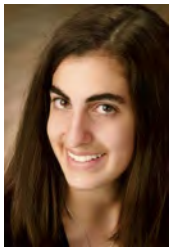
2014 Fellow Reports

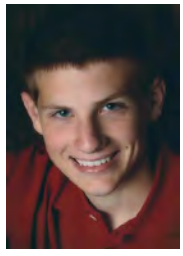
The reports of Tau Beta Pi's 80th Fellowship Program and the 2013-14 Fellows are presented here. The reports constitute the only specific obligation to the Association after being appointed by the Fellowship Board. Their reports were written in May, and the verb tenses may sound wrong when read later.

Of the 40 fellowships awarded a year ago, 27 of the students have been paid cash stipends totaling $270,000. Each of the recipients expresses appreciation to advisors and major teachers, to family and helpful friends, and to the Association, donors, and the Fellowship Board for the honor of being named a Tau Beta Pi Fellow.



Nadia L. Ahlborg

Shabab F. Alam



Kevin V. Andreassi

Whitney L. Anthony

Nadia L. Ahlborg, OH Γ '13
Tau Beta Pi Fellow No. 803

This past year, I began a Ph.D. program in materials science and engineering at Stanford University. I joined William Chueh's group, to study materials for solar thermochemical (STC) water splitting. In the first step of STC water splitting, a solar concentrator is used to heat a metal oxide "oxygen storage" material until it releases oxygen. In the second step, the temperature is reduced and water vapor is used to oxidize the material, releasing hydrogen.

In addition to being carbon-free, this method of hydrogen production is potentially more efficient than electrolysis or electrochemical methods of water splitting and, therefore, an exciting option for transforming solar energy into fuel. My studies will focus on rational materials design of the "oxygen storage" material. I am currently building equipment that will allow me to simulate STC reactor conditions and evaluate the thermodynamic and kinetic properties of candidate materials.

This summer, I look forward to mentoring a research experience for undergraduate students while bringing the full capabilities of our equipment online. Outside of research, I have recently become involved in the Society of Women in Engineering's outreach programs and in the Stanford Energy Club. I thank Tau Beta Pi for the support I have received throughout my engineering education. Although graduation is still several years away, my current future plans are to secure a position in government or private industry research.

Shabab F. Alam, AL Ε '13
Fife Fellow No. 165

This past year, I completed my master's degree in electrical engineering and then enrolled in the Doctor of Science program at the University of South Alabama for one semester. My research involved coming up with a new fault modeling and mapping methodology for quantum-dot cellular automata technology (QCA) and integrating it into a CAD tool. QCA is an exciting quantum computing technology that is being researched as a possible replacement for current transistor technology. Since it's still a new technology, there is a need to come up with CAD tools that will allow for designing systems with this new technology. My advisor, Dr. Waleed-al-Assadi, provided invaluable input and advice during the course of the research. We were able to successfully come up with a method for mapping faults between a design done in QCA technology and current technology and integrated it into a CAD tool that had been developed by a previous master's student.

Graduate school provided a new and enlightening experience for me since I was able to take advanced classes on various topics that interested me. Examples of courses I took were VLSI, Robotics, Advanced Embedded Systems, and Cryptography. My research allowed to me gain in-depth training and knowledge in the field of nanotechnology. I believe this experience will prove invaluable when I continue my graduate studies in the Ph.D. program at Georgia Tech this fall.

Kevin V. Andreassi, MI Α '13
Tau Beta Pi Fellow No. 804

I entered the University of Notre Dame's Ph.D. program in mechanical engineering in July 2013, as a member of Dr. David Go's Small Scale Transport Research Laboratory, studying a new approach to thermal energy conversion using thermionic emission and microdischarges. However, as the summer and fall semesters progressed, I found that research was not the right path for me, and that my passions were going to take me in another direction.

After my undergraduate experiences studying mechanical engineering and Spanish at Michigan State University, I felt a desire to continue my education at the graduate level, to set myself up for a personally satisfying career that would enable me to contribute to the engineering profession. After much discussion with professors and administrators across many different departments at Notre Dame, I found that the university's Master of Science in Business (MSB) was the right choice for me. The one-year program at the Mendoza College of Business maintains high ethical standards, emphasizing individual integrity, organizational excellence, and a concern for the common good, and will also give me the vital business skills needed to apply my engineering background across any number of disciplines.

I have applied to and been accepted by the MSB program within the past few months, and will begin taking courses in June 2014. While my graduate experiences have taken a different path than I expected, I am nonetheless excited to be continuing my education, and I know that this will spur me on to a successful engineering career.

Whitney L. Anthony, TX Δ '13
Matthews Fellow No. 16

When I began my master's degree in the fall, I was expecting to learn about structural engineering, and I did. I took courses in steel, prestressed concrete, dynamic loading, foundations, and finite element modeling while maintaining a 4.0 GPA. I also participated in a semester-long design studio where we designed a 25-story steel building to resist 110 mph winds and moderate earthquakes using both moment-resisting frames and eccentrically braced frames.

But what I did not expect was the research assistantship I was offered a month into my schooling. The civil engineering department decided to redesign its undergraduate curriculum, and I was assigned to the committee to assist with data gathering and researching curriculum requirements. Throughout the process, I learned a lot about how people learn, and I got to experience a behind-the-scenes view of the education system.

Participating in the curriculum redesign enhanced my experience in my graduate courses because I started paying attention to course learning outcomes and became more deliberate about strengthening skills like communication, teamwork, lifelong learning, and leadership.

Alexandra V. Bayles

Robert J. Broman

Benjamin D. Carmichael

Allison K. Cerutti

I am thankful for the support from Tau Beta Pi during this past year and am honored to have served as a ΤΒΠ Fellow. After I graduate , I will begin my career as a structural engineer, and I am excited to start applying everything that I have learned to real world projects.

Alexandra V. Bayles, DE A '13
Tau Beta Pi Fellow No. 805

I am pursuing a Ph.D. in chemical engineering at the University of California, Santa Barbara. This year, I've dedicated my efforts towards completing courses in advanced transport phenomena, mathematics and intermolecular forces, and beginning my doctoral research.

Under the direction of Professors Matthew Helgeson and Todd Squires, I started a project probing both the structure of the electric double layer and colloidal interactions in room temperature ionic liquids (RTILs). There are salts that have melting points below 100 °C. Due to their unique physiochemical properties, RTILs show promise for incorporation into efficient and safe electrochemical devices including high energy-density batteries, super capacitors, and dye-sensitized solar cells. In such electrochemical applications, the soft material's nanostructure controls key material properties (e.g. charge mobility), which in turn affect device performance.

Over the past few months, I've investigated how two techniques, neutron reflectometry (NR) and microrheology (MR), can be used to directly characterize the nanostructure of RTILs. Though these tools offer rich spatial, species and mechanical property resolution of complex materials, they have only been used to study RTILs in a limited scope. My immediate future work includes conducting NR experiments at Los Alamos National Laboratory in the summer of 2014, and continuing MR experiments at UC Santa Barbara. Ultimately, I hope to use my experimental results in tandem with evolving theoretical models to provide a comprehensive understanding of RTIL nanostructure and the parameters that influence it.

In addition to the TBP Fellowship, I was awarded a National Science Foundation Graduate Research Fellowship in the spring of 2013. I am grateful for the opportunity to continue my graduate work with the support of these two organizations.

Robert J. Broman, CO A '13
Fife Fellow No. 166

As a ΤΒΠ Fellow, I recently completed my M.S. Finance degree at The University of Texas at Austin (UT). My graduate business studies were an excellent complement to my B.S. in petroleum engineering as I had the opportunity to learn about finance in the context of the global energy industry. My courses covered many facets of finance including investments, corporate finance, and risk management, and the Center for Energy Finance Education and Research at UT hosted many industry events that fostered my understanding of a myriad of energy-related issues. My curriculum also included a course on energy derivatives, which enabled me to learn about the wide variety of financial instruments used to manage risk and promote investment in exploration and production ventures. Additionally, I conducted research on how IDRs (Incentive Distribution Rights) manifest themselves in the partnership agreements of upstream and midstream MLPs (Master Limited Partnerships).

In the coming months, I will be taking qualifying exams for the ERP (Energy Risk Professional) and CFA (Chartered Financial Analyst) designations. I will also begin work as a production engineer for SM Energy Company in Billings, MT and will be responsible for assets located in the Bakken field, which is one of the most prolific unconventional plays in the world. I am looking forward to being immersed in oilfield operations over the next few years and also working towards my P.E. license. After gaining industry experience, I would one day like to pursue a Ph.D. in petroleum engineering and teach. I thank Tau Beta Pi for their incredibly generous support of my graduate studies.

Benjamin D. Carmichael, AL B '13
Fife Fellow No. 167

Over the past year, I have completed my coursework and a large portion of my research for my master's degree in mechanical engineering at the University of Alabama. My graduate studies have certainly presented challenges so far, but they have proven to be immensely rewarding. I have had the opportunity to work with brilliant minds at UA, and this year has also opened my mind to the frontier of my field, exposing me to concepts that foster ingenuity and creativity.

My curriculum focused on applied nonlinear mathematics and mechanical vibrations with short ventures into mechatronics and acoustics. Through these classes, I have worked with colleagues on several projects outside of my research that have made my experience very well-rounded.

My research focuses on two related areas: refining the understanding of the dynamics of an Atomic Force Microscope (AFM) cantilever and improving mechanical characterization of biological samples with nano-indentation. In the fall, I had the privilege of providing experimental data and discussion for a paper dealing with a linearization of the motion of the AFM cantilever that is now published in "Sensors and Actuators A: Physical." I spent the latter half of the year working in collaboration with Virginia Tech to develop and implement a more sophisticated model of viscoelasticity for human breast cancer cells.

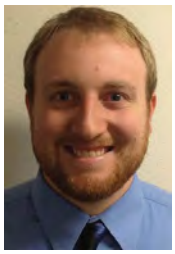
In addition to my studies, I have remained active in the University Band programs and have served as one of the drum majors for the 2013 marching season of the Million Dollar Band. The support of ΤΒΠ has been tremendously helpful in my graduate studies, and I hope to one day reciprocate so that its support may remain for future engineers.

Allison K. Cerutti, MO A '13
Fife Fellow No. 168

This past July, I began a master's program with Northwestern University Prosthetic-Orthotic Center. The program began with an online curriculum from July through December. Courses included anatomy, biomechanics, materials science, and behavioral sciences. Throughout one project, we explored a patient case scenario and developed a treatment and follow-up plan. Additionally, I worked for a prosthetic practice in St. Louis as a medical documentation assistant. I learned the value of proper documentation—vital to the current health care climate. Working for this company was a worthwhile experience with wonderful co-workers.

In January 2014, I moved to Chicago to begin the onsite curriculum. In our assessment course, we developed skills in patient history taking and orthopedic assessment. Additionally, we studied common spinal pathologies and corresponding orthotic treatments. During lab, we took measurements and impressions of one another and fabricated various spinal orthoses. Recently, we focused on upper limb amputation and corresponding prosthetic interventions. I fabricated different styles of prostheses for multiple patient models with amputations. Working with patient models reinforced my passion to serve this patient population among others.

In March 2015, I will have earned my master's of Prosthetics and Orthotics and will be eligible to begin residency. Present demands within the profession require future clinicians to be innovative and knowledgeable about research and technology. I believe my engineering background will strengthen my clinical skills and bring new insight. Finally, I have the University of Missouri and Tau Beta Pi to thank for the opportunity to attend such a prestigious P&O program.



Matthew P. Charnley

Peerawat Charuwat

Chelsea M. Ehlert

Meghan C. Ferrall

Matthew P. Charnley, IN Γ '13
Tau Beta Pi Fellow No. 806

After completing my undergraduate work at Notre Dame in chemical engineering & mathematics, this year consisted of starting my studies at Rutgers University towards a Ph.D. in mathematics. The first year classes took up most of my time, but I was also able to start getting involved with research. After the first semester of the standard three introductory courses, I was able to pass my written qualifying exam and move on to more advanced and specific classes in the spring.

Over the course of both semesters, I also began doing research with Dr. Michael Vogelius in partial differential equations and numerical analysis. His most recent work involves 'cloaking by mapping' or the mathematical analysis of being able to hide abnormalities in materials from impedance imaging. I have been working in this area, along with studying a numerical technique called 'perfectly matched layers' that allows calculations for infinite domain wave equations (sound propagation) to be carried out in a finite domain without affecting the results. My next step is to learn more about these two topics and see if there is any connection between them that can be used to simplify both ideas.

During the spring semester, I was involved in a teaching assistant training program, and will begin serving as a TA in the fall. All of these activities are well in line with my career goals, as I am hoping to end up in academia as a professor and researcher. My graduate program should last approximately four more years, after which I will move on to either post-doctoral positions or a full-time position at a university.

Peerawat "Noon" Charuwat, VA Δ '13
King Fellow No. 52

I would like to thank the Tau Beta Pi committee and everyone who has helped me throughout these years. I would not be able to accomplish this far without the ΤΒΠ King Fellowship. Last summer, I was commissioned as a second lieutenant in the Royal Thai Army Corps of Engineers. I have worked corporately with the Third Army Area to develop a new training approach against terrorism. This year, at Virginia Tech I completed all my coursework required for master's degree in the environmental and water resources engineering department. Courses ranged from principles of environmental engineering, toxicology, and chemistry to water and wastewater design. It has been an exciting year and I obtained so much practical knowledge towards my engineering profession.

In addition to coursework, I have been advised by Dr. John Novak, Dr. Gregory Boardman, and Dr. Charles Bott on thermal degradation of long chain fatty acids. My research focus is on optimizing methane gas production with co-digestion process at low temperatures. Through my research, I have had an opportunity to gain some hands-on experience working as an engineer with a local wastewater treatment plant. Other than coursework and thesis, I competed in Virginia Water Environmental Association Student Design Competition. I am also an active member of Engineers Without Borders.

I am expecting to graduate by May 2015 from Virginia Tech. I feel very privileged to have this education opportunity as a ΤΒΠ Fellow. Upon completion of my master's degree, I hope to use my knowledge to help those less fortunate.

Chelsea M. Ehlert, NY Γ '13
Fife Fellow No. 169

This past year, I started working towards my Ph.D. in materials science at Rensselaer Polytechnic Institute. I had previously completed a majority of the graduate coursework during my undergraduate career and therefore was able to finish all required coursework by the end of this fall semester. After passing my qualifying exam, I moved out to Albuquerque, New Mexico, to begin the research for my thesis at Sandia National Laboratories.

Moving across the country for the first time was an experience in itself, but spending a single semester out here at the lab has already taught me so much as a researcher. I am studying the mechanical degradation of lithium ion batteries caused by cycling. My work involves a unique approach to studying the cell components, in-situ, through the use of fluorescence confocal microscopy. The ultimate goal is to understand how charging mechanisms on the particle level interact and affect the bulk properties of the battery and eventually lead to cell failure.

My plans involve remaining at Sandia to complete my thesis research before graduation. I am so thankful for Tau Beta Pi's support during my graduate studies. Tau Beta Pi has not only supported me financially but has also taught me valuable lessons in time-management and leadership during the presidency of my chapter that I will carry throughout my career.

Meghan C. Ferrall, FL A '12
Tau Beta Pi Fellow No. 807

During my Fellowship year, I completed my second year of graduate study in the joint biomedical engineering Ph.D. program between Georgia Tech and Emory University. During this time, I finished up all my required graduate coursework, gained teaching experience, and focused on my dissertation research in Dr. Manu Platt's lab. Over the course of the academic year, I was a teaching assistant for a course in the fall and and a course in the spring. Both opportunities provided me with different training scenarios for STEM education and supported my desire to go into academia upon completion of my Ph.D.

My dissertation research focuses on kinetic modeling of extracellular matrix degrading enzymes called cathepsins. Cathepsins are a family of the body's most potent collagenase and elastases, which are often upregulated in tissue destructive diseases like cancer, atherosclerosis, and osteoporosis. I've developed a computational model to predict matrix degradation based in the presence of different combinations of these understudied enzymes.

I also worked with Dr. Ellen Moomaw at Kennesaw State University to learn how to design and make mutant enzymes to further perturb our system and validate my model. The Platt lab is a part of a NSF STC for emergent behavior of integrated cellular systems and I've presented this work at many of the monthly computational modeling group meetings as well as the 2014 Site Visit & Retreat.

After completion of the Ph.D. program, I plan to pursue a career in academia or at a research hospital, where I hope to be working with a research team on developing personalized screen technologies and therapies for cancer patients. Throughout all this, I've remained active in ΤΒΠ through the Georgia Alpha and Atlanta Alumni Chapters.

Evan M. Gates

Nathan B. Gaw

Robert J. Griffin

Chin G. Hooi

Evan M. Gates, PA Γ '13
Fife Fellow No. 170

I am currently a Ph.D. student in the biomedical engineering (BME) department at Duke University. I conduct research in Dr. Brenton Hoffman's Cell and Molecular Mechanobiology Lab. As a whole, the lab's research focuses on understanding how mechanical signals from the environment are detected, integrated, and manipulated by cells to generate a physiological response. Specifically, I am attempting to discover the importance of molecular force transmission pathways in small-scale model tissues. By understanding the pathways by which cells internalize mechanical cues and transmit this information to neighboring cells, we can gain a better understanding of physiological processes such as embryogenesis, wound healing, and metastasis.

In the last year, I had two articles published based on my undergraduate research involving the development of transparent conducting electrodes.

This spring, I was awarded a three-year fellowship by the National Science Foundation graduate research fellowship program to continue my studies. I am incredibly thankful for the external support, especially from Tau Beta Pi, which enables me to expand the knowledge within biomedical engineering and biological sciences and provides useful information for the development of advanced medical devices.

In the next year, I plan to foster outreach and stimulate interest in higher education in the Durham community, particularly to children in the public school system. After completing the Ph.D. program, I would like to remain in academia and conduct research in the field of translational medicine.

Nathan B. Gaw, AZ B '13
Fife Fellow No. 171

This year, I completed my master's degree in biomedical engineering at Arizona State University. Being a graduate student has been a very rewarding experience because it has helped me grow in greater knowledge through practical experiences.

In the fall semester, one of the classes I registered for was a practicum with a professor I had been working for during my undergraduate senior capstone class. I continued to develop a device for use in stroke rehabilitation. This device consisted of a glove with an inertial measurement unit (IMU) that detected acceleration and angular velocity of the patient's hand. The data collected from the IMU in the glove was used to quantify patient movements during therapy sessions. In November, I presented this device at the Neuroscience 2013 conference in San Diego, CA.

At the end of the semester, I put my main focus on completing my master's thesis. Humans are capable of transferring learning for anticipatory control of dexterous object manipulation despite changes in degrees-of-freedom, i.e., switching from lifting an object with two fingers to lifting the same object with three fingers. However, the role that tactile information plays in this transfer of learning is unknown. I performed a study in which I examined how reducing tactile information in the subjects' hands would affect this transfer. Through analyzing motion and force data from the object the subjects lifted, I determined that subjects use different force modulation strategies when tactile information is reduced. This information will be useful for developing neuroprosthetics that better emulate human motion.

Next year, I will be in the industrial engineering doctoral program at Arizona State University. My research will involve determining better ways to decode neural signals. I am very thankful for the TBΠ Fellowship because it has enabled me to focus on doing well in my classes and perform high-quality research.

Robert J. Griffin, TN Γ '12
Stark Fellow No. 36

In my year as a TBΠ Fellow, I was able to get the ball rolling as a graduate student. This was my first year in graduate school as a direct Ph.D. student, so there was obviously a little bit of adjustment to be made. I also was able to successfully pass my Ph.D. qualifying exam, so that I can officially be considered a Ph.D. candidate. In addition to studying for my qualifiers, I took several courses in vibrations, dynamics, and controls.

This year, I also began the current formulations for simulating dynamics of multibody systems that also not only contain rigid bodies, but also have flexible ones. As the need for high-precision movement becomes more apparent, the use of compliant mechanisms becomes more common, some of which make their compliance by flexing. If we can more accurately simulate this flexing motion, we can then create better designs.

For the summer, I secured a position working in the TREC lab, helping with their development of a humanoid robot to compete in the DARPA Robotics Challenge. This work seeks to develop a robot that can go into a disaster area environment and perform a wide array of tasks. This work may carry through to the fall.

I have greatly appreciated the support and the opportunity that this fellowship has allowed me. It has been very beneficial to furthering my work.

Chin G. Hooi, FL I '13
Fife Fellow No. 172

My 2013-2014 has been a splendid year of change and eye-opening experiences with the support of the TBΠ Fellowship. I started my master's in aerospace engineering at the University of Maryland (UMD) last fall. In January 2014, I started my master's thesis research on the topic, "Flight Dynamics and Disturbance Rejection Controller Design for a Twin Cyclocopter." I'm fabricating one of the few flying twin cyclocopters in the world under the advice of Dr. Derek Paley at the UMD Collective Dynamics and Control Laboratory (CDCL).

The cyclocopter is a rotorcraft with its cyclorotors operating on a horizontal axis and has superior maneuverability and disturbance rejection capabilities. Currently, I am modeling the flight dynamics of this novel platform to better understand the underlying dynamics. This is in order to design controllers for enhancing its handling qualities in the presence of external gusts and disturbances.

Likewise, I authored a paper titled "Design, Rapid Prototyping and Testing of a Ducted Fan Micro-Quadcopter," which was accepted in the 70th American Helicopter Society Annual Forum & Technology Display. I was also awarded the 2014 Vertical Flight Foundation Alfred Gessow Scholarship for displaying excellence in Vertical Flight Research and promise in a vertical flight career. On a final note, the Unmanned Aerial Vehicle (UAV) startup I founded and am leading has successfully recruited multiple summer interns and we are moving towards flight testing our flagship prototype.

Jennifer L. Jones

Bryan Q. Kah Ming

Zachary A. Kaufman

Carl J. Kirpes

Jennifer L. Jones, MD Γ '13
Hanley Fellow No. 9

In the past year as a ΤΒΠ Fellow, I completed my first year of graduate studies at the University of Virginia in the department of materials science and engineering. My year was focused on completing the coursework and thesis research required for a master's of science in engineering program.

My coursework focused on the study of microstructures, thermodynamics of materials, and fracture mechanics. This summer and upcoming year, I will be continuing research on my thesis under the supervision of my adviser, Dr. James T. Burns. My research focuses on the effect of high altitude environments on fatigue crack propagation rates in aerospace aluminum alloys. I am looking at the effect of water vapor pressure and temperatures seen in operation on aerospace aluminum alloys. The research will inform and justify fracture mechanics based models that incorporate the beneficial effects of these inert environments into life prediction protocols.

In addition to my studies, I am an active duty Ensign in the United States Navy attached to the Navy ROTC unit at the University of Virginia. Subsequent to my studies, I will serve as a nuclear surface warfare officer; first on a destroyer home ported in Rota, Spain, and then on to a year of advanced nuclear power training. I will then be assigned to a nuclear powered aircraft carrier.

Bryan Q. Kah Ming, IL Ε '13
Spencer Fellow No. 58

Throughout the past year as a ΤΒΠ Fellow, I have had a sensational time in the master's civil engineering program at Southern Illinois University Carbondale. Balancing between research, teaching, and coursework has certainly been a learning experience. However, having this fellowship has undoubtedly alleviated the pressure of having to find additional financial aid to fund my tertiary education. This in turn, allowed me to focus more on my research on the subcellular localization and phytotoxicity of engineered nanomaterials.

The first major highlight of the year was the National Institute of Environmental Health Sciences PhytoScholar Award. Winning this award provided me the opportunity to present part of my ongoing research on the differential phytotoxicity, distribution and subcellular localization of silver in different chemical states at the 10th International Phytotechnologies Society Conference. The second major highlight was my induction as an associate member into Sigma Xi. These tremendous opportunities have certainly been rewarding experiences that will continue to motivate me to excel in both my academic and career pursuits.

My emphasis for next year is to further develop research protocols for scanning electron microscopy and transmission electron microscopy analysis on biological and non-biological samples. Upon completing the M.S. program, I plan to carry on with a Ph.D. program in civil & environmental engineering. I would like to reiterate my utmost gratitude to the ΤΒΠ Fellowship Board for supporting me through this incredible year.

Zachary A. Kaufman, FL Α '13
Forge Fellow No. 2

During my first year in the combined master's/Ph.D. program at Stanford University, I have taken six courses, four of which are focused on analog circuit design. In my advanced analog circuit design class, my final project, a high-bandwidth transimpedance amplifier, won first place in the class design competition.

During this year, I have participated in research rotations through two different labs at Stanford. In the first group, I worked on a biological lab on a chip project. This project involved designing analog blocks, including comparators, voltage-controlled oscillators, impedance sensors, and temperature controllers. This project helped me to develop skills using the Cadence circuit design suite, which is the most common tool used for circuit design.

I am now working on my second research rotation. On this project, I am developing a wideband, low-noise amplifier for a radio frequency (RF) integrated circuit. This assignment is part of a larger project to develop an RF front end for a Sub-Nyquist radio. Such a radio would have the advantage of being able to adjust its frequency on the fly. This would allow it to adaptively avoid strong interference signals. This radio would see application in a crisis situation where many agencies would like to communicate. A radio that can adaptively adjust its frequency would be able to seamlessly connect various groups that normally use different frequencies to communicate.

Finally, I have accepted an internship for this summer at Texas Instruments with an analog design group. This internship should allow me to gain some industry experience in this field. I will be working on a team designing DC-DC conversion integrated circuits.

Carl J. Kirpes, IA Α '12
Fife Fellow No. 173

As a ΤΒΠ Fellow, Carl was able to expand upon his achievements in scholarship, leadership, and service in the spirit of fostering a liberal culture in engineering. In addition to furthering his research in applying systems engineering to industry, he also found time to volunteer in his community and receive high marks in all of his courses. Carl won third place in the global Society for Engineering & Management Systems Student paper competition and presented his research "Systems Engineering Application in an Engineering Design Build Firm" at the IIE conference. He will be presenting two more research papers at the conference again this year and received second place in the Construction Division Student paper competition. Also active in his community, Carl found the time to undertake community projects with the Drumm Farm Center for Children, the Wounded Warrior Project, Bike MS, the American Red Cross, and Tour de Hope.

Carl will be going to work at GENESYS Systems Integrator, an engineering design build company in Kansas City that helps manufactures produce their products better, faster, safer, and at greater value via business, process, and technology innovation and integration. GENESYS works with a range of clients in the automotive, building products, general industrial, and waste-to-energy market niches. Clients include companies such as Mercedes-Benz, General Motors, Tesla, and Owens Corning. He plans to use the knowledge he gained in his graduate studies to springboard the adoption of systems engineering application in industry and hopes to someday "pay it forward" as Tau Beta Pi has done.

Kaitlyn S. Kliewer

Ina A. Kundu

Trevor J. Layh

William S. LePage

Kaitlyn S. Kliewer, FL H '13
Centennial Fellow No. 28

My first year of civil engineering studies at Princeton University was both a challenge and an exciting chapter in my academic career as I begun working towards by Ph.D. During this year, my main focus has been to fulfill major coursework requirements for my degree with classes predominately focused on structural dynamics and structural health monitoring. In this time, I also joined Brank Glisic's structural health monitoring research group where I have begun the initial stages of my research.

My research is currently supported though the National Science Foundation GRFP. My research goal is to develop structural health monitoring methods to evaluate the performance and integrity of a structure through the use of dynamic monitoring with long-gage fiber optic sensors. I have begun the preliminary stages of this research through small scale dynamic laboratory tests on health samples and will transition to determining the dynamic damage detection capabilities on a damaged structural sample.

Over the summer, I will continue with my research and studies as I participate in the dynamics summer school at Los Alamos National Laboratory. While there I will work on research in cyber-physical systems with a multidisciplinary team. My future career plans include continuing to work in the structural health monitoring field for either a government laboratory or industry position. I would like to thank Tau Beta Pi for the opportunity it has helped to provide me through this Fellowship.

Ina A. Kundu, AZ A '13
Fife Fellow No. 174

After graduating with a dual degree in mechanical engineering and mathematics from the University of Arizona in May 2013, I started pursuing my master's degree in mechanical engineering at MIT in September 2013. Within the past year, I have enriched my theoretical background by taking an acoustics and sensing course, finessed my coding skills by taking numerical simulation and computational science and engineering courses, and built a desktop lathe in an elements of machine design course. Continuing the tradition from my undergraduate days, I assumed a leadership position in the Graduate Association of Mechanical Engineers and became an officer in my graduate dorm. In my spare time, I dabbled in oil painting, volunteered at the Food Bank, and tutored under privileged youth in math.

Simultaneously, I started working on a project that will later comprise a part of my Ph.D. thesis. Working under the guidance of Brian Anthony, Ph.D., I have been developing a mechanical device to precisely determine the location of two objects (more specifically, a biopsy needle and an ultrasound probe) with respect to a patient. Ultrasonic imaging is becoming increasingly prevalent in hospitals and clinics due to its superior resolution, affordability, and safety compared to conventional methods. Currently, operator variability presents the greatest challenge for ultrasonic imaging. For biopsies, if the needle is not aligned with the imaging plane, the operation could prove disastrous for the patient. Thus, reducing operator variability in a controlled manner is of utmost importance. Preliminary results verified my controlled experimental setup to determine the location of an ultrasound probe with respect to a patient was valid.

Trevor J. Layh, SD B '11
Sigma Tau Fellow No. 40

My first year as an aerospace engineering & mechanics M.S. candidate at the University of Minnesota has been an exciting one. I've decided to take an aerospace systems focus working within the Guidance, Control, and Navigation research group. Over these past two semesters, I've taken multiple controls and navigation courses that included working on topics such as linear systems, robust and optimal control, and estimation filters.

Through one of these courses, I've had the opportunity to develop my own attitude determination and navigation system during GPS outages for the unmanned aircraft owned and operated by the UAV Research Lab at UMN. This project required the development of a navigation filter that makes use of various on-board sensors to construct an attitude and heading reference system to determine aircraft orientation coupled with a dead-reckoning system to calculate location. After developing the estimation algorithm, I implemented my design into the UAV flight code and conduct a variety of ground and flight tests to validate and improve my design.

This project and course has been directly applicable to my research which is focused on using cell-phone signals to aid an inertial navigation system when GPS has been lost or degraded. My research partners and I have developed an estimation filter that integrates these cell phone signals, and we plan to conduct flight tests proving our concept and design this summer. I plan to complete my M.S. degree within the next year and plan to find a successful career as an aerospace engineer in industry where I hope to continue working on navigation, estimation, and control of aircraft systems.

William S. LePage, OK B '13
Anderson Fellow No. 7

In September 2013, Will commenced Ph.D. work at the University of Michigan and joined the Advanced Materials and Mechanics Laboratory under the direction of Prof. Samantha Daly. Using advanced experimental mechanics techniques such as high-speed digital image correlation, Will is characterizing the effect of phase transformation during fracture of shape memory alloys (SMAs). SMAs are a modern class of metals with established success in biomedical devices such as endovascular stents, and promising properties for other fields such as adaptive aerospace components and vibration damping cables for civil structures. Will's experimental work on SMA fracture will inform the development of constitutive models for both existing and upcoming applications of SMAs.

Will's on-going work towards his thesis spans across macroscopic and microscopic length scales to discern a complete picture of SMA fracture from extrinsic, metallographic, and crystallographic scopes. Will optimizes his experimental setups with novel improvements such as cross polarizing optics for glare elimination. Furthermore, he has become acquainted with the Daly group's particular specialty of scanning electron microscopy with in-situ digital image correlation.

Will is eagerly learning the intricacies of experimental mechanics with the hope of establishing his own research group. After earning his Ph.D. in mechanical engineering, Will aspires to be an engineering professor who cultivates a passion for inquiry and a dedication to service.

Pawan Maharjan

Choolwe M. Mandona

Danielle M. Martin

James P. Mazza

Pawan Maharjan, LA E '12
Fife Fellow No. 175

As a TBP Fellow, I completed the first year of my master's degree in mechanical engineering at Texas Tech University. In addition to the required courses, I took two electives: Linguistics, which helped me improve my spoken English and Legal Aspects of Forensic Engineering, which taught me a lot about legal systems and how engineering failures are handled in this country.

I am also working on my master's thesis, which is "Residual Stress Determination and Flaw Detection Using Electronic Speckle Pattern Interferometry (ESPI)." I use ESPI technique to measure residual stresses and detect flaws in engineering components and compare results with that obtained from strain gages and theoretical calculations. If the results are similar, I can develop a more accurate and quicker method to detect flaws and measure residual stresses in manufactured industrial products.

Additionally, I have been involved with some student organizations. I am a representative of Graduate Student Advisory Council and have been actively working for its two commissions: "student advocacy and welfare commission" and "academic & professional development commission" to improve student life and education of all graduate students.

Over the next year, I plan to graduate and build a purposeful career in the field of failure analysis. I hope to contribute in reducing engineering failures and building a safe environment, and pay back to the community. Also, I plan to be involved with engineering and outreach organizations.

Thanks a lot to Tau Beta Pi for honoring me as a Fellow and investing in my graduate education. I feel proud to be a part of this great organization and cannot express how grateful I am.

Choolwe Mandona, OH Ξ '13
Zimmerman Fellow No. 2

Being a ΤΒΠ Fellow this past year has been a learning and a rewarding experience. Besides being admitted to the environmental engineering masters' program, I was selected to participate in the one-year certificate program entitled Engineering for Developing Communities. In this program, I took classes focused on water, sanitation and health (WASH), sustainable development and fieldwork methods. To complement these courses, I will be conducting a fieldwork practicum in Rwanda this summer with the non-governmental organization DelAgua Health. This practicum involves a mass intervention of distributing cook stoves and water purifiers to locals in the Western Province of Rwanda.

My work with the Engineering for Developing Communities program expanded outside the classroom. I had the privilege of being part of the co-ordination team that organized a WASH symposium within the department. This symposium brought WASH experts from the U.S. and other parts of the world to present challenges and innovative strategies towards the global issues of water, sanitation and hygiene. I also had the opportunity to present a final paper project entitled Chinese Development Works Well in Africa at the Humanitarian Technology Conference in Boston this may. At school, I also attended workshops and seminars focused on the global development issues.

Academically, I had the privilege to explore different avenues of research within my lab group and the department as a whole. I was also a teaching assistant for environmental engineering processes and environmental microbiology while taking advanced courses in water chemistry and microbiology. This work has led me to pursue water research in UV treatment of carcinogenic volatile organic compounds, which will begin this fall.

Danielle M. Martin, SC A '13
Fife Fellow No. 176

This year I completed my first year in the dual MBA/MS bioengineering program at the University of Pittsburgh. I am concentrating in both marketing and finance in my MBA program and medical device engineering in my engineering master's program. My engineering courses have been focused on product design and development, as well as musculoskeletal biomechanics, because I am interested in a career in the orthopedic medical device industry.

In addition to completing 34.5 credits in course work, I had a strong focus on translational research and entrepreneurship throughout my first year of graduate school. I worked as a graduate fellow for the Wallace H. Coulter Translational Research Partners II program that works to identify, select, develop and commercialize university research projects. Through this position I gained valuable knowledge about the key components needed to effectively start an entrepreneurial business.

During the spring semester, I also competed in the Randall Big Idea Competition, an annual entrepreneurial idea competition to showcase and support the growing innovation network in Pittsburgh. My partner and I won first place and $20,000 for our ACL regeneration project. We have interest from several economic development groups in Pittsburgh and we will continue our commercialization efforts in the coming year.

This summer I will be interning with Bayer Healthcare in their brand management division and look forward to gaining business experience to complement my rich technical background. I will graduate in April 2015 and will pursue full-time positions leveraging my dual degrees in the medical device industry.

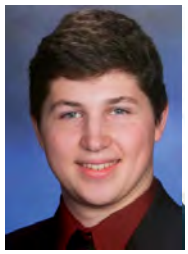
James P. Mazza, NY Π '14
Lynnworth Fellow No. 7

This past year I began working towards my master's degree in electrical engineering at Rochester Institute of Technology. The year was full of exciting new courses as I focused on the design of digital systems for my curriculum. I was able to complete courses in both computer as well as electrical engineering, broadening my knowledge base of digital systems.

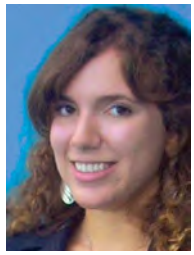
My studies included work in reconfigurable computing as well as multiple processor systems. My research has primarily been in the tradeoffs between hardware and software for color image processing applications. Specifically, I worked with a dual core Cortex A-9 Processor two implement two different algorithms. The algorithms were tested using Posix threads, SIMD instructions, as well as a combination of the two. Finally, the algorithms were run on a multi-channel framework within an FPGA to determine the speedup achieved in hardware.

Following my graduation this spring, I will take several weeks to travel throughout Europe and Southeast Asia. Once I return, I am moving from my home in New York to Dallas, Texas, to pursue a career as a design engineer. I thoroughly enjoyed my time as a ΤΒΠ Fellow and I look forward to many exciting years as an electrical engineer.

Samantha A. McBride



Adrien L.H. Perkins



Isamar Rosa Plata

Jean Paul D. Santos

Samantha A. McBride, NV A '13
Tau Beta Pi Fellow No. 808

My year as a ΤΒΠ Fellow has been full of opportunities and exciting new experiences. During the summer, I had the fantastic opportunity to study abroad in Germany and participate in research there while also taking classes to improve my language skills.

The research at the Universitat Leuphana in Luneburg involved study of eutectic salts for thermal battery applications to improve engine efficiency. Working in a lab group in a different country was a great experience because I learned about the importance of communication and collaboration.

In the fall, I began graduate work towards a Ph.D. in chemical engineering at Rensselaer Polytechnic Institute. I've taken many wonderful graduate classes that have greatly improved my abilities and knowledge in engineering. In particular, my ability to apply math towards solving complicated fluid and heat transfer problems has developed. I joined a lab group working on interfacial fluid mechanics under Dr. Amir Hirsa.

My dissertation is focused on how fluid flows influence chemical processes, and our lab group has been funded by NASA to potentially fly an experiment aboard the ISS in a few years. I'm very excited about continuing my graduate education and remaining involved in academia. I'd like to thank Tau Beta Pi for the opportunity they have given me and the important boast in fulfilling my goal of becoming a research professor.

Adrien L.H. Perkins, NJ B '13
Fife Fellow No. 178

During the past year, I have been working towards my master's degree in aerospace engineering at Stanford University. Graduate school has allowed me to delve deeper into aerodynamics and control systems for aircraft and explore new areas. Outside of classes, I have had the opportunity to be a founding member of the Stanford Unmanned Aerial Vehicle (UAV) Club helping to build a community of UAV enthusiasts on campus.

The highlight of the past year has been an experimental course in design, construction, and testing of an autonomous aircraft. Along with a small team of students, I have put to use many control practices taught in class designing and implementing a control and navigation system for a custom built aircraft with the goal of being the fastest and most accurate at finding targets in a search area.

While I have focused on completing the required coursework during the past year, I have also taken advantage of the wealth of courses offered, learning about new topics such as Global Positioning Systems (GPS). During the upcoming summer I will be pursuing research to design and build a UAV capable of navigating in a GPS denied environment to find the source of a GPS jammer, tying together my newfound interest in GPS and my interest in control systems. I am extremely grateful for Tau Beta Pi's support during the beginnings of my graduate career. In the next year, I will be finishing my master's degree and while I am uncertain as to whether I will pursue a Ph.D. or just enter into industry, I look forward to whatever new challenges the future will bring.

Ismar Rosa Plata, PR A '13
Nagel Fellow No. 16

This academic year, I started my M.S./Ph.D. in structural engineering at Stanford University. In this first year, I have focused on coursework, taking exiting classes such as advanced structural analysis, finite element analysis and fracture mechanics. In addition, I am getting started on research under Dr. Michael Lepech in the topic of Regolith Biocomposites (RBC).

Long-term space exploration presents an interesting problem: the shipping costs are expensive and the predicted resources available are ice water and regolith dust. In collaboration with the NASA Ames Center, we propose that RBC, which are fabricated by combining water, regolith dust and a protein, could provide a cost effective alternative for the creation of lasting extraterrestrial structures. Currently, studies into the microstructure and the behavior of RBC's are underway. My current role in the project consists of studying the rheological behavior of the material, information crucial to create a mixes with constant properties and the form shaping of RBC into structures by robots in the future.

We envision that a material created using the same techniques and with similar mechanical properties to RBC could be used for terrestrial applications, specifically for pavements and housing in developing countries. We predict that the new material, in addition to high thermal mass and fire resistance, will have strengths comparable to low-strength concrete and higher than current packed soil methods (i.e. adobe). During the course of my Ph.D., I hope to shift my research to such terrestrial applications, and study the resilience, strength and feasibility of this novel material, concentrating in its deployment as a low-cost green alternative while completing a minor in policy in the management science & engineering department.

Jean Paul D. Santos, UT A '13
Lynnworth Fellow No. 8

This past Fellowship year was filled with excitement, challenge, and many good changes. I recently completed my first year as a master's student in electrical engineering working towards a thesis. Currently, I am working on a research project that involves designing an antenna array for interplanetary communications for NASA's Mars Rovers. Maintaining good connectivity is of utmost importance and necessitates the state-of-the-art in antenna design. My work has been focused on both the development and the implementation of many novel design methodologies that enhance the quality of service and make the system robust to antenna orientation.

In addition to full-time graduate student research here in University of California, Los Angeles, I have been taking many classes in the area of electromagnetics. My first quarter involved taking classes on advanced electrodynamics and antenna design. It was interesting to study the fundamentals of electromagnetic theory involved in designing antennas and understanding the electromagnetic scattering phenomenon used for stealth design. I continued this journey into the next quarter taking the second phase of the advance electrodynamics class and a class on microwave and millimeter wave circuits.

In the current spring quarter, I am building my knowledge by taking another class on antenna design and numerical electromagnetics. It is so intriguing to see many facets of physics and mathematics involved in this research area, and I am applying the many concepts I learned as an undergraduate student at University of Utah. I want to thank Tau Beta Pi for sponsoring my fellowship year, and I am looking forward to contining as a Ph.D. student in antenna engineering to make enduring contributions to this field.

Jared D. Smith

Kyle A. Steiner

Alaina L. Strickler

Joseph D. Tank

Jared D. Smith, NY Θ '13
Fife Fellow No. 180

This year I began an M.S./Ph.D. program in environmental and water resource systems engineering at Cornell University. My thesis project is rooted within the Earth Energy IGERT research group and deals with spatial analysis of geothermal resources in New York and Pennsylvania. In addition to thesis work, I have taken a plethora of courses on the design of sustainable energy systems through the IGERT program. These have included wind power, hydropower, lifecycle analysis (LCA), and energy economics to name a few. All have been very informative and have enhanced my understanding of what is needed in order to obtain a sustainable energy future.

Outside of academics, I have remained active in ΤΒΠ as a member of the NY Delta chapter at Cornell. I am the subcommittee chair of a mentorship program that I helped establish for freshman and sophomore Cornell engineers to receive advice from upperclassmen in their degree program. I would like to become a chapter advisor for NY Delta as I become more familiar with the college and progress through my Ph.D.

After graduating from Cornell, I plan to continue working on the assessment of natural resources for the purpose of sustainable energy and development. I would also like to apply ecohydrological modeling techniques toward the conservation of natural systems.

Kyle A. Steiner, FL Α '13
Fife Fellow No. 181

This past year, I completed a master's degree in electrical engineering, taking four courses in the fall and three in the spring. I enjoyed courses in artificial intelligence, antennas, RF systems, as well as controls. During this time, I had the opportunity to work as a teaching assistant in both the mechanical and electrical engineering departments assisting with the Design 1 course in each discipline. I enjoyed assisting students with their design projects as they integrated what they had learned from the various engineering core courses.

I also worked as a research assistant in the Center for Intelligent Machines and Robotics. The lab recently received a serial-hybrid vehicle from the Air Force Research Base with dual Ackermann steering and independently driven wheels. I worked primarily on the software and electronics throughout the year, redesigning the emergency stop system as well as the braking and steering systems. The vehicle will ultimately be used as a research platform, and was therefore not covered under a contract. This made for some interesting situations as we often had to repurpose resources available from the lab rather than purchase new parts.

At the end of the fall semester, I accepted a position with Raytheon and began making plans to move back to my hometown of St. Petersburg, Florida with my wife. I'm looking forward to beginning my career this summer working in RF testing and design.

Alaina L. Strickler, OH Α '13
Williams Fellow No. 34

As a chemical engineering graduate student at Stanford University, I have spent the past year engaged in a mix of class work, research, and campus related activities. In the fall and winter quarters, I rotated in the labs of Stacey F. Bent and Curtis W. Frank. With professor Bent, I studied the atomic layer deposition of catalytic thin films for electrochemical hydrogen production. In professor Frank's lab, I worked toward enhancing the stability of high conductivity polymer membranes for anion exchange fuel cells through novel material design. This spring I was awarded a National Science Foundation Graduate Research Fellowship and, after passing my pre-qualifying examination, joined Thomas F. Jaramillo's research group.

In professor Jaramillo's group, I am aiming to enhance the economic viability of fuel cells by developing high performance core-shell nanoparticle electrocatalysts for the oxygen reduction reaction (ORR). Specifically, my work will be focused on identifying the structure-function relationship of the core-shell nanoparticles by elucidating the effect of geometric and electronic structure on catalytic activity through nanoparticle synthesis and characterization. I then hope to leverage this knowledge to achieve a more active ORR catalyst. This area of research fits very nicely with my personal vision of conducting research on sustainable, environmentally friendly technologies within the broader framework of renewable energy development.

This past year has afforded me a number of personal and professional growth experiences. Although it has been an extremely busy period, I have found it both rewarding and enlightening. I look forward to the continued challenges of graduate school and the intellectual fellowship that comes with working alongside an excellent group of researchers and academics.

Joseph D. Tank, IA Β '13
Arm Fellow No. 5

My year as a ΤΒΠ Fellow at the University of Southern California was spent focusing on classes and becoming familiar with the lab I will be working in as I continue with my Ph.D. work in aerospace engineering. My primary focus was getting ready for my screening exam this coming January, which will be a test over the material learned in classes. A large portion of my classes have been in my major focus area, which is fluid mechanics. I also took classes in my minor focus area, controls, and some higher-level mathematics classes.

My second focus was on getting to know the lab that I will be working in, and setting up hot wire probes to be used in our wind tunnel. I began familiarizing myself with the lab by attending lab meetings with all undergraduate and graduate students. After I had a basic idea of what was going on in both our wind tunnel and water channel, I was able to attend teaching sessions put on by some of the senior graduate students that introduced some of the instruments and techniques used in the lab. I was also able to assist other students in setting up and running experiments. My largest contribution to the lab to date was the set up of a hot wire system in our wind tunnel with another graduate student. This hot wire system will allow us to gather high frequency data at a point in the wind tunnel.

My experience in classes and getting to know the lab have been very enjoyable, and I look forward to continuing my education in the coming years.

Xuerong Xiao

Gerardo A. Zamora

Xuerong Xiao, PA B '13
Tau Beta Pi Fellow No. 809

As a ΤΒΠ Fellow, I am working towards the end of my first year of Ph.D. career at Stanford University in the department of electrical engineering. During the year, I have been completing coursework for degree requirements, as well as doing research in nanophotonics.

I focused on theoretical studies in my classes. The knowledge I acquired this year meshes well with my research areas. For instance, waveguide theories deepened my understanding in electromagnetics. Nanophotonics laid the foundation of my research on photonic crystals (PCs). Numerical methods such as FDTD and FDFD became essential tools for me in simulating electromagnetic phenomena involving periodic structures.

The computation of PCs usually assumes infinite structure. A new design of finite PC with reflecting boundaries realized by Braggs reflectors can reduce edge loss and the finite structure has similar properties to an infinite crystal. My research simulates and investigates the phase information of the reflected fields based on the new structure. By engineering the position of the Bragg mirror, we could make tunable optoelectronics devices.

Over the next few months, I will begin to incorporate rigorous coupled-wave analysis in the simulation and build an FDFD solver for 3D problems of interest. I plan to transfer from academia to industry after completion of my Ph.D. program, working with a research team in the field of nanophotonics.

I would like to thank Tau Beta Pi for the support it has given me throughout my pursuit of an engineering career.

Gerardo A. Zamora, ND A '13
Fife Fellow No. 182

My fellowship year, I worked in the field of cryptography with a professor at NDSU. Our research first lead to the area of secure multi-party computation, in which properties like privacy and correctness can be achieved using certain assumptions. In this area, we were able to come up with a two-party protocol for secure integer comparison concretely faster than the best known protocol. We are currently trying to publish these results.

In this work, two servers can run this protocol in order to conclude whether the current highest number is less than the new one, or if it is greater than or equal to it. Later in the year, our research turned towards the direction of secure program evaluation. In which we did a literary survey about the topic, and took the next step ourselves, which is to redesign the processor itself in order to evaluate these programs in a secure manner. This is still a work in progress for now, and it might lead into my master's thesis.