 2003, Ira A. Fulton, founder and CEO of Arizona-based Fulton Homes, established an endowment of $50 million in support of ASU’s College of Engineering and Applied Sciences.

His investment served as a catalyst, enabling the development of a dynamic portfolio of strategic initiatives that benefit our students and faculty and the communities where they live and work.

Throughout, Ira A. Fulton has remained an active supporter of the school that bears his name. He is a familiar face to students and a regular presence at events such as this semiannual FURI Symposium.

“I strongly believe you cannot have a great city without a great school of engineering.”

Ira A. Fulton