

# 2018 Fellow Reports

*The reports of Tau Beta Pi's 84<sup>th</sup> Fellowship Program and the 2017-18 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 April, and the verb tenses may sound wrong when read later.*

*Each of the 26 recipients expresses appreciation to advisors and 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.*



Paige Balcom



Suri Bandler



Mikayla Barry



Michael Bennett

## Paige Balcom, NH A '16 Anderson Fellow No. 10

I began my graduate work in mechanical engineering at the University of California, Berkeley. I'm focusing in heat transfer and joined Dr. Van Carey's lab, and I'm also heavily involved in development engineering. I completed the majority of my master's classes in heat transfer, development engineering, and started a new research project to transform plastic waste in Uganda into roofing tiles.

In Uganda, much of the plastic waste is burned, 99% of roofs are made of thatch or metal sheets, and 84% of the population relies on subsistence agriculture. My project seeks to reduce plastic waste, offer an affordable, quality roofing option, empower Ugandan entrepreneurs, and maximize sustainability through energy efficiency.

We're exploring flat plate fusion technology, which would be highly energy efficient and require little start-up capital, so entrepreneurs could set up their own tile manufacturing businesses. I've partnered with Gulu Univ. and ChildVoice International and recruited an interdisciplinary team of Berkeley students. We were awarded 2nd place in our category of the Big Ideas competition, and I also received a grant from USAID to fund an assessment trip to Uganda this summer.

For outreach, I presented about the new field of development engineering and transitioning to graduate school to undergrads at the ASME E-Fest West conference. I also volunteered at a weekly after school science program in a low-income neighborhood of Oakland. I founded a new student group called the education initiative for development that connects students from a variety of disciplines with experts to discuss education in developing countries and practical ways to make an impact. I am sincerely grateful for the TBPi Fellowship—it has enabled me to explore a range of opportunities and better equipped me for a career in development engineering in Africa.

## Suri Bandler, MA B '17 Fife Fellow No. 211

After graduating from MIT with a double major in computer science and engineering with a minor in literature, I began my master's program in computer science with a concentration in artificial intelligence at MIT.

This year has been engaging and extremely fulfilling with three primary focuses: research, teaching, and coursework. I'm a member of the genesis group in CSAIL. Our group works on understanding how humans' story understanding faculties separate us from other primates and animals, providing a framework for modeling every capacity of human intelligence. My research focuses on developing a humanly-plausible cognitive theory and a computational framework for modeling rhetorical intelligence capable of understanding this "how." Over the past year, I have developed a prototypical implementation that analyzes simple newspaper articles for an author's intentions regarding blame, sympathy and doubt.

I was a teaching assistant both semesters this past year, with various responsibilities from recitations to holding office hours to writing exams. It's been an extremely rewarding and fulfilling experience and has given me the opportunity to give back to the computer science community and to learn core principles of my field in an even deeper way. It's taught me that you don't really know something until you've built it and taught it.

I have also taken challenging courses that have given me the opportunity to pursue material that is directly related to my specific field of study and to participate in more hands on coursework.

Afterwards, I'm going into industry to apply the engineering knowledge and skills. My master's has so far been incredibly stimulating, rewarding, educational and productive, and it would not been possible without the generous support of Tau Beta Pi.

## Mikayla E. Barry, TX A '17 Williams Fellow No. 38

Since graduating from Texas A&M University with my B.S. in biomedical engineering, I have begun my doctoral program in materials at the University of California, Santa Barbara. During this time, I have studied the core topics of materials science and begun research on bio-inspired polymer coatings under the guidance of Dr. Rachel Segalman.

My project seeks to prevent the attachment of marine organisms on ocean-going vessels; this process, known as "marine fouling," costs the United States \$200 billion per year in increased fuel usage and repair costs. My work uses sequence-defined polymers (which enable exact control over both the chemistry and order of polymer chains) to elucidate the roles played by both the type and location of chemical groups within the microenvironment seen by fouling marine organisms.

This year, I investigated the role of hydrogen bonding in marine fouling, comparing two chemically-similar polymers that varied only by the presence or lack of hydrogen bond donor groups. Outside of research, I have shared my excitement for science through outreach to the public. I regularly volunteer at events that introduce families and children to chemistry and materials science concepts. I am also a co-leader of a biomaterials activity for workshops that teach girls in middle and high school about regenerative medicine.

In the future, I hope to expand my role in scientific outreach with the goal of encouraging future scientists and improving communication with the public. I am very grateful for Tau Beta Pi's support for my graduate education and am honored to represent TBPi as a Fellow.

## Michael D. Bennett, PA E '17 Arm Fellow No. 9

I am finishing the first year of my MS program in civil engineering (geotech concentration) at Virginia Tech. My research is being conducted through VT's center for geotechnical practice and research (CGPR), a consortium of professionals whose input guides the program's selected research topics.

My research focuses on improving organic soils via mixing them with cement. Years of work by previous researchers have made cement mixing a robust, readily quantifiable procedure for strengthening inorganic soils. Since organic soils' chemical compositions differ from those of inorganic soils, the principles of organic soil-cement mixing differ from those for inorganic soil-cement mixing. Therefore, CGPR members have requested a systematic investigation of the cement requirements for organic soil-cement mixing.

Shortly after undertaking the organic soil-cement mixing research I realized that, given the limited extent to which organic soil-cement mixing is understood, pursuing the thesis option would provide an additional semester for investigating this topic. I am grateful that my TBPi Fellowship has made staying an extra semester, and thus

*(Continued on next page)*



Grant Boggress



Chantel Charlebois



Brian Cully



Michael Dunn

earning an MS with a thesis, possible for me. My goal is to repay TBI for its financial assistance by using my additional semester to take my research further, and thereby contribute more to the engineering profession, than I would otherwise be able.

After completing my MS, I plan to work in geotechnical engineering practice for several years and become a licensed professional engineer. At that time, I plan to return to earn a Ph.D. in civil engineering. Also, since I have had many outstanding engineering mentors, I plan to remain active after graduation in groups like TBI where I can mentor young engineers.

### Grant F. Boggress, KY A '17 Spencer Fellow No. 62

During my time as a TBI Fellow, I began the Ph.D. program in mechanical engineering at Rice University. I had the opportunity to work with physicians, engineers, and physical therapists at Mayo Clinic on better calibrating musculoskeletal models. These models allow us to understand patients' muscle force and neural control during movements, and thereby help treatment providers design more personalized rehabilitation protocols for orthopaedic and neurological conditions.

In particular, through the cancer prevention and research institute of Texas our lab has started working with surgeons at MD Anderson Cancer Center to use our models to improve patient recovery after surgery to remove pelvic cancer.

Outside of class and research, I was able to continue my passion of promoting engineering to the next generation by becoming a mentor for DREAM. Through DREAM, I made weekly visits to Austin High School to lead students through a semester-long engineering design project. Throughout the semester we also included talks on college readiness, careers available in STEM while, and our experiences in engineering and other STEM fields.

I am incredibly grateful for the support of Tau Beta Pi over this past year. It has been so rewarding, both in and out of the research lab, and it would not have been possible without Tau Beta Pi and the generous donors.

### Chantel M. Charlebois, NY II '17 Fife Fellow No. 212

After graduating from Rochester Institute of Technology with a BS in biomedical engineering, I began my Ph.D. at the University of Utah in the bioengineering dept. My first year consisted of taking courses focused on neural engineering as well as completing two rotations.

After my rotations, I joined Dr. Christopher Butson and Dr. Alan Dorval's labs whose research focuses on neuromodulation. For my first project, I have been developing patient-specific brain models to simulate electrical stimulation and recording in the brain of epilepsy patients. Electrocoorticography is used to record aberrant brain activity in the brain and localize seizure onset. We will be using these brain models to simulate steering current to certain regions of interest within the brain to modulate brain activity. I intend to present my current work at the BMES and Society for Neuroscience conferences this fall.

Outside of my research, I have been involved with the graduate women in bioengineering group working on professional development and advice from other women in the industry. I organized a "bioengineering mish mash" workshop at a local camp for k-12 girls in STEM to learn about brain electrophysiology and design their own heart valves.

I would like to thank TBI for their gracious support during my first year of graduate school. This support has allowed me to have flexibility in finding a lab and helped prepare me for my future. After obtaining my Ph.D. in bioengineering, I hope to complete a post-doc and teach and do research at a university.

### Brian P. Cully, MD Γ '17 Fife Fellow No. 213

I graduated from United States Naval Academy with a degree in aerospace engineering and a commission as a submarine officer. Later, I moved to the United Kingdom to begin a one-year master's degree in sustainable energy technologies at the University of Southampton. This program focuses on developing and implementing engineering solutions to energy challenges while balancing their economic, social, and environmental impacts. A rigorous course load has featured topics ranging from sustainable cities and transport networks to nuclear, electrical, and ocean engineering.

Under the supervision of Dr. Ian Williams, my dissertation work aims to create a framework for ports of the future to use in their potential implementation of cold ironing, or docked ships' use of on-shore grid electricity in order to reduce emissions and possibly save money. The shipping industry has recently committed to significant carbon reduction, and cold ironing would help it achieve these goals. The Univ. of Southampton benefits from a strong relationship to the port operators and marine scientists. As such, it is an ideal place for a naval officer to explore energy topics that relate to shipping applications. I look forward to attending the Naval Nuclear Power School in Charleston, SC, upon completion of my master's degree.

Beyond the classroom, I have been an active member in the university's photography society and in the Campus Collective, a sustainability-minded student group. I was also fortunate enough to become a leading player on Southampton's water polo team, which provided fun competition and travel opportunities across southern England. The cultural exchange between the US and UK was an incredibly interesting aspect about studying across the pond, and these experiences have made me a more well-rounded naval officer. I sincerely thank TBI and its members for supporting my studies.

### Michael R. Dunn, AL B '17 Matthews Fellow No. 20

After graduating from The University of Alabama with my B.S. in civil engineering, I began my graduate studies at The University of Texas at Austin. Over the past two semesters I have been engaged in both coursework and extensive research activities as I work towards completing my master's degree. I have been able to tailor my coursework to fit my specific interests, and have enjoyed taking classes in public transportation, traffic flow theory, traffic and behavior modeling, and urban planning, among others.

I was signed on as lead researcher on a new project for the City of Austin, where I am building a data-driven framework for ranking the performance of traffic signal corridors in order to increase the efficiency of signal retiming operations for the city.

Shortly after arriving in Austin I was selected as the vice president of publicity for the joint student chapters of the Institute of Transportation Engineers (ITE) and the Intelligent Transportation Society (ITS). Through this responsibility I have had the opportunity to network with transportation professionals from across the country, plan a wide variety of events both technical and social, and participate in recruiting the best and brightest transportation engineering students.

As we move into the summer, I am excited to attend the annual meeting of the western and Texas ITE districts this summer in Keystone, Colorado, where I will be representing UT as part of the intercollegiate traffic bowl competition. Additionally, I am looking forward to continuing my research and beginning to construct my thesis. I am incredibly thankful to Tau Beta Pi for the support that this fellowship has given me, and everything that it has allowed me to pursue through graduate study. It has been invaluable in preparing me for a successful career as I move forward.



Kyle Gilman

**Kyle J. Gilman, WY A '17**  
**GIECO Fellow No. 2**

Following my graduation from the University of Wyoming with a B.S. in electrical engineering, I interned with the U.S. Air Force research laboratory in Dayton, OH, where I researched 3D image segmentation of elastomer particulates from optical serial-sectioned data using machine learning and image processing. This pipeline allowed the AFRL team to further study the geometry and electrical characteristics of an important composite polymer material.

In August, I began my Ph.D. studies at the University of Michigan joining the research labs of Dr. Laura Balzano and Dr. Jason Corso. With Dr. Balzano and Dr. Corso, my research has focused on convex optimization with computer vision applications. I currently work on solving computer vision problems with robust principal component analysis to complete low-rank matrices with missing data and/or additive sparse corruptions. This methodology has many useful purposes in video foreground/background segmentation and subspace tracking for classification. Methods to encourage semantically meaningful group sparsity particularly interest me.

I've also been a part of the Univ. of Michigan data driven discovery of models team—a DARPA project to develop an automated model discovery system for users with little data science background to quickly implement machine learning pipelines. As part of the team that builds and implements the system's primitives, I've focused on understanding, implementing, and improving the Grassmannian Robust Adaptive Subspace Tracking Algorithm, specifically to autonomously choose an appropriate step size in the Grassmannian manifold descent.

I'd like to take the time to again thank Tau Beta Pi for its generous support towards my doctoral education. I'm honored to have been selected as a TBPI Fellow and am grateful for the many opportunities this fellowship has afforded me.

**Katherine A. Hollar, ID Γ '17**  
**Anderson Fellow No. 11**

Since being a TBPI Fellow, I began pursuing a master of science in mechanical engineering en route to a Ph.D. in materials science & engineering at Boise State University. I have also actively led two biomedical engineering projects with both focused on understanding and characterizing healing ligament or knee meniscus degeneration. Because of the novelty of investigating knee meniscus degeneration, I was recently selected to receive a NSF Graduate Research Fellowship. In addition to research, I completed my first year of classwork, which has helped provide the foundation to successfully interpret the results of my research projects.

This year, I also had the opportunity to instruct an introductory material science & engineering lab. Because I was given the chance to prepare lectures and explain complicated subjects in an understandable manner, it re-confirmed my career goal to become a professor.

Besides academics, I have also been involved in community outreach, such as participating in an annual event called Bronco Day. This is a time where prospective students come to visit BSU and learn about the numerous opportunities present. Through the BSU engineering dept, I introduced the research I completed as an undergraduate, which was on the development of an imaging technique to measure wear in joint prosthesis. More importantly, a brief demonstration of this technology was used on a sample hip liner. Through this demonstration, students were able to witness how biomedical engineering can be successfully used to make transformative changes in the field of medicine.

I am truly grateful and honored for the support from TBPI. Through this fellowship, I have been able to fully immerse myself in my academic studies and research. I plan to continue to conduct biomedical research that has never been explored.



Katherine Hollar



Rebekah Koehn

**Rebekah R. Koehn, IN Δ '17**  
**King Fellow No. 56**

After graduating with a degree in mechanical engineering from Valparaiso University, I attended the 41st annual meeting of the American Society of Biomechanics in Boulder, CO, and presented the findings from my final undergraduate research project.

Shortly after, I moved to Columbus, OH, to pursue a Ph.D. in mechanical engineering at The Ohio State Univ. with a research focus in biomechanics. In my 1st year, I completed several courses in the areas of statistics, health and rehabilitation sciences, mechanical engineering, and physical therapy. These courses have provided me with a well-rounded base of knowledge which has already proven to be useful in my research efforts.

I also began working in the neuromuscular biomechanics laboratory as a member Dr. Robert Siston's group. My first project was aimed to better inform clinical treatment and rehabilitation processes for total knee arthroplasty (TKA) patients by examining changes in neuromuscular control post-operatively. Using muscle activations as a surrogate measure for neural control, I computed modular muscle activation patterns from walking tasks at 6 and 24 months following TKA. I will present my initial findings at ASB's 42nd annual meeting in Aug. 2018 and am currently working to expand this project to include data from TKA patients who were also tested pre-operatively.

In addition to my coursework and research, I attended the 2018 annual meeting of the Orthopaedic Research Society in New Orleans, LA, attended various seminars on biomechanics and physical therapy, and began to develop a mentorship role by training new undergrad researchers in our lab group. I am very thankful for the generous support of TBPI and for the opportunities which were opened to me through this fellowship.

**Mark R. LaFollette, KS A '17**  
**Fife Fellow No. 214**

After graduating from the University of Kansas with a degree in chemical engineering, I began my graduate studies at the University of Delaware in their chemical engineering doctorate program. During this past year, I have been mostly focusing on completing the core coursework in chemical engineering of thermodynamics, transport phenomena, and kinetics and reactor engineering as well as a deeper understanding of mathematics through numerical methods and probability & statistics.

In addition, I have broadened my interest in catalysis through an electrochemical energy engineering class and a surface science course on the chemistry and physics of surfaces and interfaces. These courses have laid out the groundwork for my Ph.D. and helped me to have a better grasp of the chemical engineering fundamentals.

I have joined the lab of Professor Raul Lobo and have begun work in zeolite catalysis. The goal of my research is to develop better catalysts for methanol to olefins to produce useful chemical products such as ethylene and propylene. I have begun to synthesize the first of the zeolite catalyst I will be using for this project. This topic will allow me to combine my passion for chemistry with chemical engineering. It has been a great honor to be a TBPI Fellow and I am grateful for the support it has provided to me over the past year.



Mark LaFollette



Victoria Marks



Conor Martin



Christopher Matthews



Catherine Meis

### Victoria S. Marks, FL B '17 Fife Fellow No. 215

After graduating with my B.S. in biomedical engineering from the University of Miami, I began my doctoral studies in biomedical engineering and physiology at the Mayo Graduate School of Biomedical Sciences. This year has been dedicated to coursework in preparation for the Ph.D. qualifying exam.

As a first-year Ph.D. student, I have rotated through a select few labs in search of a thesis advisor. While I have not made my final decision regarding my thesis lab, I have had the opportunity to be mentored by four excellent scientists. In working with Dr. David Linden's lab, I presented my work with enteric glial cell signaling at Mayo's young investigator research symposium. I helped build a system for electrophysiological recording in awake, behaving mice with Dr. Luis Lujan. I studied memory formation with Dr. Gregory Worrell in the Mayo systems electrophysiology lab. I have further investigated physiological monitoring with Dr. Clifton Haider. I have submitted abstracts to both the BMES and Asimolar conferences in hopes of presenting more in-depth discussions of my first-year lab experiences.

Outside of lab, I am on the executive boards for the Southeast Minnesota Chapter of BMES and the Southern Minnesota Section of IEEE. My responsibilities therein include planning social activities for graduate students and finding interesting speakers for section meetings. I am also involved with the initiative for medical equipment sustainability and am helping organize follow-up trips to Belize and El Salvador to propose solutions to problems from our last visit.

This year has been incredibly challenging and rewarding, and I am very thankful for the support from Tau Beta Pi which has helped ease the transition to graduate school. I plan to continue my studies of physiological monitoring and digital signal processing as I choose my advisor and begin my thesis research.

### Conor D. Martin, NY N '17 Record Fellow No. 1

During the past year as a TBPI Fellow, I have begun my studies as a graduate student at Caltech and will be continuing on in the space engineering Ph.D. program. Following completion of the master's portion of my degree track, I will then begin work towards my Ph.D.

My first year in this program has been focused on advanced coursework in fundamental aerospace engineering topics including applied mathematics, space propulsion, and fluid & solid mechanics. In addition, I have also been involved in an integrated aerospace engineering course focused on all aspects of spacecraft design and mission planning. This course culminated in a team project working on a soon to be launched student spacecraft mission called Autonomous Assembly of a Reconfigurable Space Telescope under the advisement of our instructor, Dr. Sergio Pellegrino, the Space Structures lab group, and Dr. Dan Scharf of JPL.

In this project, I have been working as a part of the telecom team on testing the on-board radio and integrating it with the VHF and UHF antennas. Through these experiences, I have been able to significantly deepen and improve my fundamental understanding of the field in preparation for my qualifying exams next fall.

I have also been volunteering in the Caltech Y: Rise tutoring program for local 8-12th grade students struggling with science and math. This has provided an amazing opportunity to mentor young students who are interested in, but also intimidated by, careers in engineering and to provide lasting guidance and support. I am eternally grateful and honored to have been selected as a TBPI Fellow this past year, it has been truly a rewarding experience.

### Christopher Matthews, AR A '17 Record Fellow No. 2

After earning a BSEE from the University of Arkansas in 2017, I began working toward a Ph.D. in electrical engineering at Georgia Tech. I joined the lab of Dr. W. Alan Doolittle, where I will be focusing on group III-nitride solar cell fabrication.

During my first semester, I split my focus between the ECE department's preliminary exam, coursework, and getting trained on the various research tools in our lab. My introductory courses in quantum and solid-state physics as well as surface science gave me a strong base to build from as I progress in my Ph.D. I was also able to pass the preliminary exam, which allowed me to have a research-oriented second semester.

In January, I began my independent research, focusing on optimizing processes for future studies and improving feedback and control for one of the lab's older tools. I have been able to identify a process that should provide a suitable baseline for device studies moving forward. I have also finished the designs for two additional control interfaces for our tool. My focus this coming summer will be on growing and characterizing III-nitride diodes as I work toward my first paper related to this research.

Once I complete my Ph.D., I plan to pursue a professorship and continue researching methods to advance renewable energy technology. I am honored to have served as a TBPI Fellow and grateful for the support that I have received. The fellowship has been a blessing throughout the past year, allowing me to focus on my research and coursework and build a strong foundation as I move forward in my graduate education.

### Catherine M. Meis, IA A '16 Record Fellow No. 3

After graduating with a bachelor's degree in materials engineering from Iowa State University, I spent the summer as an intern in corporate research and development at Medtronic, PLC, working to help develop implantable glucose sensors.

I began my Ph.D. in materials science and engineering at Stanford University in September. So far, I have largely been focused on completing core course requirements within materials science to prepare for qualifying exams. I have also enjoyed taking elective courses in topics related to potential future areas of research, such as biomaterials for regenerative medicine, cellular mechanotransduction, and biological macromolecules.

I joined the supramolecular biomaterials research group under the supervision of Dr. Eric Appel. The group has core expertise in developing hydrogels primarily for biomedical applications, such as drug and vaccine delivery. My initial project involves materials characterization of one of the group's hydrogel platforms; specifically, we are trying to understand how the interactions between the polymer matrix and polymer nanoparticles influence mechanical properties.

Outside of courses and research, I have joined the Materials Research Society and the Stanford Polymer Collective. I enjoy helping with STEM outreach, organizing poster sessions, and brainstorming ways to promote networking and collaboration across campus and with nearby industry. I am so fortunate to have been selected for this generous fellowship from TBPI, and I look forward to continuing my graduate studies and exploring available opportunities at Stanford.



Alekos Michael



Andrew Morgan



Lagnajit Pattanaik



Benjamin Pesante

**Alekos J. Michael, CO Z '17**  
**Record Fellow No. 4**

This past year as a TBI Fellow, I began pursuing a master's degree in aerospace engineering with the aero-astro department at Stanford University. My first two quarters consisted of vigorous coursework geared toward artificial intelligence and robotics, which laid the foundation for my current research in autonomous aerial systems.

With the resources of the aerospace design lab at Stanford, my current project focuses on testing and validating potential methods of implementing autonomous drones for public transportation with the Uber Elevate initiative. Major cities are plagued with gridlock traffic and limited parking spaces, making it extremely difficult for commuters to maximize the efficiency and productivity of their days. Having a local network of automated aerial transportation systems will certainly alleviate the roadways, reduce time spent travelling bumper to bumper, and open the skies to the possibility for the personal "hover cars" of the future.

Overall, I am honored to have been selected as a TBI Fellow and I am sincerely grateful for the support the award and the community have offered me to further my graduate studies. I am excited to complete my graduate education and apply the knowledge and experience I have gained into designing and fabricating a new product for my own drone startup called AeroShield.

**Andrew S. Morgan, OH Λ '17**  
**Tau Beta Pi Fellow No. 816**

Following graduation from Youngstown State University in the Spring, I have spent the past year as a TBI Fellow beginning my Ph.D. at Yale University. Arriving at Yale in the summer, I immediately began research in Professor Aaron Dollar's grab lab, which primarily focuses on design and functionality of hand prosthetics and robot end effectors.

Within this past year, I have completed 8 of the 10 courses required for my program and have worked on three projects, two of which have been submitted for publication. One area of great interest in the robotics community is that of using robot grippers for dexterous manipulation. Upon joining the lab, I began working on learning "modes" of within-hand manipulation using underactuated robot end effectors and various machine learning techniques. As a third author on the paper, this work was accepted to the International Conference on Robotics and Automation (ICRA) and was nominated for "best manipulation paper" for the conference.

I continued with an extension of this project which looks at understanding what generalized features are most important for gripper state estimation. These features may help us define primitives to approach the decades long study of dexterous manipulation in robotics.

As I begin my career as a researcher in the ever-evolving field of robotics, I so am excited to contribute to this international community. I am so immensely thankful for the support of TBI and the fostered opportunities this fellowship has afforded me. I look forward to what we can all do for enhancing the science community in time to come.

**Lagnajit Pattanaik, OH Γ '17**  
**Centennial Fellow No. 32**

This past year, I have had the opportunity to take challenging, yet enlightening, graduate coursework and make new friends along the way—especially current Tau Beta Pi Fellows: Charles Wan and Kevin Tenny. Additionally, I have used this time to set the foundation for my thesis work.

After graduating from the Ohio State University, I held an internship at Owens Corning under their composite materials business. There, I helped develop multilayered and multifunctional nonwoven mats, extending different input chemistries to the pilot plant scale.

My first semester at MIT involved solidifying my chemical engineering fundamentals with classes in thermodynamics, mass and energy transport, and numerical methods. During this time, I also searched for a thesis project and advisor that piqued my interest. In the end, I decided to be co-advised by Professors Bill Green and Klavs Jensen, joining a project to develop a retrosynthetic planning software.

For these past few months, I have worked on small data quality projects to better learn the software while finishing the core requirements for my major. Since the predictive capabilities of the software are built on machine learning approaches, I also enrolled in a computer science elective to learn the necessary skills. In the coming years, I hope to hone my skills as a computational chemist to integrate supplementary tools into the software to increase its accuracy. I am incredibly thankful to Tau Beta Pi for helping to fund my future.

**Benjamin Pesante, DC B '17**  
**Tau Beta Pi Fellow No. 817**

The objective of Ben's research this year was to study the interaction between synovial fluid and knee articular cartilage using microscopy techniques, in order to develop a better understanding of the physiology of articular cartilage that may lead to novel treatments for osteoarthritis. Here, bovine cartilage explants were harvested, and different groups were prepared for testing. These groups were scraped (osteoarthritic) explants in neutral solution, scraped explants in synovial fluid, and un-scraped control explants in neutral solution.

Polarized light microscopy was used to take both surface and cross-sectional images of the explants. Once the images were processed using various computer programs, measurements were taken to see the effects of synovial fluid on articular cartilage. Dependent variables included superficial zone thickness, surface texture, and signal intensity of the cartilage explants. Results showed significant differences in signal intensity between scraped samples in synovial fluid and scraped samples in neutral solution.

Ben will continue his research on articular cartilage by studying the viscosity of synovial fluid using nanoparticle tracking, and studying the displacement of the fluids on articular cartilage by measuring the movement of fluorescent nanoparticles in the solutions.

After completing his thesis, Ben plans to submit his research to be published. This fall, Ben will begin work in biomedical industry, and after a year will attend medical school. He is very interested in biomechanics and sees a future in sports medicine and orthopedics.



Taylor Rothermel



Kevin Tenny



Caelin Tran



Mikayla Walters

### Taylor M. Rothermel, SC A '17 Record Pi Fellow No. 5

After graduating from Clemson University with a B.S. in bioengineering with a concentration in biomaterials, I began my doctoral studies at the University of Minnesota–Twin Cities. This first year has been focused on taking challenging courses to expand my knowledge of biomechanics and cellular engineering techniques as well as beginning the lab work that will be the foundation of my thesis.

After doing a rotation with three professors, I joined Dr. Pat Alford's lab which is studying the mechanics of adaptive tissues. My research focuses on examining the stress-strain behavior of vascular smooth muscle cells and cardiomyocytes using a cellular microbiaxial stretching method to understand cellular anisotropy and develop biomechanical models.

Outside of lab, I have been fortunate to have the opportunity to perform outreach to the local community. One of the most meaningful experiences I had this year was traveling to a local elementary school to teach students what it means to be an engineer by having them design and construct helmets out of household objects and test the effectiveness of their helmets on a crash test dummy.

I am extremely grateful to Tau Beta Pi for supporting my pursuit of a graduate degree through this fellowship. This past year has been both exciting and challenging, and I look forward to the rest of my academic career as I continue to grow as an engineer.

### Kevin M. Tenny, KS A '17 Dodson Fellow No. 4

After graduating from the University of Kansas, I spent the summer months working on campus as a summer residential assistant, an assistant engineering librarian, and an editor for StatPearls, LLC. During that time, I published five, first-authors articles: two are in the *Journal of the Electrochemical Society* and three are on PubMed.

Additionally, I passed the F.E. for chemical engineering and am now listed as an "Engineer-in-Training" with the State of Kansas. I began my Ph.D. in chemical engineering at the Massachusetts Institute of Technology in September 2017. This past year, I have had the opportunity to take challenging, yet enlightening, graduate coursework and make some new friends along the way—especially current TBPi Fellows: Charles Wan and Lucky Pattanaik.

I am co-advised by Dr. Fikile Brushett (chemical engineering) and Dr. Yet-Ming Chiang (materials science & engineering), where I work on improving energy storage devices for grid-level implementation. Through the generosity of the U.S. Department of Energy joint center for energy storage research, I will be continuing to explore areas in energy storage development through novel materials and models throughout my doctoral studies.

Outside of research, I continue to read various fiction and non-fiction books, as well as play the piano. Recently, I was appointed the athletics chair for one of the graduate dorms where I will be in charge of fitness classes and maintaining the in-house gym. I look forward to the rest of my graduate career and the leadership opportunities that await. Finally, I would like to thank everyone at Tau Beta Pi—students, administrators, donors, and so many more—who have helped me get to where I am today. I am indebted to you all.

### Caelin Kiem-Toan Tran, CA Γ '17 Forge Fellow No. 6

Last year, I graduated from Stanford University with a bachelor's degree in chemical engineering and shortly after began my mas-

ter's degree in computer science (CS). The following quarters have been packed with exhilarating classes, research projects, and teaching opportunities.

This spring, I will graduate with a master's in CS with a focus in artificial intelligence, and I am excited to begin my first job in Boston, Massachusetts. My motivation to study CS stems from my experiences in the renewable energy space, which have led me to believe that there are powerful, deeply intertwined trends in energy, mobility, and technology that require knowledge of AI to understand and develop.

My courses in machine learning, neural networks, and modeling have given me that knowledge, and I have already had a number of opportunities to make use of it. One application that has captivated me is the use of satellite imagery to predict crop yields in developing countries. Modeling food production is important to agriculture everywhere, but traditional data collection methods are expensive compared to remote sensing.

In addition to learning and practicing cutting-edge CS, I have also had the pleasure of teaching it as a course assistant for computer systems classes. I have continued serving my TBPi chapter as an advisor and feel very proud watching its new leadership grow and succeed.

The TBPi community has been an important part of my life as a student, and I am endlessly grateful for the flexibility and support provided to me as a TBPi Fellow. Thank you.

### Mikayla G. Walters, AL E '17 Zimmerman Fellow No. 6

After being named a TBPi Fellow, I spent the summer in Santiago, Chile, doing research in synthesis of polyazomethines at the Pontificia Universidad Catolica de Chile with Dr. Claudio Terraza. This wrapped up my Spanish minor for my B.S. from the University of South Alabama (USA).

In August, I started the master's program in chemical engineering also at USA. I completed all of my coursework this year, building on the fundamentals by learning how to handle non-idealities and gaining experience with methods and coding needed to solve more complex problems.

I served as a teaching assistant for the junior level laboratory course. This summer, I will improve upon one of the first-time experiments. My research is with Dr. Brooks Rabideau in molecular dynamics simulations for cellulose solubility in aqueous quaternary phosphonium hydroxide. Cellulose is a widely available and highly underutilized resource, which can serve as a feedstock for many platform chemicals or be converted into ethanol. The current challenges are in processing it in a cost/energy-efficient and environmentally friendly way, hence I am researching an improved solvent system.

I am on track to defend my thesis proposal in May and graduate in December 2018. I really enjoyed my elective course, industrial chemical process engineering, where my group and I completed hand-drawn P&ID's and conducted a process hazard analysis. During this course, I gained a new passion for process design and analysis. Executing the basic engineering phase for a reaction system was both engaging and fulfilling to me, and I enjoyed solving problems and completing the technical documents.

I hope to work for Evonik Industries in Alabama as a process/project engineer. I am very grateful for the generosity of TBPi which has allowed me to prioritize my courses, research, and teaching duties. I have learned so much more about myself and my goals this year and look forward to starting an exciting and challenging full-time engineering position.



Charles Wan



Richard Yang

## Charles Tai-chieh Wan, NY $\Delta$ '17

### Nagel Fellow No. 20

Upon graduating with a B.S. in chemical engineering from Cornell University, I began my Ph.D. in chemical engineering at MIT. In addition to continuing to pursue my interest in electrochemical energy based technologies, this past year, I have had the opportunity to take challenging, yet enlightening, graduate coursework and make some new friends along the way—especially current TBPi Fellows: Kevin Tenny and Lucky Pattanaik.

The first semester in particular provided an opportunity to revisit and expand upon core chemical engineering topics including thermodynamics, transport phenomena, and numerical methods, with a focus on approaching problems using first-principles. Jointly supervised by Prof. Fikile Brushett and Prof. Yet-Ming Chiang, my research centers on designing advanced materials for redox flow batteries for grid storage applications, particularly to accelerate the transition away from fossil fuels and towards intermittent renewable energy sources, while also improving the reliability and efficiency of the current grid.

To achieve such a goal requires next-generation materials, the focus of the research I have performed and plan to. This includes surface modification of porous electrode materials, biomass-derived sustainable electrodes, metal semi-flow cells for improved energy density, and mixed polymer-ceramic membranes to mitigate active species crossover. Spanning the fields of materials science, electrochemistry, chemical engineering, and mechanical engineering, this task will require furthering our understanding of phenomena at multiple length scales, with the paradigm of basic, fundamental research with urgency.

I am extremely grateful to Tau Beta Pi for this award, which has helped make my transition to graduate school smooth. The TBPi community has been generous to me, and I anticipate paying it forward throughout my career.

## Richard Yang, WY A '17

### Sigma Tau Fellow No. 43

Last year, I graduated from the University of Wyoming with B.S. degrees in computer science and computer engineering. I interned at University of Southern California's institute for creative technologies before starting my M.S. program in computer science at Stanford University.

Amongst challenging coursework, I continued to pursue my previous research. My first author paper "Predictive Liability Models and Visualizations of High Dimensional Retail Employee Data" was accepted at the 2018 International Conference on Innovation in Artificial Intelligence conference. I was also a contributing author to a workshop paper "Simulating Collaborative Learning Through Decision-Theoretic Agents", which was accepted at the 2018 Artificial Intelligence in Education conference.

Last quarter, I joined the Stanford MobiSocial computing lab as a research assistant to pursue research with Dr. Monica Lam. My research is on the intersection of artificial intelligence and human-computer interaction, specifically involving user interfaces and interaction with virtual assistants. We currently have a paper under review for the 2018 User Interface Software and Technology Symposium.

This summer, I will be an AI Scientist intern at NIO in San Jose, working with the autonomous vehicles and data science team. I want to express my gratitude for TBPi's generosity and support of my education. I am very fortunate and honored to be selected as a TBPi Fellow.