I-STEM EDUCATION INITIATIVE

Science, Technology, Engineering, and Mathematics Education | University of Illinois at Urbana-Champaign

2018: THE YEAR IN STEM EDUCATION

ILLINOIS

UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

A SAMPLING OF ILLINOIS STEM EDUCATION OUTREACH PROGRAMS*

Discipline/Unit:

- ☐ ACES
  - ACES Family Academies: https://acesalumni.illinois.edu/events/aces-family-academies
- ☐ Aerospace Engineering
  - Illinois Space Society: http://iss.ae.illinois.edu/
  - Illinois Aerospace Institute (IAI): http://iai.aerospace.illinois.edu/
  - Ilini Aerospace Outreach (IAO): email: aero-outreach@illinois.edu
- ☐ Bioengineering
  - Biomedical Engineering Group (BMES): http://bmes.ec.illinois.edu/
  - BioImaging Research Experience for Undergraduates (REU): http://nano.illinois.edu/REU-Bioimaging/
- ☐ Biology/Microbiology
  - Chung Lab: https://mcb.illinois.edu/chunghj/neuroscience-outreach/
  - Graduates in Ecology and Evolutionary Biology (GEEB): https://www.life.illinois.edu/geeb/
  - MCBees—MCB Graduate Student Organization: https://publish.illinois.edu/mcbgrad-gsa/; https://www.facebook.com/
- ☐ Chemical and Biomolecular Engineering
  - Brady STEM Academy: http://chbe.illinois.edu/outreach/brady-stem-academy
- ☐ Chemistry
  - Bonding With Chemistry: https://chemistry.illinois.edu/resources/women-chemistry/women-chemists-committee/events/bonding-chemistry
  - REACT: http://www.chemistry.illinois.edu/outreach/react/index.html; email: thereactprogram@gmail.com
  - Women Chemists Committee (WCC): https://chemistry.illinois.edu/resources/women-chemistry/women-chemists-committee
- ☐ Computer Science
  - ChicTech: http://wcs.illinois.edu/chictech/
  - CS@Illinois Sail: https://www.facebook.com/illinoissail/
  - Girls Engaged in Math & Science (GEMS): https://cs.illinois.edu/outreach/gems-computer-science-camp-girls
  - Women in Computer Science (WCS): http://wcs.illinois.edu/
- ☐ Dietetics
  - NutrImpact: http://publish.illinois.edu/nutrimpact/; email: nutrimpact@gmail.com
- ☐ Engineering
  - Engineering Open House (EOH): http://eoh.ec.illinois.edu/
  - Engineering Outreach Society (EOS): https://publish.illinois.edu/engineeringoutreachsociety/
  - Engineering Advocates: http://eib.ec.illinois.edu/engineering-advocates/
  - ICANEXSEL: Illinois-ChiS&E Alliance for Nurturing Excellence in STEM Education Leadership; email: info@chiprep.org
  - Illinois Engineering Ambassadors: http://ambassadors.engr.illinois.edu/news.html
  - Engineers Without Borders (EWB)
  - Engineering for Social Justice Scholars (ESJ)
- ☐ Entomology
  - Bugscope: http://bugscope.beckman.uiuc.edu/
  - Entomology Graduate Student Association (EGSA): https://publish.illinois.edu/uiuc-egsa/
  - Pollinatarium: https://pollinatarium.illinois.edu/

*For a complete listing of Illinois STEM Education Outreach programs, see: http://istem.illinois.edu/resources/stem-ed-outreach.html

- Genomics
  - Genome Day: https://www.igb.illinois.edu/acquainted/genome-day
- Geology
  - Bruce Fouke Research Group: https://www.geology.illinois.edu/people/fouke/
- Integrative Biology
  - Graduates in Ecology and Evolutionary Biology (GEEB): https://www.life.illinois.edu/geeb/
  - Plant Biology Association of Graduate Students (PBAGS): https://www.life.illinois.edu/pbags/
- Mathematics
  - Association of Women in Math (AWM): http://www.math.illinois.edu/awm/
  - Girls Engaged in Math and Science (GEMS): https://math.illinois.edu/gems
  - Illinois Geometry Lab: https://math.illinois.edu/research/igl, email: igl@math.uiuc.edu
  - Math Carnival: Gathering for Gardner: https://faculty.math.illinois.edu/~lanius2/outreach.html
  - Summer Illinois Math Camp (SIM): https://faculty.math.illinois.edu/~emerrim2/SIM_Camp/
  - Sonia Math Day: https://math.illinois.edu/sonia-math-day
  - Urbana High School Project (ALEKS, Math)
- Mechanical Science and Engineering (MechSE)
  - American Society of Mechanical Engineers (ASME): http://asme.mechse.illinois.edu/
  - Bahl Research Group: http://bahl.mechse.illinois.edu/
  - Engineers Volunteering in STEM EducatION (ENVISION): https://publish.illinois.edu/envisionuiuc/events/
  - MechSE Education Outreach: (Joe Muskin: Education Coordinator: jmuskin@illinois.edu)
  - Pi Tau Sigma: url: http://pitausigma.mechse.illinois.edu/; email: ptsillinoisalpha@gmail.com
  - Rheology Zoo: http://ewoldt.mechanical.illinois.edu/index.html
- Technology
  - Makergirl: https://makergirl.us/
- Robotics
  - iRobotics: http://irobotics.illinois.edu/
  - Illinois First: http://www.firstillinoisrobotics.org/
- Physics
  - Physics Van: physvan@physics.illinois.edu
  - Physics Young Scholars Program: https://npl.illinois.edu/YoungScholars.asp
- Veterinary Medicine
  - Vet Med Open House: http://vetmed.illinois.edu/about/open-house-demos-and-exhibits/
  - Veterinary Student Outreach Program: http://vetmed.illinois.edu/asa/vsop/

Centers:

- Center for Global Studies
- Center for Nanoscale Science and Technology
  - Nano @ Illinois REU: http://nano.illinois.edu/
- NCSA
  - Blue Waters
    - Blue Waters Graduate Fellowship Program: https://bluewaters.ncsa.illinois.edu/fellowships
    - Blue Waters Internship Program: https://bluewaters.ncsa.illinois.edu/internships
  - CADENS: http://avl.ncsa.illinois.edu/category/cadens
    - INCLUSION: https://reu.ncsa.illinois.edu/welcome-to-reu-inclusion/
    - SPIN: http://spin.ncsa.illinois.edu/

- POETS
  - POETS Research Experience for Undergraduates (REU): a 10-week summer research program that provides undergraduate students with an opportunity to explore careers in research: https://poets-erc.org/reu/
  - POETS Research Experience for Teachers (RET): provides opportunities for middle and high school teachers to be immersed in the culture of engineering research at a POETS institution and develop curriculum based on POETS research through a paid fellowship that comprises both summer and year-long activities: https://poets-erc.org/ret/
  - POETS Young Scholars Program: an opportunity for high school students to advance their goal of pursing higher education: http://poets-erc.org/education/pre-college/young-scholars-summer-research-program/
- RailTEC: http://railtec.illinois.edu/

Student Groups:

- Society for Advancement of Hispanics/Chicanos and Native Americans in Science (SACNAS): email: uiuc.sacnas@gmail.com
  - Cena & Ciencias: http://publish.illinois.edu/cenayciencias/
- Sistas in STEM: https://twitter.com/sistas_in_stem?lang=en
- SWE (Society of Women Engineers, Illinois chapter): http://societyofwomenengineers.illinois.edu/outreach/
  - Dads and Daughters Do Science (DADDS): 1st–3rd grade girls and their dads to do hands-on engineering activities together.
  - Engineering Round Robin: day-long campus visit allows high school girls to explore engineering fields: https://www.societyofwomenengineers.illinois.edu/upcoming-events/2017/10/7/engineering-round-robin
  - For Kids Only (FKO): SWE engineering students visit Leal Elementary's kindergarten class weekly to do an engineering lesson and a hands-on activity.
  - Introduce-A-Girl-to-Engineering Day: https://www.societyofwomenengineers.illinois.edu/upcoming-events/2018/2/17/introduce-a-girl-to-engineering-day-2018
  - Mommy, Me, and SWE: outreach for 4th–6th grade girls and their moms.
  - Outreach to Champaign-Urbana Special Recreation Center (monthly)
  - Step-Up. Monthly outreach at St. Matthew Middle School doing STEM topics and an engineering project.
- Women in Engineering (WIE): http://wie.engineering.illinois.edu/

Externally Funded:

- NCSA
  - Blue Waters
    - Blue Waters Graduate Fellowship Program: https://bluewaters.ncsa.illinois.edu/fellowships
    - Blue Waters Internship Program: https://bluewaters.ncsa.illinois.edu/internships
  - CADENS: http://avl.ncsa.illinois.edu/category/cadens
    - INCLUSION: https://reu.ncsa.illinois.edu/welcome-to-reu-inclusion/
    - SPIN: http://spin.ncsa.illinois.edu/
- Extreme Science and Engineering Discovery Environment (XSEDE)
  - XSEDE Scholars Program: https://www.xsede.org/xsede-scholars-program
  - XSEDE Student Champions Program: https://www.xsede.org/web/guest/student-champions
- Illinois Partnership for Respecting the Identities of Students in Engineering (iRISE): http://irise.illinois.edu/

CONTENTS

A CAMPUS-WIDE INTERDISCIPLINARY COLLABORATION...

In spite of the severe economic challenges at both the local and state levels, 2018 was an eventful year in STEM Education initiatives at the University of Illinois at Urbana-Champaign. With well-known dedication, faculty, graduate students, and undergraduates on our campus extended their research and teaching expertise by working together and participating in interdisciplinary activities to design accessible, high-quality, innovative STEM Education programs.

The 2018 I-STEM magazine features more than 350 pages of selected stories highlighting how cutting-edge research innovations on our campus successfully transferred to STEM Education initiatives to increase and diversify students' interests in STEM projects. Each story illustrates contextually powerful STEM activities bringing new learning perspectives to what traditionally has been perceived as disengaged scientific research. Each story exemplifies that STEM Education is not only about sciences, but also about the educative value and the social good of scientific innovations and research. Concentrating our efforts to improve STEM education does not serve only to prepare the future STEM workforce, but also to respond to the interests and values of all legitimate stakeholders, in particular those traditionally not heard in the STEM education context.

Technology inventions, scientific discoveries, engineering applications, and mathematical models cannot happen in a homogenously expressed environment. The stories in the 2018 I-STEM magazine will convince you that it is essential to have and ensure diversity of perspectives and thinking in classrooms and laboratories to maintain the vitality of STEM creativity. We are thankful to our faculty and students and recognize their various campus-wide STEM communities. We hope that, with the necessary support at the local and state levels, they will strengthen their interdisciplinary collaborations to continue making an impact in 2019!

Luisa-Maria Rosu

Interim Director, I-STEM Education Initiative


BUILD
COOL

INTERDISCIPLINARY STEM EDUCATION OUTREACH

MECHSE OUTREACH GURU JOE MUSKIN EXPOSES TEACHERS, STUDENTS OF ALL AGES TO STEM EDUCATION

Febrary 15, 2018

"Everywhere you go—the ubiquitous Joe." —Betsy Innes

If you make the rounds of campus outreach very often, you will soon discover that one of the constants in the STEM-education-outreach universe is Joe Muskin. Education Coordinator for Mechanical Science and Engineering (MechSE), Muskin is an outstanding ambassador, both for his department and for the University. A tireless, creative teacher, he's come up with innovative ways to communicate the material he's teaching for the countless STEM education activities he's been involved in. From teachers, to current Illinois students, to high school students, to elementary (and even pre-school) students, he's broadened the knowledge of those he's worked with about specific areas of engineering as well as STEM outreach. Regarding long-term impacts, he's helped to pique participants' interest in engineering and STEM education/outreach and has helped to recruit students into engineering, STEM, and to Illinois.

Muskin explains how the control box the machine shop built for the Wind Maze project works.

Muskin acknowledges that his goals in STEM education and outreach are not just to recruit needed manpower into STEM, but to show how enjoyable it can be:

> **"STEM outreach is so important, not only do we need to be more involved in STEM fields, but many people find these endeavors very rewarding! We want to make sure everyone knows what a career in STEM might feel like so they can decide if it is something for them. Too many people don't realize the fun, creativity, and excitement in STEM."**

What he finds particularly rewarding is:

> **"seeing a student's face light up as they work with tools and ideas they didn't think they had the skills to work with. I really get a lot of joy seeing students realize they can do really fantastic things."**

Even more fulfilling is seeing the long-term results of his efforts.

> **"But perhaps the most rewarding is when I run into someone I had worked with years ago and see that they are now heavily involved in STEM. Seeing students go into college, graduate, and work in industry or academia in the STEM fields really makes it all worthwhile."**

Part of what makes Joe Muskin so great at discerning what schools, teachers, and students need

is that he was in the trenches himself. He served as a middle school science teacher at Next Generation School in Champaign prior to arriving on campus, where he has been involved in education/outreach for several centers, grants, and departments.

For instance, at Nano-CEMMS (the Center for Nanoscale Chemical-Electrical-Mechanical Manufacturing Systems), Muskin and his crack team were involved in a wide variety of Stem Education events. Day in, day out, like a well-oiled machine, he and his staff routinely exposed the public to some of the university's exciting, cutting-edge research housed in the center. Joe has also been involved with the nano@illinois RET and REU, and is currently working with the NSF-funded POETS (Power Optimization for Electro-Thermal Systems) Engineering Research Center and iRISE (Illinois

Joe Muskin explains the property of Nitinol to teachers in his session at the 2nd Annual Beginning Teacher STEM Conference.

Joe Muskin shows off a 3D printed object one of the GAMES campers made on the 3D printer they designed and built.

partnership for Respecting the Identities of Students in Engineering). In his current position in MechSE as its Education Coordinator, Muskin has continued to his modus operandi of STEM education outreach comprised of engaging, hands-on activities, often involving cutting-edge research.

Hands-on lessons. In most of his roles since coming to Illinois, one key responsibility has been to come up with hands-on activities. Joe never met a hands-on activity he didn't like, whether it be a tried-and-true one or a brand new one fostering emerging new technologies. And having taught middle school science for many years, his trademark, inquiry-based science and engineering lessons appeal to and may be adapted to students of all ages. While a setting might call for a certain activity, such as 3-D printing, he has the knack of taking that activity and tailoring it to appeal to the age/knowledge-level of the classroom or group of students involved in a given setting.

Venues. Joe is comfortable teaching in a variety of educational settings that vary in location and length of time. Activities might be on campus and last for a week, such as summer camps or professional development trainings for high school science teachers. They might be campus events ranging in length from two days to one day, to a few hours, such as open houses, a one-day presentation at a WYSE camp, or workshops. Or the activity might be at a school and last for an hour or two, such as a science fair, a STEM night, or a school visit Joe makes by himself to conduct outreach activities with groups of students, such as an activity for a specific class during its time period.

What does a week in the life of Joe Muskin look like?

It might involve conducting on-campus professional development workshops for science teachers from around the state.

Teachers

Rather than a two-hour lecture, Joe's method is to get teachers excited about STEM education via having them participate in engaging, hands-on activities which they can then share with their classrooms.

For instance, in July of 2014, Joe taught a workshop at the 2nd Annual Beginning Teacher STEM Conference which targeted 100+ new teachers from all over the state. During his workshop, Muskin introduced teachers to an activity kids will always remember—working with the memory metal, Nitinol, whose shape can be changed but when it's placed in hot water, it returns to its original shape.

One activity on Joe's calendar might involve helping teachers participating in POETS' RET (Research Experience for Teachers) prepare and deliver innovative curriculum to their students.

As POETS' Education Coordinator, he's been collaborating with a team of four local science teachers who've been tasked with creating a multi-week unit related to power, heat, and power density that's aligned with Illinois' Next Generation Science Standards. By helping teachers develop engaging curriculum that exposes students, many of them underserved, to cutting-edge technologies, he's helping to broaden the engineering education for numerous local students.

Left to right: Joe Muskin and Jessica Perez converse with David Bergandine about his students' research projects.

For instance, in 2017, David Bergandine's chemistry students at University Laboratory High School (Uni High) did multidisciplinary research projects about heat pipes. As part of the lesson, students tested twelve different variables about heat pipes, and in the process, learned a great deal about heat flow and heat transfer. The lesson was born when Bergandine and Muskin visited a professor who was using a heat pipe to cool electronic circuitry. "Oh, that's interesting," they thought. "Maybe we can try to build one and see if it would work?"

Another POETS RET-developed curriculum involved local 8th graders building solar cars. In spring of 2017, eighth graders at Uni High in Urbana and Next Generation School in Champaign spent weeks designing solar cars, then testing them to see if they would move when exposed to bright light. Integrally involved with the curriculum development and testing, Muskin claims the goal was to:

"create a well-designed unit in which students problem solve, design, and engineer…We also want them to have fun and to see what engineering is really like—how it is a creative field where people invent new things to solve interesting problems!"

Joe has also been involved with several other RETs (Research Experience for Teachers), including the nano@illinois RET.

Many relationships Joe's built with teachers have turned into long-term collaborations.

For example, Kim Wright, a Danville Lutheran science teacher had participated in a Nano-CE-MMS teacher institute in 2010, and when Joe had encouraged participants to consider the Center to be a resource for them, she took him at his word. In 2013, as a reward for six 5–8th grade students' doing well on the compound microscope unit, she contacted him and then brought them on a field trip to Illinois to experience a Scanning Electron Microscope (SEM) and to learn how to use 3D printers.

Fostering STEM Ed Outreach

Meetings that appear regularly on Joe's calendar are those with students regarding outreach with community groups, engineering clubs, STEM fairs, or in school classrooms.

He has inculcated a love of engineering outreach into students ranging from grad students to undergrads, even down to elementary students working with younger students as well as the public.

For instance, Muskin has had a significant impact on Engineering grad students' passion for outreach by helping to design an innovative graduate course.

Working with iRISE, he teamed with MechSE faculty to teach the ME598, Sustainable Engineering Outreach course in Spring 2017. During the course, 16 Engineering grad students learned about:

1. issues of power, privilege, and identity related to STEM education and outreach;
2. the benefits, challenges, and rewards of engineering educational outreach; and then
3. put into practice what they'd learned with some local high school students.

As part of the iRISE-Centennial High AVID partnership, both the Centennial High students and their iRISE grad student mentors presented their projects featuring motor-controlled wheelchairs at the Pygmalion Arts Festival in September 2017. Extremely excited for the general community to see what his students had accomplished, Joe Muskin

Joe Muskin explains how TinkerCAD works to a class of Jefferson Middle School students.

indicated that the collaboration benefitted both the high schoolers and grad students.

Plus, as a continuation of last year's iRISE/AVID students' wheel-chair design projects, in 2018, Joe will be helping AVID students redesign and form a business plan for their products.

Joe often serves as a mentor for both grad and undergrad students wanting some experience in STEM education outreach or who have come up with a brainchild they want to try out.

For instance, when MechSE grad students Matt Milner and Ashley Armstrong decided to start a grad student outreach group, ENVISION, Joe took the two under his wing, gave them advice, and helped them network. Then, along with the Booker T. Washington principal, he helped them plan the

Joe Muskin helps a student test her team's solar car.

first-ever BTW engineering fair, a win-win both for both the BTW students, parents, and Illinois student volunteers. ENVISION is now a staple at many local outreach events.

When it comes to helping students' dreams be fulfilled, Joe is not afraid of a challenge, such as an outreach to students in a rural school, like Philo's Unity East.

So when iRobotics' Arsalan Aslam expressed an interest in reaching out to a rural school because they are often overlooked and their students short-changed, Muskin agreed. "We wanted to make efforts to fix that problem," he acknowledged. So in April 2014, Muskin, iRobotics, and Pi Tau Sigma leaders planned the school's first-ever Engineering Night. The night's activities addressed a range of engineering disciplines: civil and mechanical engineering and even physics while Muskin and a team of Illinois students from MechSE, the iRobotics student organization, and Pi Tau Sigma, a mechanical engineering honor society, served as proctors for the different stations.

He might be making an on-site visit to a local school, with an undergrad protégé in tow.

When MechSE senior Nathan Dostart wanted to convince elementary to add "engineer" to their list of possible careers, Muskin arranged for him to spend some mornings at Stratton School in Fall 2013. With Joe's help, Dostart did several hands-on activities with Zanne Newman's fourth graders, in the hopes that some might end up saying, "'I want to be an engineer.' I think it would be really cool," Dostart adds.

Joe isn't above a twofer—using outreach to expose youngsters to engineering AND to introduce another group of students to the rewards of STEM outreach.

For instance, in February 2016, garbed in rubber gloves and protective goggles, Next Generation School (NGS) eighth graders on a field trip to BTW shared the art of making bouncy balls with its kindergarteners. According to NGS teacher Bryant Fritz, it was a win-win for both groups. His eighth graders experienced working with young children and taking principles they've learned down to a level younger students can understand. BTW youngsters were exposed to lab principles, scientific equipment, and, of course, ended up with a ball that they had made all by themselves. And they all had fun.

In another twofer, Muskin helped train NGS 6th–8th grade students who participated in NanoDays, a program offering unique hands-on learning experiences about nanoscale science. Muskin also helped supervise the two-day event, held at the Champaign Public Library on Friday, April 4th, 2014, and the Orpheum Children's Science Museum on Saturday, April 5th. NGS students demonstrated to visitors the unique properties of nanoscale materials. Besides learning a lot about

nanoscience, the students also learned to adapt their presentation for not only their peers, but an audience ranging from preschoolers to adults.

To help schools expose their students to emerging technologies, Muskin isn't afraid to get his hands dirty.

In fact, in 2015, when a number of the local middle school teachers who had just gotten 3D printers in their classrooms but weren't sure how to use them approached Joe Muskin, he teamed up with ECE grad student, Kitt Peterson, to develop a curriculum that introduces rapid prototyping to sixth graders. So during the 2015–2016 school year, around 90 middle school students at Jefferson, Franklin, and Edison Middle Schools learned how to use TinkerCAD, a free, online software, then designed keychains, which were then 3D printed.

High School Students

Joe Muskin has had a significant impact on numerous high school students trying to settle on a college/career path. Through his activities, he teaches not only them what engineering is about, but has no doubt recruited a number of students to both engineering and Illinois as they have "Aa-ha" moments.

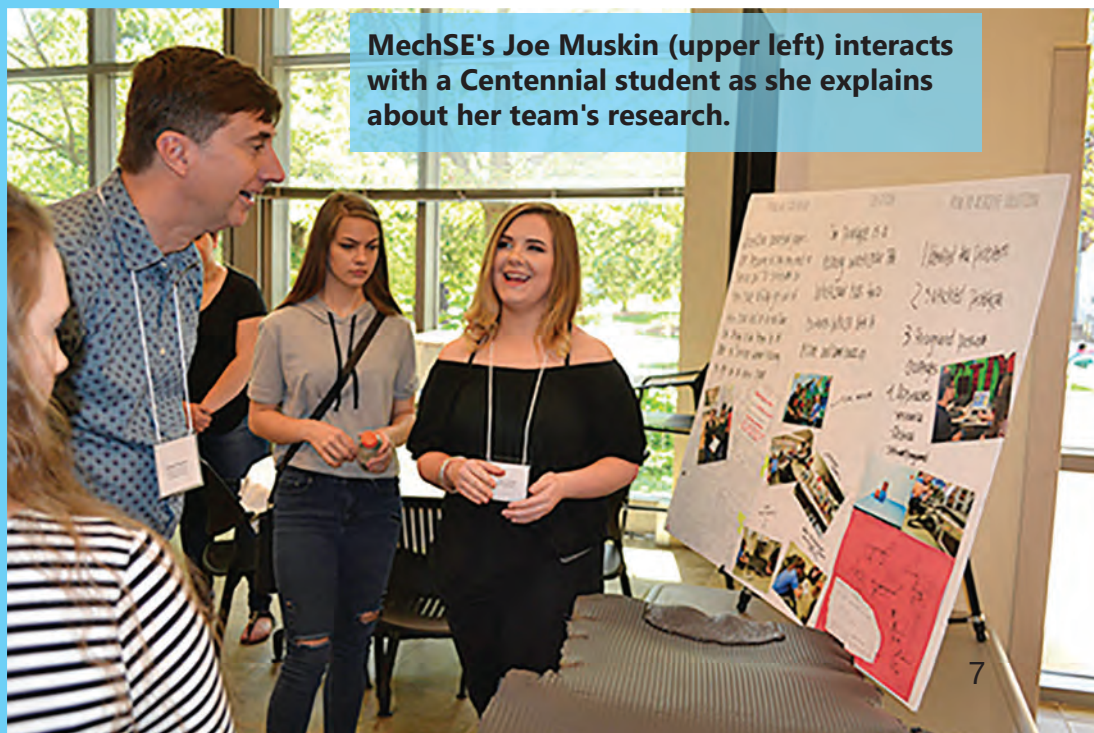
He's regular at a variety of outreach events for high school students, including summer camps like WYSE, which exposes students to numerous engineering disciplines, including Mechanical Engineering, and GAMES, with its emphasis on increasing the number of women in engineering.

Joe is passionate about his role as one of the co-directors of the G-BAM (Girls Building Awesome Machines) GAMES camp. In his fifth year with the camp, along with other MechSE faculty coordinators, he has worked tirelessly to help revamp the curriculum, ensuring that students are exposed to cutting-edge research going on at Illinois and that they have challenging, engaging design projects.

Similar to G-BAM, but co-ed, MechSE's WYSE (Worldwide Youth in Science & Engineering) Camp, Exploring Mechanical Engineering, also helps high school students do just that. Most of the campers at this perennial camp are pretty much set on careers in engineering…They're just trying to figure out in which discipline. And MechSE's WYSE camp appears to have the potential to assist them in their decision-making process. So Joe and his colleagues spent the entire week exposing campers to some of the fun stuff in mechanical engineering.

In another recruiting scenario, Muskin does his part to woo prospective students to MechSE and Illinois during the MechSE High School Visit/Open House. For instance, during the Fall 2014 event, he manned an exhibit which gave visitors the opportunity to do some hands-on rapid prototyping.

Joe serves as an excellent University-community liaison, helping to disseminate information about innovative research going on in MechSE through various grants. Because he's aware of both MechSE faculty and students' strengths, he often serves as a liaison to connect faculty and schools. He's arranged numerous win-wins—facilitating opportunities for MechSE faculty and their students to expose local youngsters to their cutting-edge research.



MechSE's Joe Muskin (upper left) interacts with a Centennial student as she explains about her team's research.

For instance, in October 2014, Muskin arranged for MechSE Assistant Professor Gaurav Bahl to introduce Sharlene Denos' Uni High engineering class to his research on opto-mechanics. Like Muskin, Bahl also believes university folk should get outside the four walls of their labs and impact the community. Plus, he's passionate about mentoring students, especially undergrads. So when he shared his expertise with some seniors at Uni High, he invited a couple of his students to tag along to share what they know and to experience outreach for themselves.

When faculty come up with an idea, Joe helps their dream become a reality.

As an example, when Mattia Gazzola came up with the Paper2Tree program, Joe helped Gazzola's dream to become a reality, helping to recruit other faculty and plan outreach activities in the two partner schools, Martin Luther King Booker T Washington STEM Academy, for the kickoff event highlighting the new MechSE program.

Muskin doesn't just serve as a liaison between MechSE faculty and students and schools.

For instance, when Sharlene Denos' senior Engineering Class at University Laboratory High School (Uni) designed and built a Wind Maze for Champaign's Orpheum Children's Science Museum in Fall 2014–Spring 2015, Muskin approached Clifford Gulyash, who heads up MechSE's Machine Shop, and a few of his cohorts to work with the high school students. Like Muskin, Gulyash would like to see the students attend Illinois. "I want 'em to come back next year," says Gulyash, who sees his machine shop as one component of the recruiting process.

Joe also has his finger on the pulse of what schools want and need, and often jumps in the trenches with them.

For instance, when the founder and head of Foundations 4 Advancement Christian College and Career Readiness Academy in Chicago wanted to expose her students to the University, Joe Muskin helped to arrange a variety of hands-on activities for their one-day campus visit.

Joe Muskin works with a teacher during an EnLiST workshop on gold and silver nanoparticles.

When schools/teachers want some outreach, they know just who to call: Joe Muskin.

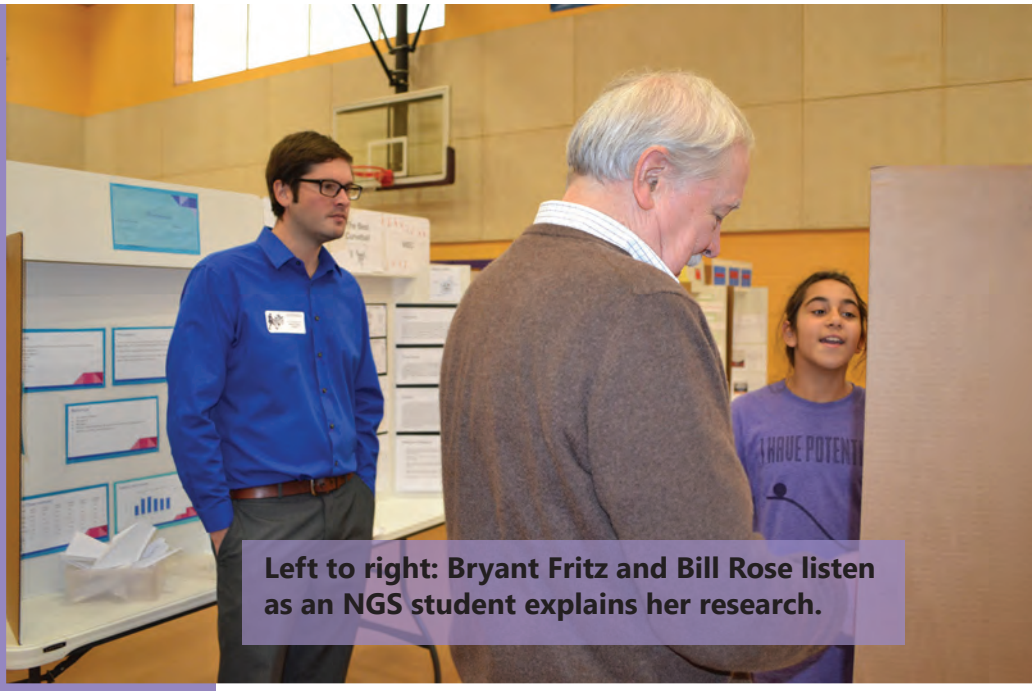
For instance, when Ryan Cowell, the principal at Booker T. Washington STEM Academy (BTW) wanted to start a Family Engineering Fair, he immediately sought out Joe Muskin to get the ball rolling. "I think that night I went to Joe," Cowell reports, "and I said, 'Hey, what do you think?' He, of course, is up for anything. He thought that was a good idea, and it started to roll from there." So with the help of Joe and some of the MechSE students he got involved, on Saturday, April 23rd, 2016, BTW held its first annual Family Engineering Fair.

Joe Muskin helps a young participant with his TinkerCAD design.

NGS STUDENTS HONE THEIR RESEARCH SKILLS, LEARN FROM COMMUNITY EXPERTS AT THE 2018 SCIENCE & ENGINEERING FAIR

Febuary 22, 2018

It was Friday, February 16th, 2018, the day of "Exploring Our Potential," the Next Generation School's (NGS) long-anticipated 2018 Science and Engineering Fair. The students finally got to stand in front of the poster they'd meticulously labored over and present the results of their research to a community expert. But while the experts had been instructed to give students not just positive feedback, but also things they could have done better or could improve upon, no doubt when mom and dad listened to their spiel during the evening session, they got only rave reviews.



Left to right: Bryant Fritz and Bill Rose listen as an NGS student explains her research.

Preparing for the fair took a lot of time. First, students had to choose a problem to study. Often it was one relevant to them personally. Then, they'd done a lot of research about their subject. Next, they'd designed and conducted their experiment, and on the day of the fair, they were finally getting to present their research.

Unlike science fairs at most schools, NGS's fair had no official "winner"; each student or team competed to do their personal best and hone their skills in several areas. For example, the goals of the 2018 fair were to help students learn the scientific method, gain a deeper understanding of their research area, learn how to conduct an experiment, plus acquire some useful skills about how to go about presenting research.

But since all the students might not end up in a scientific field doing research, possibly even more important were some real-life skills they gained that they'll be able to draw upon throughout their lives. For instance, they practiced standing in front of an audience and presenting, interacting with someone they didn't know, and learned to think on their feet when responding to questions about their research.

And according to NGS' middle school science teacher, Bryant Fritz, the day of the fair wasn't the first time they'd presented their research to someone. First, they practiced by themselves (and probably to mom and dad). A few days before the fair, they'd practiced in the classroom, and the students had made an outline of the major points that they wanted to make sure that they didn't forget to say. The day before the fair, they actually got to go down to the gym and see their boards and all the stuff, their artifacts, set up on a table. Then they presented to small groups of students in their class, while their classmates wrote down feedback and suggestions about how they could improve.

Although the 2018 fair was pretty similar to what they'd done in the past, according to Fritz, for the students, the fair never gets old. He says:

"It's really amazing to see how excited the students are still about doing it. And I remember the first day that I introduced that we were going to start working on the process of the science fair. There's always a lot of students, their eyes get really big because they remember past projects that they've done and they remember that it was a really memorable experience for them."

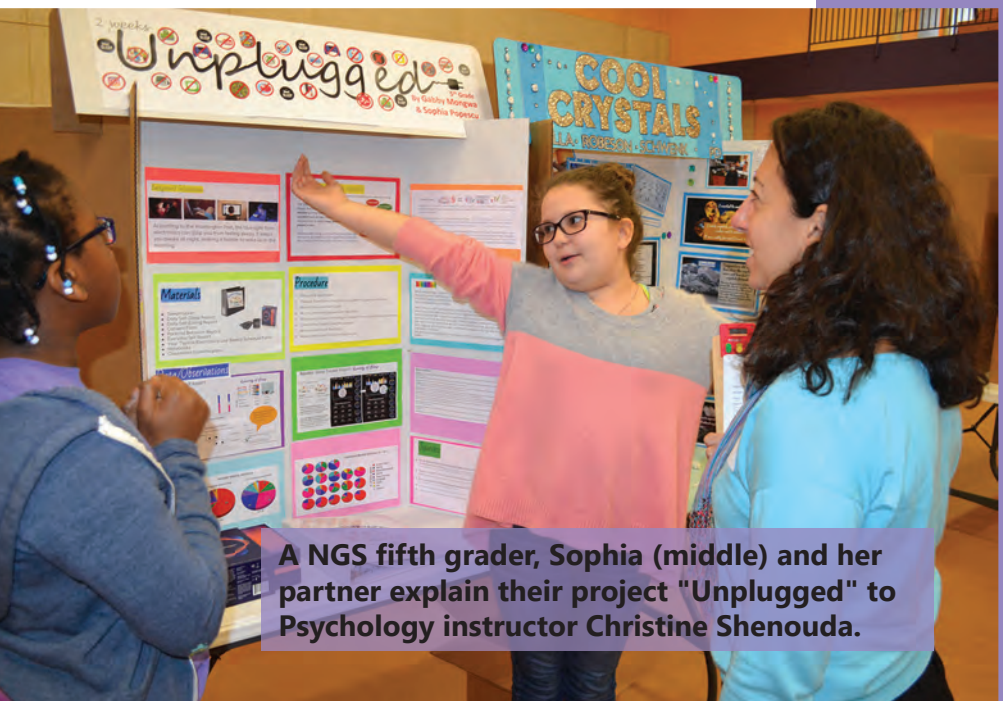
As in previous years, students could either choose to do an independent project or work with a partner. One thing Fritz found surprising was that even though middle school students tend to be pretty social, a lot fewer had chosen to work with a partner than he expected. “I think the students enjoy kind of being able to take direction by themselves.” They’ve also discovered that working with a partner involves additional challenges, such as figuring out schedules in order to spend extra time testing and working together outside of school.

Regarding what topics students would choose, they were encouraged to choose one that was of interest to them personally. For example, several chose topics that had to do with sweets. One experiment, “Sweet Science,” was about baking cookies, as was “The Baking Battle.” Some dealt with a favorite of kids of all ages—candy. One study called “Candy Snap” looked at the brittleness of different candy bars; another “Gummy Bear Osmosis” the results were that while gummy bears would distort and expand, they never completely dissolved—which makes one wonder: “What besides sugar is in gummy bears?” The student researcher suggested that maybe something acidic might have helped, and he should have tried citrus. In their first year in the science fair, all of the 3rd graders did the same study: “Save the Ice Pop!” In other experiments using food, the title said it all, such as in, “Milk to Plastics,” “Making Electricity From Oranges,” and “Coke Explosion.”

Some experiments used salt/sugar, such as, “A Solar-Powered Desalination Experiment.” In “A Race to the Boiling Point,” the student studied whether adding salt or sugar helped water boil faster. In “Cleaning Pennies,” a student who used

An NGS student presents his research project.

salt, plus other things readily available in the home, learned that cleaning products comprised of something acidic, specifically vinegar and salt, effectively cleaned tarnish from pennies—something those of us who use make-your-own cleaning products might find useful. Other studies dealt with electronics/engineering, such as “Can You Beat AI at Tic Tac Toe?” and “Phototaxis: Using a Light-Tracking Bristlebot,” and “Lego Brick Bridges.”



A NGS fifth grader, Sophia (middle) and her partner explain their project "Unplugged" to Psychology instructor Christine Shenouda.

Some of the older students chose topics that have made the news recently. For instance, one eighth grade girl who plays sports was interested in recent research about head injuries. After researching all the latest studies regarding CTE brain disease, she then did a couple of simulations doing some different conditions with eggs. “So she learned a lot from that one,” Says Fritz. “That was a good one.”

Another girl built on last year’s project, a homeless shelter built out of a cardboard box inspired by CU at Home’s One Winter Night, an event where people camp out in shelters in downtown Champaign to raise awareness of

Champaign's homeless community. So this year's project took last year's to another level: she built a custom house for her dog, choosing materials to help make it warm in the winter, but cool in the summer. "It was kind of fun to see her picking something that was so personal to her," says Fritz, "and she's got pictures of her dog and all the dimensions are based on the size of her dog and all these things."

This reporter was keen to hear the results of one study which is personally relevant to most of us, "Unplugged," in which two students compared sleep patterns with and without electronics to determine the impact electronics have on sleep and mood.

NGS Head of School Chris Bronowski was particularly excited about this one:

> **"They have so many wonderful ideas about what they're going to do next and what they should have done with this project. They ran into all of these road blocks...but they have all of these fabulous ideas about what they would do next and how they would modify their research in order to get results that are more accurate."**

As in past years, numerous community experts were on hand to help judge the projects, including several Illinois faculty and PhD students, along with some Next Generation School experts. And as a testament to how valuable and rewarding these experts find the fair, many consider the fair to be a highlight of their year and have come back year after year.

Take Andrew Sweet, a Ph.D Student who's in PEEC (Program in Ecology, Evolution, and Conservation Biology). Sweet's research, which he calls "fun most of the time," is using DNA to look at the evolutionary history of birds and their parasites.

He shares why he keeps coming back:

> **"I love seeing what the kids have been working on. I think it's really exciting to see young ages developing an interest in science and asking questions and critically thinking about ways to test the questions that they have. Coming up with their own studies, working together to come up with their own studies, and then drawing conclusions from what they learned."**

He believes it's also important that they're thinking about how they could improve their study in the future, thinking about future experiments they could run or different variables that they could change. "So it's really exciting to see the wheels turn when you ask them a question, and they have some knowledge about what they've been working on, and encouraging them to keep going. So, it's fun to see that."

NGS Preschool science teacher Grazi Murad, in her 2nd year at the school but her first time on the expert team, says she enjoyed it tremendously. She explains:

An NGS student presents her research to Applied Health Sciences Assistant Dean Gretchen Adams.

> **"I'm so proud of the children and their projects. They know everything about the project, and they're having so much fun, and they've been telling me the interesting things that they're learning. They're really excited to share with me all the things they've learned. It is really nice: I can see all my preschoolers and how much they have learned."**

According to Gretchen Adams, Applied Health Sciences Assistant Dean and a regular at the fair, she keeps coming back year after year because of the students' excitement about the research.

A group of NGS students present their project to Grazi Murad.

"Because it's so great to see the curiosity in the kids and that they try to develop a method to try to answer their questions. And I enjoy most that I can tell they're doing it. So they're coming up with the questions, and they're trying to go through and follow the scientific method to try to come to an answer, and I love that, 'cause it shows me kind of what they're thinking, and how they're going through it. So that's why I keep coming back. Their enthusiasm makes me kind of want to keep seeing what they're doing."

Does she see any future chemists?

"Oh, absolutely! For sure. Yes, I see all kinds of budding scientists here. In fact, on this person's sheet, I just said, "Way to go! You're a budding scientist!"

Head of School Chris Bronowski acknowledges that for the school staff, the kids, and their families put a great deal of time and energy into the fair. "There's a lot of work that goes into it," she admits. But she also believes the pros far outweigh the cons.

"I think there's always those moments for families, for children, for us, we question 'Why are we doing this?" But then you see the end product, and you see everything that they've learned and all of the skills that they've learned as they've gone through the project, and that's what makes us keep going year after year with it."

Bronowski shares an anecdote about the fair's impact on students. "I ran into a former student at the grocery store a few weeks ago, and we were laughing about one of his middle school projects that had kind of a funny mishap, and then how he had kind of fixed it and moved on. But those things stick with children for so long. He's in college now but it sticks with him that he was able to figure that out and move on, and I think it struck me that's really so powerful and profound."

What's the hardest thing about the Fair for the kids? "When you present," says fifth grader Yahyah, "I think the background research is the hardest. Because it'd be bad to look at your board and keep on reading the whole time. So in background research, you have to memorize most of it."

A fifth grader, Sophia, whose research was on, "Do electronics affect sleep?" reports that her favorite part of the fair is when her poster is finally finished! "I really like the satisfaction of when you're done, because it's a lot of hard work. And then when you're finally done, you get to relax. So the board looks really nice when you're done, and that's my favorite part."

Despite the huge amount of work doing the fair entails, Bronowski is already looking forward to next year:

"Tomorrow we'll start planning for next year's fair and talking about the things that we want to do differently, and other things that we could add or change to make it better."

ESGA HELPS VISITORS COMBAT FEARS AND PHOBIAS AT THE 2018 INSECT FEAR FILM FESTIVAL

February 28, 2018

We're not going to force anyone to fall in love with any insect; we just want them to be informed." – Entomology PhD student Charles Dean

Got a kid who is fascinated with insects? Conversely, got a kid who has a panic attack every time he or she even sees a bug? (Or, let's get real, are you yourself perhaps a bit leery of them?) Do you love mocking really bad, really cheesy films—in this case, B horror flicks about insects? Folks who could answer "Yes!" to one or more of the above questions showed up at Foellinger Auditorium on Saturday, February 24th for the 35th Annual Insect Fear Film Festival (IFFF). Hosted by the EGSA (Entomology Graduate Student Organization), the festival not only exposed the around 500+ visitors to films about insects, but it possibly helped them overcome some unfounded fears and/or learn how to nurture "good" insects through both fun and educational activities. And hopefully, participants left a bit more knowledgeable about insects in general…and the star of the show, the Tick.

The Festival was begun in 1984 by Entomology Department Head, Professor May Berenbaum, with some help from her husband, a professor who also happened to be a film buff. Billed as:

Dr. Nathan Schiff of the USDA Forest Service shows just a small portion of his insect collection.

"Scaring the general public with horrific films and horrific filmmaking since 1984."

The 2018 IFFF did not disappoint.

Why was the IFFF begun? According to entomology PhD student and EGSA president Charles Dean:

"There is this phobia of insects that is pervasive throughout society. And with that comes a fear that they might be bad or dangerous for you. While that's true sometimes, it's not always true."

Dean, who's studying the co-evolutionary relationship between wild parsnip and parsnip web worms in Berenbaum's lab, says the idea behind the IFFF was to use movies—both B quality movies and funny ones—to:

"undercut the phobia and start a dialogue within the community about what insects do and how they affect your life.

Professor May Barenbaum, creater of the Insect Fear Film Festival, (right) and Integrative Biology Professor Katy Heath.

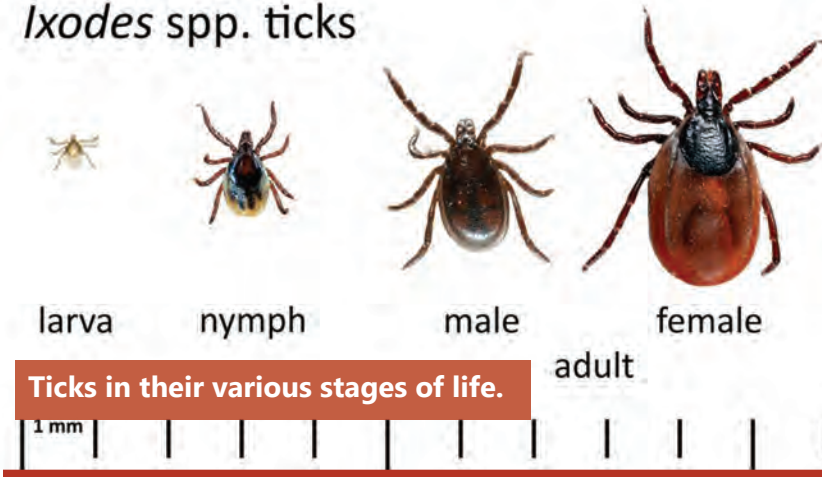
Over the years, it has really become sort of a communal gathering point in Champaign-Urbana and we're really proud of it."

The films for the 2018 edition of the festival featured, of course, the insect of the hour—the lowly tick. One of the shorts, billed as "family friendly," included Ben10: The Big Tick, an animated TV series episode about an enormous tick-like alien bent on destroying Earth. In the second, Soldiers of Fortune: Bite of the Ruby Red, a scientist searches for a cure for a deadly tick-borne fever in Central America.

The feature film (not quite so family-friendly), Ticks, was about a group of teenagers on a wilderness retreat who encountered super-sized ticks mutated by agricultural runoff from an illegal marijuana-growing operation.

While the tongue-in-cheek implication inherent in the Festival's title was that some of the films—or the insects starring in them—might make your hair

EGSA Outreach Coordinator Jacob Dixon.



Ticks in their various stages of life.

stand on end, it was the intent of the planners that via closer proximity and education, participants might even get over their entomophobia (defined as "excessive or unrealistic fear of one or more classes of insects," by Wikipedia, which lists a raft of them, including apiphobia (fear of bees), myrmecophobia (fear of ants) and mottephobia (fear of moths or butterflies). A quick Google search reports that an overly anxious fear of ticks is entonophobia.

According to EGSA's Outreach Coordinator Jacob Dixon, who also works in Berenbaum's lab, studying navel orange worms, claims that exposing people to insects is really important in order to help them overcome unfounded fears.

"A lot of times when people are scared of insects, they never go out and try to look for them, and when they run into them they get scared."

Dixon stresses that their outreach activities are designed to help people slowly get comfortable with insects through controlled exposure and education.

"A lot of times, outreach is really aimed at "Here's an insect. I'm holding it. You don't have to touch it."

He adds that further communication with people about an insect can slowly alleviate one's fears.

"'They're not harmful,' he continues. 'They might be a little fast and spooky.' But it helps people get comfortable with insects. And then you can have a conversation saying, 'They don't bite, and they aren't poisonous. But these ones are, but they're not going to jump at you!' Through that, people get more comfortable and understand them more."

A young visitor proudly poses with the drawing he made as part of the art contest.

Although Lyme Disease is not fatal, Dean reports, “It's not fun.”

Plus, another opportunity designed to help youngsters (and adults!) overcome their fear of insects was EGSA’s famous Petting Zoo, which allowed visitors to pet, hold, and examine up close tarantulas, beetles, and other insects & arthropods.

One activity featured during the Festival, which, EGSA Outreach Coordinator Jacob Dixon calls, “pretty cool!” was the IFFF Art Contest featuring tick-themed artwork submitted by local K–12 students. According to Dean, because it’s for a broad age group, students’ contributions were divided into different categories based on age—lest kindergarteners become dismayed over being beat out by a high schooler—or vice versa. For the judging, “A tribunal of graduate students will vote for our favorites,” Dean explains, “and then we announce them at the event and give out awards.”

Other family fun activities at the Festival included face painting and creating insect-shaped balloon sculptures. Plus, visitors could purchase IFFF t-shirts and/or, for the kiddies, stickers of their favorite (or most feared) insects.

Plus, to liven things up even more, May’s daughter, a ventriloquist, made an appearance.

The goal of the EGSA and Entomology in doing the Festival and other outreach activities, is to integrate themselves into the community. In fact, they do a lot more than host the insect film festival every

Dixon is currently looking at a fiber chemical and its effect on navel orange worms and the cabbage looper and its effect on their development. He adds that the worms are actually a big pest on almonds, pistachios, walnuts, and other nuts as well.

But the Festival was a whole lot more than just a mock-fest (or therapy session) featuring really scary (or really bad) films about insects. It was also a unique STEM education opportunity to learn about insects.

To get the scoop on ticks, visitors of all ages could stop by the info booth to learn all about them. For instance, visitors could learn how to identify ticks by observing them up close (though separated by a layer of plastic!), and how to keep themselves safe when outside. Visitors also learned what to do if bit by a tick, and how to identify the early signs of Rocky Mountain Spotted Fever and another disease spread by ticks, Lyme Disease.

According to Dean, while Rocky Mountain Spotted Fever was historically a big concern:

> **“The big one that we are on the lookout for these days is Lyme Disease. Lyme disease has the characteristic bullseye rash that you have to spot right away, because the other symptoms that come along after that can be mistaken for a fever, but by the time you get those, it's too late.”**

Two young visitors show off the balloon butterflies they got at the IFFF.

year. They have a farmer's market booth every year during Pollinator Week. Dean even reports that he's even gone to people's homes and gotten rid of their wasp nests for them.

One of EGSA's most important outreach activities is to visit schools. According to Dixon, the group's Outreach Coordinator, they have a long-standing partnership with many of the local schools they've visited in the past. During the busy months, they could have multiple outreach events in a week. However, during the winter it's pretty slow. The group has also been fairly regular visitors at the Orpheum Children's Science Museum.

What's their message during these various outreach events? They talk to participants about insects, telling them what to do about certain insect pests, along with another important part of their message—underscoring that there's also a good side to insects. Take pollinators, for example. They strive to communicate to not just kids, but the public, why everyone should care about the honey bee decline and the bumble bee decline. They also stress the importance of insects as decomposers, and their work in helping to make compost.

Why is engaging with the community, especially schools, so important? Dean shares the importance of outreach to schools, particularly for the specific age groups.

"Basically, we want to not only produce good research in this department, but we want to also be a part of the surrounding community. We want to have an immediate effect on people's lives around us. We'd rather not exist behind closed doors."

Like the IFFF, some of the EGSA's other more popular events have also been film related. For instance, when they hosted the creator of the X-File, who had used a lot of May's work for inspiration for his movies and TV shows, upwards of 1000 people showed up for the event, which included a Q & A with the audience. Also, in 2017, they invited a producer and director who had worked on several insect-themed horror movies, like Mongolian Death Worm and Lava-Lantula. "All the classics," Dean boasts.

Besides outreach, the EGSA also organizes support activities for the around 35-40 Entomology grad students who comprise the organization, such as arranging transportation to different conferences. For instance, last fall they traveled to Denver for the National Entomology Association meeting. The EGSA also organizes social events for the grad students, like bowling and camping.

Of course, they consider community outreach to be one of their most important activities.

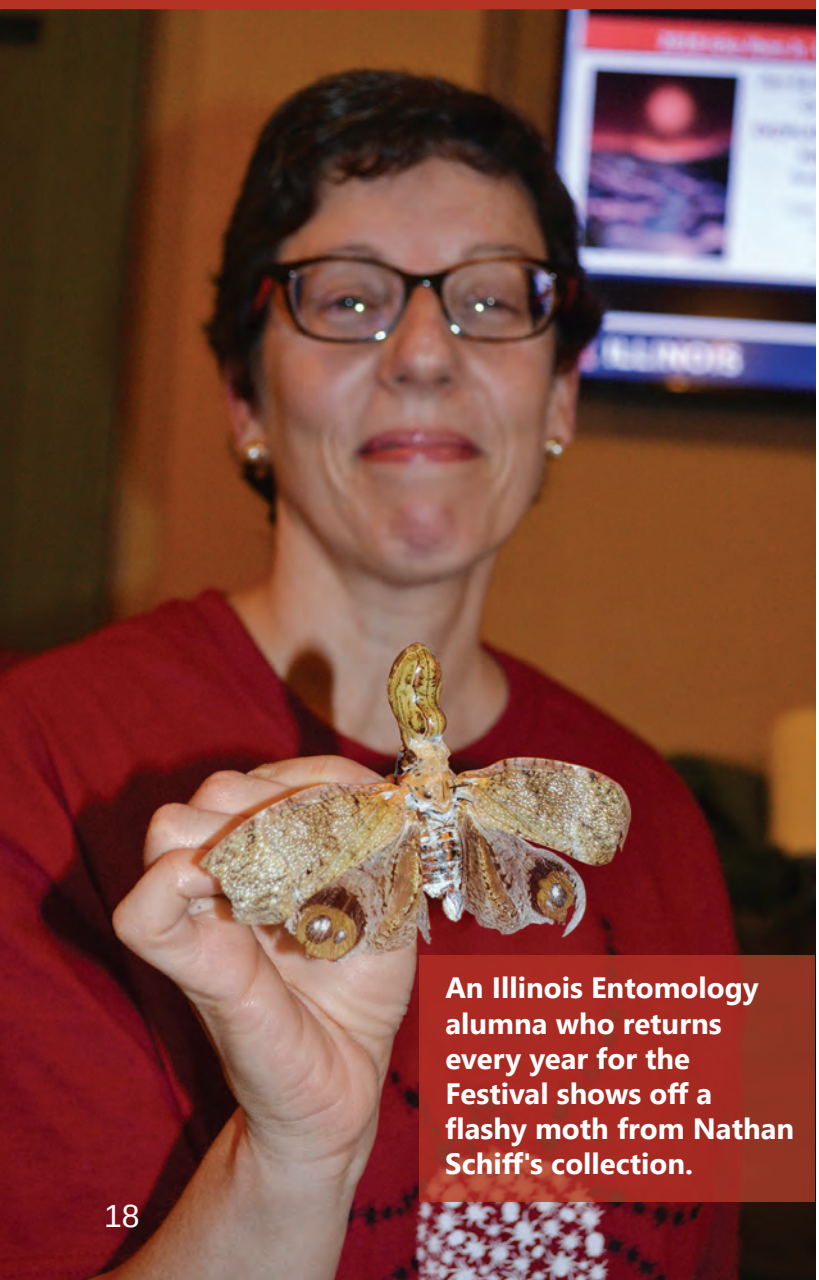
"When doing an outreach at a school for kindergartners through second grade," Dean explains, "that is their earliest introduction to insects. So what insects are, what they do, which ones to avoid, and what you can do to help the ones we like—like the bees and butterflies that stop by your garden."

They also bring younger students, such as second graders, on field trips to the Pollinatarium. “So they can see honey bee colonies,” Dean explains. “They can see different insects around a preserved prairie stand.”

Dean indicates that their goal regarding outreach to high schoolers and young adults is more career related.

“A lot of times it’s introducing the idea, but if the idea's already there among them, it's nurturing this idea that this is a really cool career path if that's your choice,” Dean says.

He goes on to share some of the benefits of a career in Entomology.



An Illinois Entomology alumna who returns every year for the Festival shows off a flashy moth from Nathan Schiff's collection.

“If you want to be involved in the sciences, and you like doing research (which I compare to solving natural puzzles for a living), and you want things like intellectual autonomy, and you want to contribute to a growing base of knowledge, then you can make a career out of that childhood hobby that your parents hated.”

Dean speaks from personal experience about parents hating a youngster’s infatuation with insects.

“I was bringing insects in the house, and my parents were not thrilled, but eventually they were happy about it once they learned I could make a career out of it. And if people are interested, we'd like to sort of nurture that. And if people are fearful of it, we at least want them to be informed.”

Regarding careers for entomologists, Dean adds that grad students that come out of their department can either continue on in academia, become teachers, or work in natural history museums or national labs.

“The field of entomological research has been the basis of many influential scientific discoveries,” he boasts. “They're a model system, and easy to maintain, easy to work with. They have a shorter generation time than other animals.”

In addition to informing the general public about what they can do to help pollinators or decomposers, and to avoid things like bed bugs and ticks:

“We also want to inform them about what it is that we do, and how we are trying to make an impact on the scientific community,” he adds.

Regarding the IFFF, Dean admits:

“We love interacting with the people around us, and we want to continue being a part of the community. This is hopefully as much fun for them as it is for us.

TEAM OF EDUCATORS, STUDENTS DESIGN FLASHY NEW LESSON ACTIVITY—A LASER LIGHT SHOW—TO TEACH UMS STUDENTS COORDINATE MATH…AND A WHOLE LOT MORE

UMS teacher Jason Pound works with a team of eighth graders.

March 5, 2018

In a fun, exciting way to learn math using cutting-edge technology, on Friday, March 2nd, two of Jason Pound's 8th grade algebra classes at Urbana Middle School used coordinate math to design a shape which was then displayed using a laser light show. And almost as spectacular as the light show itself was, the number of people, both on and off campus, who were involved in various ways to contribute to what MechSE Education Coordinator Joe Muskin calls, "a really cool outreach activity."

How'd the thing work? First, students defined the object they wanted to project using coordinate math and graph paper. This produced a list of coordinates, which they then entered into a computer program file which created a series of positions. These commands were then sent via another program which controlled a laser spot aimed at two mirrors mounted on Lego controllers; these directed the laser. The programming made the controllers rotate, causing the reflected laser spot to move from one position to another to trace out the patterns that the students had defined, which lit up the fluorescent paper. Voilà!—a laser light show.

Why go through so much effort just to teach some math? An Illinois professor involved with the project, MechSE's (Mechanical Science and Engineering's) Arend van der Zande, explains why:

> **"What we are trying to do with this activity is give students a way to apply mathematical concepts, like coordinate systems, to make something at the moment that they learn about the topic."**

Van der Zande recalls that in middle school, he had never really done anything with the math he learned.

> **"It was just rote memorization of a bunch of rules, without anyone explaining why they were important. It wasn't until years later that I learned how the topics could actually be used and applied."**

He adds that, in addition to using math in a real-world application, students start learning some coding at the same time via the activity. They learn:

> **"how to use code to manipulate things in the real world and visualize how numbers can be turned into motion and shapes. This gives them hands-on experience developing coding skills that are incredibly useful in the modern world, while getting a more intuitive view of how abstract mathematics can be used."**

And in addition to all that, he adds: "It also makes learning fun!"

Adam Poetzel, an instructor of secondary and elementary mathematics education from the Curriculum and Instruction Department created the lesson

plan for the activity, along with Joe Muskin. Poetzel agrees with van der Zande that the activity's application of math skills to solve a problem in the real world benefits middle school students.

"Too often, students practice math skills in school, but don't get to apply those skills to a real-world situation."

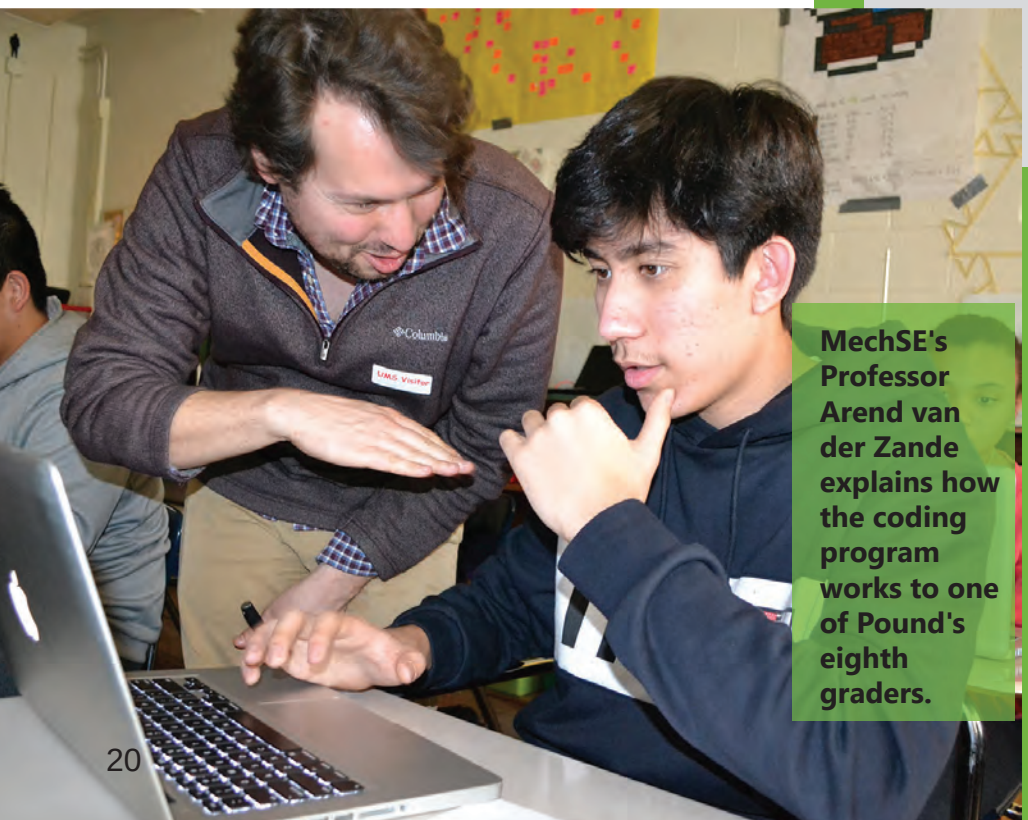
In addition to seeing "how math can be used as a tool to create an interesting 'laser show' of their design," Poetzel reports that in this lesson, students were able to "apply their knowledge of the Cartesian Plane to control the path of the laser." Plus, students were not only able to "design their own paths," but Poetzel adds that the lesson also had "a nice problem-solving component to figure out the least number of points needed to guide the laser through their designed path."

In regards to how the project came together, Muskin was particularly pleased by the number of folks who contributed.

He explains:

"What I think is kinda' cool about this is all these people working together, from teachers to students to professors, to create this system that we hope will be a nice method to teach coordinate systems to students in a very motivational way."

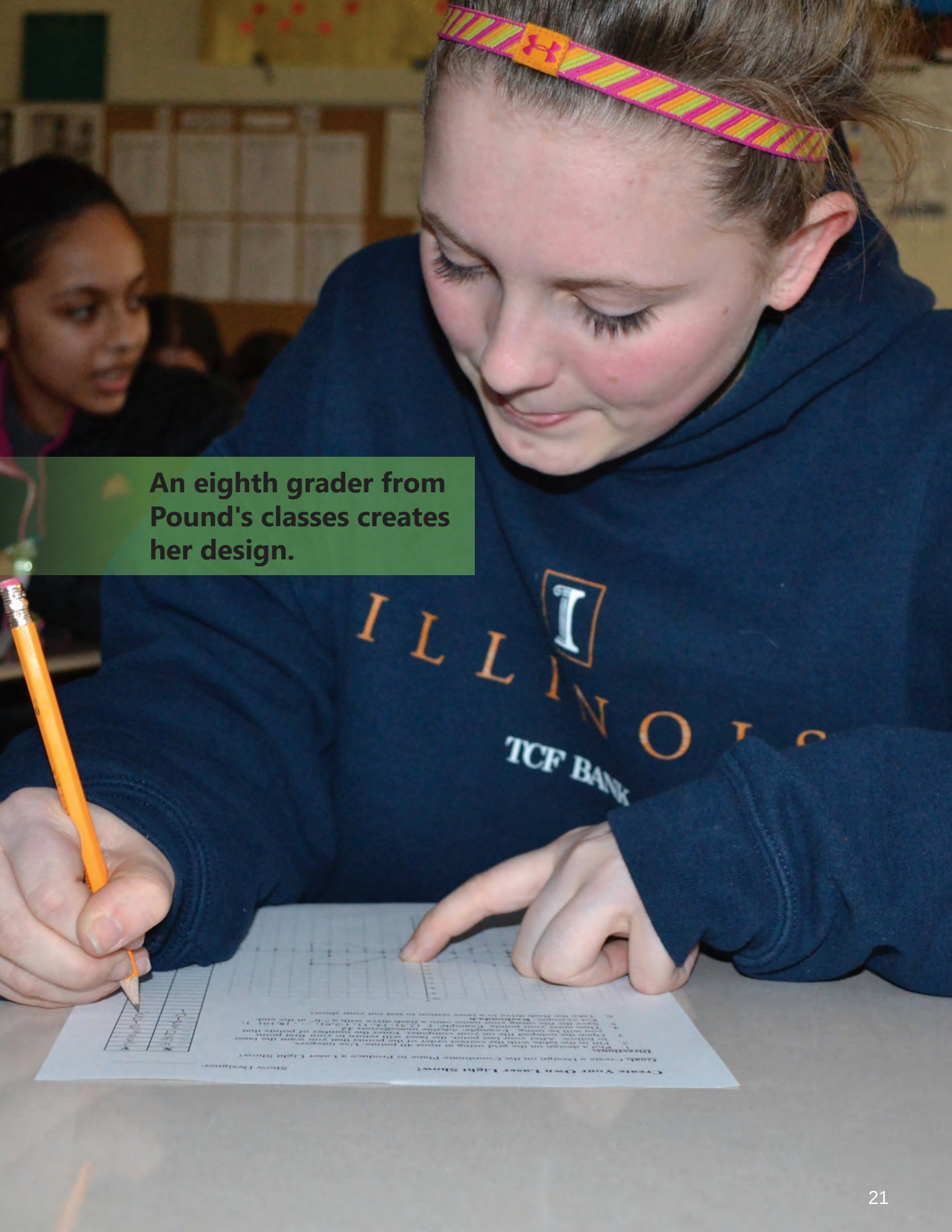
Centennial HIgh senior, Edward Lu, getting the laptops set up to display the laser light shows.



MechSE's Professor Arend van der Zande explains how the coding program works to one of Pound's eighth graders.

The original laser show project—sans the coordinate math element—was the brainchild of high school engineering teacher, John Roach, who teaches grades 10–12 at Morton East High School in Cicero, Illinois. In the summer of 2016, Roach participated in the nano@illinois RET in van der Zande's lab, where he learned to grow 2D materials using a chemical vapor deposition furnace, then transfer the 2D materials to new surfaces.

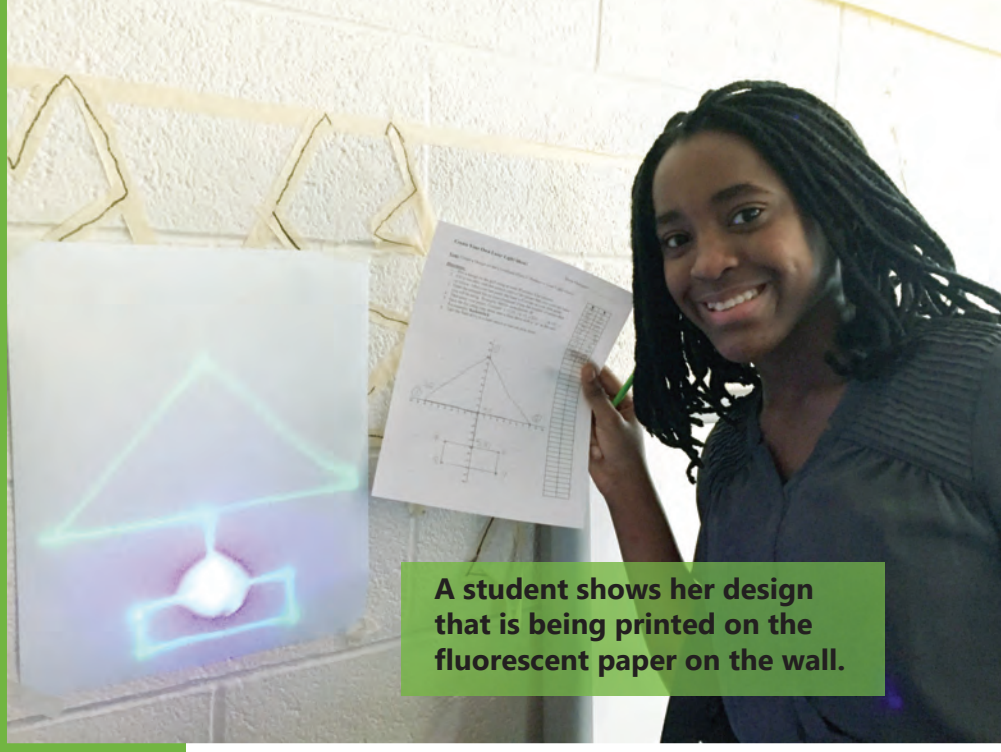
Van der Zande explains that in his lab, they study nano devices so small that they can't be seen with the naked eye, so they have to develop



An eighth grader from Pound's classes creates her design.

new tools that allow them to probe the properties of very small things. According to van der Zande, the inspiration for the laser show came from a piece of equipment in his lab called a confocal microscope, which scans a laser over light sensitive materials and solar cell devices. It allows his team to study how the devices react when they shine light at different spots, thus teaching them a lot about the properties of the material.

John Roach reports that his lesson idea, a simple laser show system, stemmed from his RET research and was born during a brainstorming session with Van der Zande and Joe Muskin. The three realized that the confocal microscope operates on almost exactly the same principle as giant laser light shows one might see at a rock concert—and the idea was born. Roach says:



A student shows her design that is being printed on the fluorescent paper on the wall.

> **"The goal was something intellectually challenging and visually stimulating—learning needs to be fun!"**

However, teachers who might want to do the lesson won't necessarily have access to a $10K confocal microscope. But while tossing ideas about, the three also realized that teachers wouldn't necessarily need the fancy version of the equipment like in van der Zande's lab. A very cheap version could be built using an Arduino controller, mirrors, Lego actuators, a laser pointer, and some fluorescent paper—all components available at any hobby shop for less than $50. Once Roach had developed the unit, he tried the lesson plans out in his classes, where he and his students worked to create the system. He reports:

> **"The students were very engaged. I think we all had a blast!"**

Although the RET was over, Van der Zande claims Roach:

> **"did an exceptional job of following up to create the activity by getting some of his best students to do extra credit developing the setup."**

And since Morton East is just a two-hour road trip away, van der Zande was able to help them out when they got stuck on some of the harder technical parts. Plus, not above doing a bit of recruiting, he claims he also got to:

> **"Advertise the cool design classes and science that we do in Mechanical Engineering at Illinois!"**

To further develop Roach's original laser light show project as an outreach activity, Muskin decided to make coordinate math the focus of the activity, making it age appropriate for use in a middle school setting. So Joe brought Centennial senior Edward Lu into the project. Working with Muskin and van der Zande, Lu wrote a program that enables Roach's system to trace the path defined by ordered pairs.

Hoping to be an electrical/computer engineer, Lu reports that since his sophomore year, he's worked on multiple engineering outreach projects with Muskin. When presented with the opportunity over the summer of 2017 to work on a laser show based on Arend van der Zande's work, he jumped at the chance.

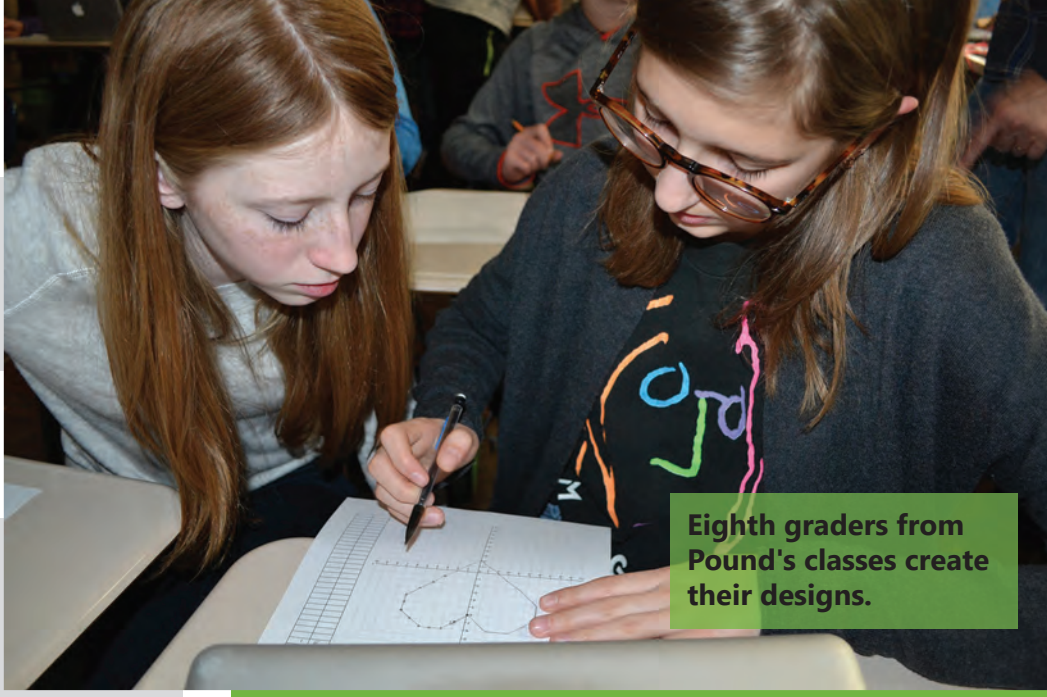
Lu explains how the Arduino program he wrote works. It allows the user to input a set of coordinate points, which are then transferred into another program, which loops through every coordinate and converts them into "positions" for two servo motors. The first motor moves to the positions corresponding to the x coordinates; the second corresponds to the y coordinates. "Since a laser will be reflecting off of mirrors attached to the motors," Lu explains, "the laser traces the coordinate points as the motors move."

Lu hopes to help younger students develop an interest in math:

> **"by showing them that math can be applied to something really cool and interesting—like lasers!"**

The activity will also introduce students to engineering and electronics at a fairly early age.

> **"With this activity, I hope to inspire middle school students to one day pursue engineering," he says.**



Eighth graders from Pound's classes create their designs.

While his original unit was designed for high school students, Roach agrees that his lesson could benefit middle schoolers too:

> **"This is a great introductory activity for programming which reinforces math skills while applying scientific principles."**

A student by his design: a "Chevy" emblem.

Unable to be at the UMS activity, Roach was quite excited to learn that someone was building upon his work and looked forward to receiving feedback regarding how it went.

Van der Zande agrees with Roach that the lesson could operate on two levels of difficulty, and therefore work with different age groups. More advanced high school students could actually build the laser light show from components to learn about electronics and engineering design. Younger middle school students could use the pre-built setup to learn about mathematics and coding. In fact, he suggests that there could even be a third level of difficulty and believes the lesson could be made even more complex.

Very advanced students could "learn how to write more complex code, for example, tell the laser where to go using functions rather than a list of coordinates," van der Zande adds. In focusing on and suggesting higher math skills, he recommends using mathematical functions to directly define the shape, for example: using the equation of a circle to make a circle, and the equation of an ellipse to create an ellipse, and so on.

Another person Muskin involved to help develop the lesson plan was curriculum specialist Adam Poetzel, who has collaborated with Muskin on several projects in which they designed and developed lesson materials through campus partnerships then implemented them with practicing teachers in local schools. Poetzel had contributed a little to the early development of the laser device, but once it and the programming interface had been designed, Joe contacted him again to partner with them regarding how to best use this with actual students. Poetzel

An UMS student and Arend van der Zande watch as Edward Lu works out some of the kinks in order to display the student's design.

considered the pedagogy and designed worksheets for the lesson.

And Poetzel is well aware of what teachers need. He joined the C&I faculty in the fall of 2007 after having taught high school math at Champaign Central for ten years. His instructional focus is the preparation and training of pre-service mathematics teachers to effectively teach diverse K–12 students. Currently, he teaches a variety of methods courses for both undergraduate and graduate candidates, including courses that examine the role of technology in today's mathematics classrooms—such as a laser light show.

In addition, because Poetzel maintains strong ties with local schools, he was also in charge of recruiting a teacher and some students to serve as guinea pigs to try out the newly developed lesson plan. So Poetzel reached out to Urbana Middle School teacher, Jason Pound, who regularly mentors Poetzel's math pre-service students and has contributed many times to C&I's math teacher education program. Pound agreed to pilot the activity with a couple of his eighth grade classes.

Pound, who has worked with Poetzel on other projects, admits that when Poetzel contacted him about the activity:

"I was immediately sold. My experience with Adam is that he writes engaging curriculum and incorporates technology."

Regarding the cutting-edge technology, Pound indicates:

"I am always excited about teaching something in a new engaging way. It appears that this is something that will really get the students excited about the content."

He adds that he's excited about keeping up to date with new revolutionary delivery methods, and providing his students with the same.

Besides being fun for students, the lesson plan could be extremely valuable for teachers by helping them meet some of the common core math standards they're required to teach. That's another reason Poetzel was brought on board—to ensure that these were met.

Poetzel shares both the 6th and 8th grade math content standards and some common core math standards the lesson addresses:

- CCSS.Math.Content.6.NS.C.6: Understand a rational number as a point on the number line. Extend number line diagrams and coordinate axes familiar from previous grades to represent points on the line and in the plane with negative number coordinates.
- CCSS.Math.Content.6.NS.C.8: Solve real-world and mathematical problems by graphing points in all four quadrants of the coordinate plane.
- Common Core Standards for Mathematical Practice: "Model with mathematics," and "Use appropriate tools strategically."

In addition to its many benefits, the collaboration is a win-win for both Poetzel and Pound in another way. Pound is currently mentoring an Illinois student teacher right now, Jake Navarez, so Poetzel thought:

"It would be a great way to also involve one of my students."

ENGINEERING OPEN HOUSE 2018 ENCOURAGES VISITORS TO CONSIDER ENGINEERING'S IMPACT BOTH TODAY AND TOMORROW

March 15, 2018

On March 9–10, 2018, thousands of visitors flooded the University of Illinois campus to participate in EOH 2018: Drafting the Future: classes on field trips, parents who played hookey from work and brought their kids, high school students considering Engineering at Illinois. And there to meet them were hundreds of proud Engineering students, eager to show off what they've been learning or researching.

EOH 2018 featured more than 250 exhibits, including many hands-on activities, demonstrations, contests, races, and other displays. Most of the engineering disciplines on campus were represented. For instance, Aerospace students and organizations showcased their discipline via several exciting rocket launches or rocket races. Physics students and members of physics societies or organizations, such as the Physics Van, exposed visitors to some physics principles. Exposing visitors to distillation, one of Chemical Engineering's fundamental separation techniques, were members of OXE (Omega Chi Epsilon), while members of AIChE (American Institute of Chemical Engineers) exposed visitors to electrochemistry.

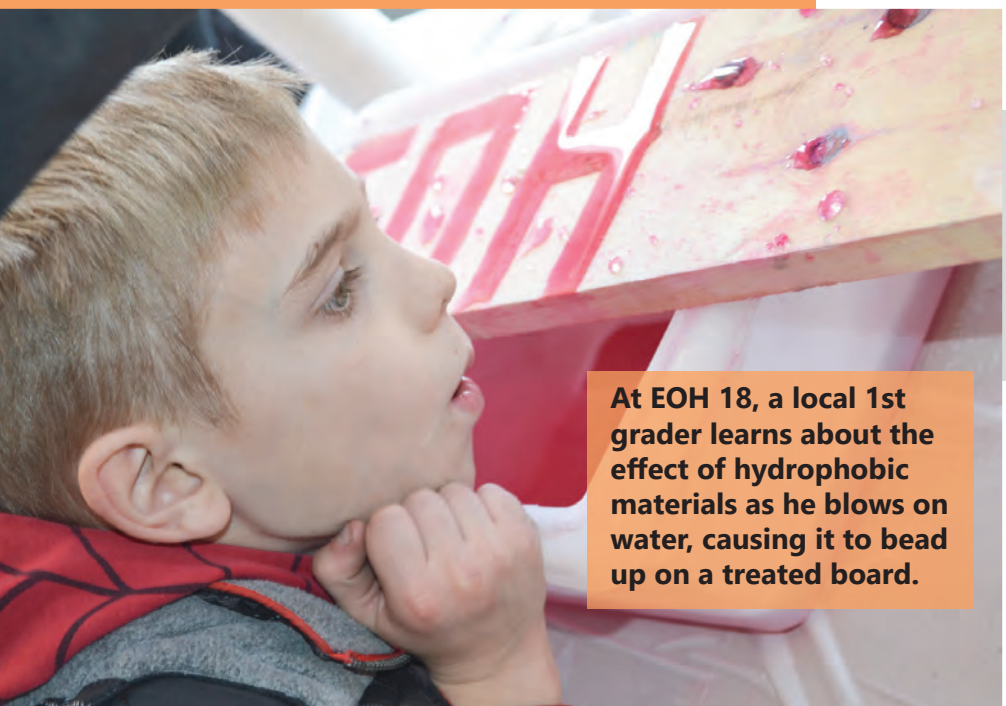
Local 10-year-old William Johnson experiences virtual reality, which allows him to find out what atoms moving around look like.

Many students at EOH were representing their labs and showcasing the research that goes on there. For example, Kyle MacKay, a MechSE Ph.D. student who studies surface chemistry and plasma assisted combustion was on hand to expose visitors to Atoms in Motion: A Virtual Reality Experience. MacKay reports that in his research, he simulates atomic motions and atomic interactions on surfaces, looking at how chemistry at surfaces affects flames and plasma when they interact with the surface."

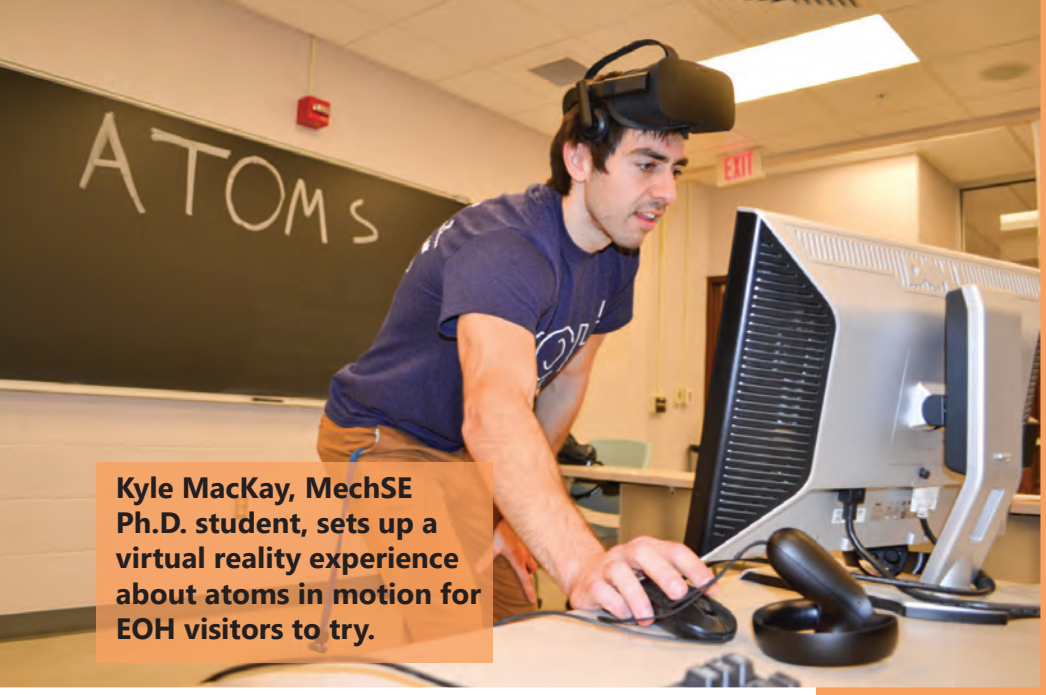
He reports volunteering for EOH because he wanted to share with the visitors some of the fun stuff he does every day.

"I really enjoy molecular dynamic simulations and the idea of molecular dynamic simulations where you can see atoms moving around and stuff."

He's evidently been thinking about doing a VR presentation related to his work for a while now. "I always thought that it would be really cool to be able to step into that and actually see the atoms moving around you," he admits.



At EOH 18, a local 1st grader learns about the effect of hydrophobic materials as he blows on water, causing it to bead up on a treated board.



Kyle MacKay, MechSE Ph.D. student, sets up a virtual reality experience about atoms in motion for EOH visitors to try.

He goes on to explain that his work with molecular dynamic simulations is:

> **"usually just in the realm of research, and only very serious scientists use them and know what they are. But it's actually pretty fun to see how atoms move around and in simple set ups like this, you can learn a lot about how phase change happens like melting and freezing and stuff like that."**

MacKay believes bringing younger kids to EOH can be a great learning experience and some of the more complex topics, such as phase change, can be explained fairly simply if kids "could just step into this fun experience that teaches them that." So he created a virtual reality setup which allowed them to do just that. Actually, he reports that learning about atomic bonds is typically something that students don't learn about, until maybe a thermodynamics course in college.

> **"But it's actually not that complicated if you look at it at the atomic scale," he admits. "And if you make it fun, hopefully they'll learn something."**

One of the first youngsters who got to experience molecular dynamic simulations via virtual reality was 10-year-old William Johnson. His dad, Harley Johnson, was one of those parents who took off work to escort his son and some his son's friends from school around to see the sights at EOH. Johnson, a MechSE Professor, knew about the VR exhibit because the grad students from his lab were in charge of the exhibit.

Johnson says he brought his son to EOH because, "The kids are really excited about virtual reality and they wanted to try it. They've heard about it and they've tried things that are similar but nothing that's quite this sophisticated."

Plus, he believes EOH with its myriad cutting-edge exhibits, like his students' virtual reality exhibit, help get kids excited about science. "They don't see them as two separate things. They don't see science as being different from the experience in virtual reality. They're really enthusiastic about it."

> **"The important thing is to be exposed to all this stuff," he adds. "They're really lucky that they get to be exposed to this kind of stuff."**

Another Illinois student, Hannah Manetsch, a sophomore in physics, and also a member of the Society for Women in Physics, was at EOH as part of the group's "Food for Thought" exhibit, which included fun activities such as egg in a bottle, and the electric pickle. She shares why she did EOH:

A young participant enjoys whipped cream...with sprinkles...that she made.

“I think it is an amazing time to be able to share our love for science with the community and with the people who come. Science is such an important part of life and even for those who don't use science every day, it is the reason why the universe exists. So I think it's just a really cool way to share that and get people interested in what science is—and I love physics—so what physics means for how you live.”

Had Manetsch seen any young, budding physicists at EOH? She wanted to at least get some interested in science. “Hopefully, they'll be interested and decide to think through more of ‘Why did that happen? That's so cool!’ and want to go do their own research and get interested in science at least.”

Another student, Austin Steinforth, who did his undergrad at Illinois in physics, and now is researching laser physics as he seeks a PhD in Electrical Engineering, shares why he got involved in Engineering Open House.

“I do EOH for the kids really. Kids absolutely love my demo. This is my fourth year straight, doing the exact same demo. It has nothing to do with my research, he admits, but I still love it, and I'll continue doing this for the next few years.”

In his demo, “Self-Siphoning Beads,” a string of metal beads succumbed to gravity, as expected; however, they also exhibited a rather unexpected phenomenon: they developed an arc, caused by the chains still lying in the container as they “pushed upward” because they were connected.

Of course, the engineering students, knowing that one sure way to engage a youngster is through sweets; so numerous exhibits were somehow related to them. Mechanical Engineering students, members of the Society for Engineering Mechanics, lured visitors with a Chocolate 3D printer (it prints out chocolate) and an automatic S’more Machine.

Many exhibits offering a taste of something—often flash frozen with liquid nitrogen. For instance, there were liquid-nitrogen frozen marshmallows and liquid-nitrogen-frozen dippin’ dots. In a refreshing departure from liquid nitrogen goodies, there was whipped cream—made on the spot by the participants who explored the chemical properties of

Austin Steinforth, Electrical Engineering Ph.D. student, who says he has been presenting his self-siphoning beads demo at EOH for the last several years.

cream and milk while vigorously shaking a container to produce whipped cream.

Another parent, Tania Lama, who was experiencing EOH along with her son as part of a field trip offered by the Urbana Middle School, explains why it’s beneficial to bring students to the event:

“I think it's a good way for them to learn and experiment and opens their eyes to what is available through the university,” she says. “It's a way for them to interact with all the stuff that you guys have going on."

Lama adds that EOH was also a chance for her son to be exposed to some things he wouldn’t necessarily experience at school. She explains:

"So far he has been enjoying all the experiments and all the things that are hands-on in the exhibits here. I do feel that this is opening his doors for learning more and for him to learn that there is more to what he is learning in middle school."

MCBEES EXPOSE JEFFERSON MIDDLE SCHOOL STUDENTS TO “COOL” SCIENCE ACTIVITIES

April 9, 2018

Helping to bring the material in science textbooks alive, and maybe even introduce some stuff not found in textbooks, eight MCB PhD students have been dropping by Jefferson Middle School during the spring 2018 semester to share their expertise with eighth graders. Slated to visit twice a month, from February through May, the Illinois students, members of the MCBees GSA (Graduate Student Association), were tasked with presenting various topics and leading some corresponding hands-on activities in Sammy Yoo and Elizabeth Wheatman’s eighth-grade classrooms. Their goal? To foster interest in science and maybe even impart their own passion for research to the younger students.

The activities touched on fun and exciting science topics. According to Mara Livezey, MCBees Outreach Coordinator, when she and the other volunteers were discussing what kind of impact they hoped to have at Jefferson, they decided to introduce interesting topics not normally taught in middle school.

Two Jefferson Middle School eighth graders study an onion root sample under a microscope.

“That way, we could introduce the students to ‘cool science’ to (hopefully) pique their interest in STEM,” says Livezey. And at the same time, they sought to “Introduce them to something that they wouldn't normally learn in their curriculum.”

Each of the volunteers then came up with their own topic; some were related to the presenter's research, but many weren’t, and were chosen because they were interesting and fun.

A group of Jefferson Middle School eighth graders study an onion root sample under a microscope.

MCB PhD student Anshika Gupta uses a black light to reveal the "germs" still left on students' hands after different methods of cleaning.

For instance the March 27th session dealt with germs—specifically, how infections like colds and the flu are spread. After discussing the differences between a couple of the primary culprits, bacteria and viruses, the MCBees led the younger students in an activity that was literally a "hands-on" demonstration.

A few students, chosen to act as “Typhoid Marys” for the group, had Germ-Glo Powder (a fluorescent

A Jefferson Middle School eighth grade student and his teacher, Elizabeth Wheatman, shake hands during a "hands-on" activity about how germs spread.

powder that simulates germs) sprinkled on their hands. To begin the simulation to illustrate how infection is spread, the students all shook hands.

Then, to underscore the need for thorough hand washing to prevent the spread of infection, students were divided into three groups; some washed their hands with just water; others used soap and water; the third group used hand sanitizer.

The length of time students washed their hands was also varied. Students' hands were then examined under a black light. Which hand-washing method work best? A thorough washing with good old soap and water.

In April, one of the topics the MCBees taught about was visualizing cell division. During this lesson, students made slides of growing onion roots, treated them with an acid followed by a dye, then looked at them under a microscope to learn about how cells divide.

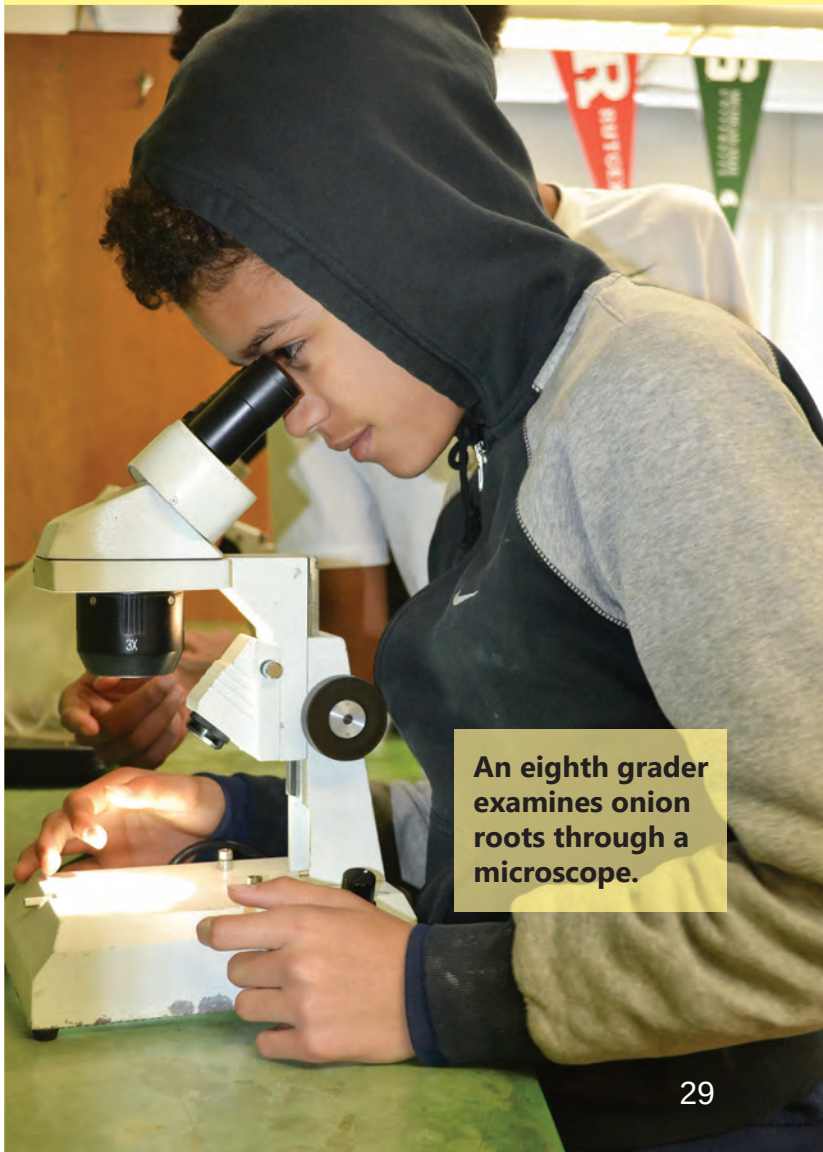
In an April session about chemical reactions, students will make elephant toothpaste using various combinations to see which has the biggest reaction.

Fruit flies will be the first topic in May, during which the students will study fruit flies to learn about human development, and while looking at flies with different characteristics (eye color, wing shape, etc.), will learn a bit about genetics.

In the final session in May, the students are scheduled to learn about rock formation and geodes. After learning about how rocks are formed, students will do a hands-on activity where they start growing their own rock crystals.

Two eighth grade science teachers who teach Flex classes, Sammy Yoo and Elizabeth Wheatman, were delighted to invite the MCBees into their classrooms. "We both have a Flex period where we're a lot more flexible with what we can do during that time," says Yoo. "So we don't have a hard curriculum that we have to follow for the Flex period. We have more freedom in terms of what we can do, so we can afford to have these guys over and do science stuff two times a month."

Yoo, who teaches 8th grade science, believes his students are reaping a couple of benefits via the partnership. For one, "They're getting good science stuff," he says. "These guys are grad students at the university, so obviously they know what they're talking about."



An eighth grader examines onion roots through a microscope.

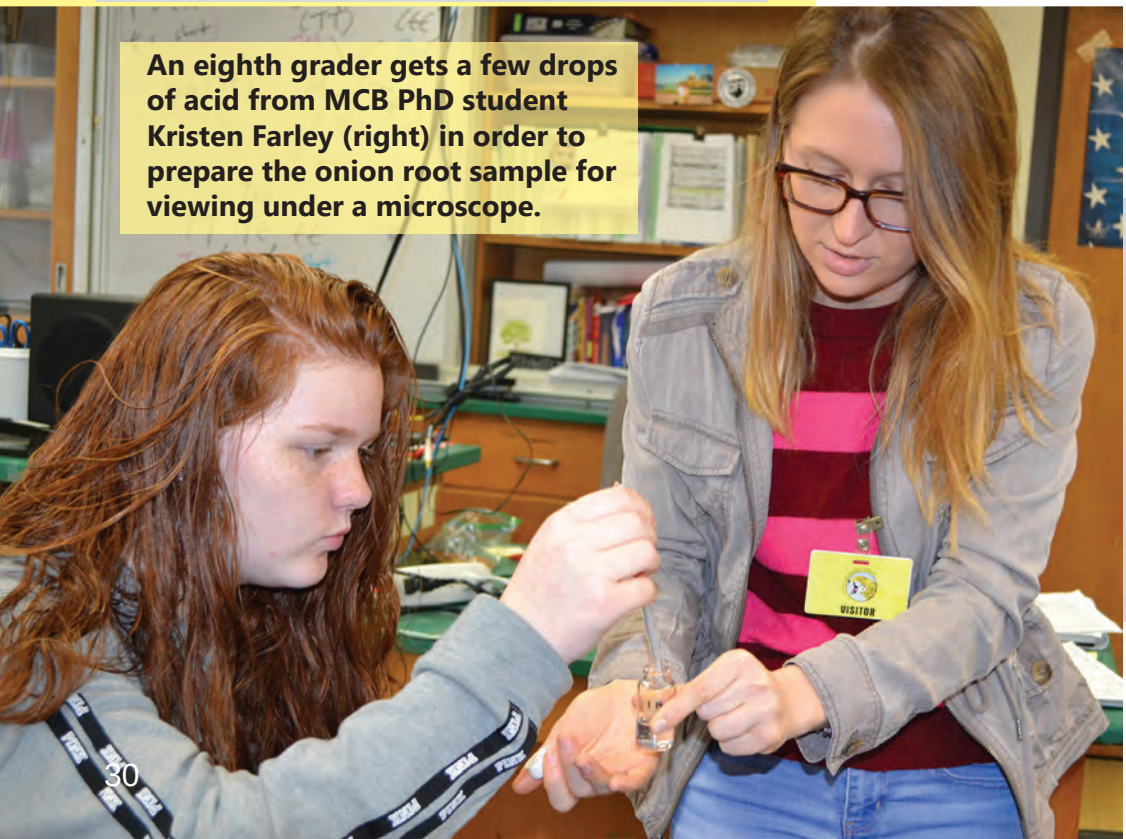
But he also believes it's good for his students to be exposed to people who are passionate about science but who aren't teachers.

"Obviously I think there's a proper place for teachers," he acknowledges, "but I feel like sometimes it's almost like your parents with the same old naggy voice. Just to hear it from an outsider, it almost affirms that what your teacher's talking about is true."

He also believes hearing from actual scientists like the MCB students, who are doing cutting-edge research to solve real-world problems might switch on the light bulb for his students. "It's a little different where their profession is science," he concedes.

"I know Mara, for example, is doing cancer research," Loo continues. "So maybe that would strike a chord with some of my students, like, 'Wow, science can actually make a change!' And 'If I'm serious about science, maybe I can help fight cancer!' That's something that they can get only from her that they wouldn't necessarily be able to get just from me. Just to expose them to that kind of stuff is always a good thing."

Two MCB students prepare an onion root sample for a student to put on a slide.



An eighth grader gets a few drops of acid from MCB PhD student Kristen Farley (right) in order to prepare the onion root sample for viewing under a microscope.

What kind of impact are the MCBee's activities having on his students? "Some kids obviously aren't going to be intrigued by anything, regardless of who's presenting it to them—whether it's me or anybody else," he admits. But some of his students are intrigued.

"I can definitely see some kids appreciate doing the hands-on stuff. They're talking about current things happening in science today, so I can see their eyes light up a little bit about that. It's exciting for them."

One MCBee member helping out at Jefferson has been Anshika Gupta, a second

year graduate student in the Department of Microbiology, who works in Dr. James Imlay's lab, where she studies DNA repair enzymes under oxidative stress.

Gupta reports volunteering for the outreach because she really likes meeting school kids and talking to them about science…and trying to get them intrigued with science.

She indicates that the MCB's major goal with the kind of activities they conduct is to "make middle school kids develop an interest in science." She adds:

Eighth grade science teacher, Sammy Yoo, adjusts a microscope to ensure that the onion root cells are clearly visible for his students.

A student does a hands-on activity about the prevalence of antibiotic-resistant bacteria.

"Giving them a physical demonstration of the concept helps them understand and retain it better. And that's what we aim to do," as opposed to just learning about it in textbooks.

According to Gupta, they also strive to introduce material that kids don't get at school.

"There are a lot of concepts which cannot be covered in textbooks," she explains. "Through this program, they also get to learn some new cool concepts of science."

How did the MCBees' collaboration with Jefferson Middle School happen?

As outreach coordinator for the GSA, Livezey says one of her goals for this year was to extend their impact into public schools in the Champaign-Urbana area. She also specifically wanted to form connections with a middle school, as they haven't regularly worked with this age group yet. So she reached out to the middle schools in Champaign-Urbana. Staff at Jefferson expressed interest, and luckily, the two teachers' class schedules matched up with her volunteer's availability. "We are hoping to continue this collaboration for years to come," she says.

LOCAL DADS AND THEIR DAUGHTERS HAVE AN INCREDIBLE TIME DOING SCIENCE AT DADDS

April 13, 2018

On a fun, daddy-daughter date that was not just relational, but also educational, around 30 or so local fathers and their daughters showed up the Mechanical Engineering Lab on Saturday, April 7th, for SWE's DADDS (Dads and Daughters Do Science) event. The event was geared towards having 1st–3rd grade girls bond with their dads while exploring science and engineering via fun, hands-on activities and challenges. The long-term goal? To pique the girls' interest in science and to encourage them that—like the Incredibles (the theme of the event) and supported by their real-life heroes, their dads—they too could someday do amazing feats in science and engineering.

Sponsored by SWE (the Illinois' chapter of the Society of Women Engineers), about 20–25 SWE members, female engineering students from a variety of disciplines, volunteered for DADDS. Their goal? To expose the 29 fathers and 31 daughters (yes, two dads brought two daughters!) to engineering, but also to serve as role models, conveying to the young participants that, "Yes, girls can do science and engineering!"

Seven-year-old Cassie and her dad show off the paper airplane they built.

According to Abby Cohen, a Civil & Environmental Engineering sophomore and one of the DADDS co-chairs, since the girls are so young, the goal wasn't to "really explain exactly what engineering is to them," she admits. She says they hoped to "just to get them more interested in math and science activities." She adds they wanted to make sure STEM is one of the girls' interests when they're younger, so that as they get older, they'll hopefully stay interested and want to learn more about it. Another goal of DADDS is to provide female role models, so the young girls "see older girls doing something like math and science so that they'll see it as an example."

So why a SWE event that focuses on having the dads come with them? Cohen says it's to get their fathers involved from the beginning and encourage them to foster their daughters' interest in math and science.

"It'll make sure the dads follow through after this event and still make sure that they're doing math and science activities at home and they're interested in school, since their dads are one of the biggest influences on them growing up."

DADDS co-chairs Tatiana Shaffer (left) and Abby Cohen.

A DADDS particpant plays with the slime she and her dad made.

Part of the morning's agenda was to introduce the girls to five different engineering disciplines. According to DADDS co-chair, Tatiana Shaffer, her hope for the outreach was not just to

> **"show girls they can have fun with science," but to "show them all different disciplines of engineering."**

Shaffer knows from personal experience how important understanding what engineering really is can be. She shares an anecdote about when her parents first suggested that she become an engineer:

> **"I started crying," she recalls, "because I thought they were talking about being a train engineer, and I didn't want to do that."**

So Shaffer's goal for the event was to give girls a taste of the diversity and real-world applications of engineering.

> **"We're trying to show kids that engineers do plenty of things, and introduce that to them early. We're trying to show them that science goes a lot more than just sitting in class, writing down assignments, and going through tests. It's applicable every day, and you can do a lot of fun crafts with it."**

So the girls and their dads rotated through hands-on activities related to: Chemical Engineering (making and playing with Slime), Mechanical Engineering (Exploding Popsicle Sticks, constructed in a lattice design held together by tension), Aerospace Engineering (Paper Airplanes, which the father-daughter teams designed then launched), Materials Engineering (Rainbow Jars, during which the girls learned that the density of various liquids would cause them to stratify, creating fun rainbow-like layers), and Electrical Engineering (during which the girls used pens with a special kind of ink that conducts electricity better than graphite or lead pens to draw a circuit on paper, then attach a battery to light up the LEDs.)

Following the five rotations, the girls learned more about chemical engineering during the Elephant Toothpaste demos, created by combining a type of acid, food coloring, and dish soap, which caused an interesting-shaped reaction (voilà! elephant toothpaste!)

A DADDS participant and her dad look at the rainbow jar they made at the Materials Engineering activity.

Then, after the pizza lunch, the girls learned more about Chemical Engineering while making their dessert: Ice Cream. Instead of the usual—Liquid Nitrogen Ice cream—it was done a bag and showed the girls the different chemical reactions that can happen when you use different ingredients. So the ingredients (milk, sugar, and vanilla) were poured into one bag which was sealed then placed in a larger ziplock bag that contained ice and kosher salt, causing a chemical reaction and freezing the ice cream. “That's cool, because the kids get to eat it and it's really fun,” admits Tatiana.

The final activity was building balloon cars out of various materials. The girls and their dads built the shafts and body of the car, attached the provided wheels, then used a balloon to act as the force that drove the car.

Why would 25+ busy engineering students dedicate a Saturday out of their busy schedules to spend time with young girls and their dads?

“Being able to show kids that science can be fun is one of my favorite things,” admits Tatiana Shaffer. The DADDS co-chair says she got involved because she loves outreach events, and “bringing in people of any age and showing them how great engineering can be. I love looking out and seeing all the dads interacting with their daughters. And they're all learning something new and having fun doing science experiments—things that are going to be really helpful, but also having a lot of fun.”

A DADDS participant and her father make airplanes in the Aerospace Engineering activity.

A junior double majoring in two seemingly disparate fields, Mechanical Engineering and Psychology, Shaffer chose to double major because, “I love both of them.” She reports that the deeper she gets into bio mechanics, the more helpful she’s finding her psychology background.

Cohen, reports taking a leadership role in DADDS because when she was involved in SWE outreach last year, it was definitely her favorite. “The girls are so cute because they're so young and sweet.” So she agreed to co-chair, indicating that “DADDS would be really fun because I love volunteering with the girls.”

According to Cohen, she finds seeing girls having a really great time doing a math and science activity to be really rewarding “Because I always felt like I was encouraged to NOT like math and science,” she admits.

Cohen’s ultimate goal, of course, is for them to end up in STEM careers.

A DADDS participant and her dad have a great time bonding while makeing a rainbow jar.

A young participant shows off her handiwork made at the Weaving Popsicle Sticks station.

One of the girls who could possibly end up in engineering was seven-year-old Cassie, whose dad thinks she might become an Aerospace Engineer.

Her dad brought her to DADDS because he was looking for:

“Something different, something exciting we can do together, and maybe learn a couple things.”

Eight-year-old Ella’s dad brought her to the event just for fun:

"My wife found out about it,” he admits, “and said we should go. I definitely wanted the opportunity to take her out. We thought it'd be fun, and she's having a good time so far.”

Is Ella going to be an engineer when she grows up?

“I don't know. Are you?” he asks Ella. “Yes!” is her definitive response.

“So this is something I really want younger girls to be more interested in, so when they get older, they want to be engineers and want to be scientists and want to do things like that when they get older. So it's really rewarding when you see a girl be like, ‘Oh, this slime activity was so cool; I loved it! I want to do something like this when I grow up!’ Instead of something typical for a girl, they might be more interested in STEM things.”

Whether the girls end up as engineers or in STEM, they definitely had fun doing the various activities, and each had a favorite.

Eight-year-old Aubrey’s favorite was “Probably the slime one!” Aubrey’s dad brought her to DADDS “because Aubrey has enjoyed science, and it's a great opportunity to see different types of experiments that she's seen in school.”

Does Aubrey’s dad think she’ll be an engineer? "I don't know,” he admits. “She does like putting things together and learning about them, but she also likes destroying them. So she might be someone that figures out how to destroy things. There's a science to that too!”

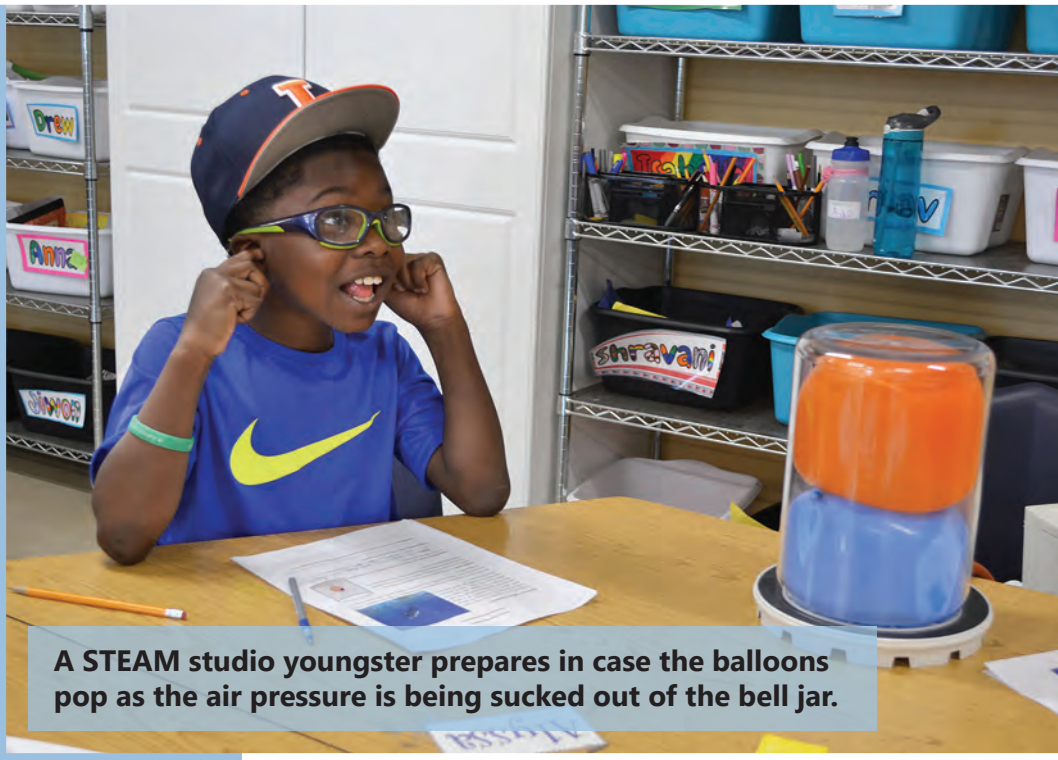
A DADDS participant enjoys the ice cream she and her dad made.

VAN DER VEEN TEAM TEACHES STEAM STUDIO STUDENTS WHY AIR PRESSURE VARIATIONS AND VACUUMS WARRANT WACKY WEATHER

May 3, 2018

What happens to balloons in a bell jar when you remove the air pressure and create a vacuum? What happens to marshmallows? The liquid in a barometer? How do these relate to our weather?

A number of STEAM Studio third–fifth graders discovered the answers to these questions and more when two PhD students from Chemistry Professor Renske van der Veen's lab visited on Wednesday, April 25th and Friday, April 27th. Because the goal of Next Generation Schools' after-school program is to emphasize STEAM (Science, Technology, Engineering, and Math [STEM], along with Art), Tyler Haddock and Ryan Cornelius dropped by to present some scientific demos about air pressure—and how these different air pressure and vacuum effects are related to the weather—as part of STEAM Studio's Wacky Weather Week.



A STEAM studio youngster prepares in case the balloons pop as the air pressure is being sucked out of the bell jar.

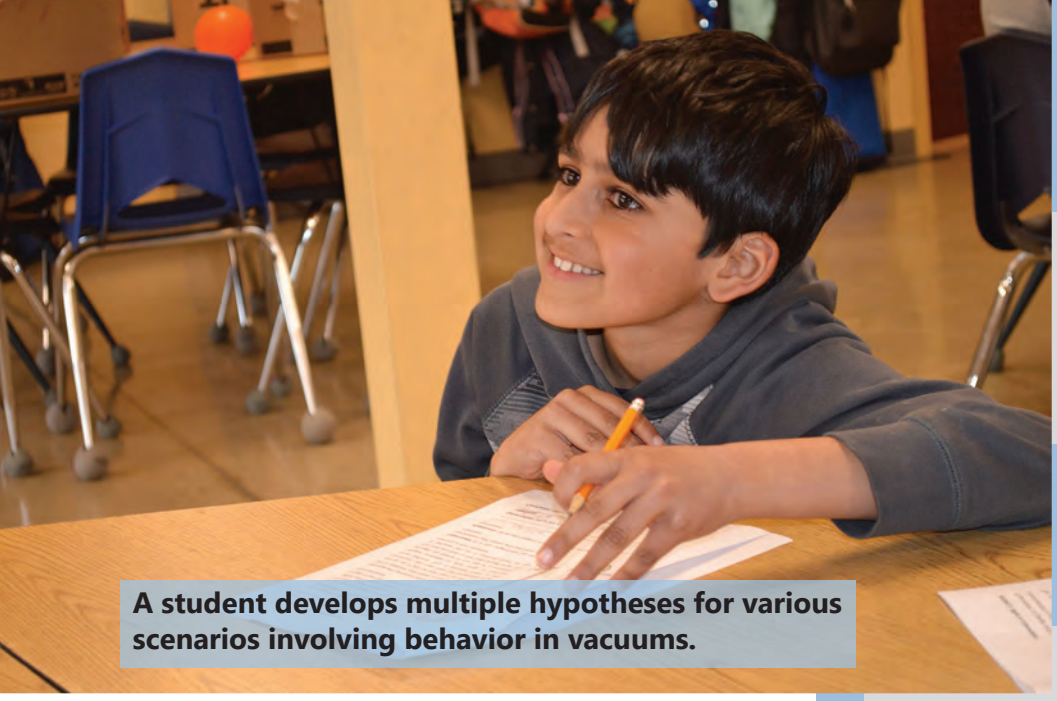
Why bring in experts to do demos? "Weather is not something that we can go outside and manipulate," explains STEAM Studio Director Angela Nelson. "We have to wait for a sunny day and then a rainy day to see how the pressure has changed. With demonstrations like this, we can create a model that recreates these conditions and allow students to observe the outcomes all in one class period."

So students were exposed to some weather-related experiments when Haddock and Cornelius used vacuum pumps to remove the air from some bell jars to determine what would happen to different objects placed inside the jars. But first, students received a worksheet, and prior to each experiment, were to develop a hypothesis explaining what they thought would happen in each experiment then report the results on the sheet once the activity was over.

Take the balloon experiment. Some of the kids (including this reporter), thought the balloons would shrink. Wrong! As the air was removed from the container, they grew. Why? Because as the number of air molecules in the jar decreased and no longer pressed on the outside of the balloon, the molecules inside the balloon remained and continued to press on the inside surface of the balloon, causing the balloon to expand in size. In fact, the balloons soon took the shape of the bell jar.

In another experiment, a barometer was constructed inverting a tube filled with colored water in a small dish of water. When it was placed inside the bell jar and the air was removed, how would the water level in the tube change? It dropped! As air was removed, it could no longer press down on the water in the dish. This lack of pressure allowed the level in the tube to decrease by its own weight.

What happened to marshmallows as air pressure was removed from the bell jar? First they expanded as the air was being sucked out of the bell jar—just like the balloon. But then, after the air was let back into the chamber, they got smaller again. What was



A student develops multiple hypotheses for various scenarios involving behavior in vacuums.

happening? Because marshmallows have lots of air pockets, as the air was removed from the container, there was less air pressure on the outside of the marshmallows than on the inside, so the inside air could easily push its way out, making the marshmallows get bigger. But once the air returned, the marshmallows shriveled back to their original size.

Another experiment involved seeing which would fall faster, a feather or a paper clip. Outside of the bell jar, the paper clip won the race. Inside the bell jar, however, the two fell at the same rate, because with no air resistance to push against the feather to slow it down, it fell at the same rate as the clip. This is verification of Galileo's experiment. He supposedly dropped objects of different mass from the Tower of Pisa and observed them fall at the same speed!

The final experiment involved boiling water. Can water boil with no heat applied? The students first learned the definition of boiling, which might be a bit different than one expects: It's when liquid turns into a vapor.

Another thing students learned was that water boils at different temperatures depending on air pressure. For example, the higher you go in the atmosphere, the lower the temperature at which water boils, because there's less air pressure. So as the pressure was lowered in the vacuum chamber, the water began to boil, and contrary to popular opinion, the temperature remained constant.

Through these demonstrations that allowed students to see with their own eyes scientific principles in action, Nelson and her teachers were able to:

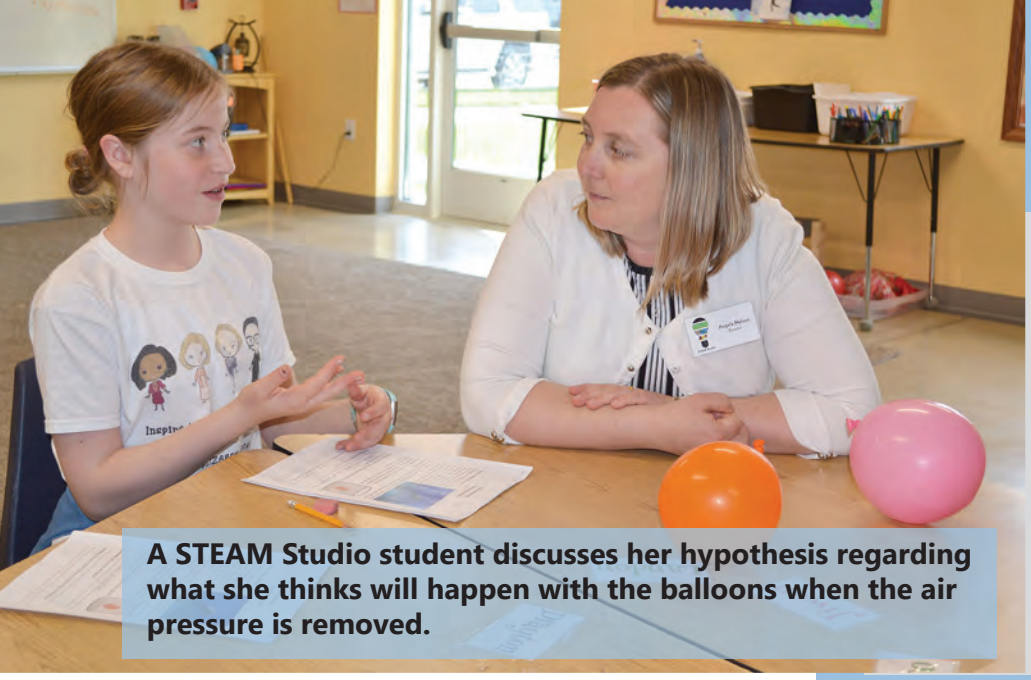
"take the more abstract concept of atmospheric pressure and make it meaningful for the students," she explains.

By encouraging students to explore how vacuums work and explore what happens to a barometer as the pressure decreases:

"The activity also went past the scope and sequence of our weather unit and explored the relationship of pressure in a range of different fields and real-world experiences," Nelson adds. "It allowed the students to explore the microscopic world of chemistry through molecules that cause the macroscopic weather changes that we are discussing around the world."

Nelson adds that her students learned more than just how the air pressure/vacuum effects impact weather. The experiments allowed her students to see multiple uses for the same technology—vacuums in space, how objects fall, Boyle's law, and the impact of pressure on boiling temperature. "This allows students to break the misconception that a science concept only applies to one situation and

Two students watch to see how fast a feather and a paper clip fall in a vacuum.



A STEAM Studio student discusses her hypothesis regarding what she thinks will happen with the balloons when the air pressure is removed.

that the interaction between grad students and youngsters goes both ways:

"As a graduate student, it's very refreshing to answer the creative questions asked as they wonder at the science of the demos. I usually have forgotten when and where I learned principles like vacuum, so to see the learning process and inquisition of the students firsthand is exciting."

opens the door for creativity and awareness of the multiple applications of a scientific concept," she explains.

Haddock, agrees with Nelson as to the benefit of their activities for her students:

"Abstract concepts in science are hard to grasp at a young age," he admits. "Seeing the balloons expand or the barometer level drop gives much more weight to the explanation of how. I could really see the gears turning as the students were asked to conclude why they observed what they did. Seeing the 'Eureka!' moment for several students is very encouraging."

He also reports he believes that the students benefitted not just by learning about science, but by interacting with the grad students.

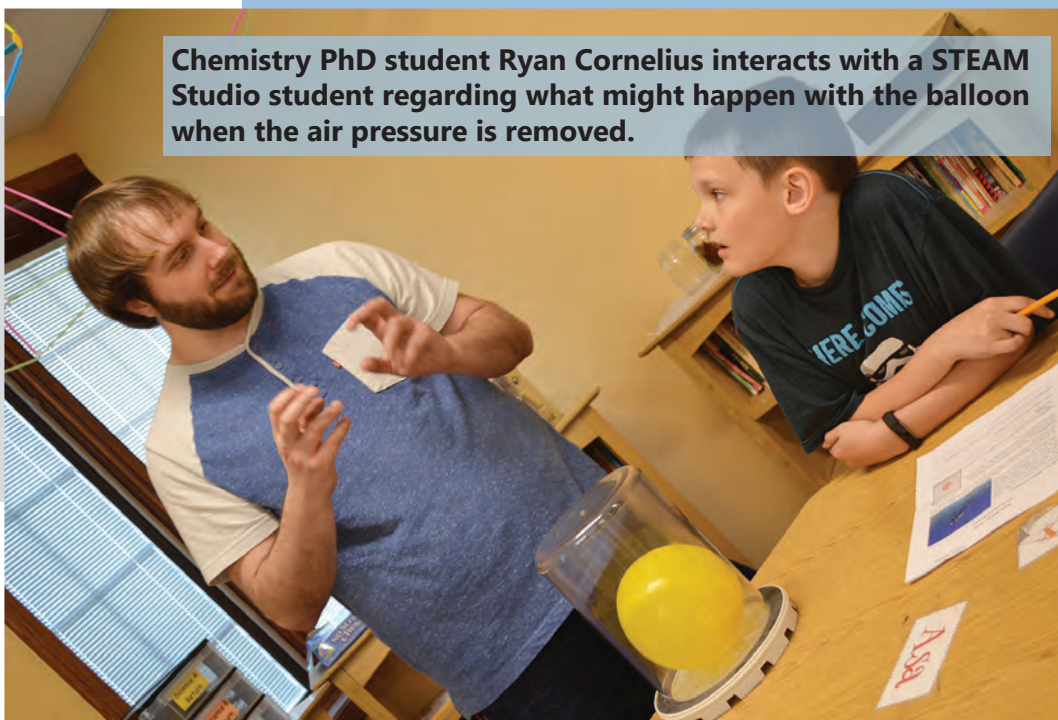
"Young students look up to college and graduate age students as mentors and role models," he says, "Getting to work one-on-one with 'big kids' can be an inspiration for students to make their own path as scientists."

But it wasn't just the younger students who benefitted from the encounters; Haddock indicates

Nelson explains why she encourages guest experts like van der Veen's grad students to visit her program:

"It allows students to interact with experts in the field and learn how research is conducted in a multitude of fields," she explains. "It also allows us to provide authentic experiences using equipment and resources that would not normally be available to us. Students also learn how to communicate and share their experiences with scientists."

Even beyond the knowledge the students gained, and their exposure to the graduate students, Nelson believes the activities fostered a spirit of inquiry



Chemistry PhD student Ryan Cornelius interacts with a STEAM Studio student regarding what might happen with the balloon when the air pressure is removed.

amongst her students, pushing them to "ask questions and search for answers." Plus, she believes having enthusiastic experts on hand to help students hunt for answers inspires them to ask more questions. In fact, Nelson believes it's meaningful for students to hear the experts admit:

> **"'I'm not sure what would happen. I have a theory, let's test it!' Knowing that you do not have to know it all and being open to discovering it is an integral part of being a scientist and can sometimes be lost to young scientists," says Nelson. "These opportunities remind them of that process."**

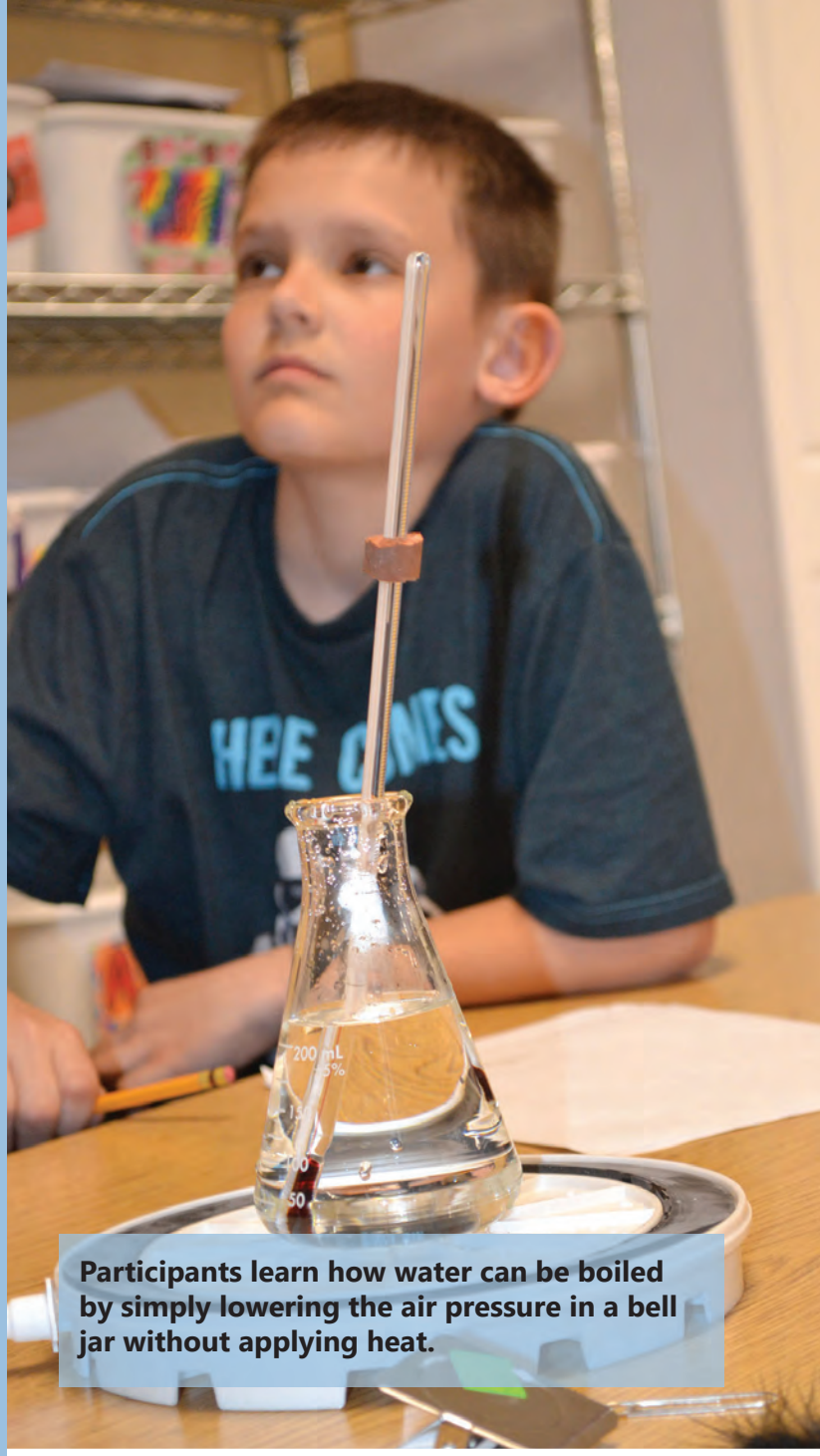
STEAM Studio Director Angela Nelson shares how the partnership with Professor van der Veen, who's affiliated with both Illinois' Department of Chemistry and Materials Science and Engineering Department, came about. Van der Veen had heard about STEAM Studio and reached out to Nelson to discuss potential collaboration opportunities. Based on van der Veen's expertise with vacuums and previous experience doing vacuum-related demos for local schools, as well as STEAM's upcoming units, they determined that activities about atmospheric pressure seemed like a perfect fit.

While the visit was beneficial for the youngsters—it was actually a win-win for both groups, because it gave van der Veen's team a chance to test run their outreach material. Van der Veen's early 2018 NSF CAREER award helped to make these experiments possible for the students. The grant allocated funding for the purchase of pressure chambers to be used in a community outreach component in the Champaign-Urbana area. So van der Veen and Haddock had been developing vacuum demos and experiments since last summer.

Haddock says:

> **"STEAM was a perfect place to do our first demos given the relevance of Wacky Weather Week, the way science is taught in an engaging environment, and the familiarity of the students with concepts related to the demos—like pressure."**

Tyler Haddock is a 2nd year Chemistry PhD student who uses X-ray and laser pulses of a trillionth of a second in duration to study how materials change when they interact with light. Ryan Cornelius, a first-year Chemistry PhD student who is also in the van der Veen research group, works on an electron microscope (which uses electrons instead of light) and is interested in studying how light changes the shape of materials within the microscope.



Participants learn how water can be boiled by simply lowering the air pressure in a bell jar without applying heat.

Nelson expresses her thanks to Van der Veen's team:

> **"STEAM Studio is thankful for the time and energy that Dr. Van der Veen's lab put into creating this wonderful opportunity."**

ORPHEUM LAUNCHES NEW ASTRONOMY KIDS' CORNER WITH HELP FROM COMMUNITY FRIENDS

June 19, 2018

"My overall philosophy is that the museum is here really as an educational resource for the community. So that's what you elevate. That's what you focus on, and that's what we raise the bar on." – Doug Brauer, Orpheum Children's Science Museum Executive Director

Orpheum Executive Director Doug Brauer.

Kids who dream of exploring "a galaxy far, far away," are intrigued with "launching" rockets, or who long to do astronaut stuff like mining asteroid rocks or climbing into a lunar lander, might want to visit the Orpheum Children's Science Museum's new Astronomy Kids' Corner. With some help from Busey Bank and a number of Mechanical Science and Engineering (MechSE) seniors who designed two space-related exhibits, the Orpheum in downtown Champaign launched the first stage of its new astronomy exhibit at a grand opening on Thursday, June 7th. The exhibit is part of Executive Director Doug Brauer's efforts to expand the museum's role as an educational resource for the community.

According to Brauer, the exhibit is one step toward his goal of fostering more collaboration with community partners.

He acknowledeges:

> **"One of the things we haven't done well, historically, is community engagement and collaborative outreach, and we want to do a lot more of that. So we're trying to develop collaborations and partnerships that will really advance the museum—take it to a place where it hasn't been before."**

One of those partners is Busey Bank, who helped to fund the Astronomy Kids' Corner exhibit and will continue sponsoring it over the next ten years. According to Colin DeCair, Busey's Associate Development Manager, who also helps with community relations efforts, Busey has been involved with the Orpheum for quite a while.

> **"We definitely believe in supporting our community and making as big of an impact as we can. We definitely believe that it's not just financial wellness, it's total, overall wellness. And one of the best things to do with that is to help communities—be it through the arts, be it through education, whatever the case may be—if it's going to help our community grow, we want to be a part of that, because a healthy community means a healthy Busey.**

Citing Brauer's plans to transform the Orpheum to be a local P–20 STEM education resource for the community, DeCair adds:

The son of Busey employee Colin DeCair tries out Orphy's Escape to Space.

"Since we're already on board, we already had that relationship, it just made sense for us to double in and be that partner to help them grow, and help the community grow, and help everyone just have a little fun at the same time."

At the event with his son, who was particularly enjoying Orphy's Escape to Space, DeCair says, "Astronomy is just a fun exhibit. It's an exhibit that's going to require a lot of support to make happen, and to look how they're wanting it to look. And we have the capacity to be able to help them to reach that goal, which is why we're fully in support of it."

The other partner helping with the Astronomy Kids' Corner was the University of Illinois' Mechanical Science and Engineering Department. Though university folk have been involved with the museum in the past, Brauer hopes to cultivate more of that:

"Just trying to be a little more proactive and take a little more advantage of that resource that's sitting in our back yard!"

So Brauer, an engineer himself with a history of working with higher education, was thrilled when one of his board members connected him with MechSE's Emad Jassim, Director of Undergraduate Programs, about having some of MechSE's seniors do Senior Capstone Projects that would contribute to the Orpheum's new astronomy exhibit.

So Brauer and his staff came up with several ideas for exhibits they'd like, and the two student teams chose the ones they were interested in. One, the Asteroid Mine, gives young visitors a chance to mine "asteroid rocks,"picking them up using a giant gripper. After placing it on the scale, they are then to use the chart to determine what kind of ore they've picked up, then send it back into the pile of ore samples.

In the other, Orphy's Escape to Space, kids can suit up like an astronaut and launch a rocket into space. But to do so, first, they must pump the handle to give Orphy's rocket enough fuel to make it into space, then push the red button to "launch" the rocket and see how far it goes.

Also part of the exhibit, Brauer converted a slide (very popular with kids) which had previously been part of a castle exhibit into a shiny Lunar Lander so kids can climb up the ladder into the lander then slide back down.

Excited to work with college students, Brauer acknowledges that the partnership dovetailed nicely with his goal to broaden the museum's reach to impact more than just young children.

"It ended up being a nice process," he admits. "From the very beginning when I stepped in, I wanted to be more proactive in the marketing and the engagement of students, and this really fit into that vision, more of a P–20 engagement with the student population versus kindergarten through third grade. So it really broadened it out."

Plus, besides gaining two new, high-quality exhibits for the museum, Brauer also got to interact with the students throughout the process of designing and building their projects, another thing that appealed to him about the project:

"I'm a very big advocate of project-based learning," he admits, "and that's exactly what these capstone projects are."

Brauer hopes this collaboration with MechSE will be ongoing, because of the unique opportunity it gives students to design something really unique.

A local 4-year-old operates the Astroid Mine at the Orpheum Astronomy Kids' Corner grand opening.

"This is just a different animal," he admits, "to develop an exhibit that's gonna' to be there long-term, that's gonna' be out there in the public." He says that in a lot of typical capstone design projects, the students "may or may not finish, and at some point it gets tucked away in some closet to never be seen again. But this was something that was going to be in the public eye and represent the students and the department and the university in a very different way than it has in the past."

Brauer reiterates that part of the appeal was that the students had to design something that was going to be at the museum for a long time and be very visible.

"And I think that's in part why the department did these two projects," he explains. "I think they certainly looked at this and said, 'Boy, this is something that is very unique that our students haven't done before.'"

But the museum-university collaboration wasn't just beneficial for the museum. It was a win-win for both partners. For instance, it gave the MechSE students a broader perspective of what a project is like, from beginning to end.

"The groups were able to take theoretical concepts that they'd learned regarding project management in other classes and bring it into this real project, where they had to go through the process of trying to figure out what it is that we're going to do and then figure out what's the best way to do it, and actually design and develop this thing. And it ended up being an interesting process."

Plus, Brauer relished being able to pour some of his wealth of knowledge and experience into the young engineers. Because his career has been split between directing global manufacturing and operations and higher education, he's well versed in not just engineering, but the best pedagogy.

"I'm in engineering by trade," Brauer says, "so it was a nice perspective that I was able to add."

For example, he helped the fledgling engineers with their timeline. They had one semester, not forgetting spring break and graduation, to complete their projects, so he helped them figure out the amount of time they had to come up with the design and go through the engineering process.

"So I really tried to bring the real world to them very quickly," Brauer says, "that we're serious about this. The museum, obviously, we wanted to have a finished product. They saw that and they embraced it."

Brauer reports that the students spent a lot of hours and late nights completing the projects. And to ensure their design was appropriate for kids, one team even met with folks in the College of Education to discuss pedagogy for young children. Plus,

both teams came up with You-Tube videos advertising their projects.

Brauer also addressed different engineering aspects, like liability, engineering, and safety, reminding the students, "'These are things that you need to consider in this.' So all of these topics that they had touched somewhere along their four-year path at Illinois they were able to bring home and really apply. I think it just added an entirely different perspective for everything that they learned...what was applicable and what wasn't applicable at times."

What did Brauer think of the collaboration? He admits:

> **"I loved it. I just got a kick out of the kids. They were very dedicated to the projects. I was very impressed by their maturity."**

With the MechSE students taking ownership of their projects, Brauer also worked to ensure that the students understood and embraced their client's vision. He indicates that the Orpheum recently held a 25th anniversary reception for founders and current museum stakeholders. The goal was two-fold: to say, "Thank you for getting us here!" to the founders who attended, and to convey to current stakeholders, "Now, this is where we're going!" He also invited the MechSE student teams. He acknowledges:

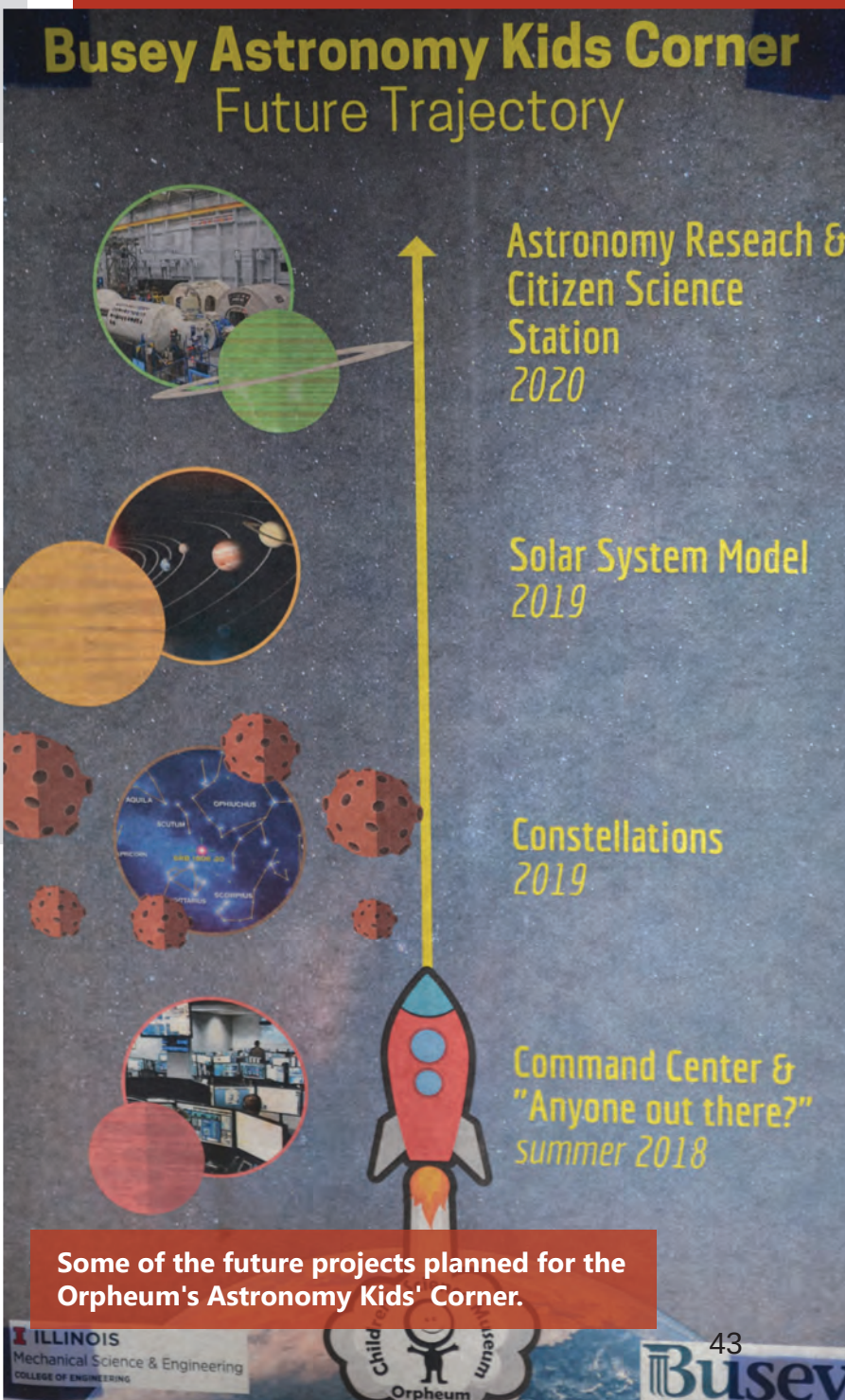
> **"We wanted them to become true stakeholders in the museum, so they could not only see what they were doing, but they could be able to understand the strategic vision of the museum."**

Brauer emphasizes that this is just the first stage of the Astronomy exhibit, and that the museum is going to continue to add to it. For instance, a financial exhibit is in the works where a visitor can step on a scale, find out how much they weigh, then figure out what it's going to cost to get them into space. There will also be a control center, and constellations mounted from the ceiling.

He also wants to ensure that the Orpheum has a master plan, a pathway through the museum. "There has to be logic. It has to be connected. Start with the dinosaurs, and we're going to leave the earth at some point, see what's out there," he says, regarding the Astronomy exhibit.

Brauer shares the strategic vision he developed when he was first hired: "We're going to strategically move forward; we're going to raise the bar; we're going to become more professional; we're going to advance the museum."

Part of what Brauer means by advancing the museum is encouraging stakeholders to "Be focused on the Children's Museum." He shares a little-known tidbit about the museum's history in explanation: "The museum was started, really, to put something in this building. The original intent was to save the Orpheum Theater." Regarding the perpetual conflict



Some of the future projects planned for the Orpheum's Astronomy Kids' Corner.

among the board and supporters between those just interested in saving the building and those interested in children's education, his response to them is this: the Children's Museum is the steward of the building. Therefore, the museum needs to grow and advance, become more engaged in STEM, and become more engaged in K–12 and beyond to include the university too—so that means P-20.

To help the museum advance, a couple of other museum-university collaborative projects are also in the works. He says:

> **"I'm really looking at, let's leverage all that knowledge and expertise, and really become a working student laboratory, quite honestly, for students."**

And along with a working student laboratory for college students, Brauer envisions the museum becoming a go-to STEM education community resource:

> **"We want to do more STEM and become a true museum," he envisions. "We want to elevate our educational offerings, be able to be more help to the schools, and still be a collaborative instrument with the University of Illinois to go out and reach an urban population and take STEM to the families and kids that normally wouldn't have access to it. I really view us as a community resource that provides access to an urban, K–12 environment in ways that others within the Champaign-Urbana area can't do or are not willing to do."**

Grateful to Busey for its long-term commitment to the museum, he also hopes to interest additional corporate sponsors. Plus, he suggests that the museum is an excellent venue for outreach when the university faculty apply for grants, such as to NSF.He explains:

> **"We want to be the outreach partner in that, because that overcomes, I think, a lot of the barriers to reach the people at the K–12."**

Two youngsters try out Orphy's Escape to Space.

Regarding the future, Brauer shares the importance of Orpheum stakeholders having a unified strategic vision and embracing that: "If you don't have that vision, you're always going to live in the present," he states, then adds, "I'm pushing for the vision; I'm pushing for the future."

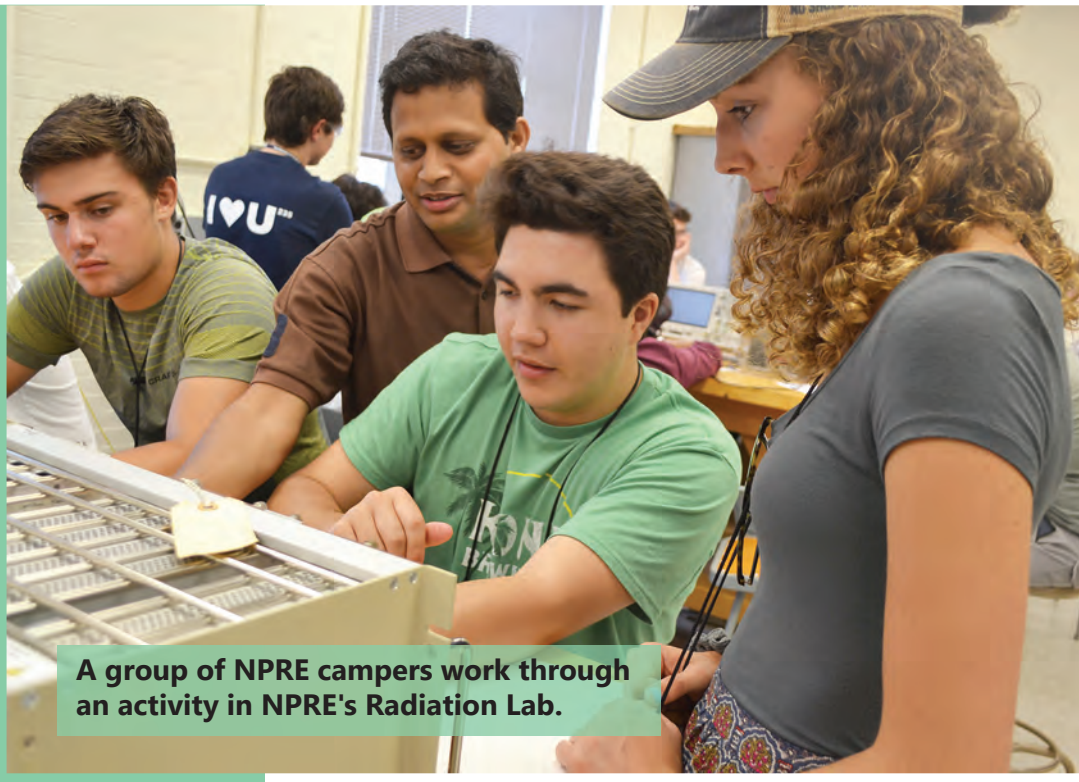
He elaborates:

> **"I wanna' have a world-class children's science museum. I want to move in that direction."**

HIGH SCHOOL STUDENTS EXPERIENCE NUCLEAR ENGINEERING—AND MORE—AT THE NEW EXPLORING NPRE CAMP

July 6, 2018

Exactly what is nuclear engineering? It has to do with power plants, right? On campus the week of June 25–29th for the first-ever Exploring NPRE camp, 18 high school students discovered that nuclear power is just one emphasis of NPRE (the Department of Nuclear, Plasma, and Radiological Engineering). Plus, the rising juniors and seniors, mostly from the Chicagoland area, who attended NPRE's week-long, residential camp not only learned about nuclear engineering, but plasma and radiological engineering as well, and how they impact our lives. Plus, they learned a bit about Illinois, and what it might be like to be an engineering student on campus.



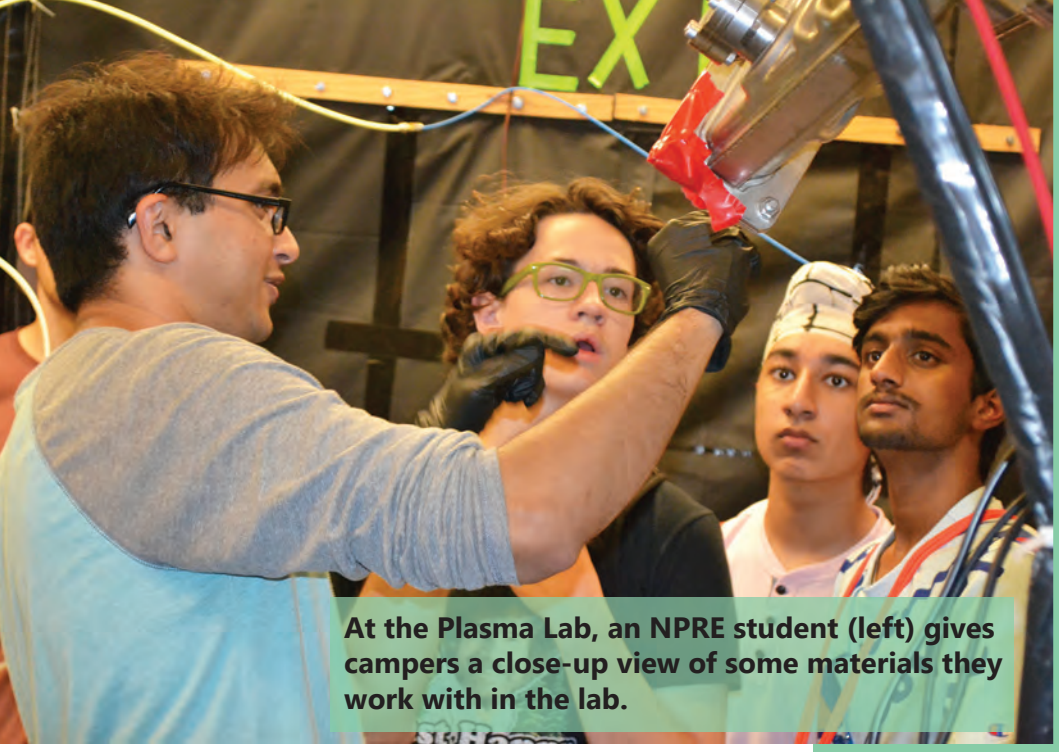
A group of NPRE campers work through an activity in NPRE's Radiation Lab.

According to Becky Meline, Coordinator of Academic Programs for NPRE and also Coordinator of the new camp, high school students are commonly not exposed to nuclear engineering unless they're lucky enough to have a chemistry or a physics teacher who happens to touch on it. Thus, NPRE's goal was to make students aware of what the department has available.

"So we wanted to basically make them aware of what nuclear engineering is and all of the different applications, because even if they've heard of nuclear engineering, sometimes they think only about nuclear power generation or stereotypes about nuclear power. But there are also a lot of other applications that they may not be aware of."

A camper works on his team's robot.

She goes on to cite a few: plasma fusion science and engineering, which is a whole area of NPRE; radiological applications, with its disparate uses ranging from medicine to national security; as well as materials-related research related to power plasma fusion. According to Meline, the activities



At the Plasma Lab, an NPRE student (left) gives campers a close-up view of some materials they work with in the lab.

planned for the camp cut across all the different areas of the department.

Throughout the week, NPRE faculty and their research groups led sessions comprised of lectures, demonstrations, tours, and hands-on activities related to NPRE's diverse research areas. For instance, in one session, campers built light detectors, or sensors, using Arduinos. One afternoon they were in one of the labs learning about radiation, shielding, and half-life. Another activity addressed nuclear medicine, such as the use of radioactive tracers, as well as radiology (X-rays), where the students also learned about different imaging modalities, such as PET and CT. Campers learned about plasma, how it affects our lives, and some of its applications. For example, one activity explored the ways plasma and radiation can modify material surfaces. Plus, with their finger on the pulse of what young people are interested in nowadays, the camp gave the high schoolers the chance to design and build their own personalized game, using Unity, a well-known game designing software.

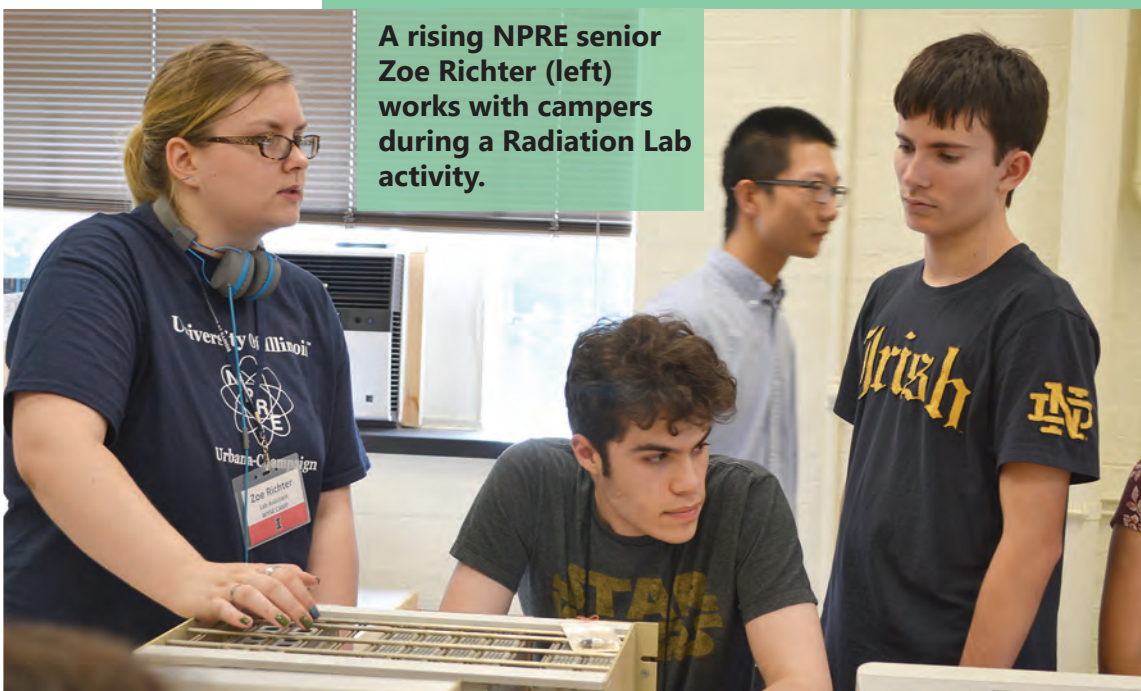
The camp also featured several tours. For instance, armed with Gamma-Ray detectors, the campers took a tour of campus to determine radiation levels of various locations. Participants also toured NCSA's 3D animation resources, and the Materials Research Lab. Plus, on Thursday, campers visited the Exelon Clinton Power Station. "We have a good working relationship with them," Meline explains, "so we're happy that the students are going to be able to meet with some of engineers from Exelon. It's the closest nuclear station to us."

But it wasn't just all work and no play. Following the visit to the Clinton Power Station, the campers visited46 another nearby attraction, Clinton Lake, for some well-deserved R&R.

And to wrap up the weeks activities, on Saturday, when their parents came to pick them up, the students presented a PowerPoint with photos to give their parents a glimpse of all that they had learned and experienced throughout the week.

Meline says NPRE's goal in doing the camp was mostly outreach—making students aware—along with maybe a little recruiting.

"It'd be great to have students say that they want to apply not just to the College of Engineering, but to NPRE directly. But even if they don't, they leave with a more educated understanding of what the area is about, and that's a good thing as well," she adds.



A rising NPRE senior Zoe Richter (left) works with campers during a Radiation Lab activity.

The many NPRE graduate and undergraduate students who were involved with Explore NPRE no doubt had similar goals. For example, Zoe Richter, a senior in NPRE, hoped to do a bit of recruiting and get some of the students interested in nuclear engineering. When she explains why she got involved with the camp, she relates an anecdote about participating in the Women in Engineering Orientation as an incoming freshman. She recalls that there was one girl representing nuclear engineering and only two girls who were interested in the field among all the incoming freshmen.

"So when I heard that our department was doing a bigger camp for people interested in nuclear engineering, I wanted to help out."

What impact does she believe the camp had? Richter says that while there was one participant in particular who was clearly interested in nuclear engineering, for many of the others, it exposed them to engineering at Illinois.

She believes that for most, their motivation for participating was:

"I want to be an engineer in general. I just want a taste of what it's like. I want to see the campus, because I'm trying to decide if I want to go here, and I'd like to meet some people and meet the campus."

So while many hadn't necessarily settled on an engineering discipline as of yet, she believes one positive impact of the camp was:

"Just helping them understand their options, understand what's available to them, try to figure out if Illinois is a good fit for them, and maybe more of them will go here, and they get to meet their new classmates, meet some new friends before they even come to campus. So I think that's really cool."

A rising junior in NPRE, Isabella Iaccino, explains an activity to the campers.

Also helping with the camp was Isabella Iaccino, a rising junior in NPRE in the plasma concentration. (For those of us who don't know what plasma is, other than in relation to blood, Iaccino explains: "It's an ionized gas. So the best example is the sun or lightning. It's when an electric current goes through some gas and pulls the electrons off of the atom. So I study how that happens, different kinds of plasmas we can make, and different things we can do with plasmas.")

Iaccino, who really enjoys outreach, got involved with Explore NPRE because she wanted to help students discover what engineering is so they can make informed career decisions.

A rising sophomore who attended the NPRE camp, Andrea Grisalez

She shares about her experience in high school:

"I had no idea what engineering was," she admits. "I knew I liked math and science, but I thought that I had to choose between them. And then, luckily enough, my high school had opportunities for me to learn about engineering and take engineering classes, but if I didn't have that opportunity at my high school, I don't know if I would be where I am today."

She adds that she really enjoys engineering and wants to help other students figure out that this is an option. She explains:

"Whether or not they want to do it, they can decide for themselves, but I want to make sure that they know this is an option if this is what they enjoy."

For the campers themselves, the first word of the camp's name, "Exploring," says it all. For example, Andrea Grisalez, a rising sophomore at Jones College Prep in downtown Chicago, who indicates that she's interested in engineering in general, says she attended Exploring NPRE because, "It's something I'm interested in, and it's a good experience."

Regarding whether she might choose nuclear engineering or not, she says she's "not sure quite yet which one," but acknowledges that NPRE's camp was "fun, and "more hands-on than I expected."

Another camper, Brendan Walker, a rising junior at Cincinnati Country Day High School, took part in NPRE's camp because he: "really wanted to get a feel for engineering and also a feel for a college campus, especially one with a College of Engineering." Still exploring, he indicates, "I'm not really sure what I want to do yet, so I kind of want to verse myself in different subjects before I make my decision."

Walker definitely achieved his goal of getting a feel for the campus. He reports that in addition to having a good time at the camp, he was impressed with Illinois:

"I'm really liking it. I'm really liking the atmosphere. I'm really liking—it kind of feels like I'm almost in college in a way. Going to classes and doing work. Everyone here is super friendly. We've made friends within the first few days. It's just a wonderful environment to be in, and the counselors are really nice, really funny. I'm just enjoying it."

MECHSE'S JOE MUSKIN ENLIGHTENS LOCAL YOUNGSTERS ABOUT 3D PRINTING DURING CHAMPAIGN PUBLIC LIBRARY EVENT

August 17, 2018

Does learning about STEM have to stop just because it's summer vacation? A number of local youth (and their moms) say, "No!" So on July 25, 20 teens (and preteens) showed up at the Champaign Public Library (CPL) for 3D Pringing 101 to learn about, then experiment with, Stereolithographic 3D printing. Courtesy of Mechanical Science and Engineering's Joe Muskin, the participants first learned a bit about the technology: they explored the equipment that's used, and learned how and why 3D printing works, including learning about the light spectrum. But even more fun was actually doing the printing itself; plus, they left the CPL armed with a couple of 3D printed objects they could whip out as proof when boasting about the activity to friends and family.

Stereolithographic 3D printing uses ultraviolet light to cure a resin comprised of photosensitive polymers layer by layer. After seeing a brief PowerPoint about the specifics, the participants worked in pairs to use a CAD (computer-aided design) software program on laptops, following step-by-step instructions to make miniature objects, such as Batmobiles or Eifel Towers, to name a few. As the participants slowly raised the build platform, the software would trigger a release of a concentrated beam of ultraviolet light for a specific time period to form each layer of the object.

Organized by Kathie Kading, the Teen Librarian, the 3D printing activity was one of several she and a team of colleagues came up with as they tried to identify different areas in which they thought teens might be interested. She then reached out to people in the community to implement the programs. And evidently Joe Muskin, MechSE's STEM Outreach guru (his official title is Education Coordinator), is one of their go-to guys.

"Joe is one of our people who always has a packed house, so we invite him back each year," Kading reports. Joe has done a number of different activities, including robotics, in addition to 3D printing, as well as other hands-on activities, which Kading says, "are always a hit!"

A youngster removes the Eifel Towers he and his partner 3D printed at the Champaign Public Library acitivty.

She continues, "People are looking for those STEAM programs, and so we've got the arts; we've got the sciences. And this year we added a business component, and that was yesterday. It was really well received too."

She admits that she pretty much gives Joe free reign to choose what he wants to do. "For him, I'll leave it up to him, because he is just such a great presenter, and he does this throughout the community." However, she says that with other people,

she often works collaboratively with them, “Because not everyone I seek out has had experience working with teens,” she explains.

Kading explains why the library does these kinds of events, especially STEM-related events, for teens. During the school year, the library has drop-in programs where people can just come in and join. However, in the summer, parents have things more scheduled for their kids, so the library tries accommodate. So CPL still has a drop-in program on Tuesdays, but also provides summer programming for which parents much register because only a limited number of kids can be served. She explains the benefits of these types of events.

“Families are looking for this kind of thing, and ours are all free, and sometimes that's a component that makes a difference.” For instance, many other local programs might cost $100 or more, so this kind of program provides STEM education opportunities for families with limited budgets, including some member of underserved populations. “This one kind of [levels] the playing field, I think, for everyone."

She says some kids might not be ready for programs of this type, so parents try out their program to see if their teen is ready to come to a program where they're not there supervising.

Joe Muskin explains 3D printing to the young participants.

However, she also says that kids come looking to gain expertise or become more knowledgeable about an area. She reports that several teens interested in starting a business who participated in their business event “actually came to hear ‘What can I do to really get myself ahead?’"

Another benefit of her program is that kids can just explore, to determine, “Am I interested in science? Am I interested in the arts? Am I interested? What might I be interested in?” She says it allows parents to send them, then talk with them at home, asking, "Hey, what did you think about this?"

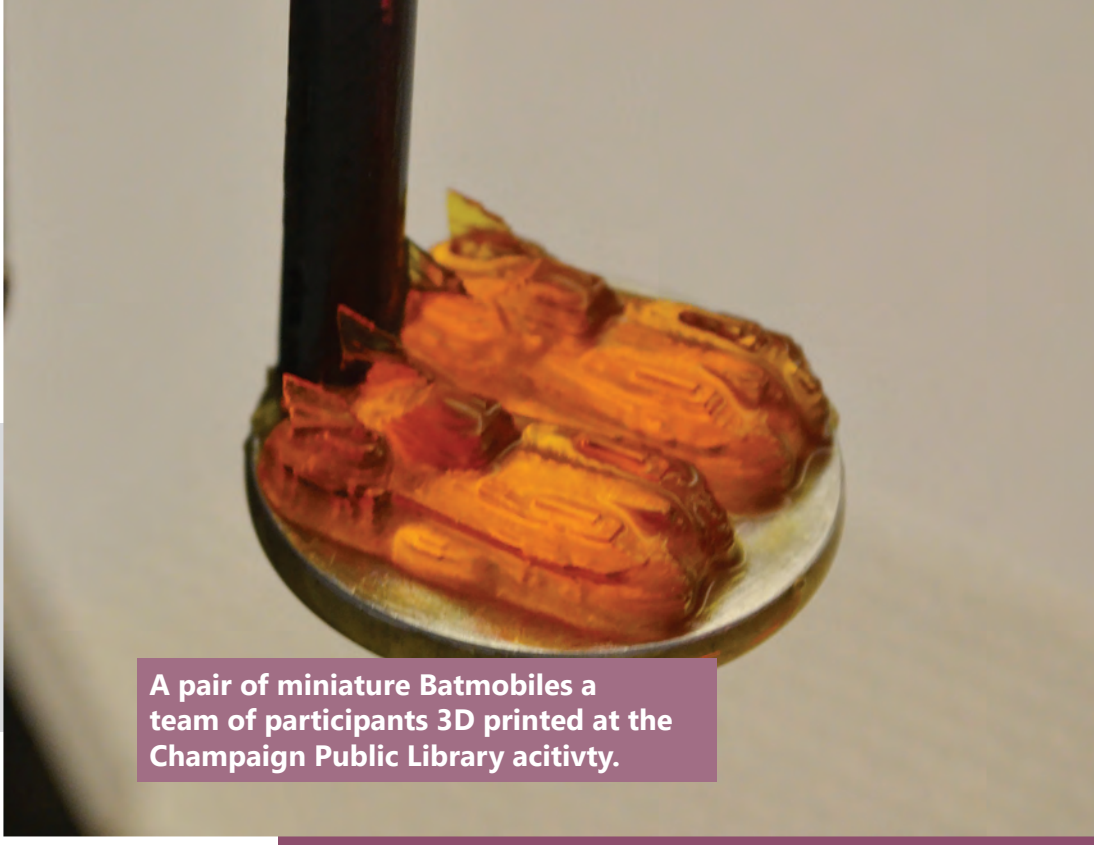
Kading appreciates having a world-class university in her back yard as a resource. “We absolutely love the university!” she gushes. “They really work with us. We have a lot of the clubs that come and then also staff from the university, and they just bring so much to the table.”

Why did the kids show up, other than that mom made them? One local youngster, Areli Olayo, a rising eighth grader whose favorite subject is math, wasn't quite sure about the benefits of coming to an event like this (“Uh, learning something I guess”); however, she enjoyed the activity. “I think it's really cool,” she reports. An ideal elder sister, she indicates that when she finished 3D printing her Batmobile, she intended to: “Probably just give it to my little brother.”

Areli Olayo (left), a local eighth grader adjusts the aparatus for the next level.

Areli's older sister, Esperanza, who will be a freshman in high school this fall, also participated. Although their mom didn't tell them until the day before that they were coming to the library event, she admits, "So I was excited when I heard about it," she says, then explains why:

"I've never done it before," she admits. "It always seemed cool, but I never thought I would actually get a chance to learn about it."



A pair of miniature Batmobiles a team of participants 3D printed at the Champaign Public Library acitivty.

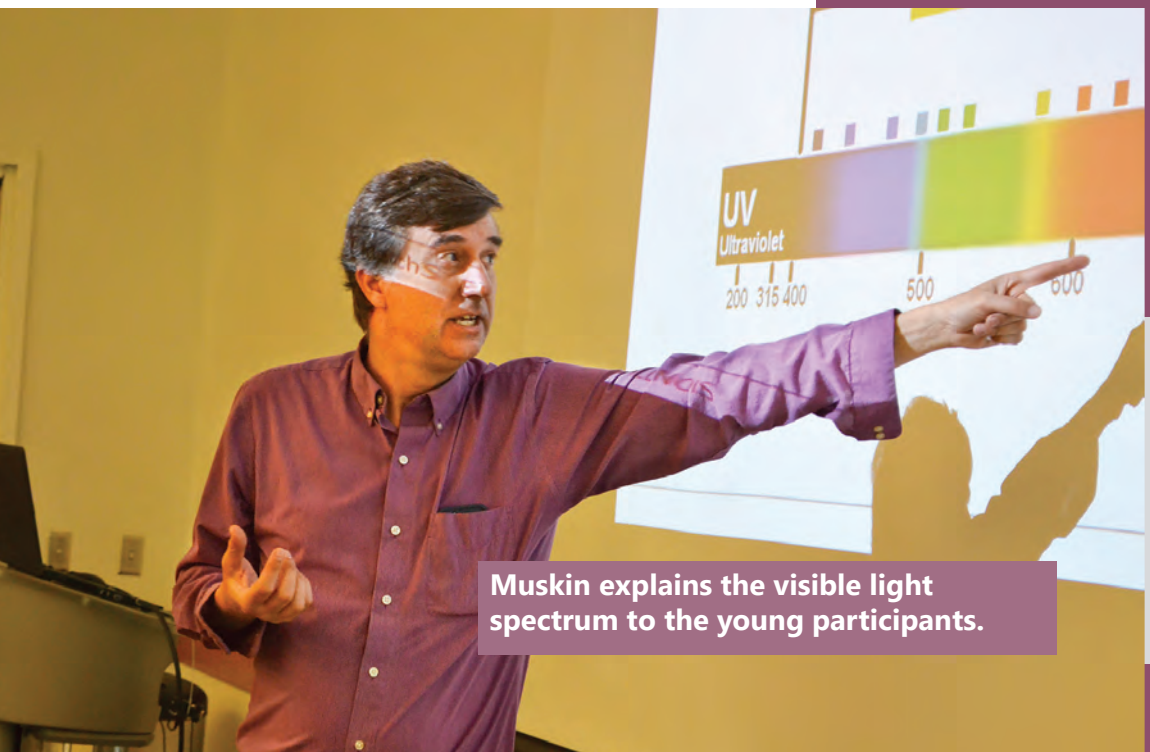
While Esperanza explains that her favorite subject in school is history, she qualifies, "I love science too!"

The girls' mother, Karen Olayo, explains why she brought her three kids to the activity.

"I am always looking for learning opportunities for my children," she acknowledges, "especially things that I don't know about…I want them to learn about technology and expand their own vision and imaginations for what they might do in the future someday."

She cites the benefit of exposing her youngsters to hands-on STEM activities, such as the 3D printing: "Kids need to be challenged to think outside the box," she acknowledges.

"Seeing and taking part in workshops like these, I believe, helps them to reach for higher goals and use their imagination better. It also gets them excited about science and opens their minds to a world of new possibilities."



Muskin explains the visible light spectrum to the young participants.

Another benefit of the event? Olayo concurs with what Kading mentioned earlier: "Free also is REALLY nice," she admits.

And of course, she appreciates how much they enjoy events like this:

"It's just plain fun!" she adds. "I love when they come tell me how exciting it was to learn something new—especially when it's cutting-edge technology!"

ROGER EBERT SYMPOSIUM EXPLORES SCIENCE COMMUNICATION TO FOSTER EMPATHY FOR THE UNIVERSE, EARTH, AND ITS INHABITANTS

(left to right) Toni Myers, Terry Virts, and Donna Cox at the post-screening Q&A session.

October 15, 2018

The Inaugural Roger Ebert Symposium, Empathy for the Universe: Storytelling and Data Visualization, not only sought to create empathy for the entire universe, but zeroed in on our little corner of it, Planet Earth. The October 1st symposium targeted media currently at the forefront of science communication: interactive storytelling, data visualization, and, of course, video and cinema. Treating participants to a taste of the premium movie-going experience, IMAX 3D, the highlight of the day featured a screening of the IMAX release, A Beautiful Planet.

The symposium was the dream child of Donna Cox, Director of the Advanced Visualization Lab (AVL) at the National Center for Supercomputing Applications (NCSA); Tracy Sulkin, Dean of the College of Media; Chaz Ebert, CEO of Ebert Digital LLC; and Nate Kohn, Roger Ebert Film Festival director. Sponsored by their respective units, along with the IMAX theater, the symposium featured a number of speakers, interactive panels, public discussions, previews of some of the AVL's 4K (ultra HD) 3D movie clips, and of course, the free screening of A Beautiful Planet at Savoy 16's IMAX theater. The post-screening Q&A featured two key players in the production of the film: the primary cinematographer, former NASA astronaut Terry Virts, and the film's director and writer, Toni Myers.

Presenting throughout the day were experts in the field of scientific communication—what Chaz Ebert referred to as "an embarrassment of riches of people and intellect." The speakers and panels focused on three emphases: Science on the Screen, Story Framing and Visualization, and Interconnectedness in Arts and Sciences. Ebert added that the trajectory for the day was to "start from above… bring it down to earth level, and then we're going to go to humanity."

Along with Ebert, Virts, and Myers, other presenters included: the Sloan Foundation's Doron Weber; North Carolina State University Teaching Professor Brand Fortner; North Carolina State University Physics Assistant Professor "Astro Katie" Mack; Illinois Computer Science Professor Karrie Karahalios; Illinois Journalism Professor Brant Houston; Colorado State University Professor of Animal Science, Temple Grandin; Illinois Assistant Professor of Graphic Design, Stacey Robinson; Rachel Switzky, Director of Illinois' new Siebel Center for Design; and Illinois Associate Professor of Media and Cinema Studies, Anita Chan.

Welcoming participants to the fledgling symposium on the behalf of the University of Illinois was Andreas Cangellaris, the Vice Chancellor for Academic Affairs and Provost, who dubbed it

"An event that we can celebrate over and over again and expand it because of who we are—a comprehensive university that has all the elements to accept the challenges we face, debate them, acknowledge the fact that we can do something about it, and most importantly, set the stage to make this happen."

Helping MC the event was Chaz Ebert, Roger Ebert's widow and the CEO of Ebert Digital LLC, which publishes the movie review site, RogerEbert.com. During her welcoming address, she stressed our interconnectedness as members of the human race. Having been a trial attorney for both the Environmental Protection Agency and the Equal Employment Opportunity Commission, she explained that she has now come to realize that "Those things were not separate—science, humanity, the way we treat people, gender parity—all of those things are part of one thing…our interconnectedness as human beings."

While sharing, Ebert related an anecdote about Buckminster Fuller:

> **When people would say "Hello," to him, "he wouldn't respond, 'Hello,' or 'How are you?' He would say, "I see you." According to Ebert, "He recognized that there is a very human need to be seen, heard, understood, respected, loved."**

She then added that she hoped the event would help to foster this mindset.

Having had lots of experience with both Science on the Screen and being "above," former NASA astronaut Terry Virts ignited the crowd by sharing about his experiences as an astronaut, commander of Expedition 43 on the International Space Station (ISS), and as one of the primary cinematographers of A Beautiful Planet. Regaling the assembly with stories about his experiences, he shared what living on the ISS was like, challenges of filming the movie, and the camaraderie that developed among the astronauts of different nationalities…despite simultaneous political tensions on earth.

Virts also shared how being in space had changed him and his perception of our planet's interconnectedness. For instance, after describing a night view of Earth and the disparities between brightly lighted spots versus certain very dark sections, he shared that he had come to this realization, "I wasn't seeing population; I was seeing wealth."

Part of what made Virts' participation in the symposiuim so special was his sense of humor. For instance, when a member of the audience commented that it takes a special person to be an astronaut, Virts responded: "You said it takes a special person. I think that's the kind of person who's crazy." In response to another query as to whether he might

Chaz Ebert at the post-screening Q&A session.

run for president, Virts quipped, "Do you have a fork? Would you mind sticking it in my eye?"

Drawing on Virts' expertise, a member of the audience asked where mankind should go next in space. He explained:

> **"I think the moon is a great place to go first, as a testing ground. Humans haven't been to the moon since 1972, so to say that, 'We've been to the moon'…well, I haven't been to the moon; nobody working at NASA has been to the moon! So I think it's a good place as a build-up approach to test, but I think Mars would be the long-term space goal."**

Sharing what filming a movie in space was like while being stuck on the Earth, iMAX filmmaker Toni Myers indicated that she'd developed a "scene list" of all the shots Virts and the other astronauts

Speakers at the Ebert Symposium.

should try to get…with this one caveat: “If an alien does come up and stick his face in the window, don’t not shoot it because it’s not on the scene list!”

Also sharing about space from an astrophysicist’s perspective was “Astro Katie” Mack.

She shares why she agreed to participate in the symposium:

> **“The idea of empathy and emotion in science communication is a huge thing for me,” she says. “It's a big focus of what I try and do is to sort of create connections between people and help people connect to the broader universe. So the idea of an event that's empathy for the universe sounded like the perfect kind of thing.”**

Plus, after looking the lineup of presenters, she added “And there are all of these amazing, talented people doing incredible things, so I was very honored to be included in that.”

Drawing from her vast wealth of knowledge about space, Mack shared a few absolutes about the universe. For one, it’s expanding. “We are currently 15.8 billion years into it,” she explains. “Star formation in the universe peaked about 9 billion years ago, and the expansion of the universe is accelerating,” she explained. “Something called dark energy—we don't know what it is—is stretching out the compounds and making the expansion speed up and pulling galaxies farther apart from one another.”

Mack says there's no center of the universe. “Unless you think, well, technically, we are each the centers of our own observable universe,” she equivocates. Plus, when we look out into the cosmos, she says we're looking back in time. This idea, along with her statement as to whether “now” actually exists inspired a lot of good-natured banter back and forth between presenters. She explains:

> **"It's so subjective. You can't define 'now' for any more than one person. When you study relativity, you lose the concept of now. So you have to figure out, when you say now, are you talking about the time the light arrives at my eye or am I talking about if I were able to stop the evolution of the universe at this moment everywhere, which can't be done. It get really, really complicated really quickly."**

Also, according to Mack, the prognosis for the universe isn’t good: “Stars will die; black holes will evaporate. The universe will become a cold, dark, and empty place. It's called the heat death. It's inescapable.” The good news? “We're not there yet!” she shares, indicating that the end of everything is still billions of years away.

At the end of Mack’s presentation, she shared her poem, Disorientation with the audience. It perfectly expressed her philosophy about space, from the first line, “I want to make you dizzy,” to the one where she admits there might be life out there, “I want the sky to stop you dead in your tracks on your walk home tonight, because as you happened to glance up and among all the shining pinpricks, you recognized one as of the light of an alien world,” to the notion that man-made lines of demarcation separating humankind from one another are nonexistent from space:

> **“I want you to see your world from four billion miles away, a tiny glint of blue in the sharp white light of an ordinary star in the darkness. I want you to try to make out the boundaries of your nation from that vantage point, and fail.”**

Regarding Story Framing and Visualization, Illinois Computer Science Professor Karrie Karahalios reflected on the gist of what she and her colleagues were seeking to communicate:

“People can actually relate better to stories than to facts. We have seen signs that visualizations actually help sway people…People can relate to a story that has a beginning, a middle, and an end, where they can connect the dots, especially a story they can relate to."

Illinois Journalism Professor Brant Houston stated, “Visualization of data is an integral part of journalism now,” then showed various examples of visualization, looking at some of the different ways journalists are telling stories and trying to establish the role of empathy.

Another concept this panel sought to convey was to beware of titles, as they often reflect the bias of the journalist or author or lead to incorrect assumptions. As an example of the inaccuracy of titles, Karahalios discussed the “Global Warming” label.

“There has been a lot of debate about why scientists chose the term global warming early-on as opposed to climate change or changes in climate. Because people think global warming, and they're like, 'Well, it's below 0 outside, it must not be true.'”

The pièce de résistance of the entire day, of course, was the screening of A Beautiful Planet in 3D at the Savoy 16 iMAX. Andreas Cangellaris, the Vice Chancellor for Academic Affairs and Provost summed it up when he called it “the kind of movie, the kind of visual experience that should be prerequisite reading or viewing for everyone.”

The post-screening Q&A session gave the viewers the opportunity to ask Virts and Myers questions that had been generated while viewing A Beautiful Planet.

One question viewers asked Virts was whether the night sky looks different now that he’s back on earth.

Terry Virts speaking at the Ebert Symposium.

Regarding the view from space, he admits:

“I look at a very different sky. You can't see it here…the light…the air. If you ever go to the Rockies or the Sierra Nevada mountains, it's awesome. But it's nothing compared to up there."

As Astro Katie alluded to in her poem, from space, one can’t see the borders of nations. Virts commented on his changed perspective in this regard: "I always feel like I'm home,” he admits, regarding being back on earth. “I never feel like I'm in a foreign country. Whenever I travel, I feel like I'm always home because I'm on Earth."

When asked how he became an astronaut, Virts acknowledged that he’d wanted to be an astronaut even as a young child. "When I was 5, the first book I read was about Apollo. One of the cardboard books with one line on it. I grew up with pictures of airplanes and galaxies on all my walls. I knew I wanted to do this since I was little,” he admits. “I was really lucky in that I got to do it!"

Regarding whether space exploration is worth the cost, Virts shared an anecdote:

“Scientists working at Fermi Lab were being asked, ‘How does this contribute to the national defense?’ They responded by saying, ‘It makes the country worth defending.’ It is what makes us humans, our exploration."

VET MED OPEN HOUSE GIVES VISITORS UP-CLOSE AND HANDS-ON INTRODUCTION TO ANIMALS, VETERINARY MEDICINE

October 7, 2018

Animal lovers of all ages flocked to the College of Veterinary Medicine on Sunday, October 7, to experience the biggest and best petting zoo around… the annual Vet Med Open House. The event featured myriads of activities ranging from seeing and touching animals, to learning how to care for them, to getting one's favorite animal painted on one's face. Most exhibits were staffed by VetMed students who were proud to share with the visitors what goes on in the College, what it's like to be a student at Illinois, and some of what they've been learning as they study to become veterinarians. For the numerous youngsters who showed up with parents in tow, the students hoped to not only inform them and give them a good time, but possibly recruit some future veterinarians into the field.

Visitors got to interact with a variety of species ranging from as tiny as a mouse, to as large as a horse. Plus, touching, petting, or even holding animals was the order of the day, whether covered with scales, like Ciara the red-tailed boa constrictor; fur, such as Kahn the border collie; or feathers, like the numerous exotic birds from Richard and Becky's Wings of Wonder Avian Rescue in Mahomet—perennial favorites at the Open House.

According to Laura Peyton, an officer and volunteer at the avian rescue, the Open House is a win-win, both for the birds and the folks who get to interact with them:

> **"Actually, it gives a lot of exposure to the birds. It gives us an opportunity for people to meet birds. A lot of times they've never touched a bird or held a bird. They've never seen a lot of the species we actually have."**

Peyton also appreciates that the Open House provides her and her colleagues a chance to educate the public. For one, she wants people to realize that birds live a long time, then explains that one of her bird friends, JayCee the Cockatoo, lives 35–40 years, while another species lives 60–80 years.

Laura Peyton holds Cracker Jack the parrot.

Peyton shares the various birds' life-spans in order to stress that owning an exotic bird is a responsibility that's not to be taken lightly. "It's a long-term commitment with these guys, and that's what we want to let people understand. You can't stick him in a hole someplace and throw in food and water once a week. You have to spend time with them. They're very social animals. You feed and water them every day."

Another responsibility potential owners should consider is that these birds require specialized veterinarians. While they get fewer diseases than

other animals, the vet costs are higher. In fact, because their birds require veterinarians with special veterinary skills, the rescue usually brings them to Illinois' School of Veterinary Medicine. Plus, in another win-win for both organizations, the rescue also brings their birds to Vet Med a couple of different times throughout the year to help train students and she explains:

"[It gives the students] a chance to handle them, draw blood, do physical exams with them. It gives them the chance to handle them so they have a better idea at what they're doing."

JayCee the Cockatoo.

Other than Wings of Wonder, most exhibits were staffed by Vet Med students, who hoped to inform the public, plus share their passion for their field with some of the young visitors. John Winter, a third year Vet Med student shares why he participated in the open house:

"To teach the public about exotic animals and see if there are any interested kids who are looking to go into veterinary medicine and maybe get involved in exotic animals as well."

Currently doing research at Professor Matt Allender's Wildlife Epidemiology Lab, his work involves diseases among snakes and turtles. Winter hopes for a career in zoo medicine or wildlife research once he graduates.

Second year VetMed student Bennett Lamczek, who was at the event to introduce visitors to his canine friend, Kahn the border collie, says he participated in the Open House because it's a really great way to interact with the public. He explains:

"I'm here to teach people about how to properly approach a dog and hopefully teach the public how to safely interact with animals, which is really part of the veterinary mission."

Lamczek has already had a couple of summer research opportunities, one at the St. Louis Zoo, and one with the Institute for Conservation Medicine, which he says, "was really cool. I worked on a box turtle project there where we analyzed the health of box turtles living within the city of St. Louis."

While Lamczek is still in the process of determining what area he wants to specialize it, he is intrigued by the One Health Initiative, a world-wide strategy for combining human medicine, veterinary medicine, and the environment as one approach to improving health. "If we have healthy animals, we have healthy people," he explains. His dream job would probably be "traveling around to different areas of the world and helping to develop programs in which humans and animals work together for the benefit of the community."

Third year Vet Med student Megan Gramhofer was on hand to communicate with the public regarding a species she's particularly passionate about… snakes. As part of her show and tell, she brought a friend, Ciara the Snake, a red-tailed boa constrictor, for the more intrepid to touch or even pet.

Ironically, Gramhofer admits, "I was actually very afraid of snakes when I was young," and confesses that the first time she ever touched a snake was actually during her first year in undergrad: "I held our Biology Lab's corn snake with my eyes closed for only about 5 seconds. Ha!"

She indicates that she became really interested in snakes during her freshman summer of undergrad, when she got to do research with the snakes on our school property. "I had always loved other reptiles and amphibians, but snakes—not so much," she admits. "Through working with them, I got to appreciate how cool and important they were." That opportunity has fueled her love of snakes, and she's currently doing research on snake fungal disease as a member of the Wildlife Epidemiology Lab.

Regarding our society's fear of snakes, she acknowledges that, " It's hard not to be scared of snakes when our culture portrays them in such scary way with movies." Her advice to help folks deal with their fears is to find out more about them. She advises:

"I think my biggest pointer is to ask questions. If you know someone who has a pet snake, ask them about it. There are books on why snakes are important to the environment. Education is the most powerful tool.

As a snake researcher, she gets excited when people ask her questions about why she loves them. "It gives me an opportunity to tell people the positive impact snakes have on the environment." For example, snakes keep rodent problems at bay because rodents are their main food source, which in turn also helps keep the tick population smaller, because the ticks live on the rodents that the snakes eat.

A tidbit of info she wanted I-STEM readers to know is this:

"Snakes are not there to chase you. Their first instinct is to get away, not to attack. If you leave them be, they won't be a danger to you or your family."

Gramhofer's dream job is to work in a practice with large animals, small animals, as well as exotic species (she had to include snakes, of course).

She loves that:

"Being a veterinarian will give me the opportunity to help people through helping their animals. Being a veterinarian in a practice allows me to help grow the human-animal bond while giving me the privilege to be there for people in a way others can't."

The scores of visitors who dropped by the Open House came to find out more about animals, personally interact with them, and to expose their kids to them too. For instance, one local woman, Libby Kacich, brought her two daughters to the open house because they both love animals. In fact, her five-year-old, Caroline, actually wants to be a veterinarian when she grows up.

"So she was really excited to come here and see all the animals and see where the students learn how to become veterinarians," her mom explains. Both Caroline and her little sister, three-year-old Birdie, who also adores animals, have been begging mom for a cat in addition to their dog. In fact, Kacich says that on the way to the open house, Caroline insisted, "Mommy, I think that they let you buy some of the animals," to which mom, of course, gave the classic parental response, "We'll see."

Another local woman, a regular at the VetMed Open House, shares why she brought her kids: "We've been here in years past, and they enjoy sticking their hand in the cow and milking the cow and checking everything out and pretending to be vets." Did her kids stick their hand in the cow? She reports: "I only had one who actually stuck their hand in the cow," she reports, but indicates that not only did she and her husband stick their hands in the cow, but, "We got grandma to do it as well!"

Third year Vet Med student Megan Gramhofer holding Ciara the red-tailed boa constrictor.

Third year Vet Med student, Chelsea Ciambrone, who is also the Vice President of Illinois' Chapter of the Wildlife Disease Association and the Class of 2020 Aquatic Chair.

ILLINOIS SPACE DAY EXPOSES YOUNG VISITORS TO "SPACE, THE FINAL FRONTIER..."

October 19, 2018

Space travel Is Out of This World! This was the message, emblazoned across the front of the event's bright orange t-shirts, that Aerospace Engineering (AeroE) students participating in Illinois Space Day (ISD) sought to convey to the 150+ young people and family members who showed up for the October 6th outreach. Hosted by the Illinois Space Society (ISS) along with other AeroE organizations, the fun-filled day featured all kinds of space-related activities. For instance, participants could view exhibits of various rocket designs, marvel at demos where things were heated with a blow torch or frozen with liquid nitrogen then shattered, plus participate in numerous hands-on activities, such as designing and testing a rocket or participating in an egg-drop competition.

Previously this event had been intended for K-8 students, but this year ISS expanded both their projects and activities to include high-school-age students as well.

One of the most popular activities was the egg drop competition, where teams of 3-4 members would build a contraption to house an egg, then drop it from a predetermined height—basically three stories—to see if their design enabled the egg to survive the fall! Not only was the egg drop a fun, creative experience, it also taught students about the effects of rapid deceleration and gravity. Another fun activity was a station where children of all ages could draw their version of space. Drawings were displayed behind the booth and formed a beautiful, colorful mural of all sorts of colors, none of which were even close to black. Drawing both allowed kids to flex their creative muscles and also showed them just how vast space can be. After all, if 50 unique drawings can't capture all of it, how can anything?

In charge of recruiting students to the event was Natalie Pfister, the PR manager for ISS and a junior in Aerospace Engineering. She reached out to many schools and community groups like the Girls Scouts and the Boy Scouts to advertise the event.

When asked why she wanted to get young students involved in Illinois Space day, she replied:

Two young visitors show off the parachute they built for the egg drop activity.

"Space science is sort of a niche, but is a really awesome area of science. It's one of those things that not all students have access to. With our day, it's completely free to all attendees, so we can access communities in the area that don't have the sort of supplementary educational opportunities to get students interested in the field."

She went on to explain how her own involvement in the field came about:

> **"In third grade, I did my project on black holes because I've always loved space, but I actually didn't know aerospace engineering was an option until my junior year of high school."**

Events like ISD can help inform students that no matter what interests or hobbies they might have, there will be a career path for them.

Another student who volunteered at Illinois Space Day was Ben O'Hearn. Similar to Natalie, he wanted to get young kids involved early in the sciences so that they could figure out what they want to be when they grow up—partly because he never got to participate in events like this when he was a kid.

He elaborated:

> **"I never really did anything like this when I was younger. I really didn't like math or science or anything until I was a senior in high school, so I never really had exposure to stuff like this, and I definitely would encourage younger kids to get exposed to this."**

Many families brought their young children to ISS's Space Day to both have a fun outing and to expand their kids' interests beyond phones and video games. For instance, Hudson Riehl explained why he brought his two sons and his daughter to ISD:

> **"[My wife and I] thought it would be a great opportunity for them to expand upon their interests and see if it's something that sparks some future education and vocation."**

Another family, the Thatikondas, attended ISD because both of their daughters are very interested in science. The elder, Sathvik, is in eighth grade and already knows what she wants to do when she grows up:

> **"I want to be the person who controls the drone and makes them."**

She explains why she really enjoys coming to these types of events:

> **"It's really fun to learn about science and how outer space works because there's no other place that you can really learn about it other than from people that are actually learning about it, and their professor is teaching them so we can get hands-on experience too."**

The younger daughter, Samiha, who is in fourth grade, says that her favorite part of the entire day was watching marshmallows be frozen in liquid nitrogen to simulate the cold of outer space.

She adds:

> **"My favorite thing was watching the thing that goes up and eats the marshmallows."**

All in all, ISS's Illinois Space Day was a great success. Many children had a lot of fun and everyone there learned something that they didn't know before. Making science fun to learn is a great way to get kids interested in it as a field, and ISD more than makes it fun; it makes it cool! Whether through drawing the night sky or protecting eggs from the forces of gravity, kids learned a lot about how the world around them works, and some may have been inspired to think about becoming a space scientist when they grow up. In any case, one important lesson should be taken from Illinois Space Space Day: reach for the stars!

An Illinois Space Day volunteer gives young visitors marshmallows frozen in liquid nitrogen.

VET MED HACKATHON FOSTERS INTERDISCIPLINARY THINKING TO SOLVE COMMON PROBLEM FACED BY CAT OWNERS: FELINE HOUSE SOILING

October 23, 2018

Having issues with your cat, Fluffy, peeing on your favorite rug? You're not alone. Hoping to come up with some solutions to this prevalent problem plaguing cat owners everywhere, two current veterinarians, Illinois College of Veterinary Medicine alums, Drs. Aaron Smiley (DVM '07) and Brooke Fowler (DVM '08), organized the recent Hackathon: Thinking Outside the Box About Feline House Soiling, which was held on Wednesday, October 10th. Sponsored by Purina, Elanco, Boehringer Ingelheim, and Medici, the Hackathon offered a $2,500 grand prize as an incentive, which attracted 39 participants interesting in coming up with a solution (and winning the prize).

Drs. Aaron Smiley (left) and Brooke Fowler (right) during the Hackathon.

In the world today, one of the most common reasons for house cats being relinquished to shelters is having urinary issues which cause them to soil in the house outside their litter box. In fact, it can be very difficult for some cats to learn how to properly use a litter box, which can make them rather unappealing for owners who are unable to put in the extra time to deal with the issue. Fowler, who is a veterinary oncologist in private practice at a specialty hospital in Boulder, Colorado, and Smiley, who has a practice in Indiana, have realized the significance of this problem and have an idea for why a quality solution has yet to be found. They think that this problem still exists because of the way the typical veterinarian thinks.

"In veterinary medicine, we are trained to assimilate information and come up with one solution," says Dr. Fowler. "But maybe for some of these problems that we were taught were unsolvable, maybe what we need to do is come up with a solution by starting at the problem and thinking in the other direction."

A team discusses their ideas for a solution.

As a result, the two believe that one way to come up with a solution might be to get people from other disciplines involved. So, they decided to return to their alma mater to host a hackathon, which is a contest designed for people to team up and use technology to solve a problem. The

The Pixo team (who placed second with their SCRATCH app) working on their design ideas.

idea was for specialists in a variety of disciplines, including computer science, engineering, architecture, design, and, of course, veterinary medicine, to work together to find a way to help cats who are not using their litter box.

"We wanted to bring divergent thinking into vet med," said Dr. Smiley, "so vets who are classically trained in convergent thinking are able to interchange creative thoughts and solutions to problems that are very difficult to solve."

The hackathon featured a total of 39 participants of very diverse backgrounds, ranging from Illinois computer science students to the CEO of a local gravel company! They all decided to attend for a variety of reasons. For example, Mandy Erdei, a vet student at Illinois explains why she attended:

"Inappropriate elimination is something that can get a lot of cats kicked out of their homes and into shelters," she said. "It's really important to get a better handle on the issue; hopefully we can have more cats with permanent homes."

On the other hand, local civil engineer Hugh Gallivan attended because he was interested in the hackathon aspect of the event. Gallivan helped organize a hackathon for the Pygmalion festival, and he came to this one because he is "interested in software and how that might apply to this problem."

Attendees also included a team from Pixo, a tech consultancy in Urbana. One member, Allie Ofisher, has actually had similar problems with her own cat. In fact, she was in the process of training her cat to use a toilet, when a guest discovered the cat using the toilet. Ofisher reports that the cat would never use it again, and she didn't think it was worth it to start the process over. Another member was Jason Berg, Director of Business Development at Pixo. Berg had done some research prior to the event, and was intrigued by the fact that they had to:

"Come up with a solution to this that also meets the behaviorist guidelines of not creating any level of trauma for the cat. So you can't negatively reinforce things, so the exercise to come up with some positive reinforcement is going to be a good one."

The hackathon began with a short introduction by Smiley and Fowler, followed by some information presented by Rachel Switzky, the director of the new Siebel Design Center. Her goal was to introduce participants to ideation, which involves looking at the end user when designing a solution to a problem. All participants were guided through this in the beginning, then had a chance to individually present their ideas so teams could form around

The panel of judges at the Vet Med Hackathon.

them. Once teams were formed, there was a finite amount of time designated for working together to solve the problem before they presented their solution to the judges.

Before they began developing a solution, participants were asked to consider a series of questions, to which Smiley responded, that would help them better understand both cats and their owners. Some of the questions included:

- What is the recommended size of a litter box?
- Are there any alternatives to litter boxes?
- What is it about peeing on soft things on the ground?
- How else do cats mark their territory?
- Is it typical to not contact a vet about litter box issues?
- Do cat owners usually resign themselves to these behaviors?
- How is trauma diagnosed and treated in cats?
- Do cats get angry? Do they pee out of spite?
- Why are some cats more adaptable than others?

Many teams opted to create websites or mobile applications which helped educate cat owners and diagnose problems. After coming up with creative, cutesy names for their solutions, such as SCRATCH, EduCATion, Dr P-Little, Cat in the Box, and LITTERAL APEEAL: THE PURRFECT BOX, teams then presented their ideas to a group of prestigious judges who evaluated the ideas based on the following criteria: originality, plausibility, solves the problem, and presentation.

At the end of the day, a group of Illinois computer science students took home the grand prize for designing a mobile application called “MeowApp!” which had a platform that would ask cat owners questions to help diagnose the problem, and included a machine-learning algorithm which gathered data from strategically-placed cameras to monitor cats’ household elimination habits and a well-though-out business model.

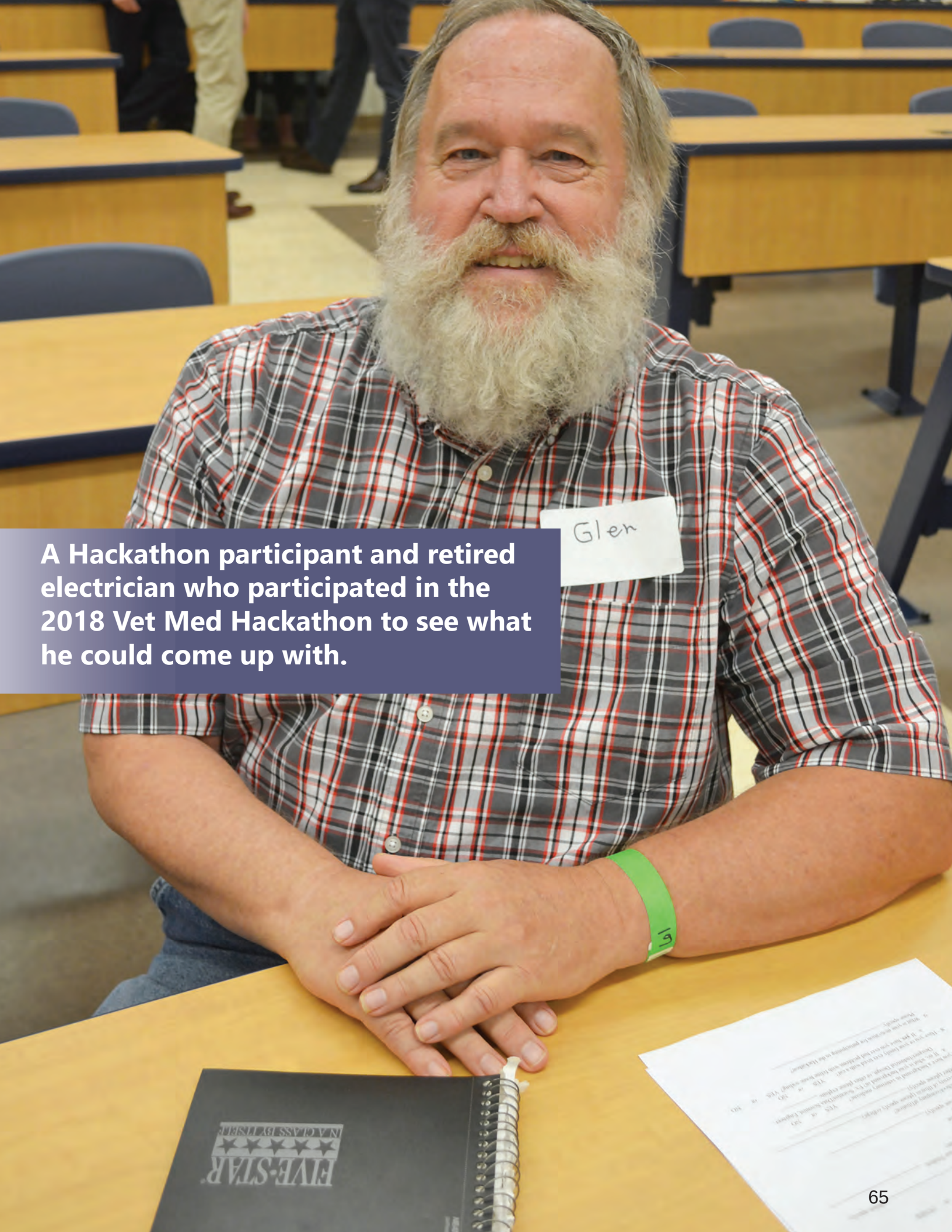
When asked about the ultimate goal of the event, both Fowler and Smiley were hoping for a new way of thinking to emerge among participants. Smiley cited the importance of working across disciplines:

> **"I'm excited to allow the veterinary students to engage with the rest of campus...We're excited to bring the power of U of I across disciplines so that the institution among each college can talk to each other and realize the resources that are available to them.”**

Fowler hoped that by the time the event concluded, that all 39 participants, when they walk out of that room at 9 o'clock, whether they did or did not win,

> **"Think differently about the problems that they face. I hope that they have changed the way that they think,” and maybe even come up with an idea that is “so brilliant and earth shattering that Purina themselves have to take it and run with it!”**

The winning team giving their presentation about their MeowApp!” design.



A Hackathon participant and retired electrician who participated in the 2018 Vet Med Hackathon to see what he could come up with.

DR. HOWARD FOURTH GRADERS LEARN ENGINEERING, PROBLEM-SOLVING, WHILE BUILDING SOLAR CARS

November 6, 2018

Design. Build. Test. Tweak. Test again. These are the engineering design process steps three Illinois Engineering seniors, Peter Sokalski, George Popovic, and Cameron Harris, have been underscoring during their Fall 2018 visits to Dr. Howard School in Champaign. Their goal: introduce Jennifer Simmons' fourth grade students to engineering via a fun solar car project. In addition to the kids learning about engineering and adding skills related to construction and problem solving, the three visitors, along with Ms. Simmons, also hoped that the students would grow personally in regards to their perseverance, communication skills. and self-confidence. Plus, their long-range goal was to show the kids that they too have what it takes to become engineers when it's time to think about careers.

Peter Sokalski, a senior in Mechanical Science and Engineering (MechSE) at Illinois who intends to begin working on his PH.D next fall, initially contacted Jennifer Simmons and met with her to discuss his idea to provide an engineering activity for her students. Along with help from Joe Muskin, MechSE Educational Outreach coordinator and Education Coordinator for the NSF-funded POETS (Power Optimization for Electro-Thermal Systems) Engineering Research Center, the two decided that her students should tackle building a solar car. During the project, tkids not only learned the basics of how a solar cell and a car work, but a lot about the engineering design process too. Plus, building solar-powered cars was the ultimate hands-on project, and allowed the students to learn a lot about construction. For instance they learned how to work with nuts and bolts and whether to apply force close or far away and how that changes.

According to Muskin, the solar cars curriculum was developed as a part of POETS' RET program. During the RET's multi-year effort, a team of four local science teachers, Uni High's David Bergandine and Sharlene Denos, Next Generation School's Bryant Fritz, and Centennial's Jay Hooper, worked to create a multi-week curriculum unit related to power, heat, and power density aligned with Illinois' Next Generation Science Standards (NGSS).

Jennifer Simmons chats with students about the solar car they built.

The students constructed their cars using wood, foam, 3D-printed wheels, and rubber-band pulleys, to name a few. They began by simply playing around with the various materials, but quickly discovered which materials were the best to use in building their cars. To get the thing to "run" via solar power, they hooked up a small solar panel to a DC motor then tested it beneath a lightbulb that generated artificial "sunlight."

In addition to the solar car projects, the engineering students also plan to teach the students a bit about emerging technologies related to the research the three of them are currently doing. These include

new material science and interfacial behaviors, as well as a quick lesson about wave-phenomenon.

Solaski admits:

> **"Wireless technology pretty much dominates our lives; whereas, most people don't really know how optic-fibers work or how wi-fi works. So we hope to introduce these topics to the kids at a very basic level as well."**

Peter Sokalski (left) helping a fourth grader build her solar car. (Image courtesy of Joe Muskin.)

Related hands-on activities they'll be doing with the students regarding these topics include demonstrating the ability to manipulate the wet-ability of materials by making a roller-coaster of aluminum foil, sticks, and water. Finally, they hope to show some wave behaviors, like internal refraction of light using water.

Sokalski, who currently splits his time between working on an optomechanical sensor for Dr. Guarav Bahl, and projects relating to condensation fundamentals/application for Dr. Nenad Miljkovic, says his goal in being involved in the Dr. Howard outreach was to diversify his presence on campus a little bit.

He elaborates:

> **"I've worked plenty with students on campus, but have yet to extend myself to the local community, and working with these kids is the best way to do that!"**

Plus, he finds it fun to see if he can explain the science and work he does at a very basic level. "Being in research is 50% performing research and 50% communicating that research," he acknowledges, and says that "practicing with kids is a good way to test the latter half of that!"

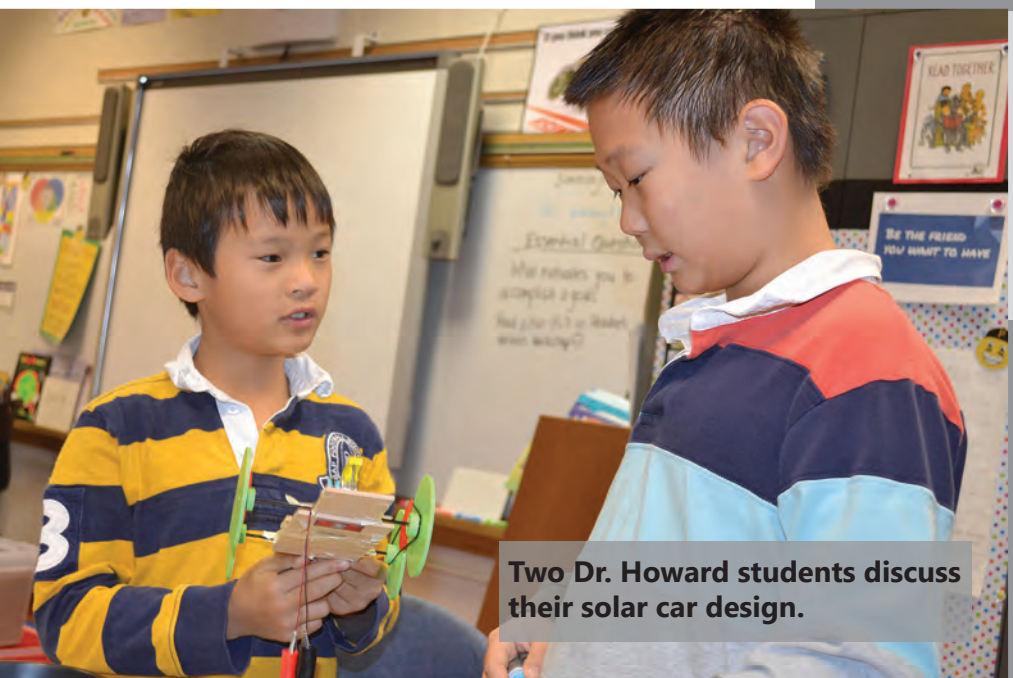
According to Sokalski, one important aspect of engineering he wanted the students to gain insight on during the activity was the engineering design process:

> **"The methodology of testing-iterating-improving is being emphasized with the solar cars."**

In fact, as part of the fourth grade students learning this process, he claims that their designs needed to fail the first time 'round, so the students would have some challenges to overcome.

He admits:

> **"It is important for bits and pieces of the car building process to not work, so the students can critically think and improve their design. I believe this is the basis of what we learn here at school."**



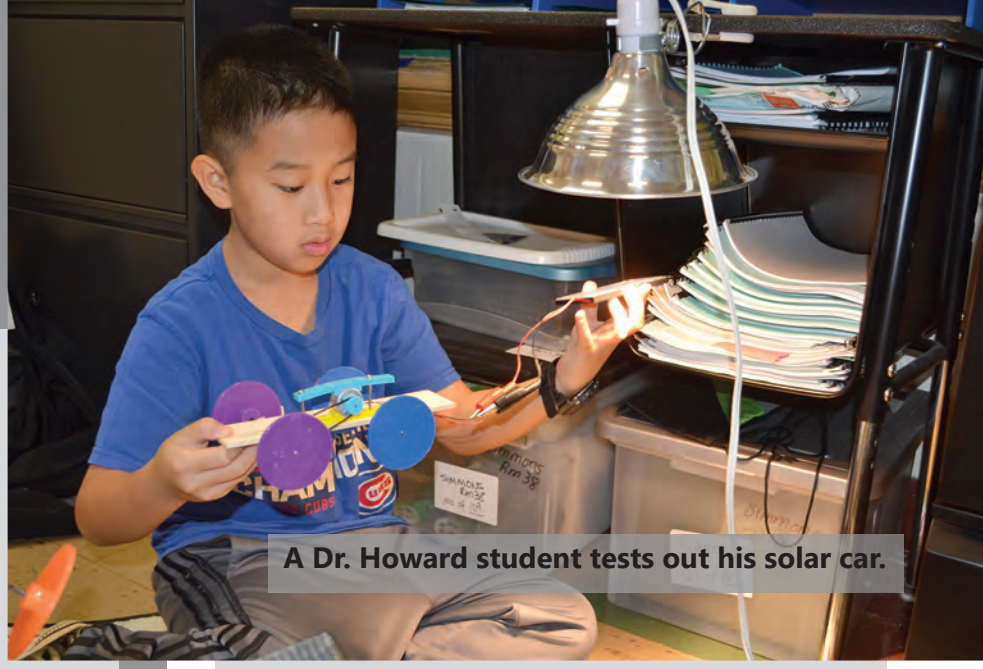
Two Dr. Howard students discuss their solar car design.

Also helping out (and getting in on the fun) was George Popovic, who's due to graduate with his Bachelor's degree in December then begin working on a Master's in January, and hopes to continue on to a PHD after that.

Popovic, who works with thermo-fluid sciences and condensation, says he got involved in the outreach at Dr. Howard School in order to pique the kids' interest in engineering.

Popovic explains:

"I want to demonstrate to the kids all the cool stuff that engineers get to do on a daily basis and hopefully motivate the kids that are already interested in becoming engineers to follow their dreams."



A Dr. Howard student tests out his solar car.

He adds that, in addition to all of the hands-on experience, the fourth graders also have to "employ a lot of creative thinking to build a decently complex project." He indicates that their strategy has been a rather laissez faire approach: to "kind of leave them alone and make them talk through their ideas and figure out the steps by themselves."

He adds the students also are exposed to team-work. For example, tools are limited, plus: "They all work in pairs of two or three, so they have to make collaborative decisions on how to tackle tasks."

The third Illinois student on the project was Physics Engineering student Cameron Harris, an under-graduate research assistant in MechSE Professor Guarav Bahl's research group. He shares why he got involved with the outreach:

"Mainly because I'm really a proponent of the idea of increasing scientific literacy just in the community in general. Being in the College of Engineering at UIUC is really great, but it's also really isolated in our thinking, and not everyone is familiar with the scientific method, and just science in general. We thought it'd be a neat idea to sort of cultivate that in the younger generation, getting other people familiar with science, and reach out to the community."

Has Harris seen any engineers in the class? "Oh, absolutely!" he acknowledges. "A lot of these kids are smarter than I am! It's been really humbling to work with fourth graders who know more than me!"

In regards to the benefit of bringing college students into an elementary classroom setting, Harris explains:

"I suppose we might be young enough to still be able to relate and interact with the kids on a personal level, and at the same time, we've had a lot more experience with this stuff. And I think it's just sort of the right age group to really interact well."

George Popovic (left) helping a student build his solar car.

Dr. Howard 4th grade teacher Jennifer Simmons would agree about the many benefits of having Illinois engineering students come into her classroom. For one, to share their passion for STEM.

“If students are volunteering to help, they have a contagious energy and enthusiasm for learning,” she explains. She adds that another perk of the project is that there are three more adults in the classroom to help, since STEM projects generate lots of questions and a need for one-on-one help.

Simmons reports being thrilled by Peter's suggestion that her students build solar cars, because their current unit in science is on energy and waves.

She claims:

> **“They are learning the forms of energy and how it is transferred, both through reading and exploration through the cars. They will remember this forever!”**

In addition to the engineering skills her students have been gaining through the project, Simmons believes that the project has been impacting them in a number of other ways that will apply to all areas of their lives.

Simmons explains:

> **“I hope that designing, building, and redesigning the cars help them with their problem-solving skills and perseverance. I also see them gaining confidence as they figure things out.”**

She also believes that their communication skills have been improving as they learn to provide explanations and ask questions.

She continues:

> **“Lastly, the hands-on experience with energy and solar power is priceless."**

Simmons adds that the project works because the guys who are leading the project “have obviously done this before.”

She claims that:

> **“They are organized and effective with the materials, yet they don't give away the answers, since they want the students to be creative and problem-solve.”**

Adding that they are all also friendly and patient, she wishes she had several more engineering students to work with her other 4th grade classes. “I feel fortunate that I was available to start when they contacted me,” she says.

A Dr. Howard school student works on building her solar car.

IGL LINKS CENTRAL HIGH STUDENTS TO THE MORE KNOTTY ASPECTS OF MATHEMATICS

November 12, 2018

Everyone is familiar with knots. There are simple knots, such as those we master when we're five-year-olds learning to tie our shoelaces. Then there are some not-quite-as-simple knots, such as those sailors use when tying rope. But on Thursday, November 1st, a team of Illinois Geometry Lab (IGL) students visited Central High School's AMSO club (Appplied Math and Science Outreach) to introduce the students to knot theory, with its even more complex mathematical knots and links, including Brunnian links. This unique learning opportunity was made possible thanks to the founder and President of the club, Anna Kinderman, who began the club in order to challenge her classmates in STEM, and who reached out to the IGL folks and organized the event.

Knot theory is the study of mathematical knots. These differ from regular knots in that the ends are joined together so that they can't be undone. For example, the simplest mathematical knot would be a ring. Brunnian links, according to Wikipedia, are named after Hermann Brunn, a German mathematician known for his work in knot theory. A Brunnian link becomes a set of unlinked circles if any one component is removed. In other words, cutting any loop frees all the other loops (so that no two loops can be directly linked.) Introducing these concepts to the high schoolers was the goal of the activity.

Third-year Math PhD student Alexi Block Gorman, who researches Model Theory mentored by IGL Director, Assistant Professor Philipp Hieronymi, began the activity by explaining the basics of knot theory. Then she and her team of math undergrads used colorful pipe-cleaners as physical models to demonstrate the various knots. The AMSO students were then encouraged to study the properties of several interesting Brunnian links by trying to create them themselves.

Block Gorman, the IGL Outreach Coordinator in charge of planning & training for visits and events, says she actually chooses what activities IGL students will do with the different groups, maps out how the activity will run, then trains the undergraduate volunteers on conducting the activity.

Alexi Block Gorman (standing) examines the knot that the Central High students made.

While the high schoolers benefitted from the activity, according to Block Gorman, the activity was a win-win; she and the IGL undergrads benefitted from it as well. For instance, the outreach activity gave them the opportunity to improve their math communication skills.

She explains:

> **"People learn to communicate abstract ideas best by making themselves formulate the concepts in very simple terms. By engaging high school students in higher-level math, they [IGL undergrads] get a chance to convey their excitement about math and also practice essential communication skills."**

How'd the IGL outreach go? Block Gorman reports that not only were the club members fun to work with, but the undergrads did really well too.

Block Gorman says:

> **"Our undergraduates are super enthusiastic about math and involving young people in mathematics early. And they did a great job connecting with the high school students."**

While Block Gorman claims that, as a grad student, she gains the same benefits that the undergrads do in terms of communicating science to a non-scientist audience. Plus, for her personally, it's a way to give back.

She elaborates:

> **"I also remember being a child and having some really deep realizations about math when I was guided by really extraordinary teachers and I want to pay it forward. It's really rewarding when you can open up young minds to a new way of thinking and get to watch them discover concepts and skills for themselves."**

Another IGL staff member who is key to scheduling outreaches such as this one is third-year mathematics grad student Brian Shin, another Outreach Coordinator who serves as the liaison between IGL and the schools/clubs they visit.

He shares why he's excited about doing outreach activities with IGL:

> **"I feel that mathematics can be a wonderful and beautiful thing to anyone willing to take the time to explore it. Outreach is a way for me to share the experience and hopefully inspire some people to explore the beauty on their own."**

Shin hoped the outreach might expose students to aspects of math that they might not encounter at school, in hopes that the students they interacted with might learn about some interesting ideas and continue to explore them.

Shin's math concentration is called homotopy theory, which roughly speaking studies the algebraic properties of geometric shapes, especially as "we deform/wiggle them," he explains.

"Mathematics is a vast subject," adds Shin. "In particular, there are a lot of really cool ideas to be had beyond the mathematics curriculum. We hope to show the students sides of math that they might not know exist."

Serving as co-sponsors for the club are Central High teachers, Thomas Gelsthorpe and Elizabeth Dickinson. Gelsthorpe calls the students involved with the club "a very motivated and interested group of high school students."

The math and science outreach club usually meet most Thursdays, where they have someone come and present. For instance, for one meeting coming up, a man who wrote a cook book from the point of molecular gastronomy is going to present.

Regarding the folks that come and present, Gelsthorpe says they look for people or groups who are interested in interacting with a high school audience and meeting them at their level. The idea is that they say, "Hey, here's some really cool things that are going on!" while presenting them in a way that is "accessible, but also kind of leaves an opening for further learning," he explains.

Anna Kinderman, the president and founder of the club and a Central High junior, says her goal regarding AMSO is to make it easy for the participating students to learn. "I've put a lot of work into trying to organize these things," she admits.

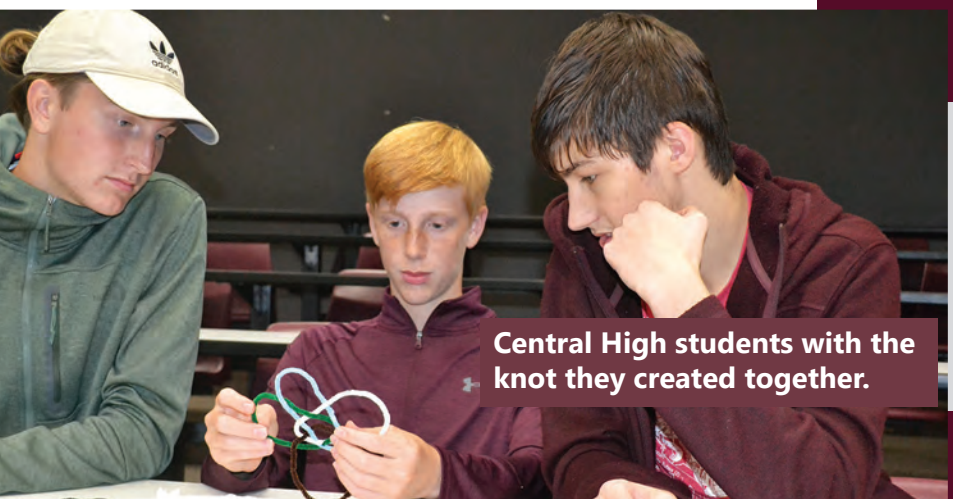
She says her goal for the club is to ensure that:

> **"It's relatively easy to show up and learn a bunch of things on science, math—anything in between—in terms of careers, their interests."**

Plus, she's learned a very important principle at her young age—one sure way to get people of all ages to attend functions: "They can come in and have free food!" she acknowledges.

While Kinderman had the opportunity to go to Uni High, she admits:

> **"I really wanted to change something here in the public school system," explaining that the idea of creating this club helped her make the decision to "stay here in the public school system and put something together like this."**



Central High students with the knot they created together.

BMES PROVIDES BIOMEDICAL ENGINEERING RESOURCES TO STUDENTS OF ALL AGES

November 14, 2018

One of the main goals of Illinois' Biomedical Engineering Society (BMES) is to shape well-rounded Bioengineering (BioE) students by providing a variety of resources and opportunities for its members. However, almost as important to BMES members is their desire to maintain the BioE pipeline by interesting high school students (and even younger ones) in going into the field—possibly at Illinois. This was the goal of one of their major outreach events of the year—Bioengineer Your Impact—which recently took place on Saturday, November 10th.

BMES Techical Director, Viraat Goel, explains his team's EOH project about hydrogels (the future of drug delivery) to several high school students.

The 13 high schoolers who showed up on campus for the event discovered what Bioengineering is about through a variety of different activities and interactions. For instance, they discovered some of the careers available in the field during presentations featuring two BioE start-up companies by current or past Illinois students: Psyonic, which makes prosthetic devices for amputees, and PhantomCor, a company comprised of current Illinois engineering students that designs synthetic organ models for surgical students to practice with.

Participants also learned what being a student at Illinois might be like as they interacted with a panel of BioE students and toured two campus buildings: Everitt Lab, the new home of BioE, and IGB, the Institute of Genomic Biology. Plus, they learned a bit more about what Bioengineers can do while being exposed to some of the projects BMES students have created for EOH (Engineering Open House), such as a prosthetic hand, learned about hydrogels (the future of drug delivery?), and made DNA origami.

In one of the key events of the day, participants then got to try creating devices themselves during the design activity. Students were challenged to create a device that would pick up a number of different different-shaped objects: beads, marshmallows, tacks, and dice. Their apparatus was to not only pick up the objects individually, but possibly have different adaptions to pick up the various objects. Students were also encouraged to try to pick up several objects at a time, and also using just one hand.

While outreach is considered to be important, BMES' main function is to provide resources for its 200+ members, most of whom are BioE majors. However, students from other majors who are interested in what BMES does also join the group; other engineering students as well as non-engineering students, such as from Biology and Chemistry.

So, to provide activities that help shape well-rounded students, BMES committees provide professional, technical, social, media, and outreach activities and resources.

For instance, one important opportunity BMES' Professional Committee provides members is professional development. In fact, some of its most popular events are its general meetings (GMs), which occur once or twice a month and feature speakers from BioE companies like Ad V, Abbot, Baxter, and Medline, who talk about their companies, network with students about interning, then collect resumes. BMES Outreach Coordinator Joy Chen calls it:

"Better than a career fair, because there are fewer people, and it's more one-on-one."

In fact, at one recent GM, a professor talked about alternative careers in BioE. According to Chen, BioE students aren't always sure what they're going to do with their degree because there are so many options. So the talk helped students narrow down what they can do with their degree, what their options are, and how to go about doing them.

In addition to GMs, the Professional Committee also schedules professional development workshops targeting specific topics. For instance, one recent workshop taught participants about coding systems, like MatLab, which many freshmen found helpful since Bio E classes use it. The committee also holds grad school and/or med school prep workshops, such as how to do initial and second interviews.

Bioengineer Your Impact participants examine a prosthetic device BMES students created for EOH.

The Technical Committee is in charge of BMES' technical teams. For example, participating in EOH is a key emphasis for BMES members, to both communicate to the public about BioE, as well as expose youngsters to BioE and possibly get some interested at an early age. Every year, BMES fields around 20 teams which complete short-term projects which they then present during EOH. "We love it and take it really seriously," admits Chen.

Another resource under technical is BMES' design teams, which are similar to EOH projects, but more long-term. Grouped in the 2–3 teams, participants work with faculty members on real-world projects.

Lest all work and no play make Jack (and Jill) dull, BMES' Social Committee also schedules numerous extracurricular events, such as picnics and study sessions, which Chen calls, "just fun stuff to relax."

One key aspect of the social activities is BMES' mentor program. Upperclassmen, even some sophomores, sign up to mentor freshmen interested in being mentored. Every year, there's a different theme; in 2018 it's Harry Potter. In fact, just like at Hogwarts, BMES recently held a sorting ceremony, during which they put a BioE hat on each freshman and sorted them into their respective houses.

A sophomore, Chen signed up to be a mentor this year, because as a freshman, she had a one—two actually: Elizabeth, who's the BMES president, and Cassie, who graduated last spring.

She reports that both mentors were really involved in BMES and:

"They taught me a lot about what BMES stands for and what you can do through BMES. I felt that making that connection through them was really helpful for me."

Although she's no longer being officially mentored, she still seeks out tips from upperclassmen—especially advice regarding:

"What classes to take, and what to expect in my upcoming years, and how to prepare for BioE, because it's pretty scary. It's a big field. It's really helpful to have connections with upperclassmen."

Another BMES' committee, the Media Committee, advertises the organization's events, including via social media, and takes pictures.

A student at Bioengineer Your Impact enjoys creating her team's device during the design challenge.

Last but not least, and a big part of BMES, is its Outreach Committee, which plans events that communicate what Bioengineering is to the community, especially youngsters and, of course, high school students. In fact, it was because of the influence BMES had on her as a high schooler that Chen joined the outreach committee.

She says:

> **"Outreach is a big part of what got me into engineering, especially BioE, so I wanted to be a part of that and see if I could inspire kids as well."**

Chen knows from personal experience how important campus exposure can be for high schoolers. She's known about BMES since she was in high school because she attended Illinois' University Laboratory High School located right across the street from the Digital Computing Lab (DCL), the former home of Bioengineering. When she would come to EOH every year, her first stop was always DCL, where she'd go through the building and see all the cool projects.

'I'd walk in the building," she says, "and there'd be a big BMES sign. And I always wanted to study Bio Engineering, so I'd walk up and say, 'I'm interested in your club. I'm not a freshman here yet, but I really hope to be here in a couple of years!'"

Chen admits that she's wanted to join BMES ever since she was in high school. So when she got to Illinois as a freshman, she went to their first GM, which she recalls featured, Psyonic, begun by a former Illinois grad student and undergrad. She admits:

> **"So I went to that and I thought it was really cool. I joined my freshman year."**

In addition to the day-long Bioengineering Your Impact outreach, the Outreach Committee also arranges more regular, monthly outreach events at local schools. For instance, this year they're going to be visiting St. Matt's Elementary and Central High School, plus Hayworth Elementary, which is a couple of hours away.

Some hands-on activities they do include a heart pump activity to teach middle school kids about different parts of the heart, or for younger kids, a strawberry DNA activity, or teaching kids about how a cell works using bubbles. Chen says these simpler activities, "get kids interested and asking a lot of questions."

Chen is excited about getting more members involved in school outreach this year. She says that last year, some members had a hard time participating because the schools wanted BMES volunteers to come during the day, when many had classes. However, this year many members have breaks in the middle of the day so Chen is hopeful that many will be able to participate in school outreach.

Chen also has big plans for expanding her committee's reach. "I really hope to grow outreach even more this year, and get more involved in events," she admits. For instance, she and her team hope to do events on weekends that parents can bring their kids to, like a big event at the library where kids can rotate through a number of stations doing different BioE-related activities. Plus, last year, Outreach did events with the Orpheum Children's Science Museum, which they hope to repeat again this year.

Besides volunteering with kids, though, Outreach also hopes to get members more involved in community service activities, such as helping around campus, cleaning Green Street, etc. To further encourage community service, Chen, who is the BMES liaison on the Society of Women Engineer's community service committee, hopes to get more people at BMES events by scheduling joint activities involving both SWE and BMES members.

Another new type of outreach activity Chen hopes to begin is a shadowing program that will give high school students exposure to research. “Not everyone can get lab experience in high school,” Chen acknowledges, so she hopes to convince BioE upperclassmen to take high schoolers under their wings, so students can experience a lab setting in a Research I university and see how everything works.

Chen admits:

“I went to school here, so I had the whole campus."

At a high school on a university campus, she had a lot of opportunities to work in a lab, and took them. “I felt like they were really helpful for me understanding how a lab works. It's very different from what you might think. She explains:

"The skills you learn in a lab are very different from the skills you learn in school. Performing experiments takes a different skill set. I think those are very valuable things to learn as early as possible.”

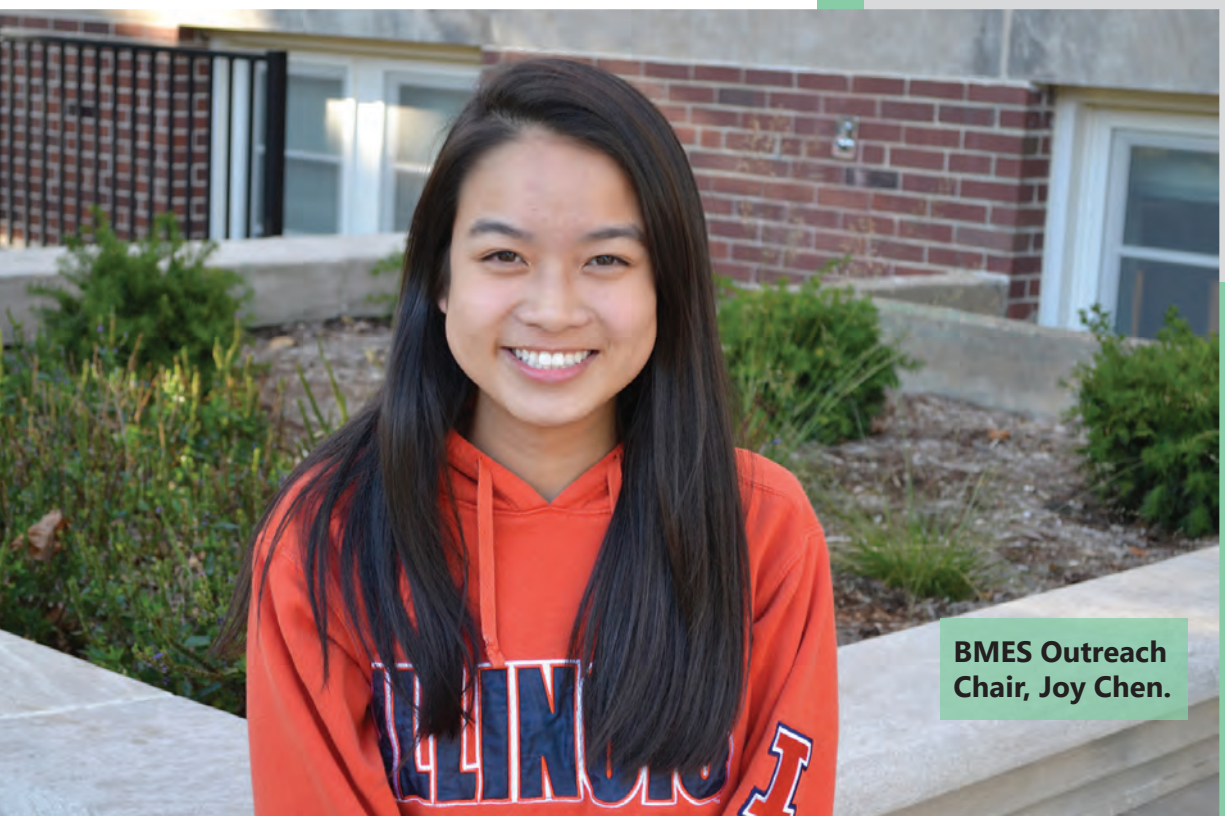
In fact, for Chen, those experiences have pretty much shaped her career choices. Most of her lab experience was in Molecular and Cellular biology, which is the research she’s interested in. While she’s considered continuing in that, she also believes engineering is important in order to find solutions to these problems and apply research to the real world. Chen says:

“That was so important to me, and I definitely wanted to continue doing this, but also incorporate it in engineering."

In fact, that’s her dream job—to get an Md PhD and do research. She’s been in a research lab doing cancer research for a couple years now, studying the effects of cholesterol on cancer metastasis (the spread of cancer cells from where the cancer started into new areas of the body.

“So I think doing research and furthering the research field is very interesting; there's always something new to discover, and I always want a part of myself to be doing that. But I also think applications, being able to apply what you learn in that research lab to a hospital clinical setting and taking it to real people, which is the medicine side of it.”

Would she go to the new Carle Illinois School of Medicine? “That's the dream!” she acknowledges. “It's very engineering based. And it's right here.”



BMES Outreach Chair, Joy Chen.

PAPER2TREE PLANTS TREES, SOWS SEEDS REGARDING POTENTIAL CAREERS IN ENGINEERING

November 28, 2018

On Thursday, November 15th, a number of community-minded Mechanical Science and Engineering (MechSE) Professors participated in Mattia Gazzola's Paper2Tree project, some for the second year in a row. The goal of the project is to enable these faculty to give back to the community in a couple of ways. First, as the Paper2Tree name implies, the professors hoped to make amends for the number of trees used up when publishing by having crews from two partners, the Urbana and Champaign Park Districts, on hand to plant two trees. The event also allowed these educators to give back to the community by sharing what they're passionate about— teaching and research. But instead of working with today's college students, they were interacting with tomorrow's—fourth and fifth graders at Martin Luther King Elementary School in Urbana and fourth graders at Booker T. Washington STEM Academy (BTW) in Champaign.

King students shovel mulch on the Shingle Oak tree planted next to the school in King Park as part of the Paper2Tree project.

The goal of Paper2Tree's outreach was to expose youngsters to engineering via age-appropriate activities related to the professors' research. For example, in the morning at King, Assistant Professor Chenhui Shao led Shalonda Carr's fifth graders in a cookie puzzle activity related to his manufacturing research. First, students received a plate covered with aluminum foil that concealed a different shaped cookie (either an "I", a circle, or a star). Next, the students stuck toothpicks through the foil to determine whether or not there was cookie in various areas on the plate. The idea was to correctly guess their cookie's shape with the fewest number of pokes. The best part was, they still got to eat the cookies whether or not they guessed correctly.

Joe Muskin (left), works with a King student who is using TinkerCAD to design a keychain which will then be 3D printed.

According to Shao, the activity was designed to teach concepts of spatial sampling and optimal measurement strategies, which are important in smart manufacturing so manufacturers can make optimal decisions and

"use minimum resources to get maximum information about processes, stations, systems, factories, and supply chains," he explains.

A King student uses TinkerCAD to design her keychain during the 3D printing activity.

Regarding the outreach, Shao says educating the next generation of manufacturing engineers is crucial. Thus, he hoped to get some youngsters interested in his field early on to "engage a large and diverse manufacturing cohort through scientific discovery and education to manufacture innovative products and discover new knowledge that will in turn benefit the society."

Carr's fifth graders also got to experience 3D printing, courtesy of Joe Muskin, MechSE's Outreach Coordinator. Using TinkerCAD, a computer-aided design software for kids, students designed a key chain, then got to watch as it was 3D printed in their classroom.

According to King teacher Shalonda Carr, having university folk visit her classroom is beneficial to her students as they not only share their expertise, but to expose the students to role models and potential career options.

"Having other people that have an expertise in something outside of my field is good for them to see what we're learning in class isn't just about class," she says. "It's about how they can extend this into maybe a university career or into a job that they want to have in STEM or anything else."

Carr also appreciates having experts working on real-world issues come and interact with her students, whom she claims are "excited to see people who this is what they do all day long, and it's not like 'This is an imaginary thing that I hope you can figure out that later on this is potentially a job.' They see people who actually do this kind of work."

Of course, one of the highlight of the morning was visiting the Shingle Oak tree that had just been planted, where the kids were delighted to shovel chips to mulch it. (The Urbana Park District folks were also delighted to have them shovel the chips!)

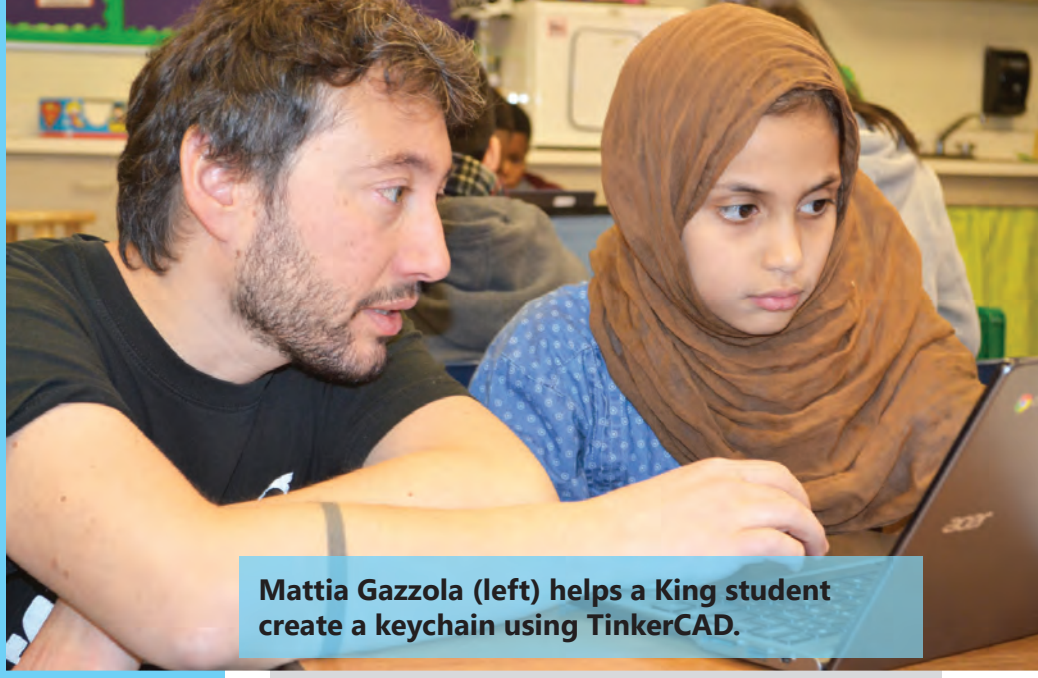
In the afternoon, several MechSE professors did activities with fourth graders at BTW in Champaign. BTW fourth graders were exposed to Gazzola's robotics research during a robotic fish activity. During an activity led by Assistant Professor Aimy Wissa and some of her students, fourth graders built (and flew) bio-inspired gliders.

In addition, Jiho Kim, a PhD student in Assistant Professor Alison Dunn's research group, did an

Assistant Professor Chenhui Shao (left), with the student who guessed the shape of her cookie with the fewest toothpicks.

activity with fourth graders about corrosive wear. Because a tree was donated in celebration of a paper he recently had published, “Thixotropic Mechanics in Soft Hydrated Sliding Interfaces," Kim was invited to facilitate the outreach event. His activity introduced the concept of wear and basic experimental procedures to young students.\

For the activity, students measured the weight of lollipops after rubbing them against sandpaper, putting them in water, and licking them, then recorded how the lollipops were reduced in weight. The activity was directly related to his research area, tribology, which is the study of surface phenomena in sliding interfaces. Kim shares why he participated in the outreach.



Mattia Gazzola (left) helps a King student create a keychain using TinkerCAD.

“I just wanted to have an experience of reaching out to society using my knowledge from my PhD study. I got a chance to do this, so I participated.”

Kim shares how he personally benefitted from the outreach, especially by learning to communicate his research in ways the children could understand:

“As a PhD student, I always present my work to professors or graduate students, who are familiar with technical words and concepts. In the outreach event, I was surprised to realize how hard it is to explain the concepts to young students. It was a really meaningful experience that made me think about easier and more efficient way of describing ideas. Also, watching the young students enjoying learning was a pleasant experience.”

His tree was planted at Douglass Park, close to the school during the week of the Paper2Tree outreach activities. However, because of wintry weather, BTW students did not participate in the planting.

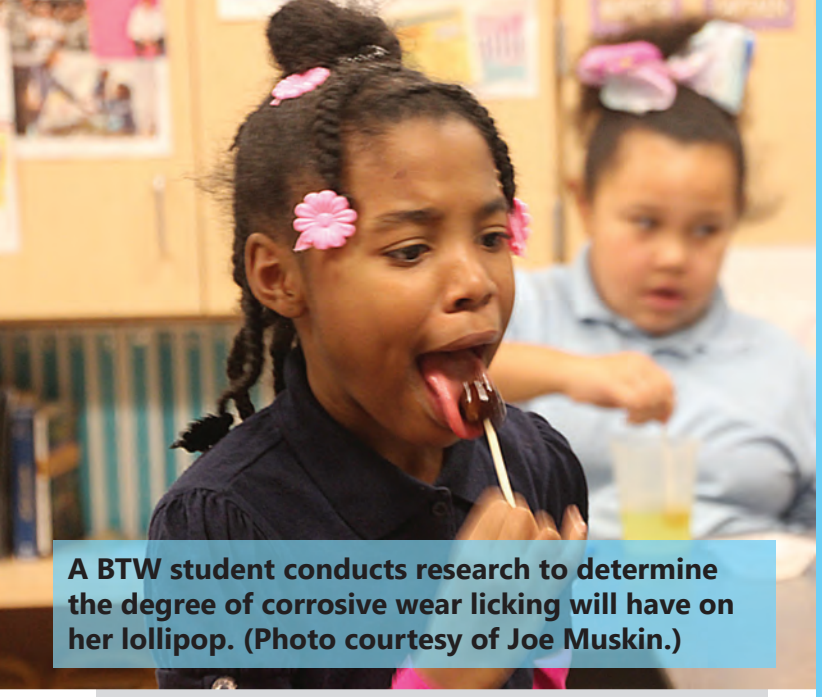
According to Lauren Johnson, BTW’s STEM Teaching Specialist, who worked with Joe Muskin to coordinate the activities, her district is very fortunate to have a world-class university so close.

“Our students get to work with people in a variety of STEM fields, connecting what we do in STEM to careers and further areas of study. Projects like this Paper 2 Trees event increase our students' engagement in learning and excitement about STEM.”

Jiho Kim interacts with BTW students during an activity. (Photo courtesy of Joe Muskin.)

MechSE Assistant Professor Katie Matlack sponsored one of the trees, a Ginko that was planted in Champaign's Douglass Park. Regarding her participation, she says,

“To me, it’s important to take an active role in giving back to my community.



A BTW student conducts research to determine the degree of corrosive wear licking will have on her lollipop. (Photo courtesy of Joe Muskin.)

Paper2Trees does this by engaging elementary school students and in developing parks in the area…The tree sponsorship was a nice way to commemorate the first journal paper our research group published, by helping to sustain green spaces in our area."

Regarding the outreach aspect, she reports, "Engaging elementary school students is important because it's becoming increasingly important to expand STEM education in our country. I hope these events spark curiosity in students, and that students will become excited about STEM-related areas."

Gazzola began Paper2Tree in November of 2017, by planting trees in Fall 2017, Spring 2018, then again in Fall 2018. To date, six new trees have been planted locally. There are now two in King Park next to ML King School in Urbana, and two in Douglass Park, next to BTW in Champaign. Plus, in spring 2018, the NCSA (National Center for Super-Computing Applications) planted a Swamp White Oak in Carle Park in Urbana to replace a diseased tree that had to be taken down. Also, courtesy of Christopher Senalik's proud wife, a Fall Fiesta Sugar Maple is now producing some new wood in Scott Park in Champaign. She had a new tree planted to celebrate his PhD paper which, ironically, had to do with old wood: "Detection and assessment of wood decay – glulam beams and wooden utility poles."

According to Gazzola, Paper2Trees has benefits besides proactively planting trees to replace the paper used by academia. For one, he considers outreach to be his responsibility, calling it

"part of the mission of the university… so we do research; we teach students at college, but it's bigger than that, right? So that's why—that's one of our duties."

Gazzola adds that it's enjoyable. "It's fun," he admits. "The kids like it, and it's nice when you bring them out and see the tree planted."

Not only does the community gain trees and the kids get exposed to engineering; but Gazzola and his colleagues also benefit from the outreach. He admits that they are required to do outreach as part of their funding, such as through the National Science Foundation. So for him and some colleagues, Paper2Tree fills the outreach requirement niche:

"Then there's also the more selfish side of it," he acknowledges, "I get to go after federal grants. The outreach is very important…It's essential—a good outreach plan, which makes sense. It's a fair request. We're also incentivized to come up with something."

All in all, Gazzola finds Paper2Tree to be quite rewarding, and is looking to the future: "I'm just happy this is going on and it was not just one thing last time. We plan to keep going with these…So every spring, plant some trees and in fall, have an event like this.

Aimy Wissa (right) and her students show off their glider.

JEFFERSON MIDDLE SCHOOL STUDENTS EXPERIENCE COOL HANDS-ON SCIENCE, COURTESY OF THE MCBEES

December 12, 2018

Extract DNA from strawberries. Look at human cheek cells via a microscope. Make paper helicopters. These are some of the fun, hands-on STEM activities Jefferson Middle School eighth graders are getting to do courtesy of the MCBees, a graduate student organization from Illinois' School of Molecular and Cellular Biology (MCB). So, a couple of times a month from October 2018 through May 2019, MCB Ph.D. students (and postdocs) are putting their research on hold for an hour or so in order to share their passion for science with Elizabeth Wheatman's and Sammy Yoo's eighth grade students. The two science teachers appreciated the MCBees' spring 2018 activities so much that they invited them back for the entire 2018–2019 academic year too.

The idea of the partnership is to expose the eighth graders to fun hands-on activities that go beyond their science curriculum. So on October 29th, the Jefferson students isolated DNA from strawberries. On November 30th, during the "What's in Your Food?" activity, the students tested various food samples to see which would have the most carbohydrates and/or proteins. (Big surprise, Coke had the most carbs and, of course, 0 proteins). One volunteer who helped out with the activity, second year Microbiology grad student Roy Rodriguez-Carrero, was hopeful that while experiencing some of the different chemical methods used to determine the carbohydrate and protein content of solutions, the activity would help the students to better understand "the importance of what kinds of food they eat."

Two Jefferson Middle School students filter the liquid from their strawberry puree they made.

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Similarly, Preeti Sharma, who recently completed her PhD in Biochemistry and now works as a postdoc, hoping that as a long-term effect of the activity, students would be inspired to:

"further analyze their food intake and strive towards a more balanced and healthy diet," and that the "hands-on experimental experience along with instant colorful results spiked their interest in science."

Sharma, whose research in cancer immunotherapy uses protein engineering to modify properties of antibodies and T cell receptors for therapeutic and diagnostic applications, was one of the driving forces behind the "What's in Your Food?" activity. Indicating that

Preeti Sharma presenting to Jefferson Middle School students on the nutritional components of food.

she has “always been interested to spark interest in science among kids,” she thought it would be interesting to teach students about the nutritional content of their food, hopefully inspiring them to "eat healthy and be healthy!” She describes how she came up with the idea for the activity.

“Since I am a biochemist, I felt that the use of colorimetric reactions, which would generate some fun colors upon reacting with certain components of food (for example, shades ranging from yellow to red if food contained sugars, and shades ranging from pink to purple if food contained proteins), would be a great way to teach students about the nutritional composition of their food, and subsequently inspire them toward a more healthy and balanced diet.”

On December 10th, the students observed different colors that are present in spinach leaves, markers, and food coloring gels or liquids, plus learned how to separate out colors using a simple technique called chromatography. Some additional activities planned for the 2019 spring semester include: examining human cheek cells under a microscope, experimenting with several different chemical reactions, learning about the different states of matter, and making paper helicopters.

Helping to organize the activities, including soliciting volunteers via their listserv of 400+ MCB grad students, is Pradeep Kumar, one of the MCBees’ Outreach Coordinators. And while Kumar says the activities at Jefferson aren’t intended to be dumbed down versions of MCB students’ research, the extracting DNA from strawberries activity was actually pretty close to what Kumar does. While Kumar doesn’t work with strawberries, he says he and some of his peers use the same protocol to isolate DNA from different cells, such as animal or bacteria cells. A third year PhD student in MCB’s Cell and Developmental Biology department, Kumar studies how DNA is organized in the nucleus. He indicates that the DNA from a single cell is about two meters long, “but it is packed into a tiny nucleus a few micron in size,” he says. “So how does that happen?” That’s what he’s trying to discover through his research.

So what’s the benefit of doing activities like this with middle schoolers? Kumar says that while the kids might have heard about some of the science addressed in of the activities they’re doing, they’ve probably never had the opportunity to actually do hands-on activities related to the topics. For example, while they probably know a little about DNA, they might not know how it’s analyzed. So the activity where students isolated the DNA from strawberries “gave them an idea how scientists isolate DNA from some sample, and how it will look in a tube.” He adds that the activities he and the others are doing gives the younger students an opportunity to visualize whatever it is they’re learning now.

Pradeep Kumar assists a student while she adds a reactant to her solution.

In fact, Jefferson teacher Elizabeth Wheatman reports that the extracting-DNA-from-strawberries activity was “perfect!” She elaborates:

> **“Because we just finished our genetics unit last week, so they go to extract DNA and see what it looks like and kind of get a refresher of everything they learned in the genetics unit.”**

Preeti Sharma shows how the solution will change colors depending on what nutrition components are in the solution.

Wheatman shares what she believes is the benefit of bringing Illinois researchers like the MCBees grad students and post docs into the classroom is to serve as role models:

> **“Students can see peers that are closer in age to them, other students, and see how they're passionate about science and what they're studying and then do some really cool hands-on activities.”**

MCB postdoc Preeti Sharma also believes that having Illinois grad students visit from graduate students from the University to local schools and their students, such as the activity at Jefferson Middle School, will hopefully inspire more and more students to get interested in math and science, and subsequently, lead them to a career in the STEM fields. The graduate program at the University of Illinois in general, and the school of MCB in particular, consists of students from diverse backgrounds, driven in science and motivated to teach and share, which, in my opinion, represents the ideal group of people to inspire the next generation of scientists.

Kumar, who’s been participating in almost all of the MCBees’ outreach events since its inception, explains why he finds outreach to be so rewarding. While he personally enjoys doing the events, he also admits that he hopes to pique students’ interest in science.

He explains:

> **“I'm a first-generation college graduate, so I'm passionate about outreach and trying to help make people more interested in science...So I feel this will be a good opportunity for me to interact with people and share my curiosity or interests with them.”**

Students add reactants that will change the color of a solution to show what nutritional components are in it.

What kind of impact do Kumar and his colleagues think their activities are having on the middle schoolers? For one, according to a small survey they administer after the activities to get feedback from the students, including what activities they liked, what they didn't like, and if they have any suggestions. He reports:

A student mashes strawberries so that she can collect the DNA from it.

"There were a few students who actually wrote that they're more interested in science now. That number was not a huge number, but definitely a few students who said they're more interested now. I believe it's having a positive impact."

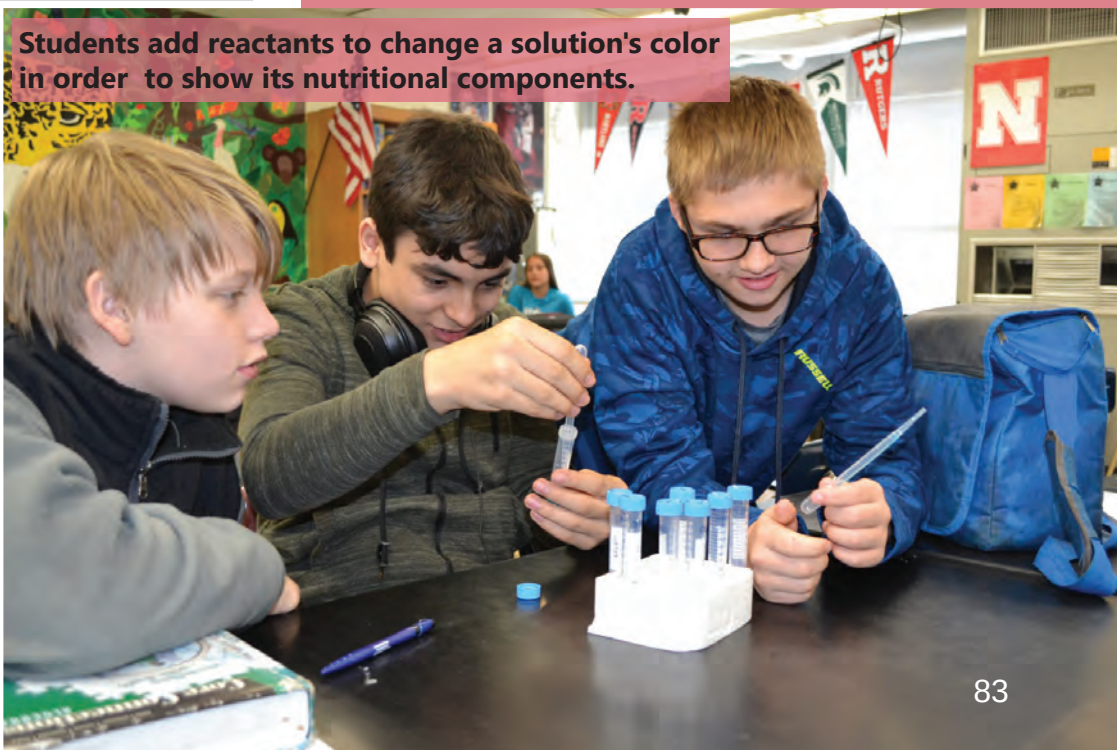
Regarding his goal of introducing the kids to things they might not get exposed to at school, he relates how last year, he borrowed some drosophila melanogaster fruit flies from MCB Associate Professor Rachel Smith-Bolton, who uses them in her research. "So I showed those flies to the kids, and some of them were really interested that we can study these flies and understand about human diseases…Those kinds of things these kids might not get to do in their curriculum. They'll never get to see a fly help people, be used to identify different things. It was a good experience. I think we are somehow having some impact on them," believing that if it's not right now, at some point, down the road, interest in science will kick in.

One MCB student who is helping out with the outreach is Roy Rodriguez-Carrero, a second year grad student in Microbiology who is studying genes that modify the enzyme methyl-coenzyme M reductase. He reports getting involved in order to "gain experience in communicating science and demonstrating scientific methods to a younger audience," in hopes that it will help to "diminish the perceived barrier between school-level education and university-level education."

Another MCB participant who is helping out at Jefferson was Rajishekar Iyer, a postdoc who just got his PhD in cell biology and neuroscience and whose plans for the future include doing research and teaching at a university. He shares that he is participating because of the impact similar outreach events had on him as a youngster.

He explains:

"I remember the first time I got to do some of the cool biology that I ended up doing in school, and it was a very informative experience. Learning about DNA, for instance, was really exciting, and it shaped who I am now. I think getting the chance to do that for kids who are right now thinking about what they want to do is really fun."



Students add reactants to change a solution's color in order to show its nutritional components.

GEOJAM HELPS EDISON EIGHTH GRADERS DISCOVER THAT MATHEMATICS IS FUN

December 20, 2018

On Friday, December 14th, 26 Illinois undergraduate students who intend to teach mathematics one day visited Edison Middle School in Champaign as part of the Curriculum and Instruction (C&I) Department's annual math outreach, GeoJam. In addition to allowing the school's 220 or so eighth graders to explore a variety of ways that mathematics can be used outside of their math class at school, through the event they discovered that teamwork can be helpful in problem solving. Plus, and probably most importantly, they also learned that math can be fun.

Adam Poetzel (second from the left) watches as Edison Middle School students play "The Mummy's Magic Triangle."

This year's GeoJam was organized by Gloriana Gonzalez, a C&I Professor in Math Education who was helping organize the event for the second year in a row, and C&I instructor Adam Poetzel, whose instructional focus is to prepare and train pre-service mathematics teachers to effectively teach diverse K–12 students. Participating Illinois students were in the Secondary Mathematics Education Program (future high school teachers) from Poetzel's CI 403 course, and Middle Grades majors from Gonzalez' CI 402 course.

Begun in spring of 2006 by C&I Professor of Mathematics Education Rochelle Gutiérrez, GeoJam is designed, according to Poetzel:

> **"To allow students to experience a creative, collaborative side of mathematics that often is underrepresented in a typical school mathematics class."**

He says another goal of GeoJam is to foster collaboration and teamwork amongst the younger students. He explains:

> **"So we want students to get a taste of mathematical challenges that require reasoning of the team in order to accomplish them."**

So instead of going to their math classes for the day, Edison students were assigned to teams and rotated through three of the eight different GeoJam activities, collaborating to solve the various games and puzzles. Participating Illinois students had come up with the different activities in order to help the younger students have fun while exploring different math concepts they themselves had been learning through their studies.

For example, during the Cookie Monster game, Edison students were encouraged to use math to beat their opponent. Based off of a game originally called NIM, this game featured cookies in multiples of four, plus a block of "stinky" cheese. Teams were to take either 1, 2, or 3 cookies per turn, and took turns getting to start first. Teams that ended up with the stinky cheese lost all of their cookies. The younger students were to figure out that if the opposing team chose one cookie, they should choose three; if their opponent chose two, then they should choose two, and so on.

This is the scenario for the GeoJam Escape Room: the players are all trapped inside the escape room, and poison gas is coming through the vents. The antidote is in the big box (actually full of candy!). Players are to work as a team to solve four different puzzles, the answer of which will open the padlocks locking the four locked bags or boxes, allowing them to access the antidote.

In the Spy Training activity, Edison teams attempting to finish their spy training to become official spies used geometric shapes called Pentominoes to unlock doors by filling them in the correct configurations.

In the Tomb Raiders activity, team members sought to unlock hidden treasures by placing different-colored jewels on a special map so that no two connected regions were occupied by the same color.

Poetzel explains:

> **"The lock only 'opened' if they figured out how to do it with the least number of colors possible. This game was based on the 'Four-Color theorem,' a famous theorem proved here at UIUC."**

Another popular game was Tangram Avengers. To "Help the Avengers Save the Universe!" players had seven minutes to bring back to life as many Avengers as possible. (If you recall, in the last movie, Avengers: Infinity War, the wicked Thanos fulfilled his dastardly plan to destroy half of all life in the universe, as with a snap of his fingers, people began to disintegrate, including several Marvel characters: SpiderMan, Black Panther, Groot, and Dr. Strange.) To "bring them back to life," players were to each use the geometric shape they'd been assigned, working with their teammates to make a tangram: a Chinese geometric puzzle consisting of a square cut into seven pieces and arranged to make various shapes.

According to Patrick Pavilonis, a senior in Middle Grades Education who helped with the Avengers activity, "They all seem to like Avengers," he says, then explains, "and they have to do some sort of action after they complete a puzzle, like shoot spideywebs or something like that. So that's fun."

Additional games included The Mummy's Magic Triangle, Bridges to Math-tropolis, and Snowman Shuffle.

According to Poetzel, GeoJam activities are different than regular school math, but still "have a lot of the same logical thinking, spatial reasoning, use of numeric patterns, shapes," in hopes that the younger students "leave the day with a positive experience with mathematics and hopefully leave with a lasting memory of something they really enjoy having to do with mathematics." To further ensure that the participants understood how the different activities connected to math, at the end of each game, the college students revealed the hidden mathematics behind it.

The secondary and elementary math education instructor explains:

> **"So students see how in these fun games they did, there are often mathematical principles or theories at work that they didn't even realize were there."**

Agreeing that GeoJam helps the students explore mathematics principles far beyond what they get in school, Gonzalez acknowledges:

After winning the GeoJam Escape Room game, the Edison students accessed the antidote to the poison (candy!)

A team of students playing the "Cookie Monster" game debate how many cookies to select during their turn.

> **“Sometimes, math in school can be perceived as challenging or boring, or the same. This is a chance for them to see that math is much more than we do in school. That they can work together, be creative, have fun. And it's supposed to be a celebration of math that's beyond testing, exams. It's just about having fun.”**

Like Gonzalez, Ciera Nickerson, an Illinois senior in math secondary education, believes that GeoJam gave the Edison middle school kids:

> **“the opportunity to see what math is like outside of what they do in the classroom. A lot of the math that we study can be transformed into different games and projects which they probably have not seen before.”**

Nickerson says she and her two partners, who created the GeoJam Escape Room:

> **"came up with different games that involve patterns, because patterns is a really big thing in math. And a lot of times, when people think about math, they don't think about the patterns we have to create in order to do math. And so we thought it would be fun to be able to play with those patterns through sudoku games, puzzles, and riddles. They all involve some sort of mathematical thinking and skills."**

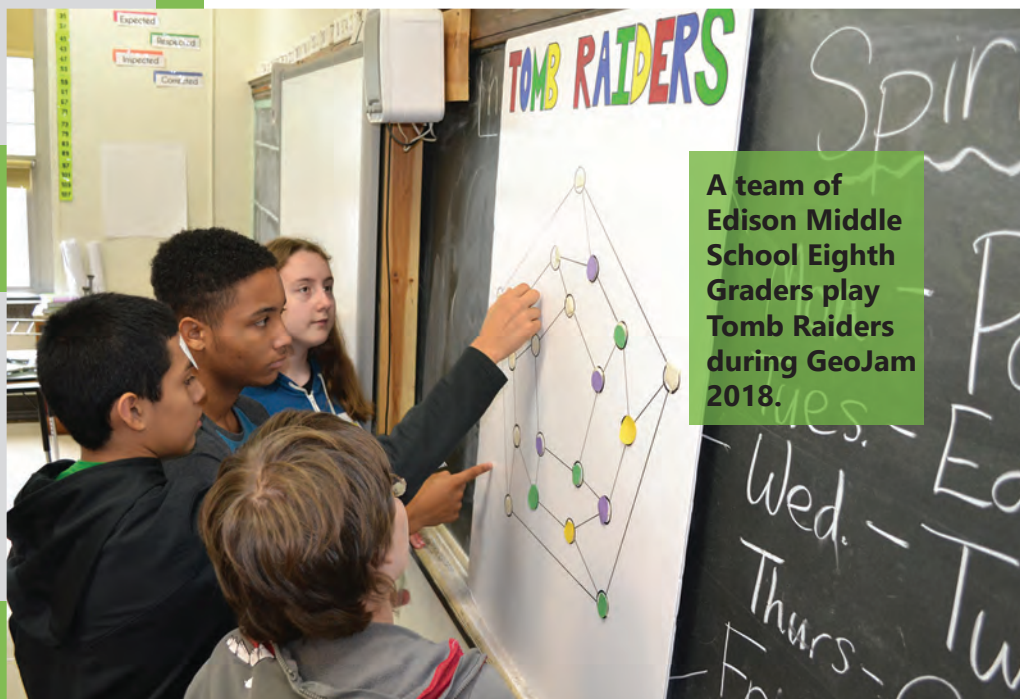
Patrick Pavilonis shares why he believes GeoJam was beneficial for middle school students:

> **"The problems they designed were not directly math based. You don't see the math right away. But there is math behind it. You work together as a team to solve some sort of scenario-based problem."**

He adds that another goal was to make sure the kids could relate to the activities. He explains:

> **“We're supposed to make it relevant to them, so we made it Avengers themed. So we're bringing the Avengers back to life. And it's a fun thing for us to do.”**

And while the Edison students hopefully gained a greater understanding of and increased interest in mathematics, they weren’t the only ones who benefitted. The Illinois students, who are math teachers in training, also benefitted. For instance, Nickerson



A team of Edison Middle School Eighth Graders play Tomb Raiders during GeoJam 2018.

Two Illinois students interact with the team of Edison Middle School eighth graders they're playing against as they select their cookies in the "Cookie Monster" game.

says participating in GeoJam gave her and her fellow college students the opportunity to show the younger students things they've been learning in their college courses.

Gonzalez shares how GeoJam benefits the college students:

> **"Our students learn that teaching math goes beyond what you do in the classroom, and it's about engaging kids, making sure that they feel that math is fun, math is something they can enjoy, they can do."**

She adds that the event also gives her students a chance to:

> **"encourage collaboration, and engage the school community in a celebration of math."**

According to Poetzel, the Illinois students also experienced designing activities outside of the curriculum to engage the students.

He explains:

> **"We really want them also to be open to bringing in some different types of learning experiences that engage students in different ways. We'd like as teachers to think beyond the curriculum, to think about engaging students in meaningful mathematical tasks that encourage collaboration, that leap off the page, that are life-sized tasks."**

He adds that the college students not only experienced creating these challenges, but learned planning, thinking about how to encourage teamwork, giving clear directions, and managing a group of students.

Also adding:

> **"So in the end, they're practicing a lot of skills that a quality teacher needs to possess in creating and managing these games today."**

GeoJam provides additional ways the college students can interact with the schools and the younger students. For instance, Patrick Pavilonis, a senior in Middle Grades Education who interned at Edison during the Spring 2018 semester, says that most of the students who participated in GeoJam are at middle schools almost every day, because they're going to be middle school or high school teachers. So Geojam gives them additional experiences interacting with the middle school students.

Pavilonis explains:

> **"We're just helping them out and getting them related to the kids on the**

Patrick Pavilonis (second from the right) watches Edison Middle School students play "Tangram Avengers."

college campus and getting to know them."

Poetzel adds that C&I also does GeoJam as a way of saying, "thank you!" to local partners for providing intern opportunities for Illinois students.

He elaborates:

"We want to give a gift back to schools. We appreciate the partnership of local schools. At Edison, we send student observers and teachers here, so it's nice to send a gift back to the school for the teachers who work with us to help provide them with...an interesting day that would be hard for them to do on their own at this scale."

What kind of impact did Geojam seem to have on the kids and did they enjoy it? Pavilonis seemed to think so. Regarding what his activity, "Tangram Avengers," taught the youngsters about math, he says, "Our activity helps with spatial awareness and geometry and being able to visualize where shapes and stuff go. So I think they're picking up on the math." Plus, he and his teammates took the kids through a "Did-You-Know" sheet, that gave them the background on tangrams, and other fun facts.

History of GeoJam. Rochelle Gutiérrez, C&I Professor of Mathematics Education, began GeoJam as part of the secondary math education program in spring of 2006. She reports, "I've had the pleasure of helping run and participate in GeoJam 2006-2017."

She adds:

"It's been a great tradition, and our students are really making an impact on local schools."

Although in 2018, she had to curtail her involvement, she was able to attend Poetzel's class in order to "help give a bit of feedback to some of his groups when they were doing mock presentations in preparation for the event," and also visited this year's GeoJam "to show support for the students' work."

From 2006-2016, the event was at local high schools (Central High, 2006–2014 and Urbana High, 2014–2016) during the evening, and was a competition where students could earn prizes from local businesses. In 2009, GeoJam was expanded to include Edison Middle School, with events similar to the 2018 GeoJam, which took place on a school day with students participating in lieu of going to their math classes. However, due to changes in the program, GeoJam currently only partners with Edison Middle School.

Gutiérrez indicates that throughout the history of GeoJam, pre-service teachers developed the math stations to involve the body and not look like school math; did fundraising (going to local businesses to get donations); updated the website; ran publicity for the event (getting math professors and others to consider attending); organized and ran registration, evaluation, and prizes at the event; served as school liaisons with Edison teachers in coordinating how the event would work there; and served as emcees for the evening event where community members and parents were also invited to attend and participate in smaller math challenges to win prizes.

C&I Professor of Math Education, Gloriana Gonzalez.

STEM OUTREACH TO UNDERREPRESENTED STUDENTS

SACNAS ADVANCES LATINA/O STUDENTS IN SCIENCE VIA AN OUTREACH FOR LOCAL YOUNGSTERS—CIENCIAS!

March 22, 2018

The 20 or so kids who showed up at the Champaign Public Library for Ciencias! on Saturday, March 17th, were exposed to more than just hands-on science activities. Sponsored by the Illinois chapter of SACNAS (the Society for Advancing Chicanos/Hispanics & Native Americans in Science), the outreach also gave young participants the chance to hear the activities in not just English, but Spanish, which, for a number, was their native language. Plus, even more importantly, presenting the activities were Latino/Latina students, which afforded many of the youngsters the chance to see students of color—people who looked like them—doing science.

At Ciencias! kids could rotate among four different stations, which gave them a chance to try their hand at a variety of activities: earthworms, bee honeycomb structures, the states of matter, and solar energy. Regarding the range of sciences addressed, SACNAS' Outreach Coordinator, Alonso Favela, explains why the variety:

"I really like showing the kids a breadth of demos," he admits. "I really like exposing the library kids to as many things as possible, and then seeing whatever they like the most, and inspiring them." So for the Ciencias! outreach events, which occur once in the spring and again in the fall, Favela tries to inspire the kids in different areas of science. Topics they've addressed in the past include organismal biology, entomology, biology, and chemical trials where they're doing ink tests, to name a few; for the March 2018 edition, the kids learned about biology and entomology (what Favela terms "showing them insects and critters"), chemistry, and even some engineering.

Favela's outreach philosophy stems from doing similar events when he was young: "As a kid, when I would go to outreach events, I always really liked the biology stuff, and I had friends that would really like the engineering or chemistry stuff. And I just want to make sure that everybody sort of has the thing that interests them."

So one station included demos with earthworms, intended to teach the kids what worms do, where they live, and why they matter, including how

A local visitor to Ciencias! plays with slime at the States of Matter station.

efficiently they compost. According to the worksheet, the goal was to "Get them to love worms!" And at the station, the more intrepid youngsters even got to hold some.

Another station was about bee honeycomb structures. Favela boasts:

> **"Bees somehow figured out the most efficient shape to structure their honeycombs."**

So SACNAS members took the kids through how bees figured it out, then kids got to make their own "honeycombs."

Another station exposed young visitors to the different states of matter—solid, liquid, and gas. The goal was to show kids the different forms and help them categorize them.

But Favela admits, “It’s mostly an excuse to mix slime and have them play with it!”

“Hands-on always helps!” agrees Elena Montoto, SACNAS president, on hand for the event.

Elena Montoto interacts with young visitors at the Bee's Honeycomb Structure hands-on activity.

The final station exposed kids to a little electrical/ environmental engineering. The activity focused on solar energy, using solar panels and wiring to connect them, and the young participants got to read a meter to determine how much energy a given solar panel was producing. (The solar energy was provided by light bulbs.)

So why would the half dozen or so SACNAS members, mostly PhD students involved with their own important research and completing their take time out of their busy schedules to do outreach? Favela reports that, for him, it’s because of the looks on the kids’ faces. He acknowledges:

“I guess just because I like teaching people about science. I like it when someone sees something, and they learn something, and their face lights up, and they understand what’s going on, and they’re sort of inspired. Because that’s what I like about science, and I want other people to get that same response out of it.”

Montoto, a 4th-year materials chemistry PhD student, likes to give kids today opportunities she didn’t have as a child.

“Personally, I didn’t have these opportunities growing up,” she admits. “I don’t think I ever went to a scientific demonstration of any sort when I was young. So to be able to have all of these demonstrations, play with slime—’Look! See how it stretches and moves around!’”

A young visitor works on a bee honeycomb hands-on activity at Ciencias!

A SACNAS member interacts with a young visitor at the "States of Matter" station.

“Science is what I do. I wish more kids would go into science. All my classes were always small in undergraduate. So if we can get more people interested in the hard sciences—chemistry, entomology, engineering—I think that’s a step up and beneficial for the kids to get them interested early.”

One local parent shares why she brought her son to the outreach:

"So he is really interested in science, so any way we can find to make science fun and make him continue to be interested in science, we'll do it," she admits.

Another parent, who used to work for the bilingual program in the Urbana School District and was familiar with SACNAS and its Cena Y Ciencias outreach with the bilingual students, says:

"I know what great work that they do with students and the scientific experiments. And my daughter loves science, so I thought it would be fun!"

Plus, like Favela, Montoto also likes seeing how much the kids enjoy it:

“The kids’ faces!" she admits. "It’s so adorable! They light up, and I just enjoy it.”

Montoto acknowledges that she also hopes to pique kids’ interest in science early on; she’d like some to end up doing science down the road. She adds:

Young visitors get acquainted with some earthworms during Ciencias!

During Ciencias! a young student enjoys learning about solar energy.

ILLINOIS LATINA/O STUDENTS IN SCIENCE FIND COMMUNITY, OPPORTUNITIES, & OUTREACH THROUGH SACNAS

March 23, 2018

SACNAS, the Illinois chapter of the Society for Advancing Chicanos/Hispanics & Native Americans in Science, is an integral part of a number of Hispanic students' campus experience. For both graduate students, as well as undergrads, it is a support system, not only academically and professionally, but socially. Plus, for students who would like to increase the number people of color in science, it provides opportunities for outreach to youngsters, including some who look like them.

One of SACNAS' main thrusts is providing support for around 40+ Hispanic students at Illinois, both graduate students as well as an increasing number of undergrads, who are members of the student organization. With an emphasis on community, one of its chief benefits is to foster networking/relationship building among the students. For instance, in addition to its monthly general meetings, the group also tries to offer a social, networking, or professional development event every month.

The current SACNAS president is 4th-year Material Chemistry PhD student Elena Montoto, who works in Professor Joaquim Rodriguez Lopez's analytical chemistry lab. Using different instruments to measure chemical reactions, she works with materials, such as polymers, her original area of interest, useful for electro-chemical energy storage and its applications.

Montoto shares what SACNAS has meant to her during her time at Illinois: “SACNAS has been great for me. I’ve kept at it since day one, basically,” she says. For instance, it’s provided her with crucial relationship-building opportunities:

“This is where I’ve met most of my friends in grad school, is through SACNAS," she reports.

Regarding SACNAS' impact, Alonso Favela, a 3rd year PhD student in PEEC (the Program in Ecology, Evolution, and Conservation Biology) and SACNAS’ Outreach Coordinator, would agree with Montoto.

“It’s been community,” he reports.

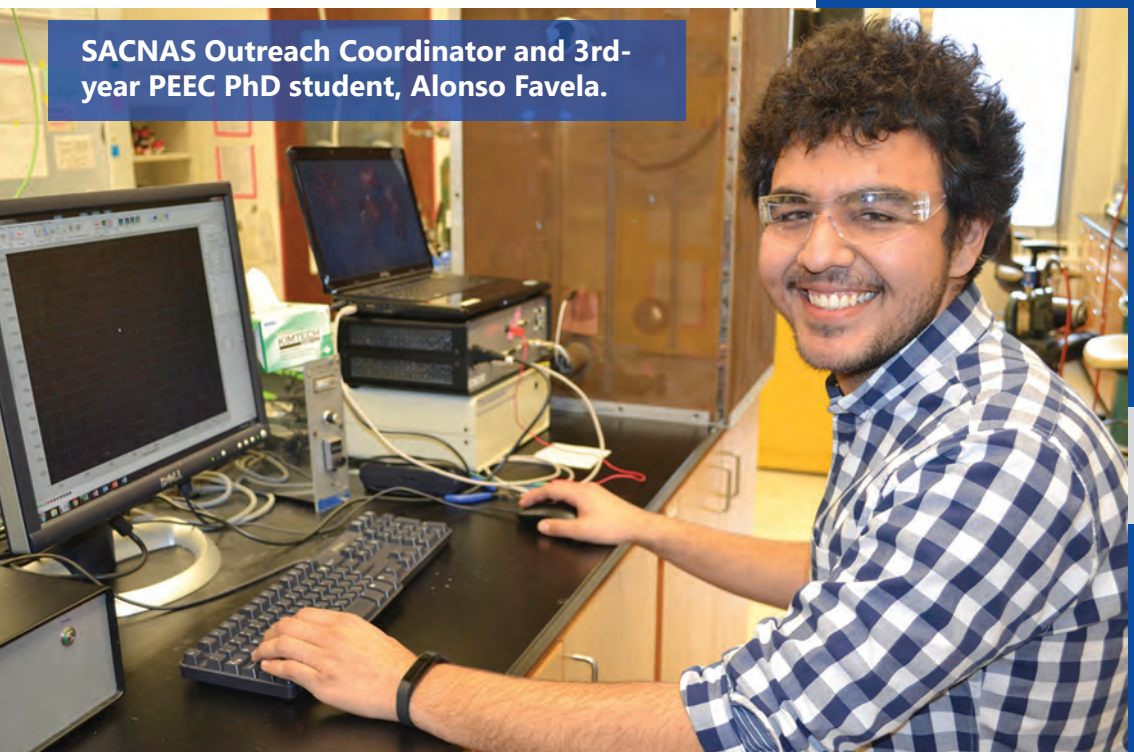
Also, for Favela, SACNAS provides him a chance to interact with other Hispanics in his field.

During a SACNAS outreach event, Ciencias!, Materials Chemistry PhD student Elena Montoto teaches about bee honeycomb structures.

"It's weird," he admits. "At least in my field—ecology, evolution, biology sort of stuff—there's not a lot of people of color, period. It's one of those fields that's…very white male. It's a very white field. You know, 'We like hiking. Let's do some ecology!'" (Favela confesses that, despite the stereotype, he does like hiking.)

Students at SACNAS' recent "Ciencias!" outreach play with slime at the "States of Matter" station.

So for students like Favela, in a field with very few people of color, the organization provides another key opportunity—the national SACNAS conference every October. One of the highlights of the year for SACNAS members, the conference enables students to network with people at other universities or companies. For Favela, SACNAS conferences have helped him to discover, "'Oh, there's other people like me at other universities! And maybe I'm the only one here, but there's more!' And eventually, I get to hang out with them and talk to them about science."



SACNAS Outreach Coordinator and 3rd-year PEEC PhD student, Alonso Favela.

Like the science he's currently researching in Professor Angela Kent's lab: looking at how plants alter their root micro community systems with the goal of making crops more sustainable. He seeks to understand how plants interact below ground and how they use nutrients.

"A big goal of it, actually, is to make plants that produce less nutrient pollution,"

He explains, referring to the nitrogen runoff caused by growing corn, which causes widespread nutrient pollution and wreaks havoc ecologically. "If we want to maintain this system," he maintains, "we actually have to start focusing on how the plant does it below ground."

Regarding additional benefits of the national conference, Montoto adds:

"It's also given me tons of opportunities."

For instance, the conference gives students a chance to present their research. In

Two SACNAS members teach young visitors about solar energy during the recent "Ciencias!" outreach at the Champaign LIbrary.

ence where she got to present. Not only that, both she and Favela won awards for their oral presentations in 2016. She admits:

> **"It's been an integral part of my time in grad school."**

In addition, attending the national SACNAS conference provides career-related perks; it sometimes leads to summer internships for undergraduates or jobs for those ready to enter the work force. Favela reports that one undergraduate student he knows who participated in the Fall 2017 SACNAS conference has an internship this coming summer as a result of attending the conference.

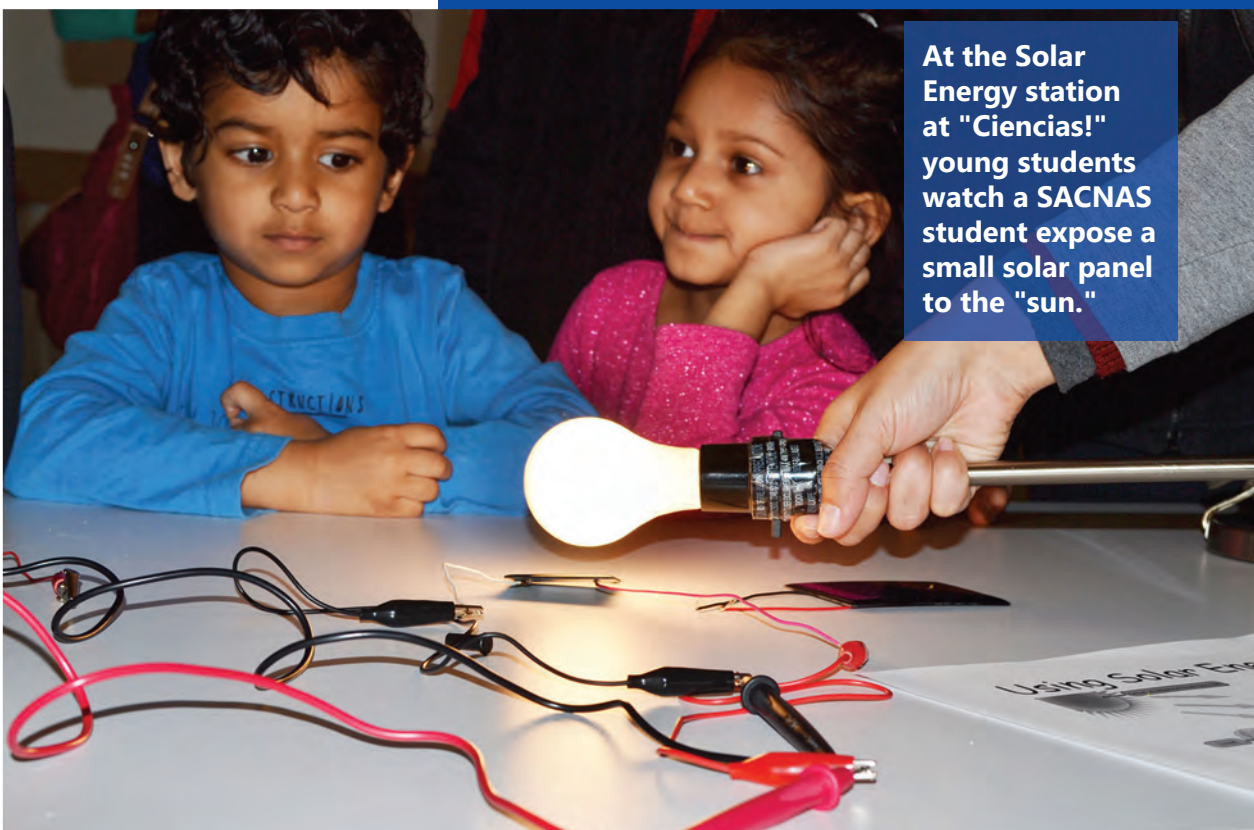
While SACNAS nets its members a lot of benefits, another important SACNAS emphasis is outreach—the chance to give back to the local community. So the group provides several different outreach opportunties for members, depending on how much time they have available.

For instance, SACNAS does several big outreach events throughout the year, such as the recent "Ciencias!" event at the Champaign Public Library. The outreach takes place once a semester, both in the spring and the fall. Also in the fall, the group coordinates with another group on campus for Latino Family Visit Day, during which one of the stops is a hands-on activity provided by SACNAS. Plus, SACNAS also does a weekly outreach for Urbana School District bilingual students, Cena y Ciencias (Supper and Science), where, in addition to pizza, SACNAS members provide hands-on activities completely in Spanish.

One reason outreach is such a strong emphasis for SACNAS is that most members are passionate about seeing an increase in the number of students in science—particularly Hispanic students. For instance, Montoto hopes to give today's kids opportunities she didn't have.

She admits:

> **"Personally, I didn't have these opportunities growing up. I don't think I ever went to a scientific demonstration of any sort when I was young."**

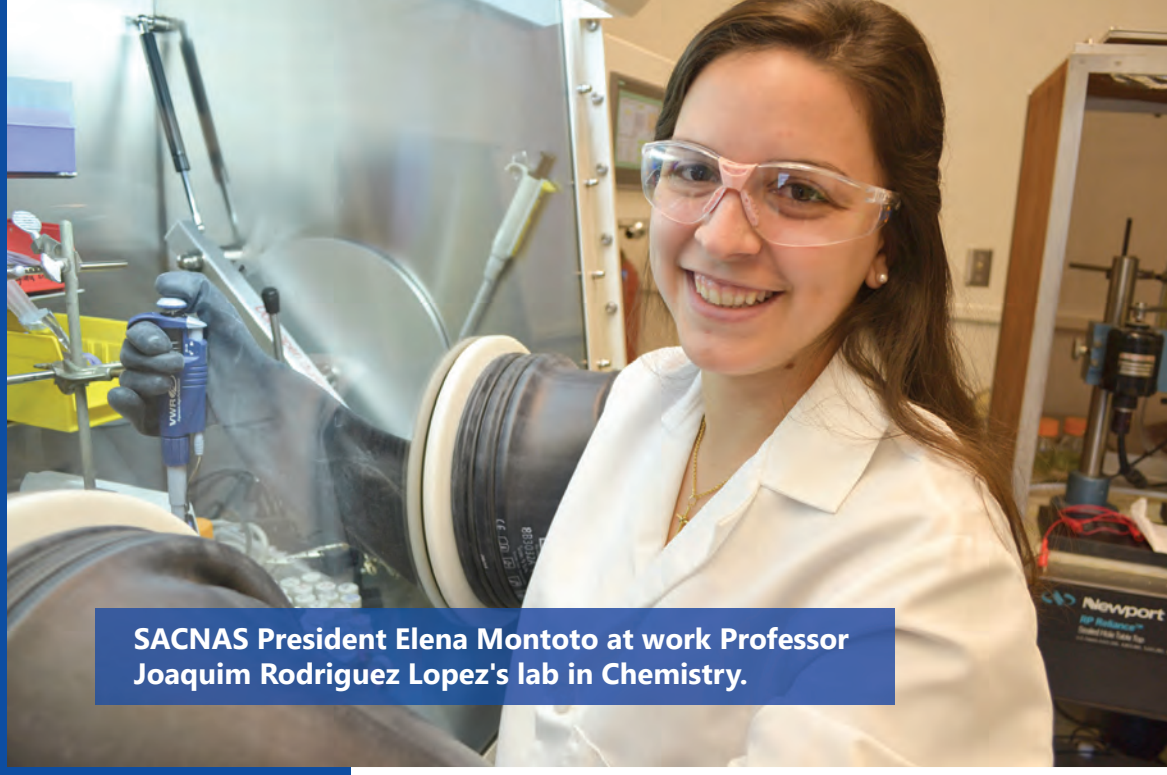


At the Solar Energy station at "Ciencias!" young students watch a SACNAS student expose a small solar panel to the "sun."

Despite not having gone to outreach events, Montoto was interested in science early. In fact, it was always her favorite subject. But how did Montoto get from an interest in science to where she is today: researching materials for energy storage solutions, such as batteries and other technologies, at large-scale installations?

She reports that, as she took courses in high school, she started to narrow down her options. For instance, she decided she didn't want to work with living things, such as people. "Medicine, for me, just pretty much scared me," she admits. "I didn't want to have somebody's life in my hands." So she went for the hard sciences. Then, her sophomore year as an undergrad, she joined a research lab and fell in love.

"So I was able to do chemistry on my own, kind of work in the lab; work out my own problems and challenges and things, so that pretty much kept me going. After that I was, 'I'll go do research, work in a lab.'" In keeping with her early love of research, Montoto's dream job is to keep doing it, either in industry or a government lab.

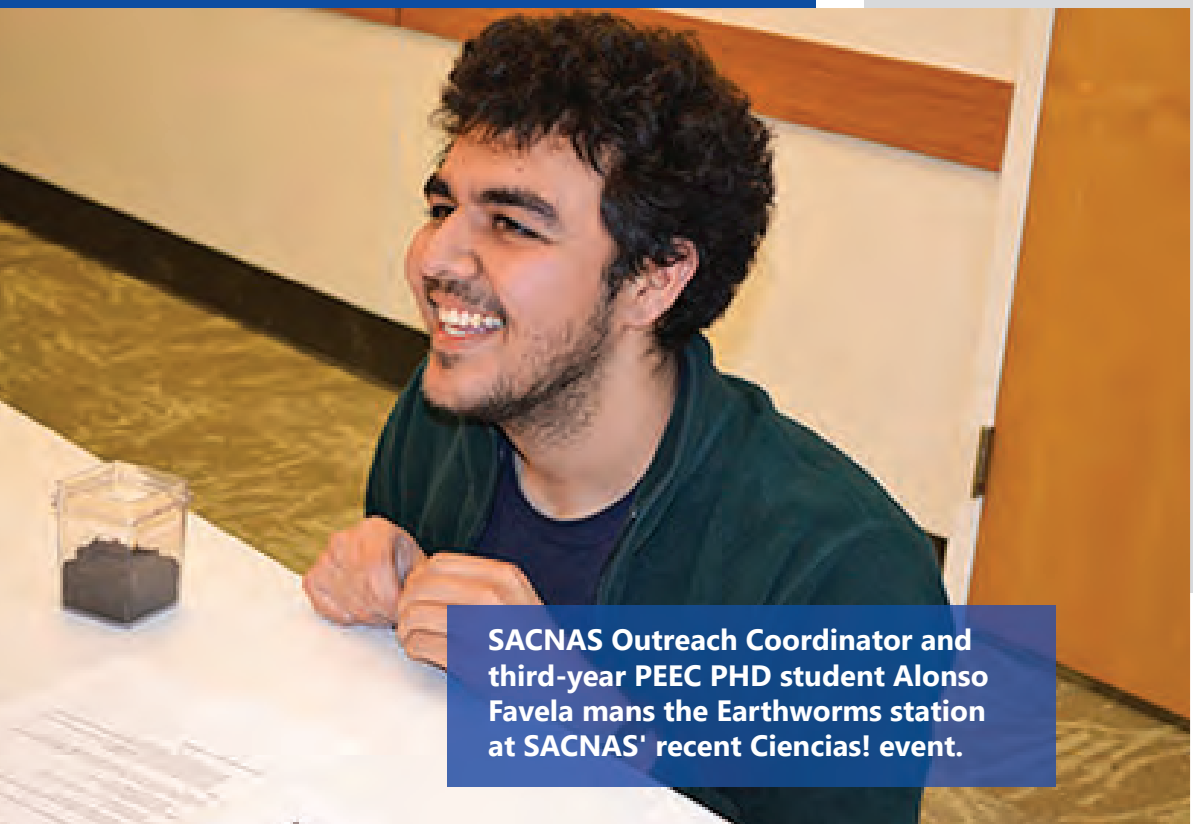


SACNAS President Elena Montoto at work Professor Joaquim Rodriguez Lopez's lab in Chemistry.

For Alonso Favela, whose dream job is to be a professor at an R1 institution, he recognizes the impact outreach can have on young students because of the impact it had on him as a child.

Like Montoto, Favela also loved science as a kid—particularly biology— which he gravitated to when participating in outreach as a child. Intending to be a medical doctor, he did his undergrad coursework in premed. However, after taking an intro biology course where he learned all about plants and how complex they are, like Montoto, he too fell in love. He champions:

"I realized that I really like plants, and that they're everywhere, and that they're so cool! And nobody gives them enough credit! So I guess at some point in my undergrad, I realized that I liked spending time with plants and insects and stuff more than people."



SACNAS Outreach Coordinator and third-year PEEC PHD student Alonso Favela mans the Earthworms station at SACNAS' recent Ciencias! event.

URBANA HIGH ATHLETES EXPLORE CAREERS IN APPLIED HEALTH SCIENCES DURING AHS DAY

May 21, 2018

On Friday, May 4th, around 20 Urbana High School athletes, along with their coaches, visited Illinois' College of Applied Health Sciences (AHS) for I-STEM's first ever AHS Day. During their visit, students were introduced to folks from the four different AHS departments (Kinesiology & Community Health, Speech & Hearing Science; Recreation, Sport, & Tourism, and I-Health). There, the high school students not only learned some things they hadn't known before about the various presenters' research areas, but they were also introduced to some possible college majors they've most likely never considered before. Plus, they also got to meet some of the College's students, including a few athletes, and find out what it's like to be a student in AHS at Illinois.

Speech and Hearing Assistant Professors Fatima Husain and Pasquale Bottalico do a tag team presentation about their research in the field.

AHS Assistant Dean Gretchen Adams explains why an event like AHS Day is beneficial for high schoolers: "It exposes them to the student experience at the University of Illinois and in the College of Applied Health Sciences."

She indicates that students might not be aware of the many career opportunities available in AHS:

> **"I consider the majors in our college to be "discovery majors," she explains, "since they are not explicitly taught as subjects in high school. Students get to learn about our majors and career opportunities in these areas, including some of the innovative research happening in our health fields."**

Regarding the college's goals for the day, Patty Hudek, the AHS Undergrad Recruiter, adds that in order to ensure that their majors aren't "discovery majors," their goal is to:

> **"Plant the seed early on, so these young folks know what we do and what we're about...It may not even be on their radar," she continues. "We want the majors in Applied Health Sciences to be on their radar before they get to college."**

So to introduce the UHS students to some of the directions they might consider when choosing their careers, a cadre of AHS administrators, professors, and students exposed the UHS group to a myriad of possibilities, both careerwise and as college students in AHS.

For instance, a dynamic duo from AHS's Department of Speech and Hearing Science gave an educational yet entertaining presentation about the research they do. Assistant Professor Fatima Husain, shared about auditory, speech, and language processing in the brain using neuroimaging and computational modeling techniques. She also shared about a disorder she is currently studying—tinnitus (ringing in the ear), which is typically associated with hearing loss.

Assistant Professor Pasquale Bottalico also shared with the students some aspects of his research in

acoustics, particularly room and musical acoustics, including the uncertainty of measurements and statistical analysis of data, along with speech intelligibility. Having discovered that he had studied opera (along with engineering) when he himself was an undergrad, the high schoolers requested that he sing for them, which he agreed to do. However, when Bottalico finally made good on his promise and sang a bit, the session was over and, sadly, most had left the room by that point.

The high school students enjoyed the session immensely, and reported that they'd appreciated learning more about speech and hearing: "Everything's been fun because I got to learn more about my ear wax and everything," acknowledges Lauren Cross. "It's more in depth."

UHS sophomore Bryson also appreciated the first session about the ears and hearing: "I liked that because I learned a lot of stuff I didn't know," he admits.

In the session on Community Health and Health Sciences, the UHS students experienced a variety of activities. They met the Service Dogs Club members, as well as some of the service dogs in training. A laborador, Alma, along with Berry the poodle, demonstrated some of things they've been learning in preparation for careers as service dogs themselves. The club members obtain the dogs as puppies, take turns taking care of them and training them. They even name them—hence the dogs have names only an Illinois student can truly appreciate: (Alma, short for Alma Mater, Berry, a derivative of Ikenberry, and Maisie, named after the crop [corn, or maize] grown in Illinois' historical test plots.

Nicki Levar (right) helps Associate Professor Steven Petruzzello demonstrate how to prepare an ECG cap prior to testing the effects of excercise on brain activity.

During the Community Health sessions, students also got to participate in some related hands-on activities: how to remove contaminated gloves without contaminating oneself; how to administer an Epi Pen, and how to bandage an injury; for instance, Sergio McClain, Jr. volunteered to have a "sprained ankle" bandaged.

The session in Kinesiology taught by Associate Professor Steven Petruzzello, grad student Allyson Box, and undergrad Nicki Levar, exposed the students to some of his research in exercise science and the psychology of exercise and sport. The student athletes' eyes particularly lit up when Petruzzello touched on the psychology behind a free-throw routine and its positive benefits, such as helping athletes to relax and focus.

Petruzzello shares the benefit of bringing high schoolers into campus labs:

"I think it's useful for high school students to see what research is and the different forms it can take. I'm not completely certain that they have a good idea of what research really is, so I think seeing that it can take forms that may not fit with their framework is helpful to give them an idea that they might want to do something like that either in college or beyond."

UHS student Lauren Cross experiences a roller coaster in virtual reality at AHS day.

A UHS student experiences a roller coaster through virtual reality at AHS day.

He also hopes he and his team corrected some misconceptions about who scientists are and what they do.

"I'd also like to think that we showed them that "scientists" or "researchers" are just regular people and not stuffy and boring," he explains, then puts a plug in for research: "I hope they at least consider the thought they can get involved in research as an undergrad when they go to college, and that it's not just playing with test tubes!"

Levar, who just graduated with her B.S. in Kinesiology, helped to demonstrate the psychological and physiological effects of exercise on brain activity, using an ECG and a stationary bike. During the interactive presentation, as she pedaled the bike, or stopped pedaling and closed her eyes, students could see the differences between the different states of exercise or relaxation via live data on a projector. Students were also encouraged to ask questions throughout the presentation.

"I tried to share a little about my experience in the lab," Levar reports, "so they would be aware of the awesome opportunities within reach for undergraduate students. I think they left the lab excited about what they learned. It was fun to interact with them and increase their exposure to new concepts and practices!"

One activity that particularly engaged the high schoolers was the student panel.

"For these kinds of recruitment events," Hudek explains, "we like to have students that have experienced our majors in applied health sciences speak to what they have done in their major, and what it's like to come in as a freshman, and how you grow as a person, and how you develop and learn." She adds that giving the UHS visitors the opportunity to hear about AHS students' experiences, "It really opens up—broadens the knowledge of the prospective students that are coming."

Lauren Cross is a senior at Urbana High School who will be attending Barton College in Winston, North Carolina this fall to play basketball. She shares about the impact of AHS Day:

"Everything was good. It was just, really, really, really good, very informational, so that's what made it good. We actually got to interact and had to do stuff that we had to be active."

Don Hardin (right) explains the rules of the Mouse Trap Obstacle Course.

She also believes the event will impact her career-related choices next year in school. “It broadens my vision of what I can do with physical therapy or exercise science, because I didn't know I can be an EMT, and I didn't know all that stuff, and now I feel like I know all that.”

Cross, who is a senior and will be heading to college next year, believes much of what she experienced will be applicable to her college experience. For example, she found the student panel to be quite helpful. She learned “what to expect freshman year…how to manage time.”

Regarding the student panel, she also felt being able to interact with college students rather than adults, whose college experiences were a long time ago, was helpful. “So I think it was good to relate to them. I'm happy they weren't adults because they couldn't tell me what their freshman year was like now, but now these are people that were actually in college.”

Adds Cross:

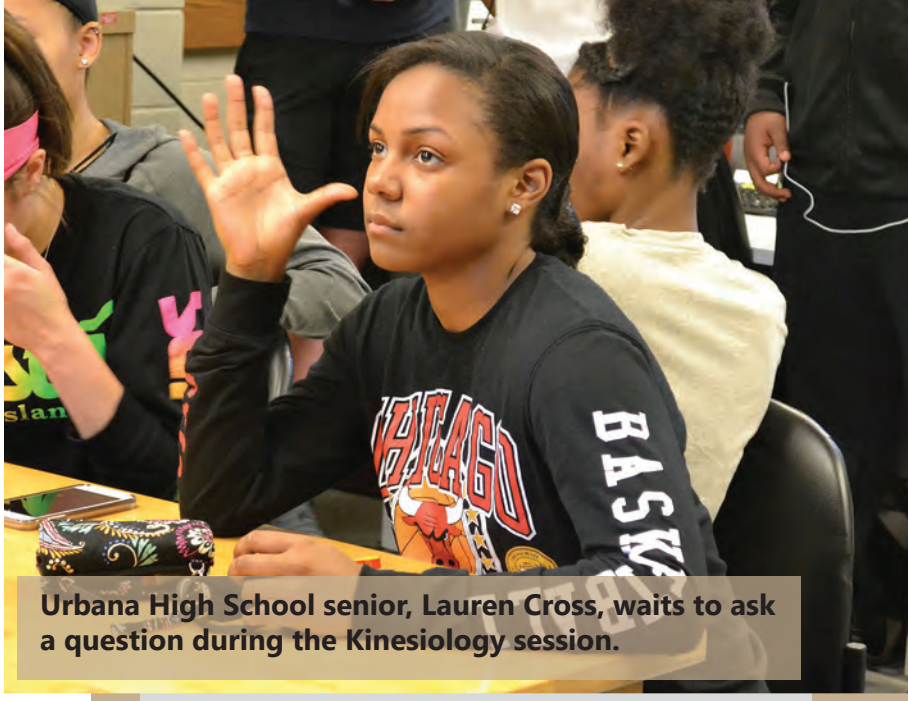
“And with me going to college, I learned more about what life would be like and what classes to take and what I'm experiencing because I'm going to be studying exercise science…This really, really helped me.”

The students definitely enjoyed the session by folks in Recreation, Sport, & Tourism (RST). For example, they played volleyball with a huge, overinflated, hot pink ball. They got to shoot some hoops (which obviously made them feel quite at home, since they’re all basketball players).

One activity was a team-building exercise led by Don Hardin: the Mouse Trap Obstacle Course, which was littered with “mines” which would “explode” if one stepped on them, along with real mouse traps which were actually set. Students were then divided into two teams (girls against the boys) at each end of the course. Then one person from each team was blindfolded and traversed the obstacle course based on the shouted instructions of her/his teammates.

Regarding the last session at the ARC, UHS sophomore Bryson reports that he enjoyed all the different activities:

“I thought it was fun,” he says. “We got to do something we actually liked



Urbana High School senior, Lauren Cross, waits to ask a question during the Kinesiology session.

to play, like basketball, and then do the mouse trap sport, which he says was fun: “I mean, it was showing us teamwork and stuff. Yeah, they all taught us something.”

Adams indicates that one of her favorite parts of the day was:

"watching the interactions between the faculty and UHS students. The faculty were very personable and really wanted to engage them," then adds, "I am appreciative of their time and help!"

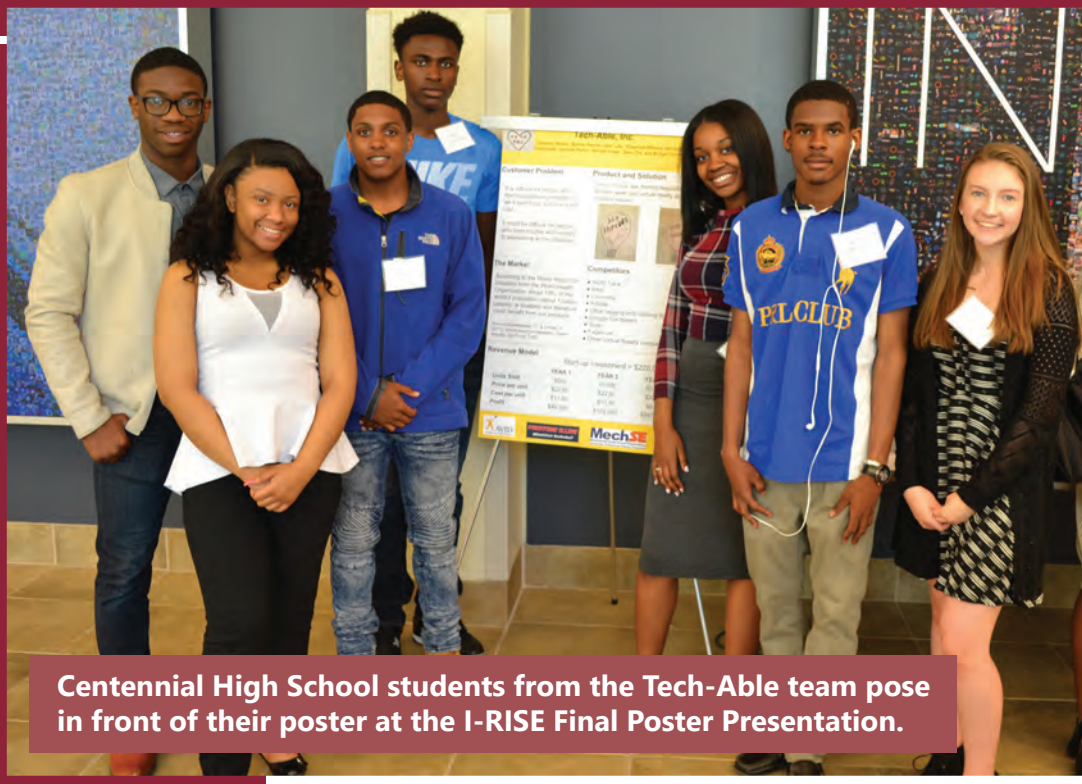
As for the students, she enjoyed:

"listening to all of their questions and observing their curiosity," adding that some students were engaged with one area, while others enjoyed other sessions.

Might some of the students end up in AHS at Illinois? Adams hopes so. In fact, that was her long-term goal for the day: that one of the activities would:

"engage them and help them start thinking of that field as a career possibility in the future, ideally pursing one of our majors in the College of AHS at the University of Illinois."

CENTENNIAL HIGH SOPHOMORES EXPERIENCE ENGINEERING/ENTREPRENEURSHIP COURTESY OF ME598 GRAD STUDENT MENTORS



Centennial High School students from the Tech-Able team pose in front of their poster at the I-RISE Final Poster Presentation.

May 22, 2018

Dream of being on Shark Tank in a few years, lauding the merits of the unique product you designed and are marketing? Some budding young entrepreneurs from Centennial High School just might.

For the second year in a row, these Centennial students in the AVID program had a chance to be mentored by Illinois Engineering grad students as part of the spring 2018 ME 598: Sustainable Engineering Outreach course. Facilitated by IRISE (the Illinois partnership for Respecting the Identities of Students in Engineering), the course was a win-win for both groups of participants. The six grad students had a chance to share their love of engineering and gain some skills regarding engineering outreach to underserved students. The Centennial 10th graders not only learned more about engineering and what it takes to be an entrepreneur, but networked with college students who could serve as mentors, not just now, but in the coming years. Plus, they gained some poster-making and presentation skills as they presented their posters at I-RISE's May 7th Poster Presentation/Awards Ceremony.

The course was taught by Mechanical Science & Engineering (MechSE) Associate Professor Elif Ertekin and Education Outreach Coordinator, Joe Muskin, along with a newcomer to the team this year, joint Engineering and Business lecturer Joe Bradley, who, according to Ertekin, "brought a lot in terms of the business and entrepreneurship perspective."

The students' projects last year were to use engineering to provide a solution to a problem in our local community—obstacles athletes in the Illini Wheelchair Basketball Program encounter while training, competing, or just in everyday life. But Ertekin indicates that this year, the students—now sophomores—were not only able to expand on their engineering designs from the previous year but to "redesign their ideas with the idea of marketability and creating a business from that perspective."

Ertekin explains that the two-year program design—which worked with the students first as freshmen, then again as sophomores—was intentional so the grad students would have a longer time period in which to interact with the students.

Do any of the young entrepreneurs plan to continue with their team's project? Ertekin says possibly:

> **"We've heard from a lot of them that they are interested in seeing how they can push this forward. A lot have already been asking about how they can continue to be involved with us even after the conclusion of the program. So, yeah, I think they are interested in finding a way to keep building off of what they've done."**

According to Ertekin, one of the major benefits for the high schoolers, in addition to the exposure to engineering, was the networking that took place.

Associate Professor Elif Ertekin (right) with Centennial High students from the Tech-Able team, whose project was athletic wear with thermal regulation.

“That's one of the most important things that I think can come out of this–building your network around you, your resources, your community of people that are going to help you along the way.”

But it’s not just the high school students who benefit from working with the grad students. Ertekin claims that the university folk have been reaping some benefits as well.

“The nice thing is that it goes both ways,” she continues. “We benefit from interacting with the students as much as they benefit from working with us. We learn things from each other, and we teach each other things, and that becomes a part of the larger community. The I-RISE program is really about setting up these long-lasting, long-term partnerships between STEM researchers here at the university and local schools and community organizations.

Ertekin adds that the program is also to remind the students that while it might be in their home town, Illinois is a world-class university, and that they’re welcome here:

“It's very important for them to see that we need them at the university and that their skills and talent that they bring are just as important. We wanted to make sure as a community that the university isn't just standing outside of being involved in the community, and we want to be a part of the learning experience for high school students and welcome them into the community. A lot of times we might draw students from other parts of Illinois, but are we really hitting the base in Champaign and other schools around here? So how to improve that presence so they know that even though they live in Champaign, we still want them as part of the university.”

When it comes to Centennial High sophomore Darius Jackson, the University has hit a home run. No stranger to engineering research at Illinois,

Darius Jackson (right) and one of his Tempo teammates show off their product, leggings that can sense that the athlete's body is overheating.

Jackson, along with being a part of the I-RISE program, was also in the Physics Young Scholars program last summer (as a freshman) doing coding, physics, and engineering.

So despite the fact that no one in his family is an engineer, and most likely as a result of these interactions, Jackson has some ambitious career goals at this point. A particle physicist for one, or an engineer…or a video game developer. Possibly all three if he can squeeze them in!

"I want to be able to do all of my childhood dreams, so when I'm older I can be like, 'I did everything. I feel accomplished.' So probably a video game developer/designer, artist, all of that stuff, I'd like to be able to do. My main priority and what I'm trying to build towards is particle physicist and engineer, because that is a harder resume to build, so I'd like to start early."

And Jackson is well on his way. He shares several things he learned from this experience. Collaboration for one: "Having eight minds working with each other," he suggests, though he adds that it was a challenge: "It's something you really have to work with."

Plus, he shares some other things he learned: "I learned how to code faster and easier, how to use everyday things with technology to make things better, and marketing. Marketing was a lot harder than I expected. I learned a lot of different things."

Sophomore, Jariyah Dillon was part of the Sensi team, which crreated a sensor system that attaches to a wheelchair to notify the user about the condition of its parts. She says she also learned a lot. While she confesses that she's "not a big fan" of engineering, she admits, "I liked the coding part. I loved pretty much everything about it other than the worries. We worked so hard on this." However, evidently one of the hardest things about the project was her tendency to worry about things.

"It was the worries," she admits. "Just worrying about if we were going to do it right-—whether or not we were going to collaborate right. I was worried about and wondering if our presentation was going to be a mess. The project was pretty easy, but it was frustrating a few times because the sensing was off for the wheelchair conditions."

Another sophomore, Toniea Barker, says the most rewarding thing about the project was encouraging each other on. "Being able to collaborate with everyone; being here at the U of I and seeing everybody present their ideas was an amazing experience because I've never encountered anything like this before, and it was lovely how there wasn't any hostility between anyone."

The hardest thing, according to Barker was coming to a consensus regarding their project.

"There were lots of ups and downs with this project, but picking the perfect project was the most difficult challenge. Each and every one of us put a piece of ourselves into this project.

Is engineering in her future? Maybe. "I actually do like engineering," she says. "I didn't think I'd like it

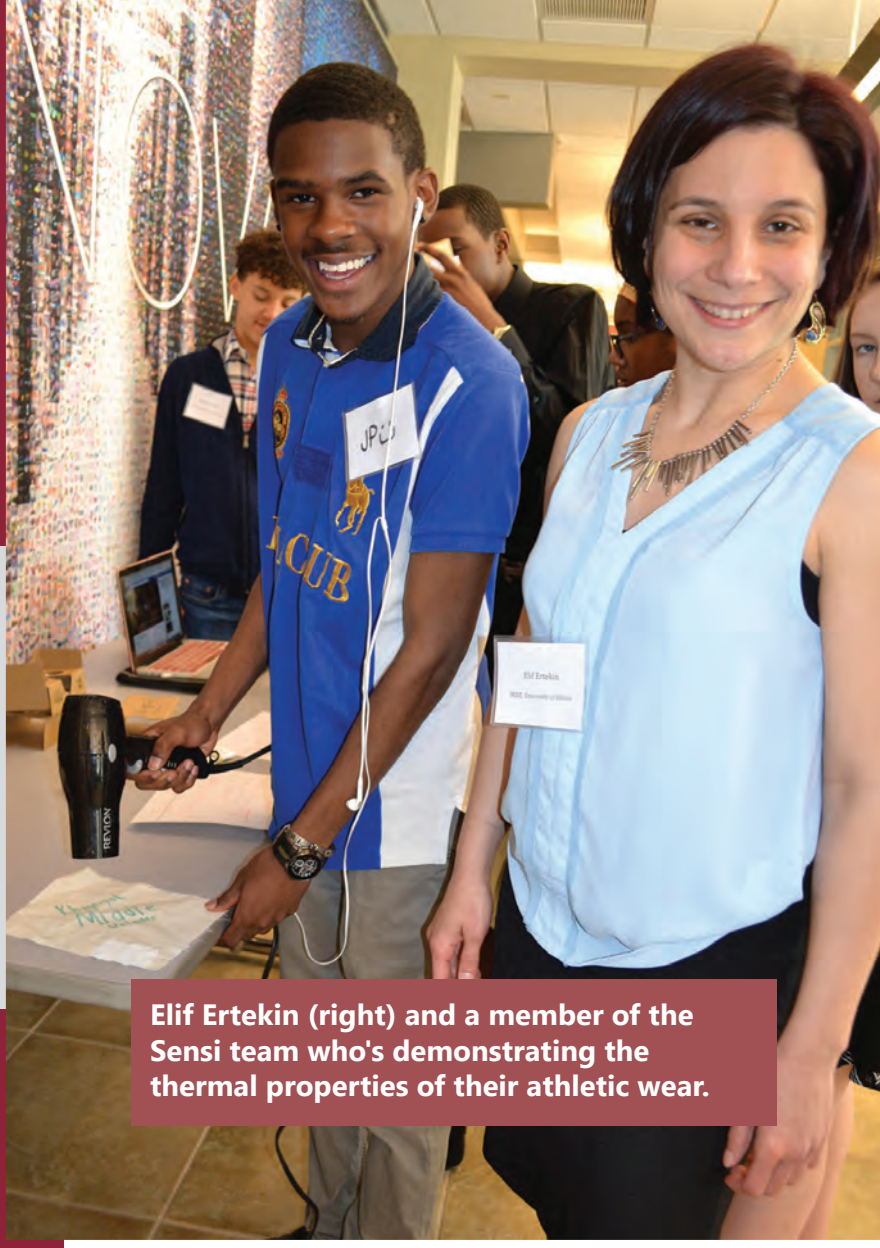
Jariyah Dillon (left), Toniea Barker (second from left) with some of the other Sensi teammates at the I-RISE Final Poster Session.

when we started this project two years ago, but it something that I will definitely look into."

The high schoolers weren't the only ones to benefit from the program. A couple of Illinois engineering students share why they got involved and what they got out of it.

For example, Aaron Anderson, a first-year, Electrical Engineering grad student, took the course because a couple of his friends had taken it and told him that it was good. One friend said it had been "invaluable for working with the high school students and gaining experience for himself."

"I guess I care about all of the technical things that I'm learning as a graduate student," Anderson acknowledges," but I think it's important to apply what I'm learning to help people and the world become a better place. So taking this class is helping me understand how to do outreach and how to apply my technical knowledge to people that need it more broadly."



Elif Ertekin (right) and a member of the Sensi team who's demonstrating the thermal properties of their athletic wear.

Anderson, who worked with the Tilt Tech group, claims some of them could definitely have a future in engineering. "There were some really great ideas, and when we had a problem we wanted to solve, I suggested several potential approaches to solving the problem, and I think the students did a good job of thinking about the advantages about each. A couple of them, in particular, clearly understood and engaged with the suggestions to think about which would be best."

The most challenging part of mentoring? Since he doesn't have a lot of formal training or experience working with high-school-aged students, he found group management to be tricky. "If they're off task, how to help them get focused. That's not something that I'm experienced with and was challenging."

He says that for the students, one of the challenges was recognizing and prioritizing the different things to work on.

"It's not like math homework where there is a problem statement and the form of the answer is implied by the form of the question," he suggests. "This project was not at all like that because we had an idea of what we wanted it to do, but there was no clear path, no example pattern they could follow. So figuring out how to work through the problem to the solution at the beginning."

Fourth-year Mechanical Engineering grad student Brian Blankenau says the most rewarding thing out of this experience was "just showing up on Friday mornings and watching these guys do such a great jobs with their projects. Brian's project was Tempo, which designed leggings/pants that would signal the wearer if they were overheating while exercising by changing colors.

While both he and his student team encountered challenges, he believes that getting university PhD students together with local high school students provided some benefits too.

For instance, Brian says that for the high school students, it was probably having a cheering section.

“I know when I was in high school, it was, for me at least, hard to understand what really college was and whether or not I would be able to do well. And to be able to have someone there to say, 'Don't worry; you guys have this!' would have been nice.”

Brian agrees with fellow mentor Anderson that the PhD students got a couple of things out of the program too. For instance, they gained some teaching skills, and got to share their passion.

“One of the things is, we don't have formal teaching training, so kind of getting some exposure to that is valuable, and then just getting the chance to be STEM ambassadors, I know a lot of my colleagues are looking for those opportunities.”

So the million-dollar question is, can some of these young entrepreneurs make some money out of their project? For example, could Tempo make a go of their sensor-modified leggings, or sell the idea to Nike? Brian says possibly: “I think when they found their competitors, there were people that were doing things in a similar area, but I think they had a neat, unique project.”

Darius Jackson, for one, hopes to continue with Tempo’s project:

“If I'm allotted the resources, then yes. I'd definitely try to market. Like you said, it's a different project, and there's nothing really out there like that. I think it could succeed if marketed well.”

Ertekin also thinks it’s possible: “The possibility from a business perspective is they could potentially license the technology to Nike or have some sort of partnership with Nike for these types of clothing for the sun/thermal regulation, which with Nike's brand would be an ideal approach. But they could also find a niche market and still be very successful and just find the targets they specifically want to chase and spend their efforts there and still become a nice size company without getting the attention of larger companies like Nike.”

Centennial students on the Tilt-Tech team with their poster at the I-RISE Final Poster Session.

POLÍMEROS! CENA Y CIENCIAS PROGRAM TEACHES ABOUT MATERIALS THROUGH A SUPPER & SCIENCE NIGHT

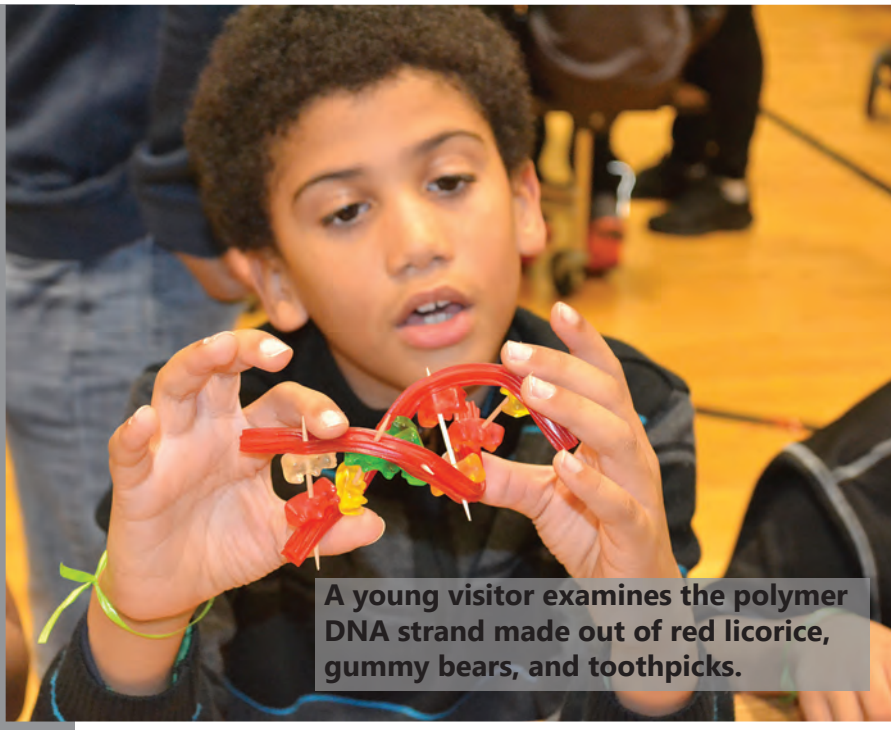
November 14, 2018

A group of around 80+ mostly Hispanic K–5 students and their families showed up for the November 5th Cena y Ciencias (Spanish for "Supper and Science") at Dr. Preston Williams Elementary School in Urbana. Supported through University partners that include the Illinois Materials Research Science and Engineering Center (I-MRSEC) and the Illinois chapter of the Society of the Advancement of Chicanos and Native American Scientists (SACNAS), as well as Urbana School District employees, and parents, the program is addressing materials such as polímeros (Spanish for polymers)—the star of the November outreach. And while the free pizza most likely provided some incentive for families to take part, based on the youngsters' excitement, it was apparent that participating in different hands-on science activities led completely in Spanish was their main focus during the evening.

I-MRSEC PI Nadya Mason explains why she and her colleagues wanted to be involved:

> **"Many factors contribute to the natural synergy of MRSEC involvement in Cena y Ciencias. First, the MRSEC's core missions of effective outreach, education and science communication are realized through having Center participants take part in creating and presenting demo ideas. Fortunately materials research is broad enough to offer a great variety of engaging themes and demos. In addition, this outreach helps fulfill a goal that permeates all I-MRSEC activities, which is to increase diversity in materials science at all levels, starting at the elementary age."**

Helping to present the evening's activities about polymers was Chemistry Associate Professor Joaquín Rodríguez López. To illustrate how polymers are unique, he had two different groups of young volunteers—one group just stood next to each other, illustrating monomers (or small individual molecules); the other linked arms, to show how polymers are linked or joined monomers.



A young visitor examines the polymer DNA strand made out of red licorice, gummy bears, and toothpicks.

In another demo about some of the more surprising properties of polymers, a student was able to insert a pointed stick coated in dish soap (which is actually is a polymer) all the way through a balloon without bursting it. Why did this work? According to Elena Montoto, a SACNAS Ph.D. student who participated in the event, in this demo:

> **"The latex polymers accommodate the stick into the macro-structure without breaking the balloon. In essence, the latex polymers in the balloon can stretch to make room for the coated stick where the dish soap is also mobile enough to cover the gaps."**

In another activity, the molecular structure of polymers was further demonstrated when kids linked paperclips together to form a chain, which they then grouped together using a magnet. According to Montoto, in this activity, the magnets represent "crosslinkers," indicating that polymers are not always single long chains, but many times singular

polymer chains are interconnected with other chains chemically by these crosslinking agents to make larger, more entangled polymers. So this activity showed that principle that polymers can be linked to create new types of large polymers with changing properties.

Kids were also given red licorice (which served as the strand's backbone), gummy bears (which represented pendant monomers, and toothpicks which they were to use to create a DNA strand of a polymer. Finally, older kids were encouraged to experiment with polymers to see who could make the bounciest ball.

I-MRSEC Outreach Coordinator Pamela Pena Martin explains:

> **"The scientific goals of Cena y Ciencias are that students 'learn by doing' (i.e., real science concepts and inquiry process are the foundation of lessons) and creating positive connections with science."**

She emphasizes:

> **"It HAS to be fun! What makes this program unique are the guiding principles, which emphasize involvement of the family unit, programming entirely in Spanish, and providing role models through the many Latino scientists who volunteer."**

During a planning meeting, Pamela Pena Martin (right) conducts one experiment they intended to have students do during an event.

To be held the first Monday of every month (except January) for the entire 2018–2019 academic year, the year-long program will look into a variety of materials, in addition to those already addressed: electronic materials (October 1st) and polymers (November 5th). These include:

- December 3: Ancient Materials
- February 4: Natural/Green Materials
- March 4: Biomaterials
- April 1: Surfaces (this will be a field trip to the Materials Research Lab (MRL)
- May 6: Materials of the Future

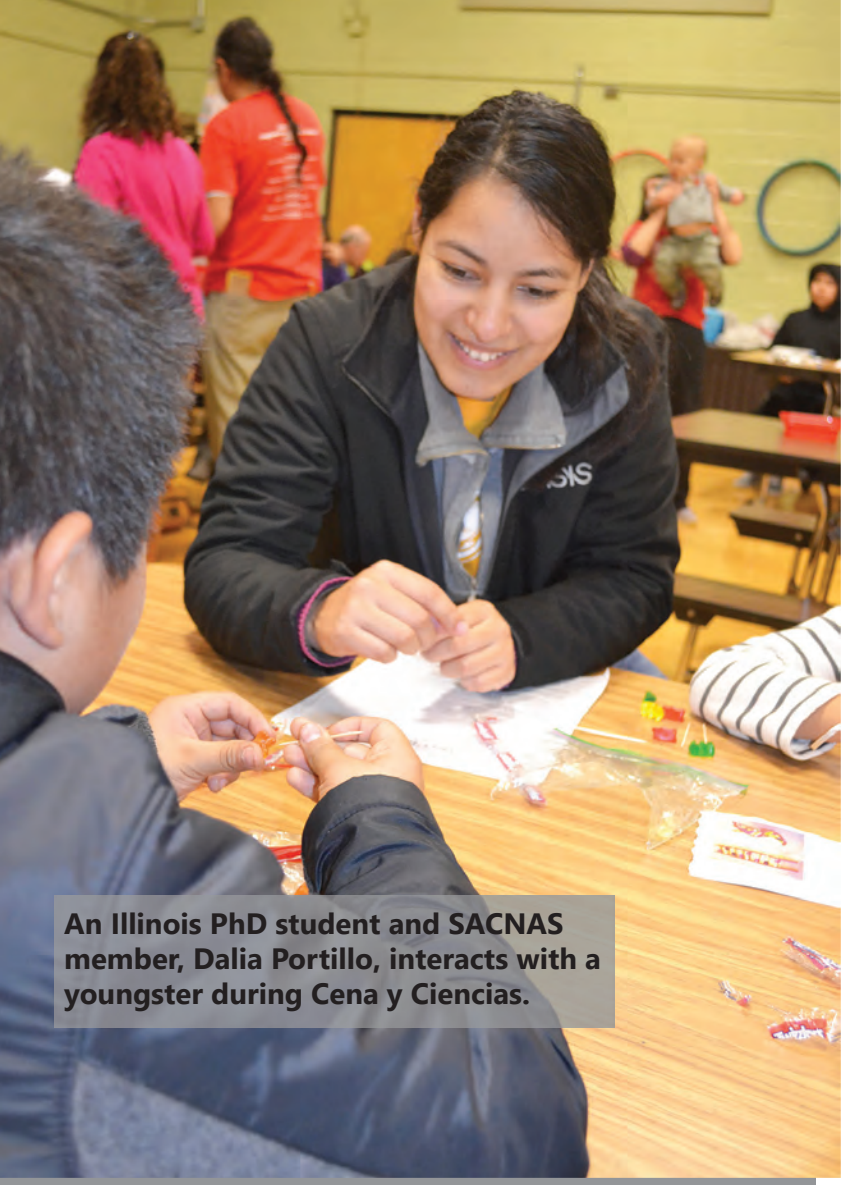
Involved with Cena y Ciencias since its beginning six years ago, SACNAS is providing a team of native-Spanish-speaking Illinois students who are passionate about science, serving as role models so kids can see scientists who look like them, and exposing Hispanic youngsters to science in their native tongue.

I-MRSEC professor Rodriguez-López, a native Spanish speaker who has worked with Cena y Ciencias for several years, expains the benefit of exposing Hispanic youngsters to science in their native language:

> **“It breaks cultural barriers. I often imagine that it is like listening to opera in your language—that someone that sounds like you can create amazing things, in this case with science.”**

Along with SACNAS, this year the content co-sponsor of the program is I-MRSEC, which is helping to provide the ideas for hands-on activities that will underscore the materials Cena y Cencias will emphasize each month. Plus, I-MRSEC is helping to foot the bill for the demo supplies and pizza. In addition to I-MRSEC and SACNAS, Cena y Ciencias is also supported by NCSA, Urbana School District 116, and 4H.

Regarding the activities, IMRSEC researchers are being encouraged to come up with creative, hands-on activities either related to their research or at least to the material they research. Also critical to the process is a planning committee that meets regularly to develop the ideas the researchers suggest into the actual hands-on activities presented each month. The committee includes



An Illinois PhD student and SACNAS member, Dalia Portillo, interacts with a youngster during Cena y Ciencias.

a mix of I-MRSEC, SACNAS, Urbana School District, and 4H representatives, including: Nohemi Campos (Urbana School District); Ricardo Diaz (4-H volunteer and parent); Luisana Hernandez, Leal School dual language coordinator; Joaquín Rodriguez-López; Pamela Pena Martin; Astronomy Professor Felipe Menanteau; Illinois grad student Isamar Pastrana, SACNAS' Cena y Ciencias representative; Physics grad student Jorge Rodriguez; and Cena y Ciencias coordinator Mariela Saenz.

Key to November's polymer acitivites was I-MRSEC Ph.D. student Prapti Kafle from the Ying Diao Research Group in Chemical and Biomolecular Engineering, who originally came up with the ideas. Other faculty who contributed to the lesson were Chemistry Professors Cathy Murphy and Joaquín Rodriguez-López.

Kafle shares how she got involved. She learned through I-MRSEC that the group's partnership with Cena y Ciencias would provide university folk the opportunity to show elementary school kids about various materials. Then, she discovered that polymers was the theme for the month of November.

"That's interesting!" she said to herself. And since she actually works with polymers, she decided to get involved. "I thought I could help in my way and show kids about what I work on and what polymers are."

Kafle, whose work involves making 2D films of semiconducting polymers for sensing bio-molecules, shares why she wanted to get involved with the IMRSEC/Cena y Ciencias partnership:

> **"I really love the work that I do in my research. I had always wanted to show other people what I do in my lab and not just confine the interesting scientific findings I observe in the experiments to myself. I wanted others to see how interesting science is—how interesting the world around us is."**

Were the lessons close to her actual research? She claims they were an introductory look at the material she works with, and explains that the activities she inspired were based on polymers in general, while she specifically works on semiconducting polymers, such as those used in electronics.

One of Kafle's goals in being involved with Cena Y Ciencias was to pique kids' interest in science. She says:

> **"I think that we can inspire little kids by showing these interesting activities. I think that if we, as junior scientists, work with these kids and show that science is fun, science is actually interesting, then we can encourage them to pursue STEM fields."**

She also hoped to fly in the face of kids' mindset that they don't have what it takes to be a scientist. She speaks from personal experience:

> **"If I can speak for myself, when I was a kid, I used to think that scientists were these very different people who are not like us, who I couldn't relate to, and that science is like a completely difficult thing that I can't do."**

So for her, one of the night's goals was to show the kids that, yes, indeed, they can do science.

Kafle's other goal was to make the general public more familiar with the work that scientists do. "I think it's an opportunity for us also to show our work to other people, to not just be limited to our lab, doing our own thing." She also claims that communicating with the general public about scientific research is a win-win: it not only inspires other people, but it inspires the scientist too. Kafle explains:

"I think it kind of motivates us when we show our work to others, and when other people think this is interesting and important, it also motivates us towards our work. We feel like our work is important; it inspires other people. It's good in both ways, I think."

Kafle reports that she found the night to be quite rewarding, personally. "It's amazing," she exclaims. "I didn't know how many kids were going to be here, but seeing all these kids and their parents come and actually do the experiments and learn and be surprised, it's actually amazing."

Another I-MRSEC researcher who is intregally involved with the program is Dr. Joaquín Rodríguez López. A recipient of one of I-MRSEC's Seed Projects this year, his group creates and studies novel electrode designs for applications in energy and catalysis.

In fact, I-MRSEC's partnership with SACNAS/ Cena y Ciencias happened through López, who has been participating in Cena y Ciencias for a couple of years as a part of his outreach activities, who explains:

"I saw a great opportunity in getting the MRSEC involved in these activities, since naturally it would contribute to a variety of topics and create the opportunity to develop exciting demonstrations and activities."

He adds that since Cena y Ciencias is an initiative run by the University community (e.g. faculty, staff, students, SACNAS volunteers), along with collaborators at the schools, "it is also important to look for support to keep it running and current."

López shares why he personally get involved in the outreach: "

I-MRSEC Ph.D. student Prapti Kafle at Cena y Ciencias.

Because I want to become a scientific role model for children, and what better way to encourage them than to reaffirm that these concepts are universal and that language should not be a barrier to learning exciting things. Naturally, Cena y Ciencias gives me the unique opportunity to contribute with two aspects that come natural to me: Spanish and Science."

López also adds that he is "very grateful that the I-MRSEC supports us with this program for this year," and wants to encourage other campus groups and individuals to join. "The group of children, and parents, is growing," he explains, "so I think that I speak on behalf of all of us in CyC by emphasizing that we want to keep up with the great interest displayed by the community."

STEM RESEARCH EXPERIENCES AND OPPORTUNITIES

I-MRSEC: CREATING A MULTIDISCIPLINARY MATERIALS RESEARCH COMMUNITY

March 15, 2018

Begun in September 2017, I-MRSEC (Illinois Materials Research Science and Engineering Center) seeks to create a community around multidisciplinary materials science research; recruiting; educating the next generation of researchers, including diverse students; and informing the general public through outreach. Funded through NSF's Materials Division, the center will receive $16 million over the six years of the grant, with the possibility of being renewed.

I-MRSEC has two goals: 1) innovative interdisciplinary materials research with applications to societal needs, and 2) interdisciplinary education and training of students in materials design, understanding, and application.

According to the PI, Physics Professor Nadya Mason, the Center's overarching goal is to create a materials research community.

Physics Professor Nadya Mason, PI of the I-MRSEC grant.

"It's not just about doing the best research, though that's incredibly important, but it's also about training the next generation and creating an environment where materials research is central."

She further defines what she means by community. "So that means that you have collaborations, both interdisciplinary and international," Mason says. "You have educational components, where you give enhanced opportunities for seminars and classes for the students in the group. It also means that you reach out to the community, both for the sake of educating the community and as a way to bring more people into materials research. The people involved in the grant also get to learn the importance and relevance of reaching out and having other people share the knowledge and appreciate what they are doing."

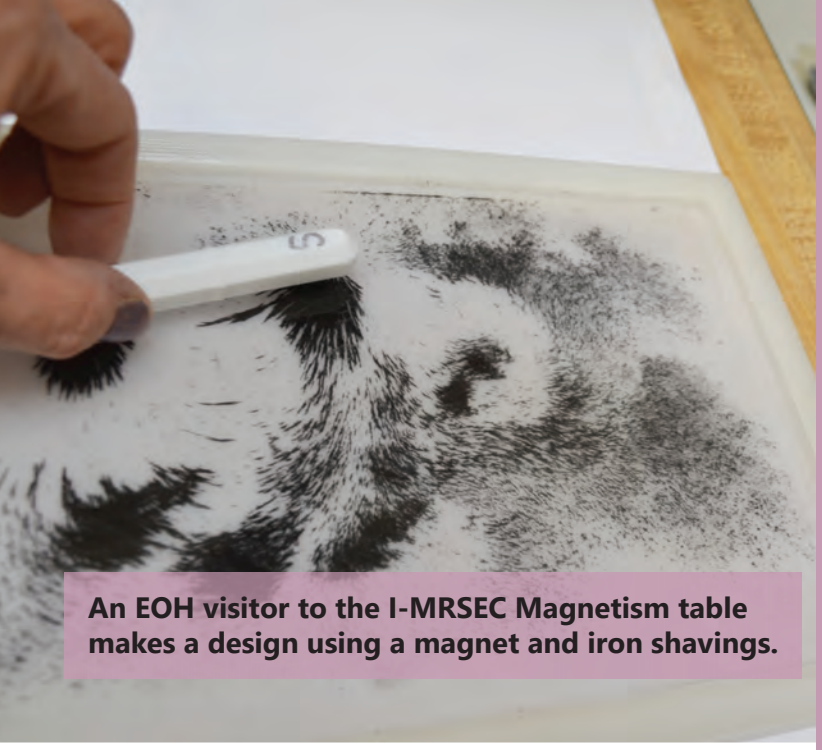
Mason reports that another important aspect of MRSEC is its interdisciplinary nature: "It has to take a research problem that requires a group of scientists in different fields to solve." So in addition to PI Mason, twelve faculty not only in Physics, but Materials Science, Mechanical Engineering, Electrical Engineering, and also Chemistry, are involved with I-MRSEC.

Mason recalls that in previous iterations of the proposal which had not been funded, they had picked the team members and then come up a problem based on the team's members. This time around, the key to their success in getting the grant was this: they sought to "Start with a well-defined problem and build the team around that."

When writing the grant, the campus community was asked to come up with ideas for research, then a panel of experts was convened to judge these proposals to determine which were most viable for the grant.

She goes on to describe the two interdisciplinary research thrusts the teams came up with. The first is magnetic materials with anti-ferromagnetic properties. According to Mason, these materials "won't stick to your fridge, but can be used in computers to store information."

The second is very flexible, small-scale materials. Mason indicates that there is a need for soft, flexible electronics that can interface with biological material. "We want electronics to interface with our bodies," Mason explains.



An EOH visitor to the I-MRSEC Magnetism table makes a design using a magnet and iron shavings.

Comprised solely of Illinois faculty, the Center has already established some industry collaborations and hope to implement some international ones, along with collaborating with other campus folks as well.

The Center's second goal is interdisciplinary education—training students in materials design, understanding, and application. Educational outreach is also another aspect of the grant that Mason is passionate about.

"Educational outreach is completely integral to the MRSEC," she says, "and it's what really appeals to me about it. It's not just another research grant."

Key to the education component is communication, another I-MRSEC emphasis:

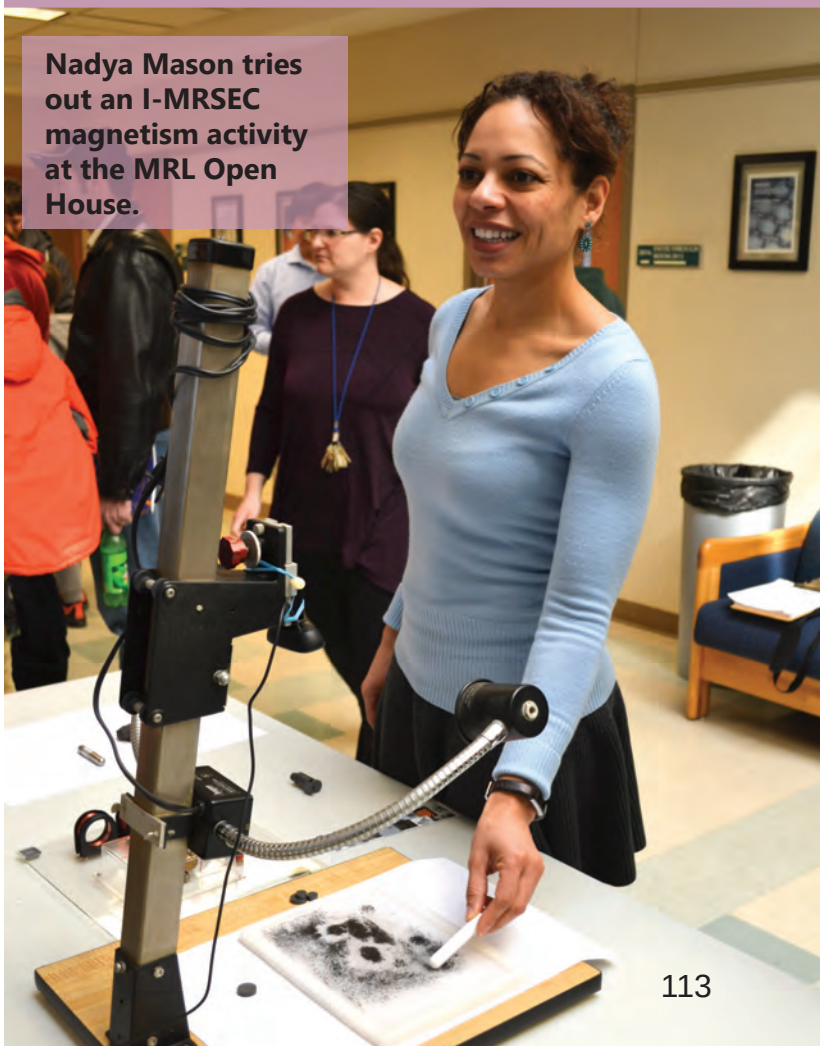
"Our outreach focus at MRSEC is improving scientific communication," Mason explains. "We decided that, as a community, we lacked communication skills at all levels, from students to faculty, both technically (giving clear talks to colleagues and peers), to non-technically (just telling the community what we are doing.)

So I-MRSEC hopes to create a cadre of researchers and students who can "effectively communicate their science in different ways," to not only make an impact but also to create a paradigm for "how to improve this in the scientific community as a whole."

Thus, I-MRSEC hopes to improve communication as they incorporate several educational/training components over the next year.

Formal Practice Symposium. One aspect of training and communication is for I-MRSEC students to learn how to give presentations and have a chance to practice their skills. So on March 2nd, a Formal Practice Symposium allowed I-MRSEC's students to practice for the APS (American Physical Society) Conference held in March every year. Both students and faculty go, and in addition to faculty being invited to give talks; students also submit abstracts, and, if they're accepted, give 10-minute talks.

"It's a really big deal for them to go to a conference like this because it is an international audience; researchers from all over world meet for this" explains Pamela Pena Martin, I-MRSEC's Outreach Coordinator. So the practice symposium was created in order to give students a chance to do just that. "They are timed," she explains, "there are questions from the audience, and we will have another I-MRSEC researcher give them an evaluation with suggestions on how to improve it."



Nadya Mason tries out an I-MRSEC magnetism activity at the MRL Open House.

Materials Research Lab Open House. One of the Center's first outreach events involved participating in MRL's first-ever Open House on March 9th and 10th. There, I-MRSEC-funded graduate students presented exhibits related to I-MRSEC's research emphases; one on magnetism; the other on topology, during which visitors could make a Mobius strip.

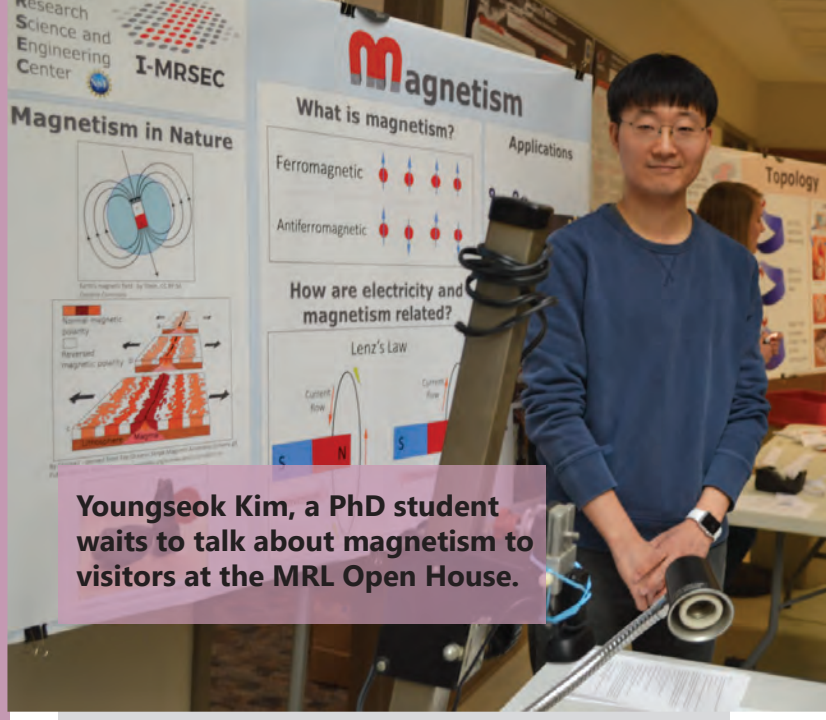
Youngseok Kim, a 4th-year Ilinois PhD student studying the numerical and theoretical perspectives of magnetic materials, shares why he participated:

> **"It's always exciting to teach new information to kids, especially about magnetism," says Kim. "Kids are so excited, because it's not something that you can see with your bare eyes, but they can interact with it and visualize what the magnetic field looks like. It's really meaningful to teach these kinds of things and ignite their interest in the STEM fields."**

Another I-MRSEC PhD student, Kathleen Oolman, shares why she got involved:

> **"I like explaining science to school-age kids in a way that they can understand. Often, I think science, and especially physics, is this very**

Kathleen Oolman, a Physics PhD student explains an activity to visitors at the MRL Open House.



Youngseok Kim, a PhD student waits to talk about magnetism to visitors at the MRL Open House.

> **big and complicated subject and can be very intimidating. So I like being able to explain it in a way that people can understand and relate to. Then maybe that leads someone to have an interest in science and hopefully to be a scientist one day."**

Research Videos. One unique education outreach project the I-MRSEC team intends to tackle this spring is a scripted, three-episode video series featuring diverse junior high students who come to a lab and learn about MRSEC research. More than a documentary, the scripted series, "will help the students that watch it, who are interested in the videos, to be engaged with the characters and follow them from episode to episode" explains Pena Martin.

The videos will also introduce young viewers to scientists, so they might be able to also see themselves as scientists, and will also include science research teachers can use. For instance, after the episodes will be clips about the science and the people behind it, who will talk about why they're interested in science.

> **"I think if they see a scientist talking about what they're passionate about, even something not science related," Pena Martin adds, "it might make a student realize that they can still be a scientist with these different interests and how those interests might affect how they are as a scientist."**

The videographer, who will also be writing the script, has experience doing science videos and working with students of this age. Plus, to ensure that the videos impact under-represented students, the students will be intentionally cast so that they reflect diverse backgrounds.

Scientific Communication Workshop. In keeping with I-MRSEC's communication emphasis, on May 18th, I-MRSEC is holding a workshop presented by Stonybrook's Alda Center for Scientific Communication .

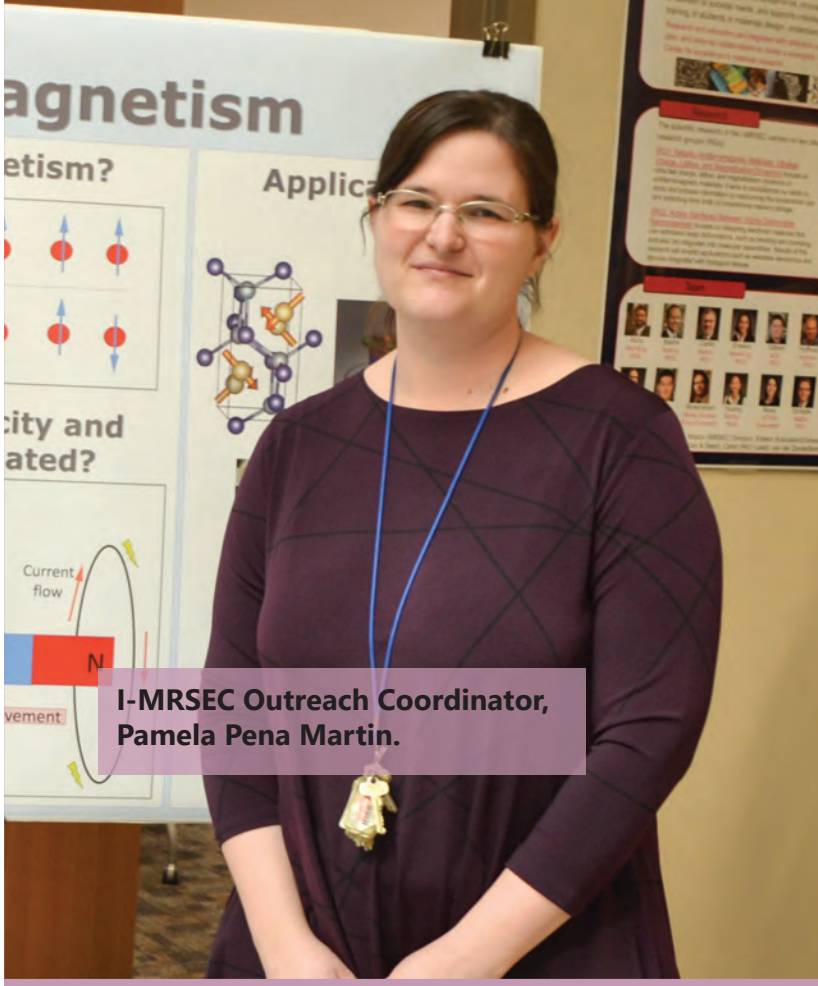
The workshop is based on the work of Alan Alda, star of the TV series M.A.S.H., who, after doing a PBS series about interviewing scientists, came up with a concept regarding how to communicate science so that people can understand.

I-MRSEC REU. One outreach program I-MRSEC will begin this summer, May 29th–Aug 3rd, is its Research Experience for Undergraduates (REU) program, which will expose eight non-University-of-Illinois students to ten weeks of multi-disciplinary materials research.

According to Pena Martin, coordinator of the REU, the goal is to give research experiences to students who may not have access to these opportunities. So they are seeking to foster diversity, specifically targeting under-represented minorities, women, people with disabilities, and first-generation students. Plus, Pena Martin's also hoping that they continue on and go to graduate school at Illinois too. "If they come here, that would be really wonderful too," she admits.

Still under development, the REU programming might include weekly student-faculty llunchеons, an end-of-the-summer event, possibly a final poster presentation, plus they hope to coordinate some activities with Physics and Chemistry's REUs. Also, while their REU participants will not be partnering with SROP, they hope to take advantage of SROP's programming. And to prepare their graduate students to serve as mentors for the REU participants, I-MRSEC intends to hold a graduate student mentor training in May. Pena Martin says one overarching goal of their outreach activities is to get young people, especially underrepresented students, to choose STEM careers, including research.

"For me, I feel like students don't have the opportunities to see themselves as scientists. So when they start to make decisions about their plans for their education later on, they don't even consider it. I didn't when I was younger. I decided to study physics after I was already an undergraduate... I think students don't get it because they don't see



I-MRSEC Outreach Coordinator, Pamela Pena Martin.

themselves as scientists, because they don't see it reflected in media."

She also hopes to show that scientists "are just normal everyday people. People who do science and enjoy other things. I'm a scientist, and I have interests outside the lab. Kids being able to see that scientists are real people that can be is really important... Math may be difficult for you, but you can still be a scientist, and that it might make you a better scientist."

PI Mason adds that the education/outreach components are also important to ensure the community's continuity.

"We want students to be able to continue this research in the future, long after the current researchers are gone. We want people in the community to understand what their friends and neighbors are working on and appreciate it and maybe inspire others to enter the field. We want people to go to politicians and the media and even just be walking down the street and say, 'Yeah, materials research is really great and cool!'"

ENGINEERING'S UNDERGRADUATE RESEARCH OFFICE ENCOURAGES UNDERGRADS TO EXPERIENCE RESEARCH

April 25, 2018

Tasha Mamaril has her finger on the pulse of research for Engineering undergrads. As the Coordinator of Engineering's Undergraduate Research Office, she provides information to engineering students about what kinds of opportunities are available. Plus, she oversees two of the college's research programs specifically for undergrads: MUSE (Mentoring Undergraduates in Science and Engineering) and the Illinois Scholars Undergraduate Research (ISUR) program, which provides scholarships for students addressing research related to the interests of the corporations which fund the program.

In a recent survey, almost half (46.7%) of Engineering's undergraduate students participated in research this past year, whether here on campus with a faculty research group, in an internship, or in a senior thesis or capstone project. And for engineering students interested in participating in research, Mamaril and her office can be a valuable resource.

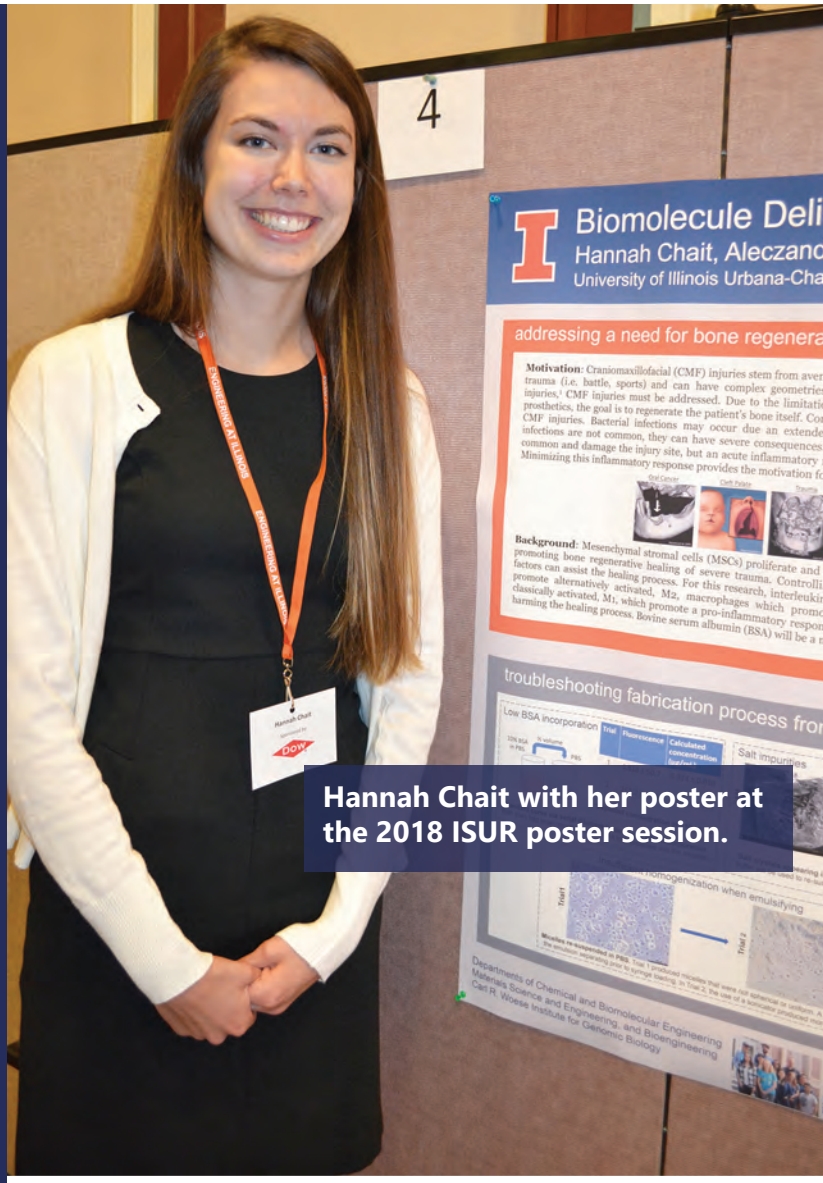
However, when it comes to connecting students with researchers here on campus, Mamaril stresses that she doesn't hold students' hands.

> **"One of my duties is to get them information about which professors are doing what. That's how I arrange things. I don't want to hand hold students. We try to give them that independence. Have them think about what they want."**

But she admits that sometimes she does hold "therapy sessions."

> **"We try to hash out, 'What is it that you're passionate about? What's your interest? Where are you looking in terms of your career right now?' So that's what I do."**

To steer students in the right direction in their search for a research experience that closely aligns



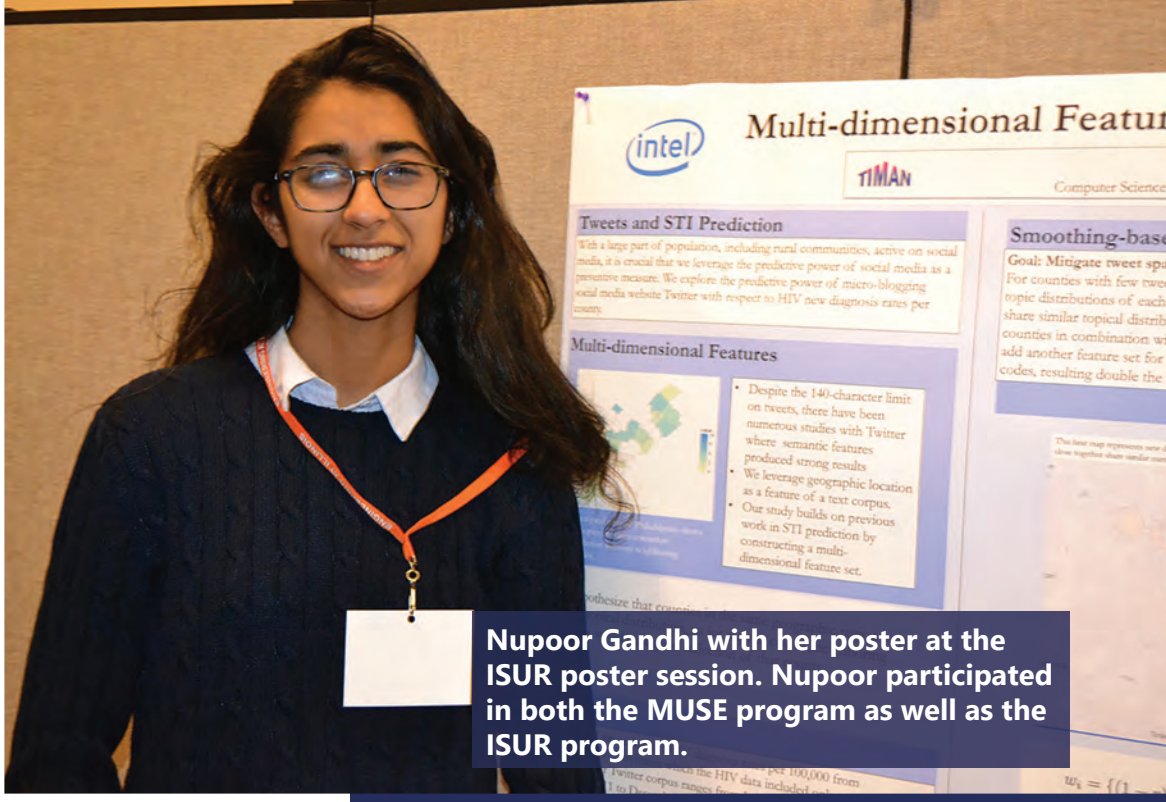
Hannah Chait with her poster at the 2018 ISUR poster session.

to their interests, Mamaril and her staff have developed a database comprised of matrices detailing research interests for all faculty based on the primary research areas in each of Engineering's twelve departments. Then, it's up to the students to discover which professor's research excites them.

And while all faculty in a given department appear on the matrix, that doesn't necessarily mean a professor has agreed to sponsor undergrad researchers in his or her lab. Students just might have to convince them that they're right for the job. "Just like any job," Mamaril explains, "they have to go out there, contact professors, ask them for opportunities to work in their research."

But given the large percentage of engineering undergrads doing research, it appears that a large number of the researchers do take a chance on undergrads. In fact, Mamaril states, “I think the culture of the college has grown to be very supportive of undergraduate research.”

Nupoor Gandhi with her poster at the ISUR poster session. Nupoor participated in both the MUSE program as well as the ISUR program.



Nupoor Gandhi with her poster at the ISUR poster session. Nupoor participated in both the MUSE program as well as the ISUR program.

As proof of the positive college climate regarding undergraduate research, a number of grad students have chosen to bolster undergrad exposure to research via Mentoring Undergraduates in Science & Engineering (MUSE). In its 3rd year, the program is run by Mamaril and Rhonda McElroy in Engineering’s Graduate Programs Office. Usually 20–30 undergrad students are being mentored by engineering grad students annually.

Another program Mamaril coordinates is Engineering’s Illinois Scholars Undergraduate Research (ISUR) program. In ISUR, participants do research related to the foci of the sponsoring corporations. Current ISUR research areas include: semiconductors, electronics, information technology, energy and the environment, chemical solutions, agricultural biotechnology, and health. Current ISUR sponsors include: the Semiconductor Research Corporation; Intel, Shell, Dow, John Deere, and Rockwell Collins.

In 2017–2018, ISUR provided scholarships for 36 participants, who conducted research in one of the above areas for two semesters.

How might an interested engineering undergrad become an ISUR scholar? It’s a bit of a process. For one, the program is not necessarily an incentive to entice students to get their feet wet in undergraduate research, but is more of an encouragement for those who have already done so. For instance, a student must first seek out a researcher in his/her area of interest, who, of course, must be willing to invest in the student. Next, the undergrad must be trained in the lab’s research until he or she becomes a contributing member of the lab.

Another ISUR criterion is that only a student whose proposed research area dovetails with the program’s predetermined areas of research can be funded. For example, ISUR sponsors are very specific; they only support students who work on projects that fit their list of categories. So the office makes a general call for proposals through its website, listservs, departments, and undergraduate program directors or associate heads to help spread the word, announcing the specific areas on which ISUR research will focus.

Once a student has determined that his/her research aligns with an ISUR sponsor’s, the next step is to work with his or her graduate or faculty mentors to write a research proposal. This is now a requirement when one applies to the program. It wasn’t in the past, but by the time students had gotten into research groups and gained skills, the semester was already halfway over. So it was decided that the proposal should be an application requirement.

While research is a key component, ISUR is about more than just the research. In the fall, ISUR participants take an undergraduate research seminar class (for credit) comprised of lectures; panel discussions; and group activities, such as peer reviews or mock presentations.

“We try to get students to feel what it's like to be a researcher by developing their communication skills,” Mamaril explains.

ISUR scholar Amber Boyce, a Chemical Engineering senior, presents her research at the ISUR Poster Expo.

According to Mamaril, the students prep the entire fall semester for the program's poster expo in April, the culminating event of the year-long research experience. This year's ISUR Poster Expo took place on Wednesday, April 18th, during which 26 of the 36 2017–2018 ISUR participants (ten graduated back in December) presented posters about the research they've been doing over the last year.

But the students' ISUR research experience doesn't have to end there; they're allowed to renew or continue participation in the program after their first two semesters. According to Mamaril, students who reapply either go deeper, focusing on another outcome or objective of their current project, or if their grad student or faculty mentor think they're ready, they might branch out into something new and actually do their own research project. She also cites rare cases where students who aren't sure what they want to do career wise might transfer to another research group in order to increase their experiences with different fields.

"I think undergraduate research experience has also helped clarify what they want to do as a career," she adds. "And we're hoping it's a STEM career!"

So why is it important for students to do research as undergrads?

According to Mamaril, undergrads usually do undergrad research because they intend to go on for a graduate degree. But she always tells students that research is beneficial nowadays even if they're not going to grad school.

She cites her own experience. She got her bachelor's in chemical engineering and didn't immediately go to grad school. But she'd done a research project her senior year, so that helped her get a job in industry.

The goal of the class is to help students to be able to communicate about their research. Part of the process is the question, "If somebody were to ask you right now, what's your two-minute speech regarding your research interest?"

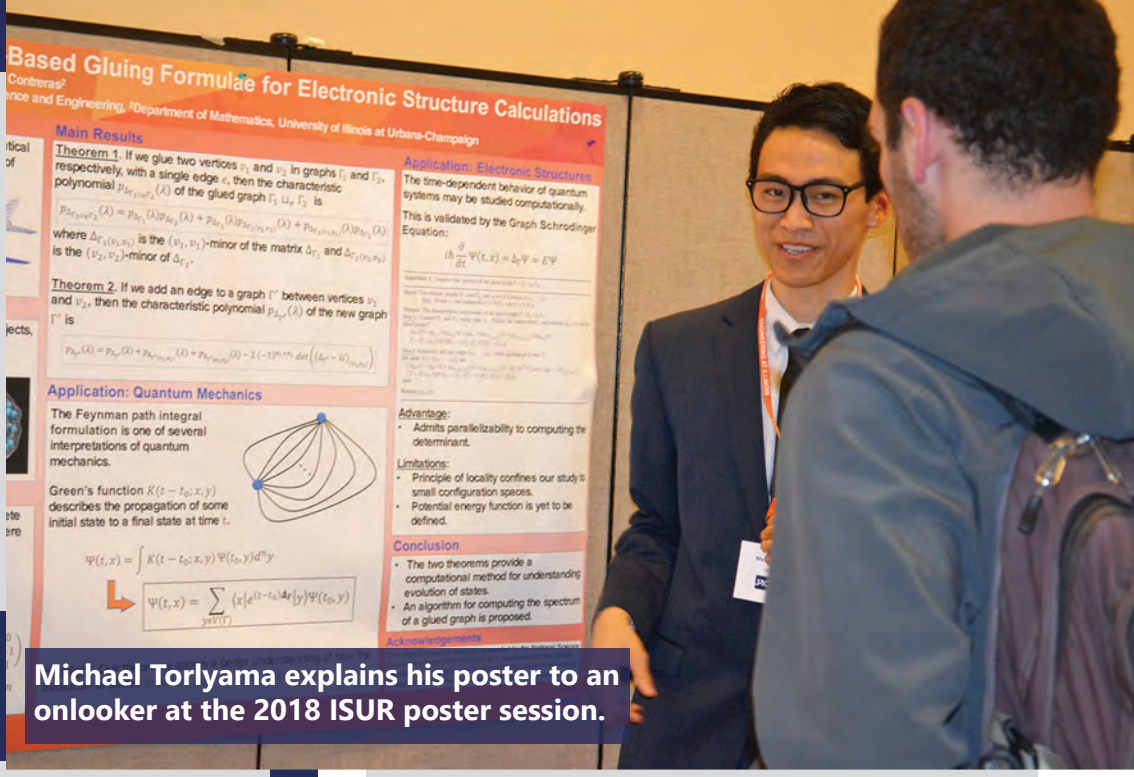
"We want them to understand what they're doing," she admits. "We don't want to be too technical about things. They understand in the beginning that science communication does not necessarily mean bombarding a person with all this jargon. We always try to exercise writing skills. They do technical summaries of articles, and they do a simplified literature review. So it's basically preparing them to understand the logical framework of research as well as training them as researchers who communicate their science."

The need for the class is quite evident at the beginning of the semester when she asks students to tell the class about their research: "I always struggle with getting students to narrow down what their research is on," Mamaril confesses. But the class evidently makes quite an impact on the students' ability to communicate. "At the end, when you ask them again, it's completely different," she relates.

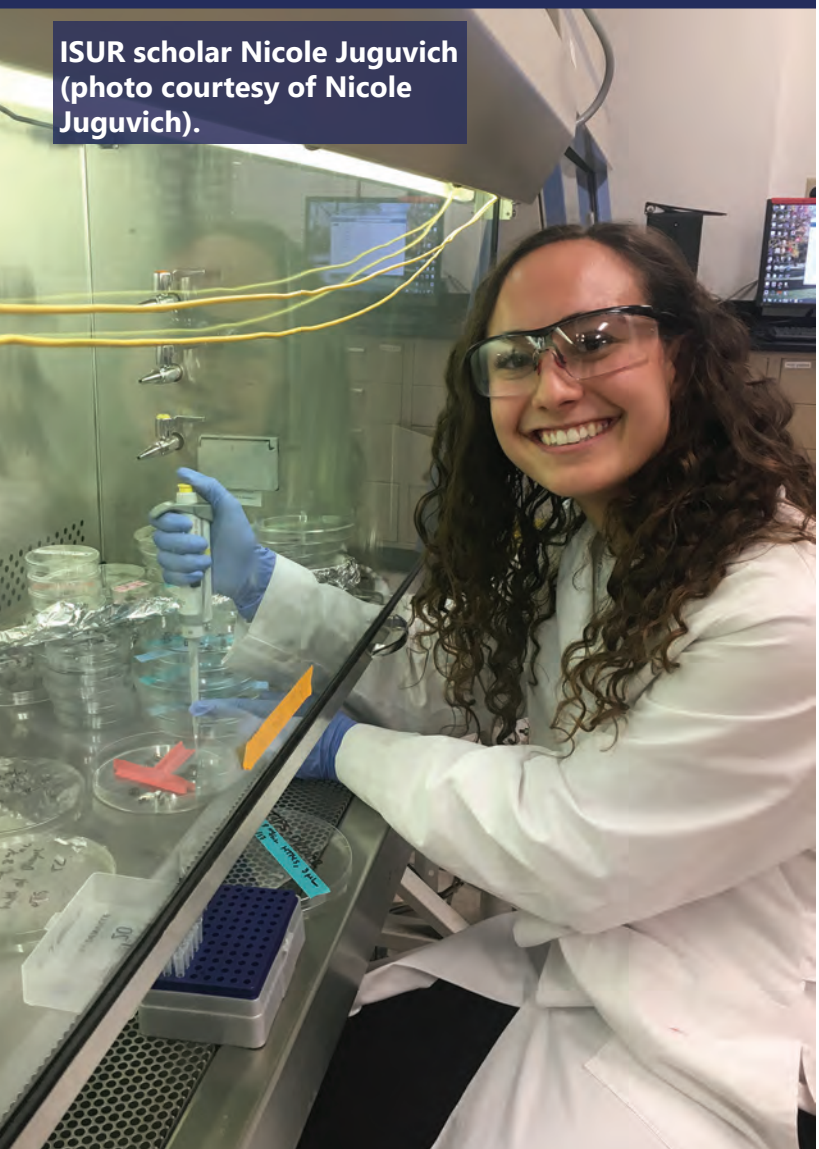
“Doing research is a way for you to develop so many skills,” she stresses, “not just technical skills or increasing your background knowledge in a specific field. But it's also about the soft skills you learn, the communication and presentations.”

But she also stresses that for undergrads set on grad school, it's:

"a very good thing to have on your curriculum vitae,” she says, “Because it's becoming more and more competitive to get into graduate programs, especially top-ranked ones. They're looking at so many amazing students with 4.0 GPAs. What's the difference? The experiences.”



Michael Torlyama explains his poster to an onlooker at the 2018 ISUR poster session.



ISUR scholar Nicole Juguvich (photo courtesy of Nicole Juguvich).

She adds that a research experience is also helpful when job hunting. According to Mamaril, during a job interview, when students are asked, "What's the most interesting thing you''ve done so far?" they’re glad if they can report, “undergraduate research,” because they've been through it, and find that it’s a topic of conversation that they can easily talk about. “It also tells employers that they have time management skills and the ability to do an independent project with structure and procedures,” she adds. "These are things we actually measure also in our program.”

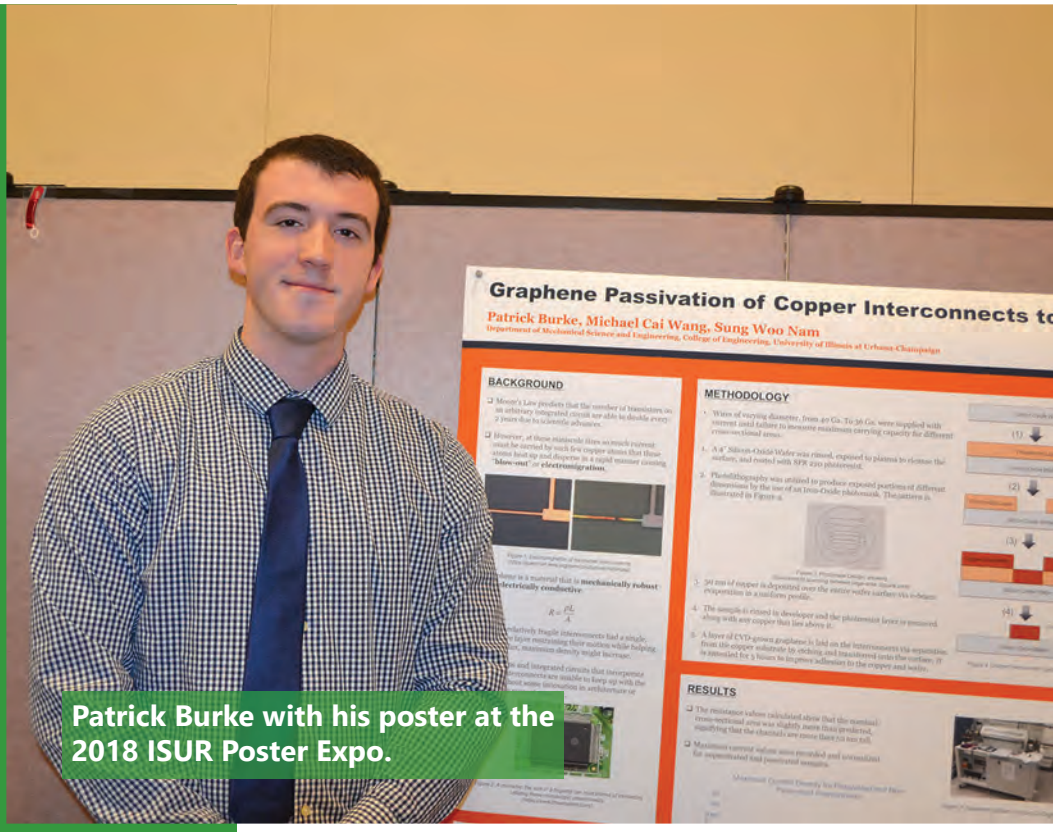
Regarding other benefits of undergraduate research, Mamaril reports that, on a learning outcomes assessment her office administers, participants said the research had helped them develop their writing skills or other things employers look at.

“You may be really smart,” says Mamaril, “but can you talk to me or write about it? Those are some of the things that we try to tell them. We try to tell them that undergraduate research is overall not just a technical skill development experience, but it's an educational enhancement in a way.”

ISUR POSTER EXPO SHOWCASES ENGINEERING SCHOLARS' RESEARCH

April 26, 2018

On Wednesday, April 18th, 26 engineering students who have been participating in the Illinois Scholars Undergraduate Research (ISUR) program had a chance to present about the research they've been conducting during the 2017–2018 academic year. For the scholars, the opportunity to do research in the lab of one of Illinois' world-class researchers not only exposed them to what research is like, but gave them a window into whether research itself, or even the topic they'd been studying over the last year, might be a part of their career plans down the road. Still others discovered that they couldn't see themselves doing research long-term.



Patrick Burke with his poster at the 2018 ISUR Poster Expo.

ISUR provides scholarships for students addressing research related to the interests of the following sponsors who fund the program: the Semiconductor Research Corporation; Intel, Shell, Dow, John Deere, and Rockwell Collins. Research areas the sponsoring corporations were focusing on in 2017-2018 included: semiconductors, electronics, information technology, energy and the environment, chemical solutions, agricultural biotechnology, and health.

In 2017–2018, ISUR provided scholarships for 36 participants who conducted research in one of the above areas for two semesters. Of those, 26 presented in this year's Poster Expo (ten graduated back in December). To find out more about the ISUR program itself, including how students are selected and additional benefits of this research opportunity, see this companion article.

Patrick Burke

What were some of the benefits students reported that they had gained from the research experience? According to Patrick Burke, a MechSE junior who has been working in MechSE Professor Sung Woo Nam's lab since the beginning of his sophomore year, it accelerated the learning process.

"I thought it was a great experience. I learned a lot," Burke says regarding being involved in research, then mentions a couple of specific areas in which he grew as a result of the research:

> **"It definitely expedites how fast I can learn compared to the classroom," he claims. He also appreciates, "just being able to look at research articles and finally understand them now that I've had experience in this group...It's been a great experience for me."**

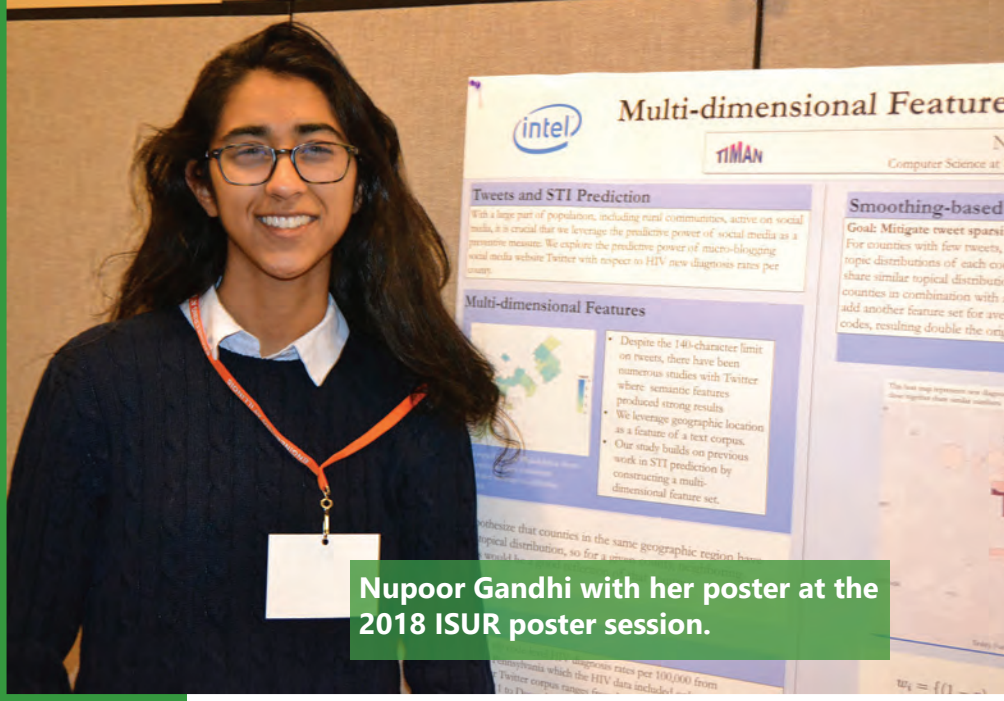
Regarding whether research might be in his future, Burke's plans after graduation include going into industry for a couple years, then maybe grad school after that.

One thing that drew him to Nam's lab and research was that it was nanomaterials devices and graphene, "which is a huge buzzword right now," he explains. Another thing that appealed to him was that it wasn't purely mechanical engineering based. Because Nam's group does a lot of graphene and material science, it allowed him to "branch out into

another area but still also stay within MechSE," Burke adds.

Nupoor Gandhi

One student who reaped the benefits of another Engineering program, MUSE (Mentoring Undergraduates in Science and Engineering), as well as ISUR was Nupoor Gandhi, a sophomore in Computer Science. She met her grad student mentor at the beginning of her freshman year as a part of MUSE, and her mentor is also supervising her ISUR research project. Funded by Intel, the project seeks to leverage social media to predict outbreaks of sexually transmitted infections.



Nupoor Gandhi with her poster at the 2018 ISUR poster session.

Gandhi reports that one challenge she encountered was that communities that aren't as active on twitter didn't have a lot of data. "So we wanted to look for other ways to represent those counties that weren't purely textual," she explains. The results of her study found that multi-dimensional features that leverage additional information were useful: "Leveraging geographic information did significantly improve our results," she states. "It improved our baseline of just purely textual information."

Another challenge she ran into was that social media is very dependent on population density. To correct that, she indicates that they "tried to use neighboring counties to kind of smooth the data for a given county. There are ways to work around it. But that is an important issue."

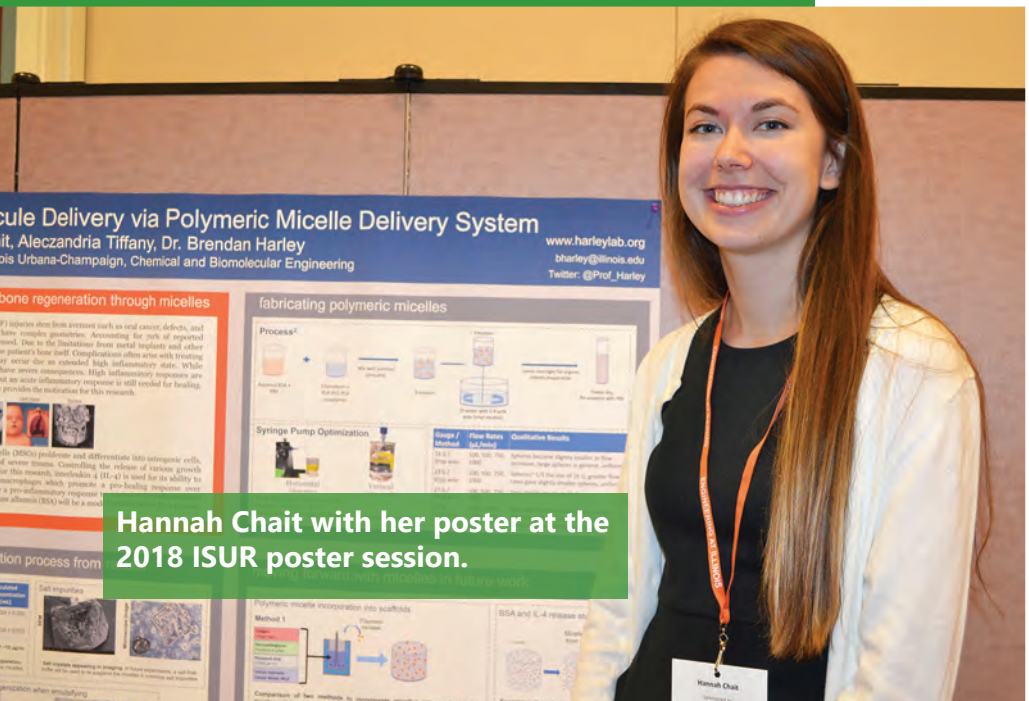
Ghandi hopes for a career in computational public policy and plans on trying to "apply pure science to improving the way that we make public policy decisions."

Regarding the results of her study, she says:

> **"using social media or using the internet in general is going to be important for any career path in data science. I think this experience has definitely been very valuable for me because I was able to learn a lot about using social media with research. So I think that's important."**

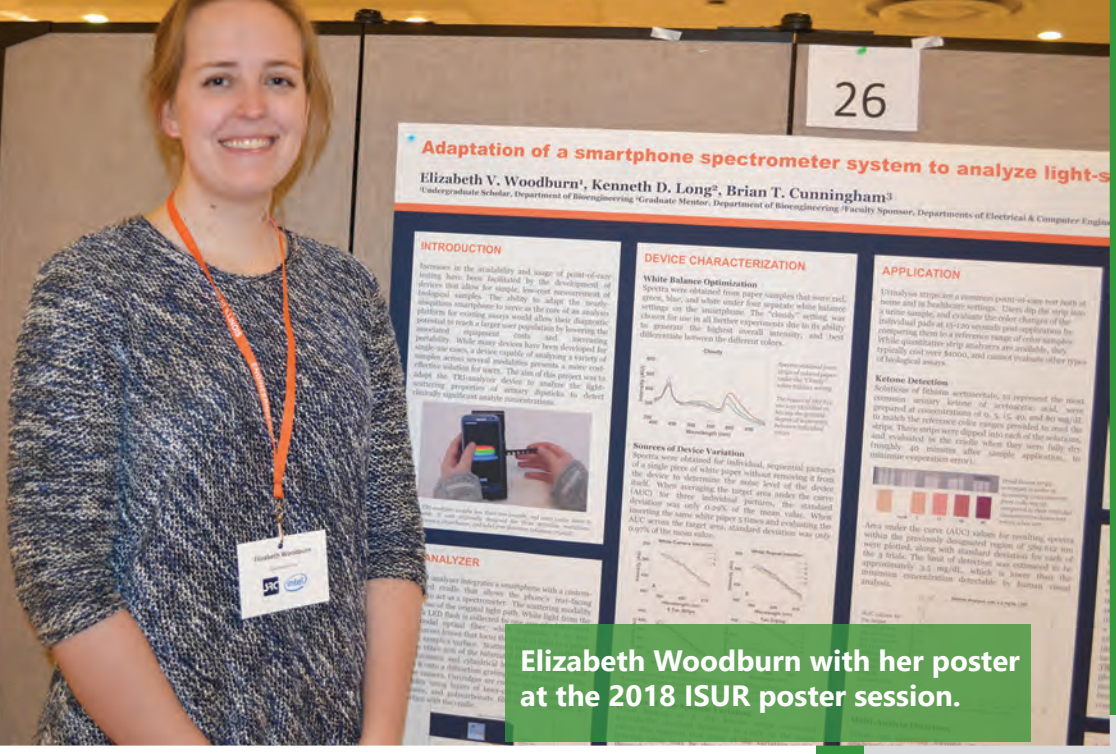
Hannah Chait

One student who learned a great deal from the experience, including that long-term, developing-new-ideas kind of research wasn't necessarily for her, was Hannah Chait, a senior in Chemical Engineering. Chait was involved in research looking at the fabrication of micelles to determine how much of a biomolecule can be incorporated into polymeric micelles. These could then be incorporated into scaffolds which would be helpful in facial bone regeneration in patients.



Hannah Chait with her poster at the 2018 ISUR poster session.

Chait has been working in Professor Brendan Harley's lab since she was a freshman. Regarding her current project, she says her graduate student, Aleczandria Tiffany, was key in helping write the proposal for the project.



Elizabeth Woodburn with her poster at the 2018 ISUR poster session.

Chait shares some of the things she learned through the research:

"It taught me a lot about how to think about problems," she admits, "and how to look at the big picture of things. With research, it can be easy to kind of get lost in the nitty gritty details, like 'I'm adding this chemical.' So being able to do that, but also look at the big picture."

Another thing Chait learned through the research? That this type of research isn't really for her. She discovered that she likes "being closer to the end goal," she explains. "This research was kind of focused on developing new ideas, which take a longer time to reach people and start impacting their lives. So I prefer research that's a little bit closer to the people."

Despite this discovery, she reports that her year of research had been a "really good experience, just seeing what I like, and what I don't like, and what areas of research I might be interested in in the future."

Elizabeth Woodburn

One student who thinks research is definitely in the picture down the road is Elizabeth Woodburn, a senior in Bioengineering, who has been doing the same research project in Professor Brian Cunningham's lab during her entire career at Illinois. Her research? A smart phone bio-sensor platform for affordable mobile detection of different diseases and conditions.

Woodburn explains how she got involved in the lab. After perusing the BioE website, she sent an email to Cunningham, whose research looked interesting to her, asking if he was looking for an undergrad. She reports: "I got lucky on the first try!" She adds that she was paired up with a really great mentor, wrote a proposal, and has been part of ISUR since the second semester of her freshman year.

Regarding working on the same project for the last four years, she reports:

"It's been really neat to see the continuity of it; I've worked on little bits of a lot of different parts of it, so I've seen it come together."

Equally rewarding was the fact that she's listed on a publication featuring the work.

Woodburn is headed to the Carle Illinois College of Medicine this summer, and plans on doing an MD/PHD.

It'll be interesting," she acknowledges. "It's the first engineering-based college of medicine, and I'm excited because it'll be very case-learning based with lots of hands-on applications."

What skills has she gained? "I think the longitudinal exposure to the same project has been really cool, starting with more basic skills, then slowly got to move into designing experiments, executing them." She adds that having the same graduate student for three years has been "really, really wonderful, because he's been able to facilitate that growth. And now I'm at the point where I'm checking with him once a week and running my own experiments."

Amber Boyce

Like Chait, Amber Boyce, also discovered that would prefer short-term research projects. Another senior in ChemE, who also works in Professor Brendan Harley's lab, she began doing research there her sophomore year. After she graduates,

she's working for Clorox Corporation doing research on consumer products.

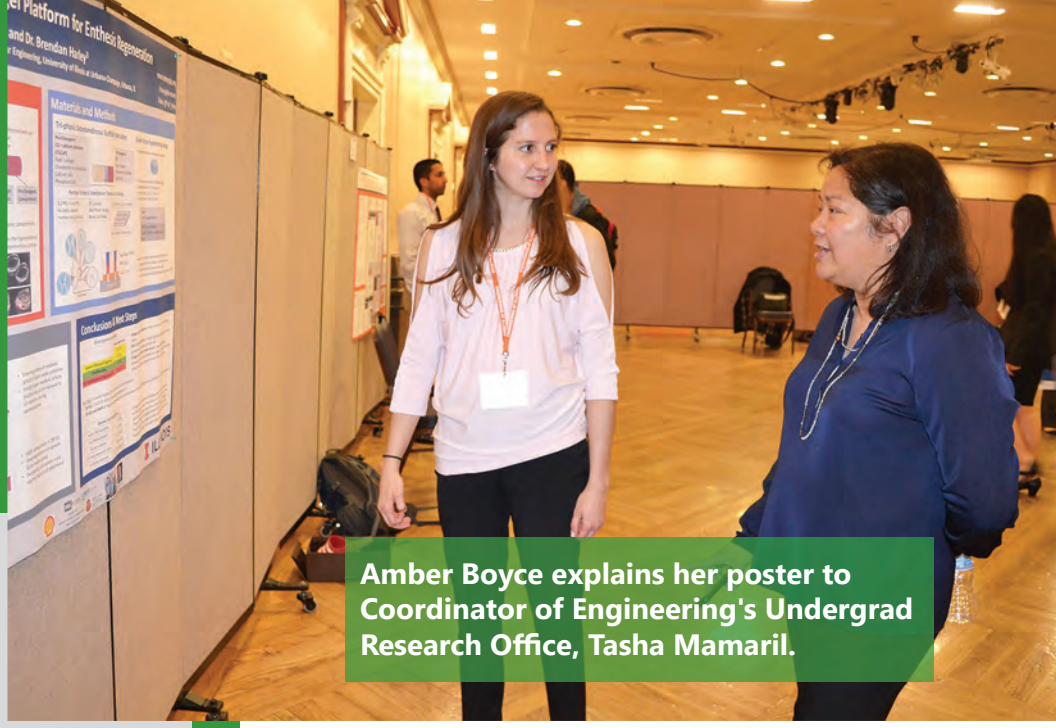
Amber Boyce explains her poster to Coordinator of Engineering's Undergrad Research Office, Tasha Mamaril.

According to Boyce, one of the biggest challenges she faced during her research was working with cells.

"We seeded cells into our scaffolding," she reports, "and the cells are really finicky; if you use expired components to make the media that feeds them, they just die. If ethanol gets spread into the container, they die. So I think that's maybe the most challenging, because then you have to spend a week or two growing them old enough to use again. So you could be set back several weeks just if you make a little mistake."

So one thing she learned was: "There's a lot of sterile techniques to not kill the cells," she reports.

Boyce indicates that while her ISUR research was more long-term and might not be applicable for decades, the research she'll be doing at Clorox will be more short-term, such as two-year projects, where she'll be "trying to improve the products that they have in order to solve consumer frustrations."



Amber Boyce explains her poster to Coordinator of Engineering's Undergrad Research Office, Tasha Mamaril.

So the next bottle of Clorox that you buy, if you notice that it smells better, you might have Boyce to thank!

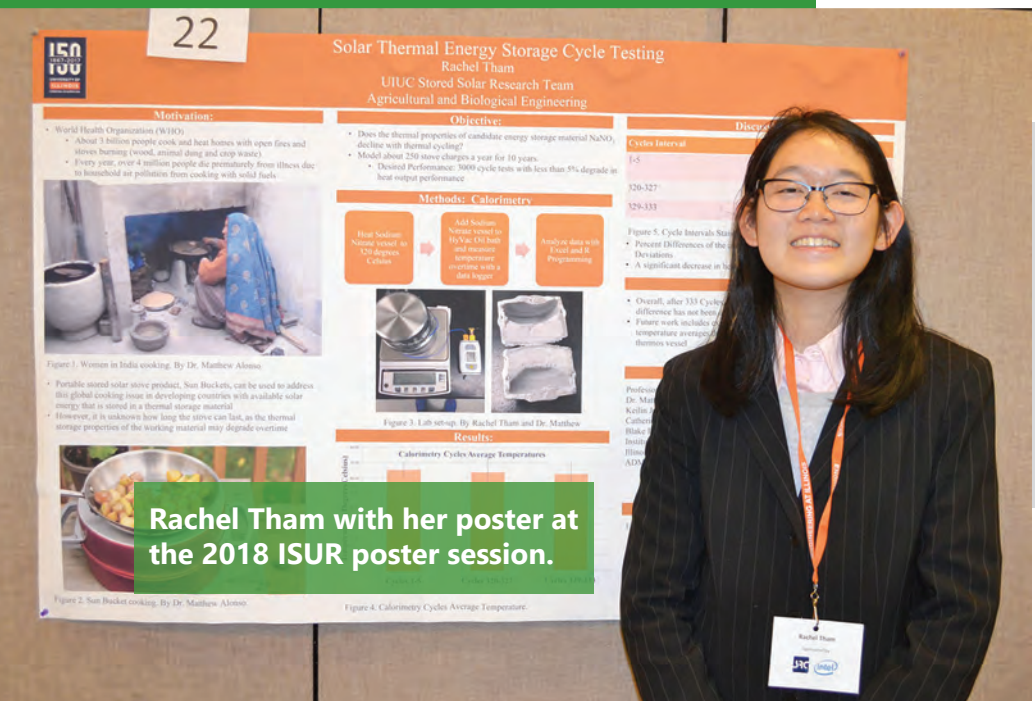
Rachel Tham

Rachel Tham, a sophomore in Agricultural and Biological Engineering, did a project testing the number of times the salt in a sun bucket could be heated and cooled to determine at what temperature the salt might not be as efficient. Tham has been involved with research since the first semester of her freshman year.

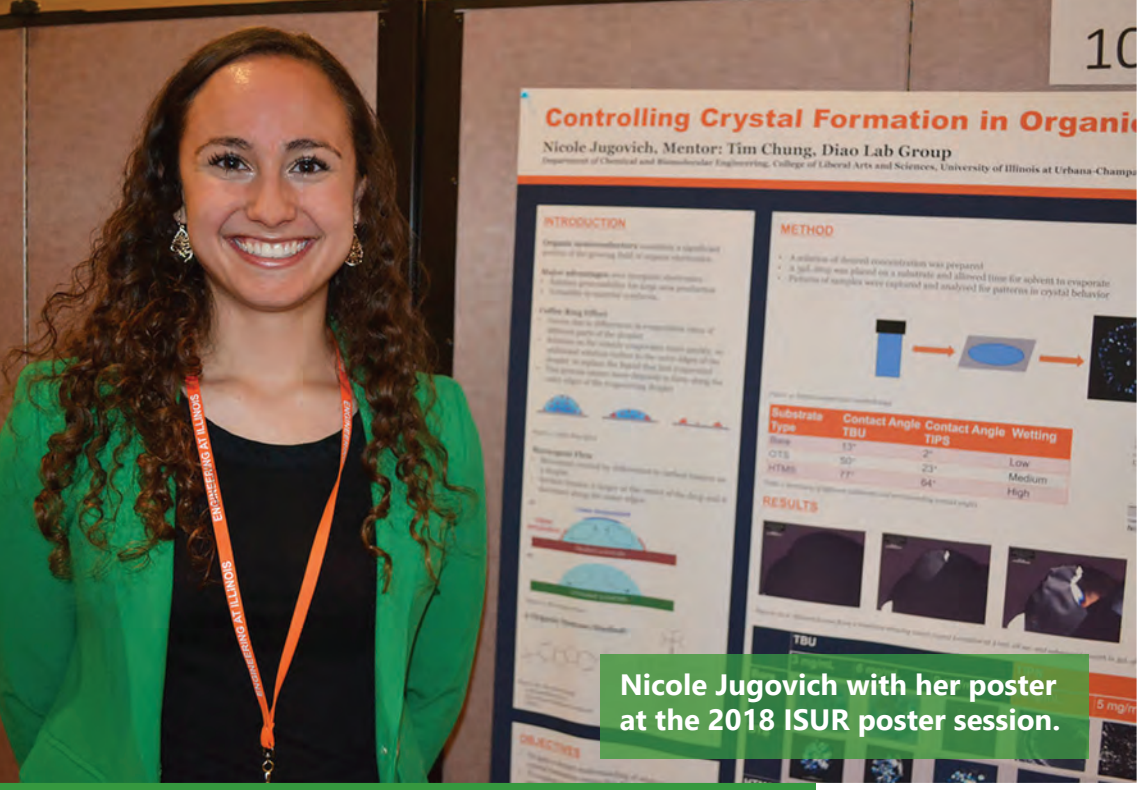
Remarking that she's a "big picture/concept" person, Tham indicates that "being able to work with the salt, especially the materials science part of it," really attracted her to the project. In addition, she was also drawn to improving the performance of the product, because it was both ecologically friendly and uses sustainable energy. She says she was excited about:

"the potential of sun buckets in not only helping to decrease the pollution of cooking with wood, but also being able to empower women in developing countries who need this kind of product in cooking sustainably."

Another reason the project appealed to her is because she's interested in



Rachel Tham with her poster at the 2018 ISUR poster session.



Nicole Jugovich with her poster at the 2018 ISUR poster session.

a career in energy storage and renewable energy, "And this project is related to that," she says.

What are some things she's learned doing research? "When you're in class, you're learning a lot of theory and equations…I felt that a lot of it wasn't really applied towards my research, in that even simple equations can be complicated in real life."

She also learned, "You don't need fancy tools to do valuable research, and realizing that you can apply anything around you and question about it is also really valuable."

Nicole Jugovich

Nicole Jugovich, a sophomore in Chemical Engineering, claims her ISUR experience, which was her first time doing research, "Very exciting!"

Her research project consisted of controlling and optimizing a simple drop-casting method for producing single crystals. Important because they're best for conductivity, these crystals could eventually be used in organic electronic devices.

She shares why she got involved with ISUR:

> **"Basically, I was always interested in further developing my lab techniques and just seeing what it's like to research and if I would be interested in doing that as a career. I feel like the only way to find out is to try it. And I like challenging myself to grow."**

What did she think? "I really liked it! I'm looking to continue researching next year as well."

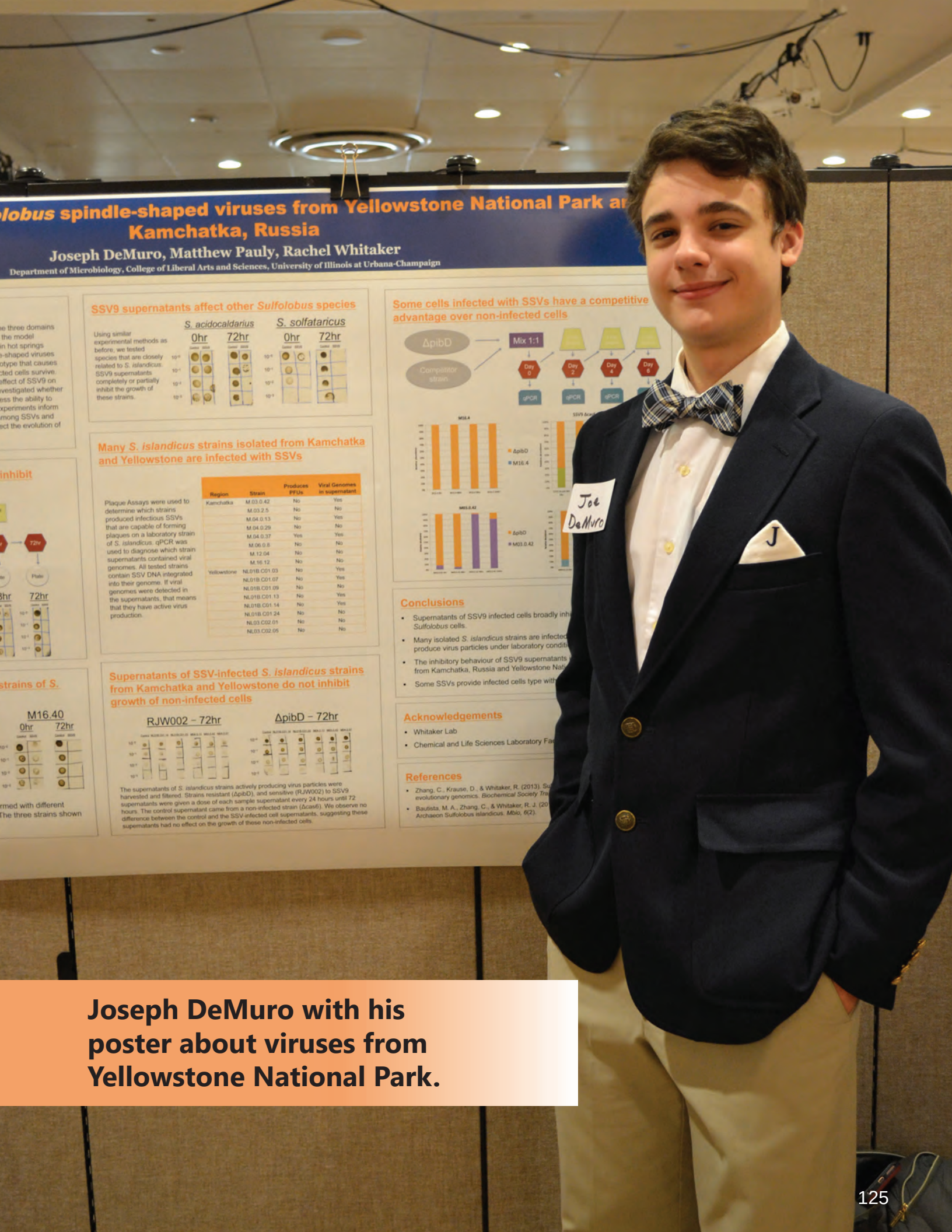
While her current grad student mentor is graduating, she's choosing to see the silver lining: "I'm excited in a way about that, because it allows me to learn about somebody else's project and explore different realms of research. I'm optimistic about just trying something new!"

Jugovich reports that one of the benefits of her experience was honing her lab techniques: "I was very clumsy with using tweezers, for example," she admits. "When I first starting using them, my grad student was like, 'Um, I see you don't have much experience using tweezers. You're holding them like you hold chopsticks or something.'" But Jugovich reports that, "Yes, I can do that much better now!" She reports that she's also much better at using the microscope, and that she understands how it works.

She indicates that she also learned a lot about problem solving and trouble shooting. For example, she detected that she and her lab mates were using a bad batch of molecules. She noticed that it was "more powdery" than a previous batch, wondered about it, and they ended up discovering that it was a bad batch and had to throw out a test. "That whole thing was a learning experience," she reports. "But it was kind of a frustrating time, because we were trying to figure out what we were doing wrong." But she recalls that it was a "good lesson in perseverance and trying to troubleshoot."

Regarding her career plans, Jugovich's career goal is to start her own line of more natural and affordable makeup. But she believes her research experience will better prepare her:

"I think that having experience, having done research will be valuable to me. In order to best achieve her goals, she believes it's important to understand what everyone who works for her will be doing: "So that's what I think is so special about having done research; it's going to allow me a lot of different perspectives."



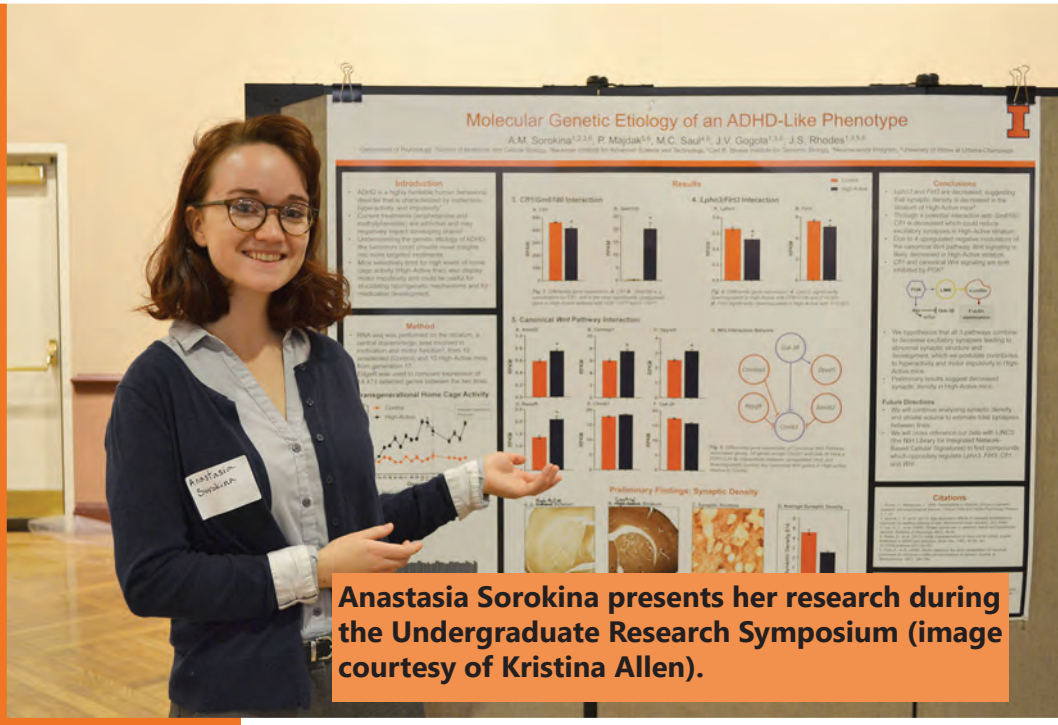
Joseph DeMuro with his poster about viruses from Yellowstone National Park.

UNDERGRADUATE RESEARCH WEEK SHOWCASES ILLINOIS UNDERGRADUATE STUDENTS' RESEARCH

May 1, 2018

"The research process includes presentation; that's something you need to learn how to do!" – Karen Rodriguez'G

As part of their research experience, around 1000 undergraduate students from across campus got a chance to hone their presentation skills during Illinois' fourth annual Undergraduate Research Week on April 15th–21st. Students from a variety of disciplines across campus presented the research they've been conducting over this past semester or academic year. While the week featured a variety of events showcasing research or capstone projects in a number of units, its signature event was the Undergraduate Research Symposium, where the students who presented shared that along with learning a great deal about their topic and specific research methodology, their research experience also gave them insight into what they might want to do careerwise.



Anastasia Sorokina presents her research during the Undergraduate Research Symposium (image courtesy of Kristina Allen).

Touted as a "celebration of student innovation and excellence in research," Illinois' Undergraduate Research Week (URW) spotlighted the numerous Illinois undergraduate students involved in research across campus.

Hosted by the Office of Undergraduate Research (OUR) and sponsored by the Provost's Office and the Stevick Foundation, the week featured open houses, poster sessions, expos, presentation of capstone projects, and symposia. The pièce de résistance of the week was the 11th annual Undergraduate Research Symposium (URS) at the Illini Union on Thursday, April 19th.

While plenty of STEM (Science, Technology, Engineering, and Mathematics) topics were represented, Research Week also highlighted work done in very diverse disciplines across campus, so not just STEM; but education, social sciences, and human behavior; health and wellness; and even traditionally non-STEM areas such as English, performances by Fine and Applied Arts students, and Architecture students' capstone projects.

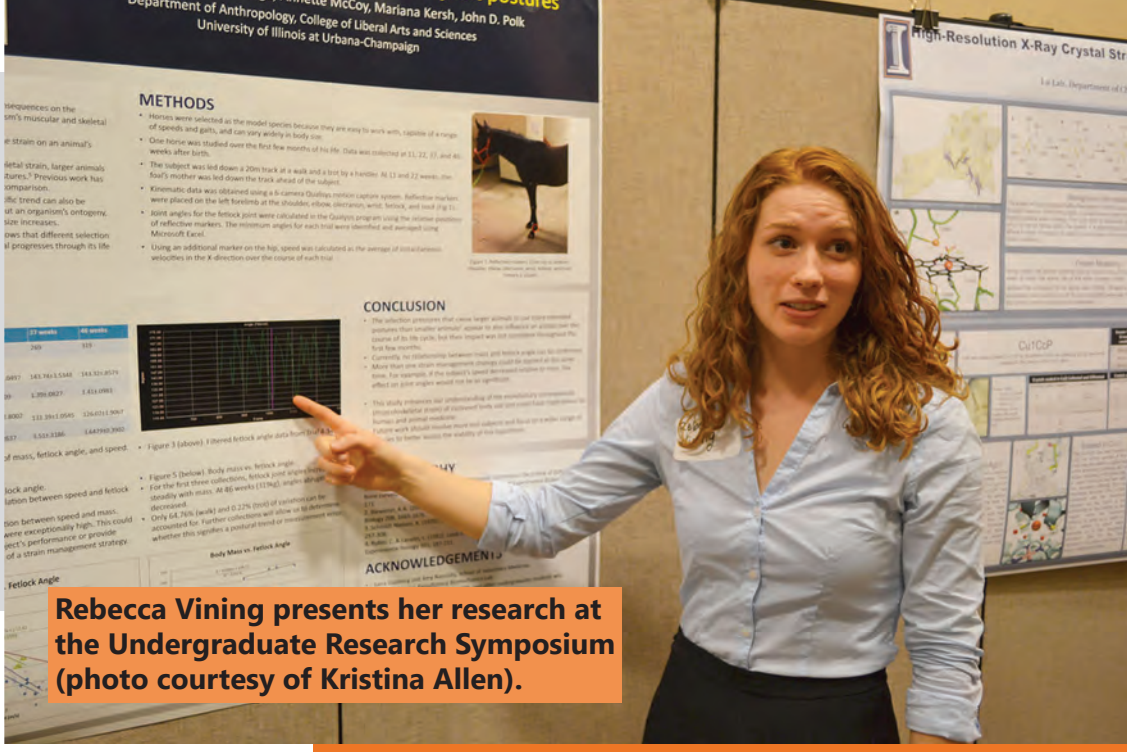
A week showcasing research, especially featuring offerings from such disparate disciplines, begs the question:

> **"Just what is research? Must it always involve someone garbed in a lab coat and safety goggles hunkered down over a microscope, or armed with a pipette and surrounded by a colorful array of test tubes, or working under a fume hood?"**

This is the mental image many of us have of research.To broaden this somewhat limited paradigm, Karen Rodriguez'G, the Interim Director of the university's Office of Undergraduate Research, has coined the term, "creative inquiry."

She and her staff, who grapple with this question on a daily basis, have been working over the last several years to not just broaden the definition but to expand the opportunities, so not just students in STEM areas or the humanities but other areas, like the arts, have a chance to do research or capstone projects.

“It’s a question for us when we’re rewarding research programs, because how we evaluate them is going to be different and should be different than someone even in the humanities, which can still be a very science-oriented idea,” she admits.



Rebecca Vining presents her research at the Undergraduate Research Symposium (photo courtesy of Kristina Allen).

So to gain a broader perspective, they’ve approached faculty from, say, dance or drama, in regards to what creative inquiry might look like in some of these disciplines.

In fact, the idea for Undergraduate Research Week actually came out of what OUR staff perceived as a need to open it up so more disciplines beyond the STEM disciplines could become involved.

According to Rodriguez'G, the Undergraduate Research Symposium itself wasn’t often a useful venue for some disciplines, such as dance and music performance. So she and her staff began asking themselves:

“What can we do to support and publicize the kinds of research students are doing that isn’t always going to show up at the Symposium?”

So they came up with a week-long celebration of undergraduate research on campus, which would include other events in addition to the Undergraduate Research Symposium, such as the Political Science Honors Symposium, and provide a way for disciplines, such as Architecture, to exhibit students’ capstone projects—things that would be difficult to do at the Symposium. In addition, holding events featuring departments or programs would also provide a ready audience.

While some units already had capstone events and just switched them to Undergraduate Research Week to bring them under its umbrella, others were new events departments or units created specifically for Research Week to feature their programs, such as some of Fine and Applied Arts’ events.

Rodriguez'G reports that throughout the 4-year history of the Research Week, some units have been involved every year, while others have participated sporadically.

The crown jewel of the Week, of course, is the Undergraduate Research Symposium. In its 11th year, the Symposium was begun in 2008 and has grown from 125 students the first year, to 250 students when the Undergraduate Research Office was created four years ago, to 800 students all total, with 400+ students presenting posters and the rest doing other types of presentations.

“Every student who has actually done research, we’ll give them a place at the symposium,” Rodriguez'G says. To ensure that the projects are actually research, students must submit abstracts, which her team checks to make sure it's research.

Besides posters, students also give oral presentations. In fact, Rodriguez'G and her staff believe it’s important that students be able to present to a general audience. “It’s easy to present in your field,” she says. She then goes on to describes a scenario where a student is “talking about something that’s super technical, but has a judge or a member of the audience who’s sitting there going, ‘What are you talking about?’”

To prevent this, she and her staff provide a number of workshops on both poster and oral presentation to help the students think about “How do you tell your story? (whether it’s visual media or an oral presentation), or “How do you create a poster that is interesting and esthetically pleasing, for instance, so there’s a balance of things and it’s not so text heavy?”

While she acknowledges that the Symposium is not a national conference and is a bit more low key, “It’s still a professional conference,” she indicates, explaining that students are:

> **“going to be acting as scholars, talking about their research. So I think, really, that’s what the Undergraduate Research Week and Symposium mean, is that it’s not just about students doing research, they actually need the whole range about what it means to be a scholar.”**

One aspect of the whole range to which Rodriguez'G is referring this: “The research process includes presentation. That’s something you need to learn how to do!”

One of the around 400 undergraduates who both learned about the research process, did a research project, and got to practice presenting via a poster was **Alex Navarre**, a senior in physics who has also worked closely with the astronomy department. Navarre started doing research his sophomore year and has been involved for the last two years. His research looked for gravitationally-lensed blazars in space to study how the earliest galaxies in the universe formed.

Navarre says he’s learned a great deal through his research:

> **“Everything from coding abilities and new coding languages, to how the professional scientific community works, to how I’m supposed to give talks, to what is expected of me in grad school, to how to build things with carbon fiber. I could go on!”**

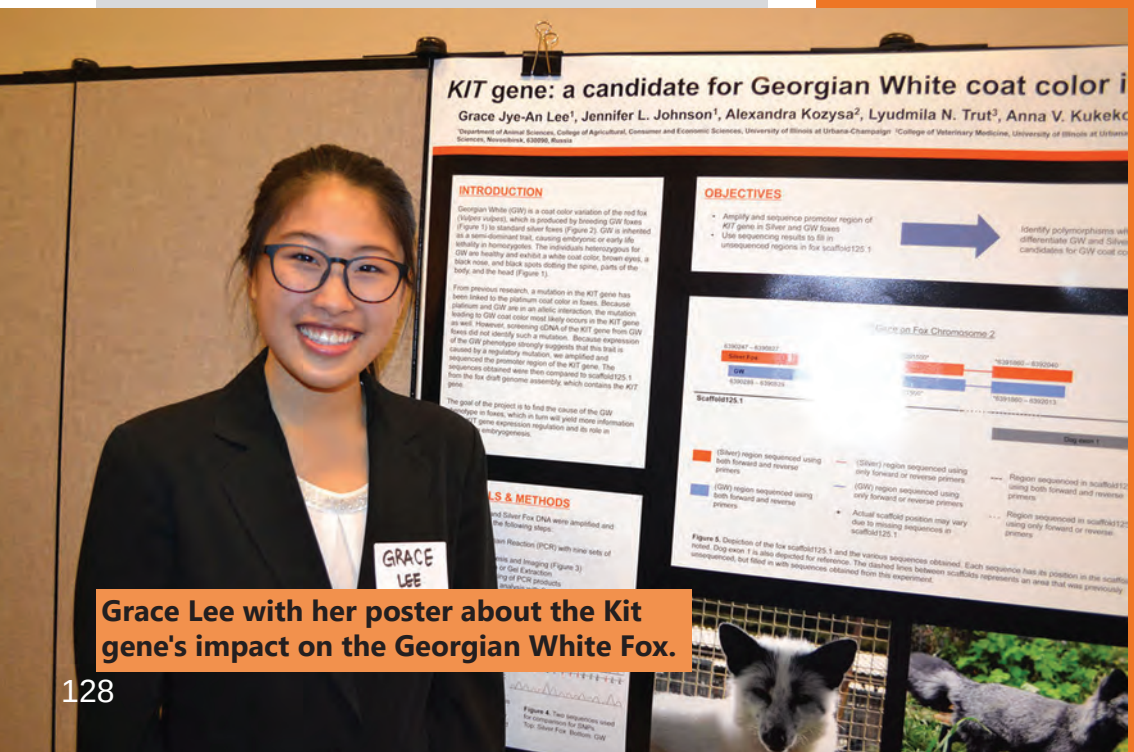
Of course, he’s also learned a lot about early galaxies: “I think it’s really cool that I can talk about all of these things, like super-massive galaxies and things that are far back in time, and be like ‘Yeah, I know about that.’”

Navarre plans to continue doing research in the future and has been accepted into grad school at the University of Cincinnati where he will be doing data analysis for an astrophysics telescope called BICEP.

Another student who presented her poster at the Symposiuim was **Anastasia Sorokina**, whose research looked at the genetic etiology of ADHD-linked behavior in a mouse model. Her preliminary results showed that ADHD-linked mice have decreased synaptic density. Sorokina says she picked this topic because she’s “really interested in neuroscience and specifically behavioral neuroscience.” Because she’s coming from an MCB background, she admits wanting to “incorporate the stuff I learned in MCB regarding genetics into a question that is broadly associated with behavior, like ADHD.”

Undergrad **Cora Low** reports getting involved in her research through the Ethnography of the University Initiative (EUI), which promotes student research about universities and colleges as complex institutions. Initially for a class, the research topic she picked looked at how international students integrate socially on the university campus. “Basically, I found five ways that they can do it,” she reports. “The most effective way was through the classroom, where they make friends with their classmates then hang out outside of class.”

One student who learned a lot about genetic sequencing through her research topic, but also learned that she didn’t want to do research as a career, was **Grace Lee**, a senior in Animal Sciences. For Lee, it was not only her first time presenting at the Symposium, but her first time



Grace Lee with her poster about the Kit gene's impact on the Georgian White Fox.

doing research. Lee's research investigated the cause of the Georgian white coat color in red foxes through genetic sequencing. She reports that she learned a lot:

"Previously, I didn't have any experience in genetics, or I had no idea how to sequence things," she explains. "So they threw me into the lab and taught me how to do it and led me along the way until I was able to push myself forward and go in my own direction and do things myself. So I got to learn a bunch of new techniques, like sequencing."

Karen Rodriguez'G, Interim Director of the Office of Undergraduate Research (center, foreground), listens as an Illinois undergrad presents her research durng the Undergraduate Research Symposium.

Lee believes her research opportunity was a great way to learn outside of class and to apply what she learned in class.

She reports:

"This is why I do better and better in classes. I apply what I learn in my research to classwork. The research helps stick the information in your brain. If you're just learning out of your textbook, yeah, you're learning it, but when you apply it, you remember more ways to learn, and it's better."

Lee says her career goals are still up in the air right now. "I'm planning to take a gap year to figure it out. But definitely still a science route, because I still have a big passion for science."

Another important thing she learned through the experience was that she doesn't necessarily want do research. "Not that I don't love it," she admits, "but it's just because I have a different future envisioned for what I want to do."

It wasn't just the undergrads who found undergrad research to be rewarding. According to Rodriguez'G, one of the most rewarding things about the program is watching students grow, "Watching them go from, 'Oh, my God! What is this?' to 'I'm so excited!'"

She admits that early on:

"Most of them were very overwhelmed by this idea of presenting at the Symposium and developing a research project. One of the things I've seen this last week as they were preparing to present at the Symposium, is the fact that they're actually seeing it come together, and they're so excited and proud of themselves!"

She reports that, looking back to the beginning of the semester, "It all seemed so overwhelming, and they had no idea what to expect. And now, they see themselves as researchers in a very real way," she claims. "And that seemed like a very far-off thing for them at the beginning of the semester."

Adds Rodriguez'G, "For me, that's one of the things that I find so fulfilling, is watching them grow, seeing what they're doing, helping them along the way."

RESEARCHSTART PROMOTES THE NEXT GENERATION OF SCIENTISTS BY EXPOSING LOCAL HIGH SCHOOL STUDENTS TO CANCER RESEARCH

May 9, 2018

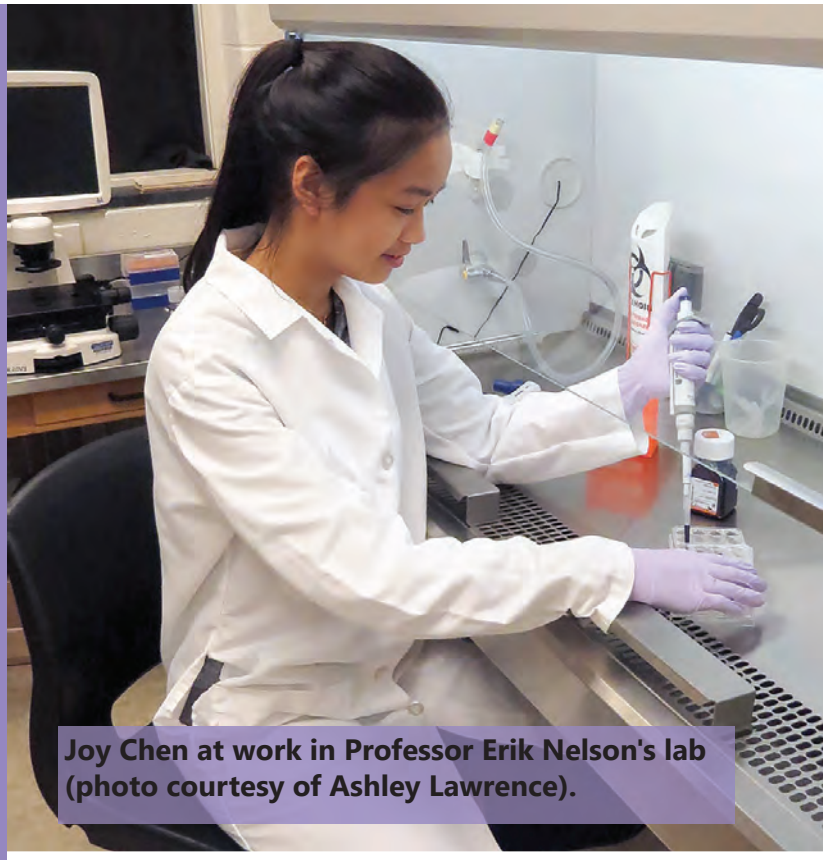
When the American Cancer Society discontinued its program exposing high school students to cancer research in laboratories, philanthropists Deborah and Ira Cohen, he's an Illinois CS alumni and she's a huge advocate for cancer research, said to each other: “I wonder if we could do something about that?” So they did. In 2015, they began researcHStart, a program which allows Illinois high school students to discover what a career in cancer research might be like via authentic research experiences in cutting-edge laboratories at Illinois and other campuses in the state.

To ensure that Champaign-Urbana students had a chance to experience cancer research at his Alma Mater, the Cohens reached out to Rohit Bhargava, Illinois Bioengineering professor and Director of the Illinois Cancer Center to be one of the founders, and researcHStart at Illinois was born. Originally implemented at the University of Illinois at Urbana-Champaign (Illinois), University of Illinois at Chicago, and University of Chicago, the program recently added a fourth partner, Northwestern University in Chicago.

The main emphasis of researcHStart is to give high school students from Chicago and Champaign-Urbana the chance to explore careers in cancer research by working full time in the laboratories of established cancer researchers on a nearby campus. Students not only gain hands-on experience in areas at the forefront of cancer research, but experience rigorous research training, lectures by cancer research faculty, and also network with faculty and mentors dedicated to helping them grow as researchers.

In addition, ResearcHStart may also be impacting the number of underserved students (especially women) in the field. For example, at Illinois, a large number of researcHStart students have been females. In the first year, all four were female; in 2016, there were four males and one female; in 2017, six were females while two were males. The incoming 2018 cohort is six females and one male.

Of course, the main focus of Illinois' researcHStart program is students getting to experience research



Joy Chen at work in Professor Erik Nelson's lab (photo courtesy of Ashley Lawrence).

with some of Illinois' world-class faculty on the cutting edge of cancer research.

“Our faculty are just amazing,” says Paloma Pearson, Coordinator of Illinois’ researcHStart program, referring to the eight faculty who currently participate. From five quite diverse departments (Animal Sciences, Bioengineering, Electrical and Computer Engineering, Molecular and Integrative Physiology, and Food Science and Nutrition), they are all part of the Cancer Center at Illinois.

Just as diverse as their departments is the cancer research they do. “It’s not all putting cancer cells in a petri dish and pipetting,” Person says. There are animal models, computer simulations, dialectics, and bioimaging. She says the program hopes to fly in the face of the notion that cancer research is:

> **“A white lab coat, and I’m going to sit there with my little pipette—that’s not how science is, especially at this university with such a focus on engineering. It’s not the only way to do cancer research,” Pearson explains.**

So the program seeks to expose students to the breadth of cancer research that's available.

"If you haven't been exposed to it, or if you think science isn't your forte, you might not know that all this happens," she admits. "I think they really want to promote the next generation of scientists."

Participants also experience career development and skill-building workshops.

"Part of the program is not just sitting in a lab doing work," explains Pearson, "but it's also doing professional development so that the students can get a little bit more of a feel what it is like to read an academic research paper and how you bolster your resume."

To expose participants to another important aspect of research—sharing it with the public—students get to present their research to family, friends, and members of the scientific community at an end-of-the-summer research symposium at one of the partner universities. Plus, in addition to all of the other benefits, students receive a $2,000 stipend for the summer.

Agreeing that the research symposium experience was quite beneficial in terms of enhancing her presentation skills is Illinois Bioengineering freshman Joy Chen, who participated in researcHStart in 2017, the summer following her senior year.

Paloma Pearson, Coordinator of Illinois' researcHStart program.

"Through this program, I could go through a project from the beginning to the end and have results that I could present. I had the opportunity to give an oral presentation at the symposium at the end of the summer, and being able to share what I did with my peers as well as professors at the university was an amazing experience."

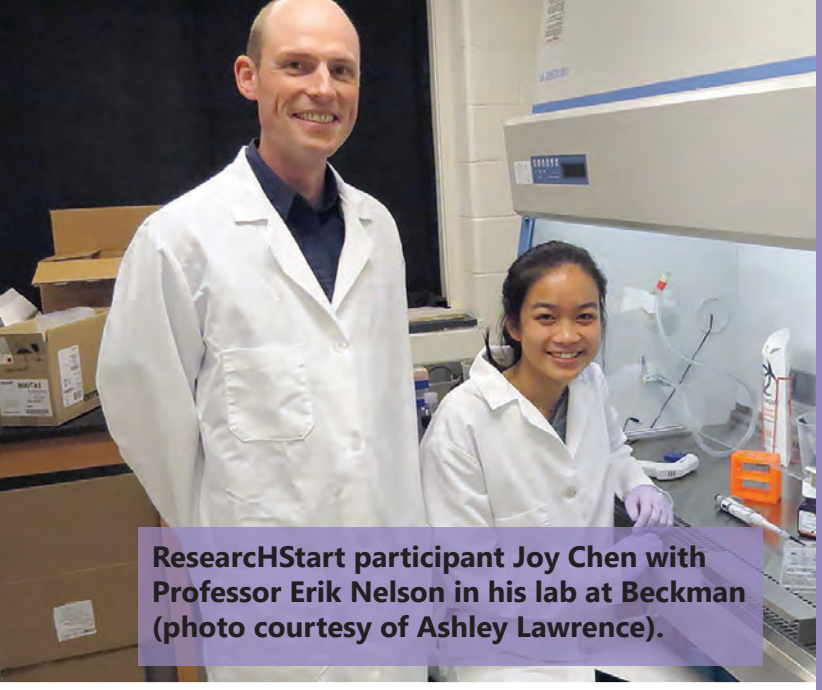
Chen's research with Professor Erik Nelson in the Department of Molecular and Integrative Physiology focused on the effects of cholesterol on breast cancer metastasis. Thus, in addition to presentation skills, she learned various foundational experimental techniques: how to use imaging technologies, plus basic lab protocols, such as RNA extraction or polymerase chain reaction. She also learned how to work with animals:

"One of the most valuable and memorable experiences I had over the summer," Chen reports, "was being able to test our hypothesis in mice. I learned how to inject, treat, and do surgery on mice. I got to use the imaging machines we have over at the Beckman Institute to check on how our mice were doing every week, which was fascinating to see."

For Chen, another unique aspect of her researcHStart experience is that it didn't end last summer: "I have been fortunate enough to continue working in Dr. Nelson's lab this past semester," she adds. "Going to lab is always something I look forward to because it's a nice break from my classes and homework. I find it exciting that I get to do research as just a freshman, working towards a larger goal that can impact the real world."

Regarding the opportunity that former researcHStart students who matriculate to Illinois have to continue working in their labs, researcHStart Coordinator Pearson is particularly pleased about it. "One of the really cool things that we've seen is that there's this continuation," she explains.

So what's the program's vision as a whole? That some participants might end up choosing careers in cancer research. Most high schoolers' career choices for the future are pretty



ResearcHStart participant Joy Chen with Professor Erik Nelson in his lab at Beckman (photo courtesy of Ashley Lawrence).

narrow—the traditional doctor or lawyer—but Pearson sees researcHStart as broadening their career possibilities.

"This gives them a taste of what you can actually do at a university," she explains, "what kind of lab work exists, but also just how fun, hard, challenging, and exciting science is. I'm married to a scientist, so I get to hear all about it."

(Her husband is a postdoc at IGB working on… cancer research.)

Has researcHStart possibly convinced some participants to consider careers in cancer research? According to Pearson, of the eight students in last year's cohort, five originally wanted to be medical doctors. In fact, she says the interview panel faculty commented: "They want to be a doctor. Do we really want them in a lab doing research?" However, by the end of the program, some had either they dropped the idea entirely, saying, "I don't necessarily know if I want to be a physician; I'd love to do research," or suggested, "Maybe I'll do both, do an MD and PhD."

This is the career goal of Joy Chen, whose plan after college is to continue on to an MD/PhD program.

"I think the research and implementation are both key to creating new therapeutics," she admits, "and I want to be a part of both of it. I want to see the research that I do to eventually get applied to engineering to create solutions and develop the medical industry even more."

And while researcHStart didn't impact Chen's decision to come to Illinois (she was already committed to Bioengineering at Illinois prior to that), she says her experience here definitely solidified her decision.

Such was the case for another of last summer's participants, Elizabeth Breen, currently a senior at University Laboratory High School. She plans on majoring in Integrative Neuroscience in college, then pursuing either an MD or MD/PHD. Breen says her research experience helped to confirm her career path.

"I knew I was sort of interested in neuroscience, but I think this really strengthened and made me sure that that was the field I wanted to go into. Because, the brain—there's so little that we know about it, and there's so many different ways that you can go really in depth into different areas of it. It's one of the fastest-growing areas of science, and I'm excited to be a part of that."

Breen worked with Animal Science Professor H. Rex Gaskins at an IGB lab studying the protein CHCHD2 in the mitochondria of animal cells. "We were seeing if knocking it out of cells would have any effect on cell respiration, specifically in human brain cancer cells." Did it? Breen says yes, cells with the protein knocked out were less viable. "Getting rid of it is good when you're trying to treat cancer cells," she acknowledges.

Breen got involved with researcHStart because she wants to do research during her college career. "I wanted to get sort of a head start on working in a lab," she says. Also, because neither of her parents are in STEM, and students sometimes need connections to land a prestigious research position in college, she also thought it would look good on her resume.

"I thought researcHStart was a great opportunity because I was going to get to do my own project, and work with a

2017 researcHStart students: Back row, left to right: Robert Forsyth, Jarron Roy, Joy Chen, Elizabeth Breen. Front row, left to right: Sarah Matatov, Yichen Yao, Malaak Saadah, Aditi Mehta (photo courtesy of Ashley Lawrence).

Ph.D student and a professor actually putting forward my own work to help the lab. So that was really what drew me to it…just being able to apply for a program like this and let my own work speak for myself."

Breen was also happy to be a part of this program because of its impact once she's in college. "It was, honestly, one of the best experiences I've had in my high school career, and I think it's put me ahead of a lot of my peers as far as being able to get these opportunities in college when I've already had this research under my belt."

Malaak Saadah, a senior at Champaign Central High School also participated in researcHStart the summer of 2017. Her study in Professor Roy Dar's lab on the proliferation and viability of cancer cells and bystander cells when treated with anticancer drugs was her first research experience.

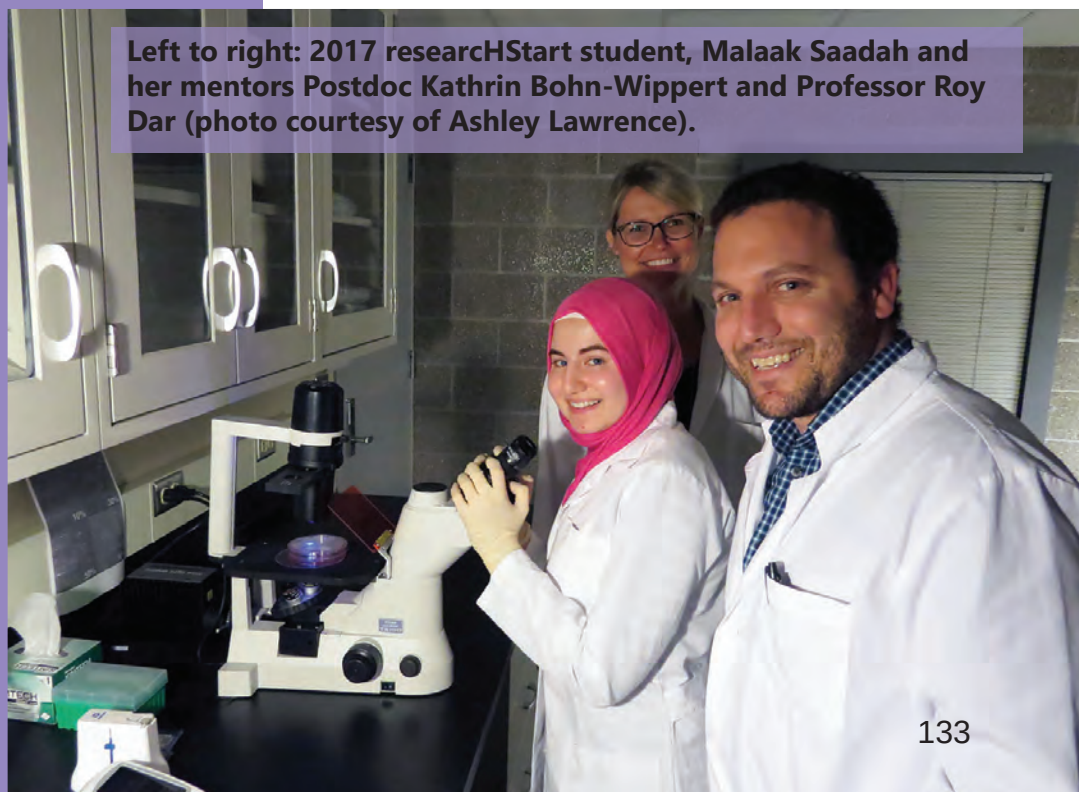
Skills Saadah gained during her research experience included learning how to use the lab equipment; basic lab protocols; plus how to grow, count, and store cells, which she calls "really cool." She learned the importance of lab hygiene, and keeping all equipment sterile and clean, "otherwise research results become inaccurate." Another skill she gained was how to analyze and organize data. Working with cells and numbers all day, she reports being "taught how to organize the information I was analyzing to make it easier to understand and interpret later on."

Plus, she learned how to efficiently present her results in front of an audience. In fact, Dar and the lab members taught her how to effectively present her results to an audience who didn't necessarily work in this field. "I think that's a very important skill and can be adapted to all aspects of my day, even as a student at school," says Saadah.

Although she's probably not going into cancer research (she's studying Civil Engineering at Illinois) she believes her experience did impact her decision because she learned more about the overall research process.

"It made me more curious about the simple things, she says. "The research that I did was in Bioengineering and although I enjoyed the learning process and the knowledge I gained, it made me realize that I'm also very intrigued in large-scale research as well."

Future prospects weren't the only thing that changed over the summer. "It's interesting to watch these kids come out of their shells," Pearson acknowledges. She calls many of the top-of-their-class participants "nerds and incredibly quiet." But by summer's end, most have newfound confidence. She relates an anecdote about one quiet student,



Left to right: 2017 researcHStart student, Malaak Saadah and her mentors Postdoc Kathrin Bohn-Wippert and Professor Roy Dar (photo courtesy of Ashley Lawrence).

Elizabeth Breen (photo courtesy of Ashley Lawrence).

who when he got up front for his oral presentation at the symposium, “He just talked, and he was animated; he was excited; he just seemed like a completely different person!”

And students become more confident in areas other than public speaking. Pearson says participants enter the program inexperienced but leave research savvy.

> **“You get this high schooler—I know if I were faculty, I’d think, ‘Oh, no, I’m going to have to baby sit this kid!’—There’s this kid; most of them aren’t 18, and they come in super scared, kind of unknowing of things. By the end of it, they’re saying words that I can’t pronounce! And they actually really understand what the science is.”**

Pearson says another rewarding thing is watching the participants’ transformation from children to adults. “You watch them grow up in eight weeks,” she reports. “I treat them like adults. You see them build their confidence. They’re working 40 hours a week. They’re treated like colleagues...but you watch, and these become partnerships.

She adds that in high school, kids don't necessarily get those dynamics. "You’re still with your parents; you have that kind of hierarchical feeling of, ‘Oh, you’re the boss; you tell me what to do.’" But the researcHStart dynamic is different. "They say, ‘No, you’re an adult, and if not, you’re going to be an adult very, very soon, and we need you to act like adults, and work like adults, and be adults!’ And you realize, everybody steps up to the challenge. And it’s really, really fun!”

Parents are astounded by their kids’ progress too. She compares parents watching their kid presenting at the symposium to “deer in headlights,” with almost a “Who is this, and what have you done with my child?” reaction. Parents have come up to her saying, “I had no idea! How can we continue this? Are there additional programs?’”

Another indicator of the program’s positive impact? Proud of their achievement, afterwards, students have requested, “Can we have our poster?” Pearson believes they’re probably on a wall in some dorm room.

She says researcHStart gives students “the responsibilities that they're going to have to have as an adults a few months to a year of them leaving the lab. That's what you give them. You empower them to be those independent individuals and investigators that a lot of them didn't know they could be. They had the idea that maybe they could do this, but could they actually do the work and deliver? They do, and it's amazing!”

Regarding the job skills gained via the program, Breen concurs:

> **“It also taught me a lot about what people expect of you when you're working, and how different dynamics work when somebody assigns something to you, and then you complete it to the best of your ability... It's like a real job, and I've never had something like that before. I was just 16/17 last summer. So it was a lot of pressure, but I think it was great that it gave me the opportunity to sort of rise to that occasion.”**

For Pearson, what’s most rewarding about researcHStart is that it:

> **“brings together a group of people who have been mostly sheltered their whole lives, and brings them into the world and says, "Grow!" I'm throwing you into something; you have eight weeks to figure this out, and only about six of them to actually do work, and do something amazing!’ You really do watch them going from a little tiny caterpillar to a beautiful person on the other side.”**

2015 researcHStart participant, Callie Miller, in the lab at the Mills Breast Cancer Institute at Carle Clinic.

I-MRSEC'S ALDA SCIENTIFIC COMMUNICATION WORKSHOP TRAINS SCIENTISTS TO RELATE TO THEIR AUDIENCE

Participants complete a folding-an-imaginary-sheet activity, which was designed to teach participants to pay attention to the other person.

May 30, 2018

"Are you doing the talk for yourself, or are you really trying to communicate? So my work is about getting people to listen and respond and relate to the other person."
– Lydia Franco-Hodges

What might fun, team-building exercises such as folding an imaginary bed sheet or carrying an imaginary plate glass window have to do with communicating? How about explaining one's research to a colleague who's pretending to be an eleven-year-old? In keeping with one of its chief goals—improving science communication—the Illinois Materials Research Science and Engineering Center (I-MRSEC)) held "Making the Choice to Connect," an all-day workshop on Friday, May 18th. Presented by Lydia Franco-Hodges from the Alan Alda Center for Communicating Science at Stony Brook University, the workshop sought to improve participants' communication skills by training them to practice relating to others.

Comprised of two sessions, the workshop's morning plenary session was open to anyone on campus, while the closed, afternoon session was for around 30 MRSEC-only researchers. During the many different exercises the workshop participants took part in, it was common to see the I-MRSEC PI and researchers, mostly full professors, rubbing shoulders with I-MRSEC postdocs and Ph.D. students as they all explored uncharted territory while participating in a number of somewhat unorthodox exercises designed to help them improve the way they communicate about their work.

One might ask, "Is this the same Alan Alda who played a rather irreverent surgeon on the television series M.A.S.H.?" It is. But Alda is also known for a more scientifically relevant piece of work, a PBS television show entitled, Scientific American Frontiers. During the show, Alda used empathy, clarity, and vivid storytelling to interview hundreds of scientists, bringing their work to life. Thus, the Alda Center, begun in 2009, was based on this second body of Alda's work, and adopted training methodologies inspired by his engaging communication techniques as he sought to bring scientific communication down to the level a general audience could understand—even an eleven-year-old.

For example, one of the workshop activities was to communicate one's research to a partner who was emulating an eleven-year-old...with an eleven-year-old's set of concerns. In an aside, lest one assume youngsters of this age group only care about friends, phones, and video games, surprisingly, a video of an interview with a group of youngsters of this age group showed some unexpected results. Besides the above interests, these fifth graders also expressed some rather selfless, more global concerns, such as the environment and sustainability, to mention a few.

The main idea during this exercise was to make a list the main ideas comprised in one's research, ostensibly mostly jargon, and then to communicate those to one's "eleven-year-old" partner without using any of the jargon.

One activity consisted of having the folks toss an imaginary ball around. Meant to foster contacting with one's audience, the idea was that before tossing the "ball," the person throwing it was to make eye contact with the person who was going to

catch it. Franco-Hodges also had them practice throwing the ball while expressing different emotions. For example, participants were to be angry or apologetic.

In another activity, participants played an old standard—Rock, Paper, Scissors. (You know, the game kids play to see who gets stuck with taking out the garbage for mom.) However, this version had a new twist; it was designed to encourage team-building by affirming the loser. So the audience divided up into pairs and played the first round. But instead of gloating when they'd won, the winner was to affirm the loser. And instead of the winner moving on, the losers moved on to play in the next round until the only person left was the biggest loser, except he'd actually won, and was loudly celebrated by the entire group.

Since the workshop was about improving scientific communication, one activity fostered coming up with creative titles. So during this exercise, researchers were to create a title describing their research, then reword it in a completely different style, such as an action movie title, or the title of a country song. One such offering that got a good laugh? “My Baby Thinks My Lasers Are Sexy!”

Another very apropos exercise had a team of 7 or 8 participants standing shoulder to shoulder. Then, in response to a suggested topic, they were to come up with a sentence, with each person submitting one word which fit in context with those spoken by all the people before them. (When one member of the team encountered a mind block, one could always resort to “and” or “the” which always got a laugh—and turned out to be quite popular words!)

One of I-MRSEC’s goals, according to PI and Physics Professor Nadya Mason, is to:

Preetha Sarkar (right) discusses her research with Ella Pek at the I-MRSEC's Alda Scientific Communication Workshop.

“Create something of a cohort of people who are effective at different levels of communication.”

While she and her colleagues are still putting together their program, grappling with, “How do we want to do this? What is the most effective way of using our resources, our time? What are our goals for the year, for the six years?”' she says an Alda Workshop had always been number one on her list.

Visiting from the Alda Center to head up the workshop was Lydia Franco-Hodges, whose training was actually in theater. She admits that she was first introduced to “scientific improvisation,” as she terms it, on joining the Center several years ago. She shares her goal in the workshop:

“My real interest, and I think Alan shares this, is getting people to be really present with one another, and to really relate to another person, and to really work on the skills of listening and bringing yourself to the conversation. And that seems so simple, but it can make a profound difference when you’re communicating and you feel comfortable enough to be able to do that. And the truth is, most of the time, we are going to feel nervous, and we are going to be maybe putting ourselves at risk, but without the ability to connect with your listener, it can fall flat.”

A participant catches an Imaginary ball activity during the Alda Communication workshop.

What brought many of the participants to the workshop? A number admitted that they don't feel particularly skillful at communicating to folks outside of their discipline.

For instance, Chris Montgomery, a PhD student in the Material Science and Engineering (MatSE), shares why he attended: "I'm interested in learning how to communicate my work to a broader audience. Generally I only talk to and present to people that I work very closely with, or are in the same field," he acknowledges.

Similarly, Mechanical Science and Engineering postdoc researcher Jangyup Son, who works in Arend van der Zande's lab studying 2D materials' heterostructures and their applications using multiple stacking and functionalization, admits:

"I want to get some training so that I can present my scientific topics to a general audience. I don't have any skills for that, so today would be very useful for my skillset."

On the other hand, Preetha Sarkar, a first-year Physics PhD student in Nadya Mason's group hopes to change the somewhat negative perception the general public has of scientists.

She indicates that she's always been interested in communicating what she does more effectively. Plus, because she believes scientists are often alienated and considered to be intimidating, Sarkar thinks more effective communication is necessary.

"I think there is no reason to think of

CEE Researcher, Sotiria Koloutsou-Vakakis.

science or scientists in that way," she continues, "so I think it's necessary that we learn to communicate what we do more effectively, so people understand that it is like everything else. This is important because it changes society's perception of science, and I think that is necessary, so I want to learn more about this."

MatSE PhD student Kaitlyn Tyler shares why she got involved with the workshop:

"Because I am interested in trying to convey science in the easiest way possible so the most people can understand it, so this is important for me to come learn."

Participants complete the Finish-the-Sentence activity at the I-MRSEC's Alda Scientific Communication Workshop.

Tyler didn't come with a specific area she hoped to learn more about, “just learning more about different ways to communicate science. So I'm just trying to gather as much information as possible.”

Regarding what she learned, Tyler says, “How important an audience is,” then goes on to explain what she gleaned about how to connect to a group you're talking to:

“Understanding why they've come to listen to you speak, and what they’re hoping to get out of it, and using that to build the connection between them as to why they should listen and care about what you're saying.”

Gabriel Burks, a postdoc in Bioengineering, explains that he went to the workshop:

“As an opportunity to improve or see if I could learn some new ways to communicate. Communicating is a common thing in my field, and we have to do it a lot, and have many different arenas where we have to communicate, so getting as many different perspectives on communication as possible is helpful and helping to formulate how I want to communicate myself.”

Like Tyler, Burks also hoped to go deeper in terms of relating to his audience.

“We always know to think about your audience, ‘Who is your audience?’ But I don't think it's as natural to say, ‘What is your audience feeling? What is your audience relating to?’ So I learned you can attach feeling and emotional connections to sometimes very abstract or technical information to come out with something that is much more relatable to the general audience.”

Lydia Franco-Hodges speaks to participants at I-MRSEC's Alda Scientific Communication Workshop.

How does he intend to apply what he learned during the workshop to what he’s doing right now?

“I have a couple talks coming up, and it'll make me look at my work from a different lens,” he explains. “What is my message, and what is the goal of my message, and how can I emotionally tie that to the audience?”

His next talk, which is about a month away, is the commencement address for Drexel University College of Engineering.

“Which is a big deal,” he admits, “so I needed to be here.”

In light of what he’d practiced during the workshop regarding a catchy title for his address, had he come up with something snappy? Burks' rejoinder? “I just need to not get booed!”

So in real life, is Alda anything like the character he played in M.A.S.H.? Franco-Hodges, who has worked with him extensively, claims:

“He is definitely a presence at the Center. Alan is the real deal. Amazing vision and a profound mission. He cares about science. He cares about society. He cares about the planet. He’s a thoughtful, thoughtful human being.”

FOSTERS THE NEXT GENERATION OF SCIENTISTS AND ENGINEERS VIA RESEARCH OPPORTUNITIES FOR LOCAL HIGH SCHOOL STUDENTS

June 4, 2018

Are you a local high school students who'd like to get paid to assist world-renowned scientists with their cutting-edge research plus expand your horizons while preparing for college? If so, you might want to consider SPHERES (Sparking High Schoolers' Excitement for Research in Engineering and Science), which sounds like a win-win, both for Illinois and the students. New this summer, SPHERES aims to engage local community high school students in an opportunity to gain research experience at a world-class research university under the mentorship of several people who are invested in fostering the next generation of scientists and engineers.

Though not currently grant-funded, SPHERES is sponsored by the Carle Illinois College of Medicine, the Bioengineering Department at the University of Illinois at Urbana-Champaign, and EBICS (Emergent Behaviors of Integrated Cellular Systems), and hopes to be a sustainable program for the years to come.

According to one of the coordinators of SPHERES, Krista Smith, their overarching goal is to increase underrepresented minority representation and participation in science and engineering. She adds:

"There's a lot of impact that can be made as an instructor in engineering, especially as a member of an underrepresented group, which one of the goals of SPHERES is to increase the number of underrepresented members in the field. The more leaders, instructors, faculty, and people in a mentorship role for the next generation of scientists and engineers that we can see are from an underrepresented group, the better because then it will generate more of a representation of those groups. That's the goal anyway."

SPHERES participant Banan Garada.

SPHERES is hoping to accept five to seven rising juniors and seniors from Champaign Unit 4 or Urbana District 116 high schools that are interested in science and technology. However, the first cohort was comprised of three students. This six-week program began on June 18th with eight hour work days and will end on July 27th with a poster session highlighting the research conducted while in SPHERES. Students must be 16 or older and either a US citizen or permanent resident to be considered.

Smith adds that although this is a summer program, she hopes students will continue their work into the academic year.

“It's a summer program that we're starting with local high school students to bring them into our laboratories for the summer, but the expectation is that they will continue to work into the academic year, too. The idea is to— instead of having them go off and work a summer job, we will bring them into our labs and hopefully get them interested in what we do by encouraging them to pursue a major in a science or engineering discipline and pay them, so it's a win-win for everyone.”

2018 SPHERES participant (center).

Participants of the program will receive five-pronged mentorship from a faculty member that holds an appointment in at least two of the three aforementioned affiliates, a teacher that will serve as a mentor at weekly meetings, a graduate student researcher, an undergraduate student researcher, and SPHERES staff members.

In addition to receiving multiple layers of mentorship, students will learn to become acclimated to a university setting, find their niche in the science community by conducting basic and applied research in Illinois’ Bioengineering labs, and gain confidence in attending college through their participation in weekly seminars related to research projects, college readiness, and scientific communication.

Smith visited Centennial High School to discuss SPHERES with some of the students and found out that some of the students interested in participating in SPHERES were previously involved in the POETS (Power Optimization for Electro-Thermal Systems) program. She recalled asking the student about their experience in the program:

“When we asked them about their experience, one of the students said, and I thought it was really cool, ‘I liked it because they didn't treat me like a high school kid. They treated me as a member of the team and you had to pull your weight because they weren't going to babysit you and hold your hand since you're a high school student.’ We want to integrate them into the daily functions of the lab culminating in a small poster or oral presentation at the end of the program. We have high standards for them.”

When asked for reason they got involved in SPHERES, co-coordinators Krista Smith and Dot Gordon finished each other’s sentences in a heart-warming response.

“Neither one of us are scientists. The science is fascinating to us, but we love interacting with the students… and we love bringing them in here to show off our facilities, equipment, staff, and people, and they always go away feeling like they got something out of [their experience].”

Gordon adds that she loves the work because “you can see the things we’re doing are awesome and it’s fascinating.”

Smith also adds that she wants to make an impact somewhere.

“I want to make an impact somewhere through my career and one of my personal interests is just equality and social justice as a whole, so if I can combine those two things, I think that is why I'm doing this. This is a way for me to personally feel like I've made an impact on someone's life career. This is something that needs to be for the greater good.”

HOW TWEET IT IS! I-MRSEC WORKSHOP HELPS SCIENTISTS INCORPORATE TWITTER INTO THEIR SCIENTIFIC COMMUNICATION REPERTOIRE

November 20, 2018

Are you passionate about communicating science, but a bit behind on the latest technology, like Twitter? Do you have an inkling what Twitter is and does, and are interested in finding out about how Twitter might be helpful to you as a scientist? Do you have a Twitter account, but haven't quite gotten the hang of how to use it?

An Illinois PhD student, Kelsey Lowe, asks a question about Twitter during IMRSEC's recent "Social Media for Scientists: #Tweetyourscience" workshop.

A number of university folk who fit in one or more of the above categories showed up at the Physics Interaction Room on November 14th for a workshop: "Social Media for Scientists: #Tweetyourscience." As the title implies, workshop participants hoped to find out more about how they might use social media—especially Twitter—to communicate science. Sponsored by I-MRSEC (Illinois Materials Research Science and Engineering Consortium), Beckman Institute 21st Century Scientists, and Illinois' Graduate College, the workshop featured a talk by the Grad College's Mike Firmand, a panel of researchers from Illinois' science community who have a good Twitter following, plus some small groups based on participants' level of Twitter expertise.

The workshop was part of I-MRSEC's continuing efforts to underscore one of its core tenets: improving scientific communication.

According to I-MRSEC PI Nadya Mason:

> **"We decided that, as a community, we lacked communication skills at all levels, from students to faculty, both technically (giving clear talks to colleagues and peers), to non-technically (just telling the community what we are doing.)"**

Helping to enlighten participants regarding the benefits (and pitfalls) of various online presence platorms, like websites and social media, was Mike Firmand, Assistant Director for Employer Outreach at the Grad College. In his talk, "Web Presence and Social Media for Professional Success," Firmand indicated that the three main benefits of online communication were to 1) share research and ideas with new audiences; 2) gain support, guidance, and information; and 3) to find opportunities and potential collaborations.

Regarding websites, Firmand recommends using a simple landing page that's easy to make and to maintain and which includes links to other places. He says static, multi-page sites can include more detail, and serve as more of an online resume or curriculum vitae. The drawback (or benefit!), of course, is that the owner often tends to ignore updating these for long periods of time.

According to Firmand, some of the benefits of Twitter are that it's very popular with people in different fields, highly interactive, and a good source of information, relationships, and finding opportunities. Twitter's main benefit? It's very fast paced. Of course, he also claims that that one of the downsides to Twitter is…it's very fast paced! Additional drawbacks are that it can be tough to navigate, it

Mike Firmand, Assistant Director for Employer Outreach at the Graduate College, gives a talk about web presence and social media for professional success.

takes practice and, here's the kicker: for those of us who find checking Facebook to be tedious and therefore only check it once a month, or who only update our personal website once every so often… he indicates that Twitter needs to be habitual!

Firmand also reviewed the pros and cons of several other social networks: LinkedIn, Github, Bitbucket, Behance, and Instagram. Regarding blogging, rather than launching a blog then fizzling out in a few short weeks, he suggests this endurance test: "Write a post a week and keep on file to see how the habit goes."

Delighted to share why they had gotten involved with Twitter, as well as some Twitter tips and tricks, was a panel of Illinois researchers.

Regarding the science content the panelists share, and who is their audience, Integrative Biology Instructor Joanne Manaster says she has a wide array of followers from all different sciences, including science communicators, science writers, and just general population. (For the record, Manaster claims her handle, @sciencegoddess, was actually a nickname her students came up with, which kind of stuck). Regarding the science she shares, she says,

> **"I just try to keep it to my areas that I find interesting, so there will be a lot of biology, and there will also be a lot of science books. So I sort of have a theme."**

In fact, she admits that if she tweets something like a music video that's not science related, she gets 0 responses. " People are not expecting that from me. So when you find your stride, people are going to follow you and look for that. And when they see something different, they think 'Oh, that's a fluke!' and just ignore it most of the time."

Regarding the science she shares, Amy LaViers, (@alaviers), a Mechanical Science and Engineering Assistant Professor, says she doesn't have many followers, "which I think gives me a lot of range in how I use my account," she explains. On Twitter, she focuses on tweets and articles that appear in popular culture about robots, which is her area of research.

> **"I tend to think of myself as a Twitter troll," she divulges, "and when I see something that I think is misrepresenting, typically, the vast capacity of human beings, I do tend to tweet about that."**

Esther Ngumbi shares with the workshop participants about her experience using Twitter.

In fact, when someone from MIT recently tweeted that robots were better than humans, she disagreed and recommended that they reconsider their choice of words. The person took her advice and actually deleted the tweet!

One audience question for the panel involved how to get a larger Twitter following: “What things get the most traction, and do you have any advice to make things go viral?”

Michelle Rodrigues, a Beckman Institute postdoc in the Department of Anthropology whose handle is @MARspidermonkey (she studies spider monkeys, obviously) advises Twitter newbies to make their tweets interesting visually.

“My trick is to try and use pictures and gifs whenever possible, because some people will like those and look at those, and then they'll actually pay attention to what you're tweeting. It helps at least with primate research. Cute monkeys go very far!”

In addition to advising how to make tweets interesting, she recommends that if people totally ignore your tweet the first time, to keep on sharing it.

Confirming what Mike Firmand shared about social media providing opportunities and potential collaborations, Shay-Akil McLean, an Integrative Biology PhD student, says he’s gotten lots of opportunities through Twitter, from getting invited to be on panels to going to conferences. He admits:

“It was because of the fact that I was discussing the research on Twitter, and that was one of the chief influences.”

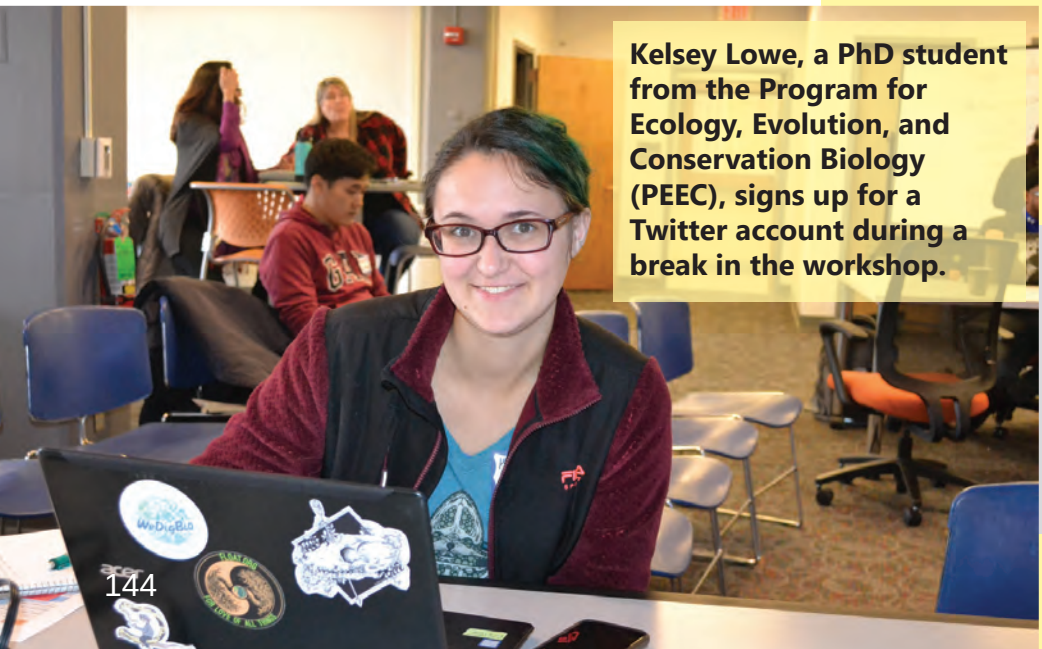
Integrative Biology Instructor Joanne Manaster shares an anecdote about learning to use Twitter with the audience.

McLean, who joined Twitter for general academic conversations, mostly shares work-related things, “as one way to communicate.”

One thing he didn’t expect regarding Twitter is that so many people actually get on it and take it seriously. “Because I feel like I still don't take it seriously all that much,” he says.

McLean admits that he uses Twitter a lot, for just about everything.

“When it comes to boundaries, or different topics, I'm pretty straightforward. With regards to whatever it is that I'm interested in, I will talk about.”



Kelsey Lowe, a PhD student from the Program for Ecology, Evolution, and Conservation Biology (PEEC), signs up for a Twitter account during a break in the workshop.

He acknowledges that he doesn't just tweet about work-related stuff. For instance, if he comes across something on Twitter about politics that's directly related to his life, he's not afraid to comment. "I feel at home doing this," he admits. In fact, he feels so at home that he's even shared his homework: "I do my homework on Twitter. I'm just live Tweeting my homework."

In fact, he's become quite well known through Twitter—not by name, of course; people know him by his handle: @Hood_Biologist.

"It's not a big deal," he says, regarding his constant use of Twitter. "But then I go places. People will come up to me in public. I can't tell you how many bars or clubs I've been to, when people are like "Oh, my God, you're the biologist!" And they really don't know my name. Nobody ever knows my name. It's hilarious!"

Regarding using Twitter to communicate about science, he claims, "I did not know that it would have such a big influence in regards to industry."

Entomology postdoc Esther Ngumbi confesses why she started using Twitter: "I was just trying to hustle my PhD!" But eventually she started gaining a following and realized that, as a Black woman scientist, Twitter was an excellent vehicle for her to not just communicate about science, but have a voice.

"Then, I all of a sudden started growing, realized that I'm a minority and there's not many of us." In fact, she believes her use of Twitter influenced other women to find their voice too.

She elaborates:

> **"There are women out there, women scientists who realized that, 'I have a voice that I can use. I have so much information that I can share!' So I started tweeting, and I started growing and having fun and just following the people who follow me."**

She indicates that sharing her work via Twitter has been "opening so many other outlets. So I just use every opportunity that I can get."

Michelle Rodrigues (@MARspidermonkey) says she originally joined Twitter for professional reasons. And while she asserts that everyone has their own balance regarding "keeping it on message and super sciencey or more personal…But I like kind of having those melded together," she says.

However, she wasn't always that way. She says that at first, she thought she "had to stay super focused and on message." However, she eventually got comfortable enough to start having fun with Twitter. While she doesn't tweet about what she had for breakfast, she does joke around, and share personal things:

> **"I will talk about things I'm interested in," she maintains, "and a lot of times, talking about things you're interested in and your hobbies and random things you're excited about are what get non-scientists actually interacting with you and following and interested in the science stuff."**

Rodrigues believes one of the benefits of Twitter is that it shows people that you're a real person, and not just a scientist.

> **"There are also a lot of people talking on Twitter about the importance of showing that scientists are real people and not white men looking like Einstein or whatever. Sometimes that really does humanize who we are."**

Following the panel, participants broke out into groups for a time of application based on their level of Twitter expertise or area of interest. For example, "Twitter 101" was for folks who had never used Twitter before. Members of this group, say, might

Joanne Manaster (left) and a workshop participant prepare to chat about "Curating your following and feed" during one of the workshop's breakout groups.

Shay-Akil McLean (center) an Integrative Biology PhD student, shares with the workshop participants about using Twitter.

have been at the stage where they needed to create an account and figure out a good handle. The “Tweeting Science” group was for those with Twitter accounts who hadn't really figured out how to use them for scientific communication. The activity for that group involved practicing writing tweets about their research. Still another group, “Using Accessible Language in Your Tweets” was for those who wanted practice communicating with a more general audience. So that group focused more on the vocabulary that they're using and thinking of ways to make it more accessible. The final group, "Curating your following and feed” was about encouraging those who currently tweet to more accurately assess and meet the needs of those who follow their tweets.

What motivated people to participate in the workshop? One participant, a PhD student from the Program for Ecology, Evolution, and Conservation Biology,, Kelsey Lowe, believes having a social media presence is becoming important in order to grow one’s career. Lowe, who studies frogs, has an Instagram account which she uses to post pictures of her field work.

“It's fun to take pictures,” she acknowledges, “and it's fun to share that, but apart from that, I'm not really sure how to navigate professionally, so that's why I came." Plus, "I'm not really sure what to post about!” she admits.

Part way through the workshop, Lowe had evidently heard enough. She was setting up a Twitter account during one of the breaks. Her goal?

“I would like to be able to network better with colleagues and stay up to date with people I don't see very often, because I collaborate with people out of town. So it'd be nice to be able to stay connected with them. I know that they Tweet, and they have very active Twitter accounts.”

She cites another reason she wants to Twitter: she’s gone to conferences where she’s seen a hashtag for the conference posted. “So that would also be very helpful to be able to engage that way,” she admits.

I-MRSEC PhD student, Kisung Kang, whose research involves simulations regarding materials with magnetic properties, especially antiferromagnetic materials, reports that he currently doesn’t use any social media, but he’s “interested” and “curious” as to whether it might help him to network in his science field in the future.

Left to right: Tweet-Savvy panelists at IMRSEC's recent Twitter Workshop: Joanne Manaster, Amy LaViers, Shay-Akil McLean, Esther Ngumbi, and Michelle Rodrigues.

UNDERGRAD/GRAD OPPORTUNITIES

CLUB INSECTA PROVIDES COMMUNITY, RESOURCES, AND EDUCATION—AND LOTS OF TIME OUT IN THE FRESH AIR COLLECTING BUGS

April 13, 2018

One would assume that Club Insecta is comprised solely of Entomology students; however, that's not the case. All one needs to join is to be an Illinois undergraduate student. While having an avid interest in insects might be expected, that, too, is not a prerequisite. In fact, that might crop up after hanging around club members for a while. Besides fostering a love of insects, the RSO (Registered Student Organization) provides its members a sense of community based on an interest in insects and a fervent desire to see its oft-maligned namesake—the insect—gain some appreciation, or at least grudging respect, from the general public. And of course, a huge perk is getting to ditch one's books and spend some time out in the fresh air and sunshine gathering insects with a net, which significantly adds to the club's appeal for its members.

As its name suggests, the club is primarily focused on all species of the Class Insecta—i.e., bugs. Comprised of undergraduates, the group often collaborates with the EGSA (Entomology Graduate Student Association) on various activities. Club Insecta also provides members academic support, such as workshops on how to apply to grad school and seminars where faculty speak about their professional life on campus. Plus, the club makes available information about entomology-related job opportunities.

Like most campus clubs, Club Insecta has officers: Liz Dabek, President, Rachael Valiunas, Vice President; Syed Ali, Treasurer; Benjamin Chiavini, Secretary; and Jihoo Kim, Social Media. Also like other clubs, the group holds some traditional fundraising events, like selling cookies on the quad.

What separates Club Insecta from its RSO counterparts, and which its members appear to enjoy immensely, is its numerous collecting events. "Every weekend that it's warm, and the weather is nice, we try to get out," admits Dabek, regarding their scheduling. Some are short collections done nearby, such as at the Arboretum or the Japan House on campus. However, many involve getting out of town for a few days and camping out, such as at Kickapoo State Park in Indiana. "We'll camp out, and we'll just go out with our nets (generously provided by the entomology department) and collect, and do aquatic collecting as well," she says, indicating that they gather all sorts of insects.

Club Insecta President, Liz Dabek, introduces local middle schoolers to Cecelia the Tarantula at an after-school outreach at the Champaign Public Library.

The members keep all of the insects they collect, then during the winter (when there aren't many insects out), they'll schedule a pinning day, which is when they teach people how to pin and mount insects and help each other ID the insects. A lot of "borrowing and lending" evidently happens during these events, especially by Entomology students who need to collect specific bugs for a class. "Yea, I've definitely done that," Dabek admits,

complaining that, “My old collection from other classes looks a little bit thin right now because it’s been taken by other people!”

The prevalence of insects outside actually determines the frequency of meetings the club holds. For example, during the warm weather (spring, summer, and fall), when more insects are out and about, the club meets once a week. In the winter, though, when the number of insects to be encountered drops considerably due to cold weather, they meet bi-weekly. Ironically, their non-insect-collecting social activities are also based on the weather. For instance, social outings, like movie nights or bar crawls to local watering holes, are mostly scheduled during the winter. However, confesses Syed, even the social events get “really nerdy because we all talk about insects!”

Since one of the dynamics common to most Club Insecta members is that they’re passionate about insects, share that passion with others is one of their chief motivations. Thus, one of the Club’s primary emphases is outreach activities, where members share about insects and correct misconceptions at schools, libraries, and at other events.

For instance, one recent outreach event was at the Champaign Public Library on April 11th. Because the library is a popular gathering spot for middle school students once school is out for the day, a steady stream of students dropped by Club Insecta’s after-school activity to look at, find out more about, touch, and even hold a number of intriguing insects in its menagerie.

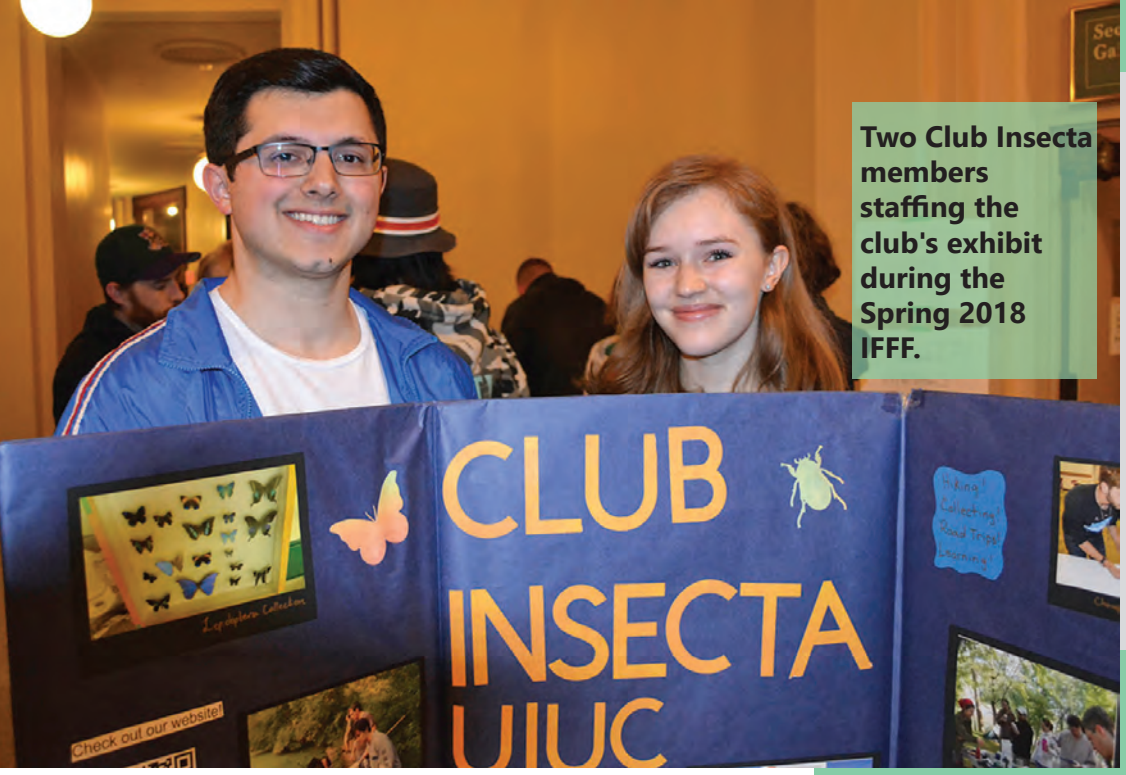
The club’s biggest outreach event of the year by far is helping out at ESGA’s Insect Fear Film Festival (IFFF), recently held at Foellinger Auditorium on Saturday, February 24th. There, the club staffed a table with a number of hands-on activities. For instance, kids could make insects using origami or even pipe cleaners, plus score a red, "Lone Star Tick" balloon (complete with the requisite star.)

During an after-school outreach at the Champaign Public Library, Rachael Valiunas watches as a local middle school student holds a grasshopper.

Rachael Valiunas and Liz Dubek at the Club Insecta table at the 2018 Insect Fear Film Festival.

For a club so devoted to a very specific discipline—entomology—what might come as a surprise is the mix of non-entomology-related majors, even among the leadership.

Of course, the club has its share of entomologists, like its President, Liz Dabek. A senior in Crop Science Insect Pest Management, Liz has had a life-long love affair with



Two Club Insecta members staffing the club's exhibit during the Spring 2018 IFFF.

insects, and says she started becoming interested in them quite early.

"So by the age of ten," she admits, "I knew that entomology was what I wanted to pursue as my passion and my professional future. I came into this school knowing I wanted to do entomology."

Dabek remembers specifically looking for an entomology club on quad day as a freshman, found Club Insecta, and joined immediately. The club, which has been around for 11 years, was very small when she joined, but has grown to about 20–25 active members over the last four years. (Incidentally, Dabek has been president of the club for the last three years—since her sophomore year.)

"It's been amazing being the president and doing a lot of outreach," she says. "We also do a little bit of extension work."

Dabek's goal for club is to improve public opinion regarding their mascot:

"For people to really learn to respect insects, to give them the respect that they deserve. I think that they are amazing creatures, and we still have so much to learn about them. We want to teach people with preconceived notions and fears about insects how awe inspiring insects really are."

Plus, she hopes to teach people that "Entomology isn't just about liking bugs," but would like to recruit more folks into the field. "You can pursue it more than just a passion," she continues. "It can be a profession. It can be more than just becoming a professor. There are so many jobs that are needed in entomology... There's a lot of things you can do with a degree in entomology or just being interested in it."

With her degree in Entomology, Dabek hopes to become a professor someday. So she'll be attending the University of Maryland this fall, working with wasps, "which is something I've wanted to do since I've learned about them," she says.

Similar to Dabek, Club Insecta's treasurer, Syed Ali, who isn't in Entomology, but a junior in Neuroscience in the School of Molecular and Cellular

Club Insecta's president, Liz Dubek, demonstrates how to make an origami insect during the recent IFFF.

Biology, has also had a love affair with insects since he was a child, but not just any insect. Early on, he became fixated on butterflies.

“Since I was five years old, I was in love with bugs,” he confesses. Then his dad took him to a Chicago nature museum with a butterfly haven. “I absolutely fell in love with the science of butterfly metamorphosis,” he admits. So every day after school, he would go out into his backyard which is adjacent to “this ginormous park,” he recalls, and collect insects: crickets, grasshoppers, but especially butterflies.

He particularly liked just watching them and seeing all the different kinds.

“They’re just so diverse!” he declares.

Since for Ali, his favorite part of entomology is studying Lepidoptera (moths and butterflies), during the recent IFFF, he immensely appreciated the huge butterfly and moth collection that was on display. But you can imagine his delight when, because of his “insider” status as a member of Club Insecta, he discovered that Room 407 in Morrill Hall has “drawers full of…these stunning butterflies I didn’t know existed.”

While Ali reports that club members also get access to resources, such as nets and pinning supplies, he says the most important benefit of the club is the community.

“Connecting with people who have similar interests.”

Cockroach 1, a male Madagascar Hissing Cockroach who was part of menagerie at Club Insecta's April 11th outreach at the Champaign Public Library.

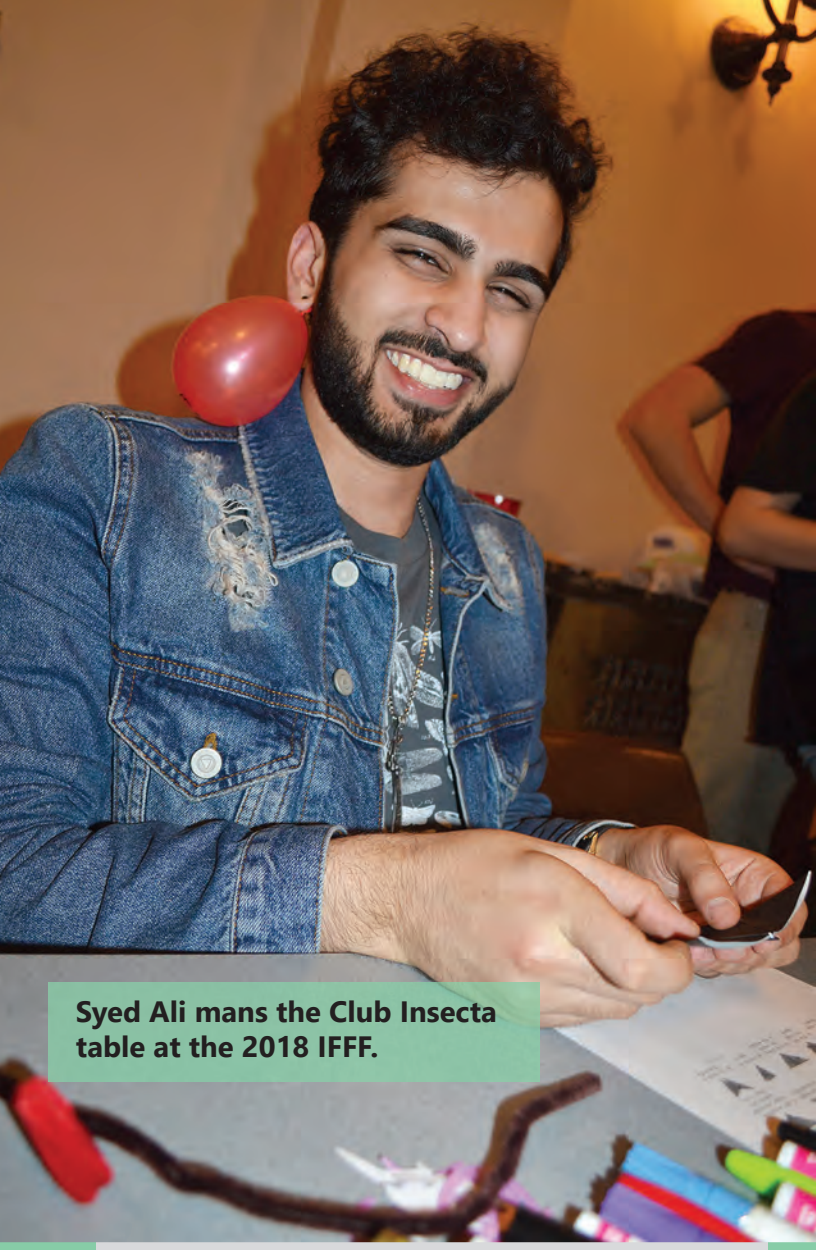
Even more than just connecting, Ali has also made some of his very close friends (Liz and Rachel) through the Club.

“I mostly met them or bonded with them through my love of insects,” he divulges.

Like Dabek, Ali’s goals are for the club to impact others’ perception of insects through education.

“I like when people are more passionate about telling their friends about bugs and that they don't have to be afraid of them. With more knowledge,

Syed Ali (left) helps local youngsters make origami insects Club Insecta's exhibit at the recent IFFF.



Syed Ali mans the Club Insecta table at the 2018 IFFF.

you can, at the end of the day, teach others that insects are just like any other animal and not to be intimidated by them."

Unlike Dabek and Ali, Rachael Valiunas, the club's vice president and a junior in Bioengineering, doesn't have a life-long infatuation with insects. In fact, she reports that before joining the club, she didn't really know much about bugs at all. But after attending a couple of meetings, she discovered that she liked learning about them.

"I like learning about different life, so I saw it as an opportunity to learn more about the diversity of life on Earth. I've enjoyed going on collecting trips and all the activities we have."

Valiunas, who is studying neuroscience and plans on either med school or grad school after she graduates, indicates that some of what she's learned through Club Insecta includes: "A lot of interesting facts about bugs and the diversity of them and their coevolution with other species that I really didn't know before…The sheer diversity and robustness of insects against their environment."

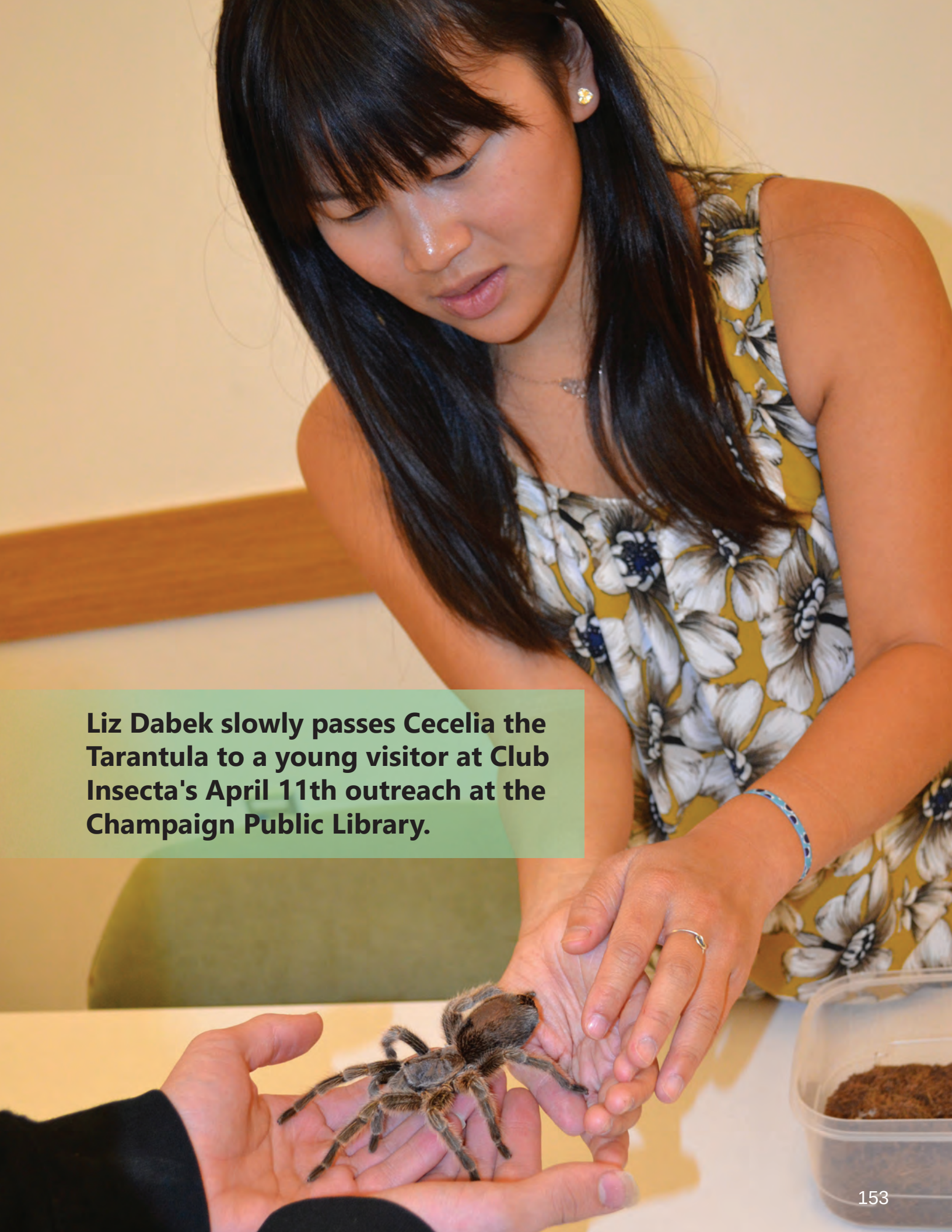
According to Valiunas, another important benefit she's gained from Club Insecta is a sense of community:

"I was also unfamiliar with a whole community of people who are really into bugs and studying bugs. I was just blown away, to be honest, by the interest and the passion and everything that I've learned."

So her goal for the club is that it would have a similar impact on others, including possibly fostering careers in entomology.

"I want the club to do the same thing it did to me to other people. For people who don't know much about bugs, to get involved, and for people who are really interested in bugs, to allow them to pursue a career involving them."

Club Insecta officers, Treasurer Syed Ali, Vice President Rachael Valiunas, and President Liz Dabek.



Liz Dabek slowly passes Cecelia the Tarantula to a young visitor at Club Insecta's April 11th outreach at the Champaign Public Library.

ENGINEERING AMBASSADORS INSTILLS A LOVE OF COMMUNICATING ABOUT ENGINEERING—BOTH INSIDE OF THE CLASSROOM AND OUT

April 23, 2018

The current president of Engineering Ambassadors (EA), Sara Kochanski, would tell you that through the organization, she's gained a desire to teach, improved her speaking and leadership skills, acquired self-confidence, and made friends. In fact, she's loved being an Engineering Ambassador so much that she hopes to do it for the rest of her life (unofficially, of course, and not necessarily on the Illinois campus). She intends to remain an ambassador for engineering and to keep sharing her passion for the field with youngsters day in day out…as a teacher.

The next president of EA, Jose De Lara (Center and two other Engineering Ambassadors, expose nine Chicago Public School students to engineering during a recent Experience Illinois session.

"Engineering Ambassadors has turned me into what I am today," she acknowledges. "I know it's odd for someone in engineering to switch."

What about the College of Engineering's EA program caused this turnaround—switching career goals from being an engineer to teaching about it?

Kochanski admits:

> **"We kept going to schools and explaining to kids these difficult concepts and I just realized that I loved seeing the light turn on. Like when they did a project, and they'd get so excited because they made a car out of a balloon and cardboard."**

But it's not just about seeing the light bulb come on. Kochanski craves impacting students the way only a teacher can. She explains:

> **"They impact so many different people and I want to be able to impart that to other people. So many people think they can't do something because one bad teacher told them that they couldn't do it. I just couldn't live with that…"**

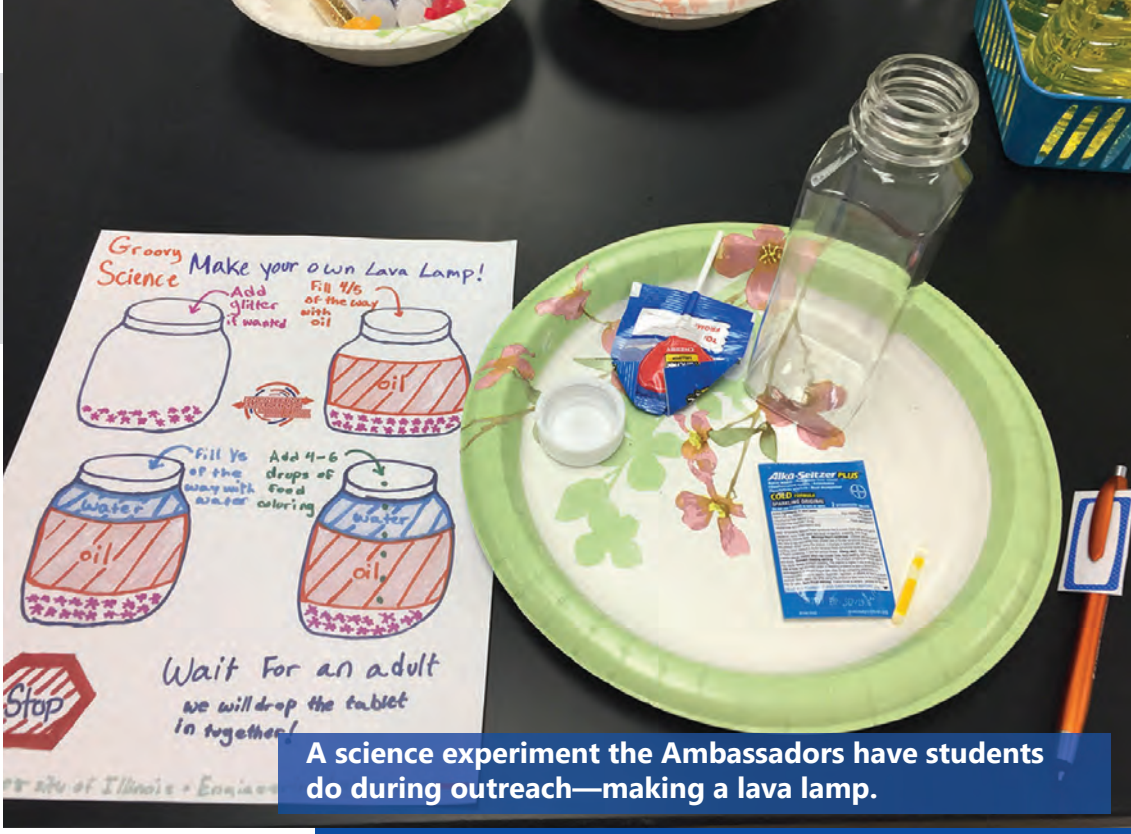
So she plans on becoming a teacher and reversing that trend.

The school visits that so significantly impacted Kochanski's career choices are one of EA's main activities. Co-founder and co-advisor, Bioengineering Associate Professor Jenny Amos, calls outreach activities in K–12 schools the group's "bread and butter."

They usually visit around three different schools a week, depending on what time slots EA students, who juggle outreach with classes and tests, can accommodate. Also, EA does outreach to not just local but regional schools, such as Chicago Public Schools, both hosting big events in Chicago for the community there and hosting CPS events here on campus.

According to Amos, EA's main mission, both through school outreach and its other activities, is:

"Changing the conversation on engineering and making it more accessible to the public."



A science experiment the Ambassadors have students do during outreach—making a lava lamp.

In an effort to change the conversation, EA's on-campus activities include its recent Speaking Competition to help STEM students improve their speaking skills, plus helping to host campus events, like Engineering Open House. In addition, because EAs are effective communicators, they often serve as the "Face" of the College for events, such as meeting recruiters for career fairs. Also, a resume review expert from the Review Me program in the Engineering Career Center has trained EA students to teach other students how to write effective resumes. Ambassadors not only train their Engineering peers, but other RSOs sign up to get mentored too. Plus, EA isn't just all work; Kochansk says they hold social events too, like the karaoke night she was going to at a friend's house.

Of course, part of making engineering more accessible is training students how to present to the public. In fact, Kochanski got her first taste of teaching courtesy of EA's mandatory training, where students learn how to present in Engineering Ambassador's style—Assertion Evidence—which goes something like this.

Engineering Scholars (standing) share about an engineering activity with local school children."

Suppose EA students have a science topic, such as "Chemistry is a building block of society," that they want to teach. "You show how chemistry is put into buildings," she explains, "and goes into the food you eat, etc. It's saying something and backing it up."

Back when Kochanski took the training, it was a 3 day-orientation. But because because EA has grown from four members back in 2012 to 40 in 2017-18, training has morphed into a 6-week class the second half of fall semester, or there's a full-day workshop in the spring for those who can't take the fall class. However, the advisers don't want it to grow too much, lest they lose the group's quality and sense of community. To ensure that the quality remains, EA leadership is considering implementing a buddy system next semester, so new EA's are mentored by the older ones.

What impact did the training have on Kochanski's ability to present? It significantly improved her speaking. "I am so bad at talking," she says. "I talk all the time, but I was so bad at it. I would say 'um' and 'like'..."

Enter "The Gavels"—all in good fun, but evidently also quite effective. Amos and co-founder and co-adviser Marie-Christine Brunet, Engineering's Assistant Dean for Undergraduate Programs,

Engineering Ambassadors present in a local classroom

somehow got ahold of two brightly colored gavels which they would liberally and loudly bang every time one of the offending filler words would crop up. Kochanski elaborates:

> **"The hammers were the worst when they first came around. Everyone was saying 'um' and 'like.' It was so horrible trying to break that habit, but no one says it anymore; we barely need them now. I never thought we'd have to do them, but it's hilarious, and it's become a staple!"**

What about when EA students need to be admonished for, say, neglecting to fulfill their obligations in a timely fashion? Enter "The PHOTO."

"That is my favorite picture of all time," Kochanski admits, referring to a photo of the two advisors frowning. Privy to how the photo came about, she shares this anecdote:

Last year, an EA leader was complaining to the advisors that Ambassadors were sometimes late to classroom visits. 'So we need a picture to intimidate them to be on time," the leader had suggested. So the two posed for "The Photo," then along with it, sent the message, "If you are late, you're going to have to talk to us!" as a deterrent. And it has evidently been working!

But despite the need for creative interventions periodically, the advisors find watching students grow and mature to be quite rewarding. They note that students who first join the Ambassadors are quite shy.

Brunet admits:

> **"We see their level of confidence climbing! And there is something very special about this," she continues, "When you teach something, you don't see automatically the immediate impact. But with this program, you see the immediate or very-soon-after impact."**

> **"Massive transformations in our ambassadors," Amos agrees.**

Kochanski agrees too and acknowledges the transformation EA has made in her and others' lives.

For instance, she shares an anecdote about the impact EA has had on her fellow Ambassadors. "First of all," she explains, inserting a caveat regarding her tendency to be vocal: "I come from a big family. I have 21 first cousins. If you aren't talking really loud, you're not going to be heard!"

Then she goes on to describe a less outgoing EA member:

> **"He was so quiet. He came in with me and was the quietest person I've ever met in my life! I can name like 20 people who were so quiet and timid, and then they joined Engineering Ambassadors, and now they're so vibrant and amazing. It's so cool to see the transformation."**

While Kochanski didn't need to overcome timidity, she has gained other benefits from being in EA. "Personally, I wouldn't be who I am without Engineering Ambassadors, she declares. "I'm a lot more secure in what I want to do, and have learned that it doesn't matter what your title is, as long as you're happy. Engineering Ambassadors doesn't

just change your résumé, it changes your life. And I mean that in the least corny way possible."

Regarding her résumé comment, Kochanski admits that EA does look good on one's résumé. "You want to have something like this on your résumé," she admits, "but we want people who care too. We don't want people who come just to put this on their résumé. Everyone goes on classroom visits every semester, and I think everyone cares about what we do."

To safeguard against perennial résumé-builders, applicants undergo a rigorous interview and selection process. Regarding the hoops students must jump through to be a part, Brunet and Amos stress that EA is not a club.

Amos explains:

> **"It's a College-sponsored program, not a registered student organization. It's prestigious. Participants have to take the training, which is a class. They're interviewed by a panel in order to get into the organization, and there are required participation points. So, it's pretty rigorous," she adds. "It's not just an organization."**

"I think that's why we are tight," Brunet continues. "Because we all believe in the same principles and commitment."

Kochanski would agree that EA's being a group of like-minded people is what makes it so special.

"Everyone in Engineering Ambassadors legitimately cares about kids and what they do, and it's really nice to be with people who have the same priorities you do," she admits. "You're never going to feel like you're 1 in 40; you will always feel like you're a part of a little family, and you get out of it what you put in."

And Kochanski has put a lot into the group; she was vice president her junior year and president this past year. She describes her presidential duties:

> **"You just have to make sure that people do what they have to do, and if there's a problem you just handle it. You talk to advisers about ideas; you start implementing them at the base level. I've been organizing an outreach for next semester, so when the next person takes over they can just plug and chug and go on."**

Regarding the prestige of being the group's president, she deprecatingly terms it: "It's just a 'glorified substitute.' Whenever someone drops out of a class visit, I have to go!"

But while she's given a lot to EA, she's also gotten a lot in return. She tells of a time when she was minoring in ECE and could not figure out a problem in her homework. She had come to EA early still trying to work on it, but just couldn't get it. Then, all the ECE majors came over. "They were helping me figure out the problem," she says. "And by the end of it, I had the homework done because they were helping me through all the steps and teaching me how to do it. Even Dean Brunet came over to make sure that we did it right… If you ever need help, people will help you."

In fact, Kochanski and another Aerospace major in EA get together all the time to do homework. "It's not only helping your resume," she adds, "but it's also helping your GPA."

Engineering Ambassador Max Asselmeier (right) works with Chicago Public School students making a Mouse Trap Car during a recent Experience Illinois session on campus.

Sara Kochanski (center) works with a student during an EA visit to a local school.

Despite all that she's acquired through EA, for Kochanski, what has impacted her the most is the relationships: "It's a lot of people that you care about, and I have a lot of friends in that group," she admits. "I love them all, they're all amazing. EA is a place that you feel like you're at home."

But even more important are her relationships with the EA advisers:

> **"Dr. Amos and Dean Brunet are the foundation of it, and they're brilliant. I look up to them, and they're one of the reasons why I want to be a teacher. These strong independent women are amazing." Then she adds, "Dr. Amos and Dean Brunet are power houses, I have no idea how they do everything they do. They inspire you to be better and help you to be a better person."**

Like Kochanski, the advisors also find EA to be very rewarding personally.

Amos admits:

> **"Engineering Ambassadors is something we both make time for. We don't have time for it, but we make time for it. We love it; we get excited to come and interact with our Engineering Ambassadors. It's kind of like a hobby."**

Brunet adds:

> **"We are very proud of our students."**

In light of the impact EA has had on her personally, what piece of advice would Kochanski give someone who was considering joining EA? For one, she'd tell them that giving presentations is not as hard as it seems, because the Ambassadors have been well trained.

"Sometimes they'll see the people who have been in EA a long time go up and talk about these topics. And they'll think, 'I can't do this; it's too much!' We've been doing this significantly longer than you have. We've been on countless visits; that's why we can do this."

Her second piece of advice is to "Just take it slow and remember your training!" And along with that, she would tell them to be confident.

"You just have to embrace yourself and realize that you're more confident. That's basically what EA teaches you, to be more confident." She says a speaker can't be a good presenter unless they believe in what they're saying and they believe in themselves.

She adds:

> **"And that's what we're trying to do: be an effective communicator and also a good presenter."**

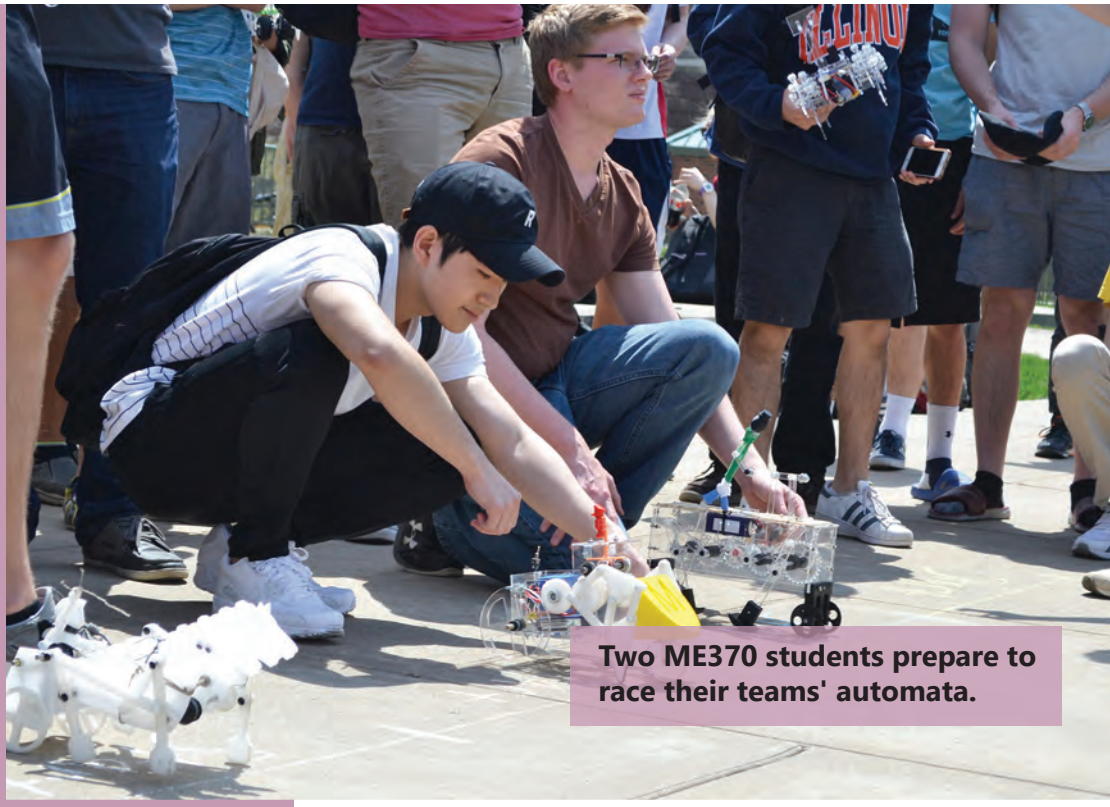
She thinks that's why a lot of people in EA end up more social and better presenters because EA is teaching them

> **"how to believe in themselves and be more confident."**

Her third piece of advice, "I'd say go to social events, because you'll make amazing friends here!"

Engineering Ambassador Max Asselmeier (right) works with a Chicago Public School student making a Mouse Trap Car during a recent Experience Illinois session on campus.

ME370'S FINAL COMPETITION—MARCH OF THE AUTOMATA—FOSTERS MECHSE STUDENTS' CREATIVITY, PERSEVERANCE, AND TEAMWORK



Two ME370 students prepare to race their teams' automata.

May 11, 2018

It was noon on Wednesday, May 2nd on Engineering Quad, and the hopes and dreams of a group of Mechanical Science and Engineering (MechSE) students were riding on the little robot they'd built for the ME370 projects course final competition: the March of the Automata. Their motivation? If their team's automaton won the race, they'd not only have bragging rights, but they'd get a bye on the upcoming final exam.

This year's race followed in the proud tradition of previous ME 370 robot races. However, while last year's objective was to successfully span Boneyard Creek via a cable, and for a couple of years before that, it was to drench the professor with a drenching machine, this year's 31 robots (built along the lines of Imperial Walkers, possibly?) were to race over the less-than-smooth terrain of the Engineering Quad lawn.

There were five heats, and the walkers with the fastest times (and the least interventions), would win their heat and get to move on to compete in the championship race. Regarding the interventions, students were allowed to intervene, say, if their robot was heading off the designated race course, was going to collide with another walker, or had fallen over. However, points were taken off for each intervention.

Regarding interventions, students were exhorted not to cheat! "I don't want to see you saying, 'I have to adjust it. I'm going to pick it up from here, walk over to here, and put it down,' Van der Zande cautioned. "It's got to go down in the exact same spot it went up in. This should be obvious, but I have seen it all!"

However, students were only allowed up to 10 interventions. "What if we have to correct it eleven times?" one student asks. "Basically, if you have to correct it that many times, we'll probably call it a day," he exhorted. "I'll say, 'Don't go further!'"

He also suggested that they use common sense regarding their racing technique. If their robot cants to the left, they should put it down on the right side, and students didn't necessarily have to point their robot straight ahead.

According to MechSE Professor Arend van der Zande who, along with Professor Leon Liebenberg, taught the course, ME370 is one of MechSE's project design classes which:

> **"allow students to implement the skills that they're learning in lecture in a really applied way."**

He goes on to explain that the goal of the "racing of automata" project, is that:

> **"they actually have to use mechanisms and linkages and creatively design something that can accomplish a task."**

In this case, the task was to go a certain distance, walking with legs, where the legs are the driving mechanism. (Wheels were allowed, but only for balance and not for drive.) Plus, an automaton which simultaneously performed another task was required to be linked to the driving mechanism.

In keeping with his "Play-in-Learning" pedagogy, Liebenberg says he "subjects" all of his students to "some form of play." Therefore for ME 370, he:

"dreamed up the idea of an automaton," which he thought would be "a perfect vehicle for students to literally 'play' with their ideas."

Liebenberg reports that they loved the activity and constructed "extremely creative, low-fidelity prototypes of their automata toys." Using design thinking, his students 1) empathized with the automaton end-users (kids!), 2) defined the problem, 3) ideated possible solutions, 4) prototyped the solutions, then finally 5) constructed and tested their final models. "The models that you saw integrated the automata toys with complex walker mechanisms," he reports.

Also in Liebenberg's section of the course, students also had to construct online design portfolios showcasing their work.

"This is another playful way for students to emotionally engage with their subject matter," he explains.

A common thread among student comments was that they'd done numerous iterations. And while most finished the race, some stalled near the beginning, while others fell over repeatedly. To this reporter's somewhat snarky wisecrack that some could have used several more iterations, Van der Zande remarks that the degree of difficulty was intentional.

"That is always the case," he explains. "This is the challenge with design. If you make something that's too easy, then it's not actually a challenge. It's an exercise. So we have to make something that it is possible to fail."

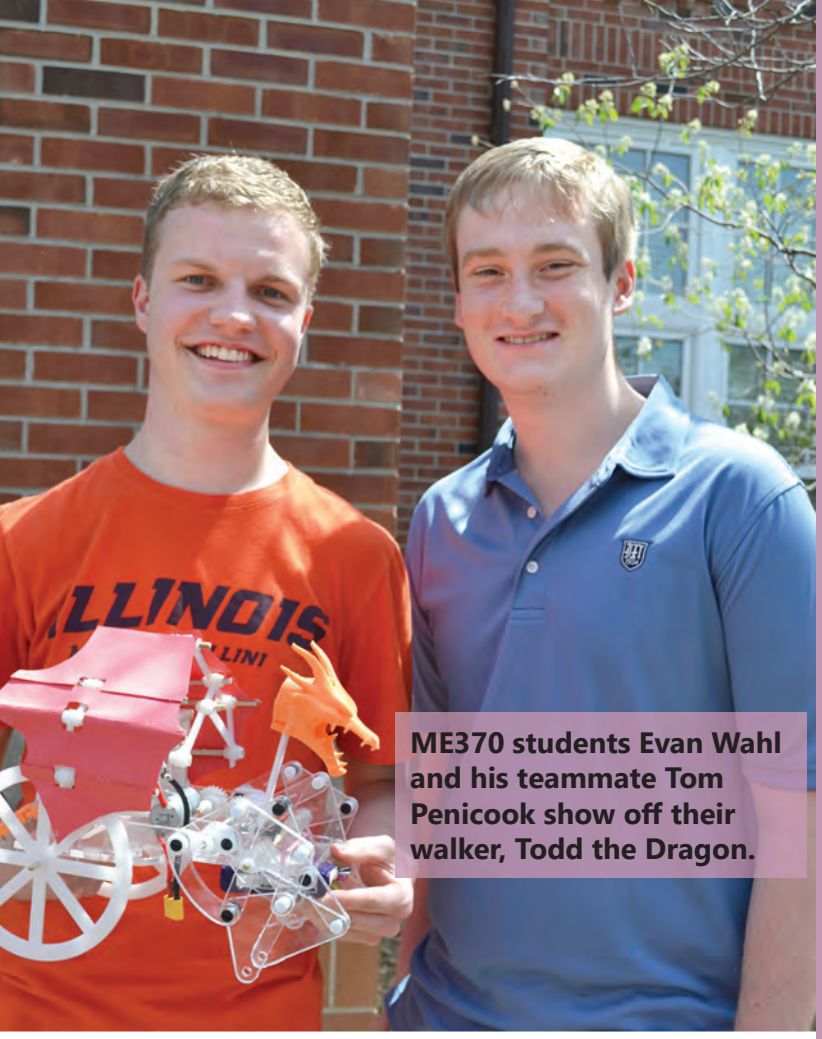
Might some of these budding engineers' GPAs be in jeopardy? "The way that we set things up in terms of the scoring, even if on the race, they only do ok, all through the semester, they're getting points for doing a good design process," explains Van der Zande. "So in the end, they're going to be ok in terms of their grades."

In the same vein, prior to the race, some of the students were discussing whether they wanted to take the bye for the final. For the team that won, "Effectively they get a perfect score on the final," Van der Zande says."

Van der Zande shares his favorite part of the class:

"Honestly, it's the days leading up to the competition. Getting to see all of these projects come together, and seeing them really engage their brains and try to figure out all of the challenges that come up when you take a concept and turn it into a reality. It's much, much more difficult to make something with your hands than to draw it on a piece of paper or make it in a computer. CAD (computer-aided design) will tell you this thing will work perfectly. But then the moment that you actually build it, all these new things come up. So, getting to see them problem-solve that—I love that part!"

ME370 instructors Professors Arend van der Zande and Leon Liebenberg.



ME370 students Evan Wahl and his teammate Tom Penicook show off their walker, Todd the Dragon.

Built into the project, along with the challenges, was a chance to have some fun...after all, these are college students– not yet full-fledged engineers. So teams chose fun names for their robots, with the automaton displaying appropriate actions. Take Todd the Dragon.

Todd the Dragon

While the goal of the walker was to go as fast as possible, students also had to have a working automaton on top that automatically moved as the walker did. So Todd had dragon wings which would flap. Plus, it also had a tail which went back and forth, with no aerodynamic impact whatsoever. How'd they come up with the dragon persona? "A few of us like Game of Thrones, so we were thinking of that dragon aspect of it," reports Evan Wahl, a MechSE junior. (See Evan Wahl's, and John Hutchinson's design portfolios, showcasing their team's work.)

Wahl echoes Van der Zande's comments regarding obstacles his team had to overcome:

"It was pretty challenging," he admits. "We ran into a lot of issues that we didn't expect to come up while we were making it, because you know, you design something, and it works on paper like it's going to work really well. It's like, "How could this not work?" But then you run into things that you never would have thought would have been problems."

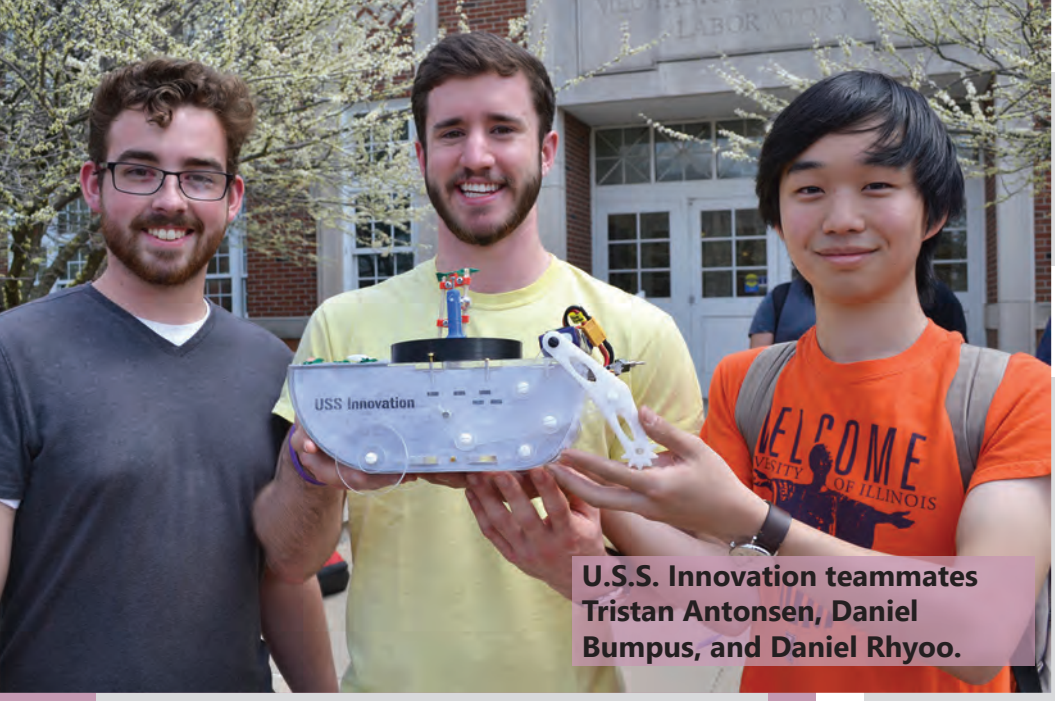
Their biggest issue? Their bevel gears. They had very small teeth and wouldn't mesh, so the team used a wood shaft which was more flexible. The bulk of Todd's construction was laser-cut acrylic, with 3D-printed red gears and, of course, a dragon head.

RoboCat

For cat lovers everywhere, there was RoboCat. Yoni Shapiro, junior in MechSE explains that RoboCat had a linkage that represents a cat's paw which swats at a ball of yarn as the walker moves. While Shapiro says their walker is fast, he acknowledges that "terrain might be an issue." Being as the racecourse began on sidewalk then transitioned to less-than-golfcourse-smooth grass, there were terrain issues. Regarding any special engineering to help with these issues, he reports, "We did the best that we could," then expalins that they made a wide base.

Did they expect to win? "We're gonna' have fun, and we're gonna' do our

ME370 teammates Sydney Coker, Yoni Shapiro, and Elizabeth Jimenez display their teams' automaton, RoboCat.



U.S.S. Innovation teammates Tristan Antonsen, Daniel Bumpus, and Daniel Rhyoo.

best," reports Shapiro, who then cites some added incentive to do well: "If you win, you don't have to take the final," he admits. "If you get second place, the final counts for 50%!"

RoboCat teammate Sydney Coker shares a challenge they encountered: "It liked to tip over!" So they added training wheels on the back to help with RoboCat's stability.

One thing Coker learned about engineering was that "How you design it is not always how it it's going to work out. You've got to tweak it along the way." Did they do some tweaking? "Lots and lots," she admits.

U.S.S. Innovation

The fastest walker in one of the heats was the U.S.S. Innovation, designed in the shape of an aircraft carrier with an automaton called the Autopilot, which spins around and tilts up and down.

Evidently the U.S.S. Innovation team encountered lots of complications. MechSE sophomore Daniel Bumpus says, "The most challenging part was last night when it just seemed like pretty much everything broke!" They had a crank break, both gears broke, one of the things on the back of the motor broke.

"That actually sheared off," he divulges, "and we had to re-solder it last night at like 2:00 am, but we're pretty pleased with how it turned out."

What did MechSE junior Tristin Antonsen learn about engineering?

"Murphy's law is very much in play here. Pretty much anything that can go wrong will go wrong. And we learned a lot about fatigue in materials, specifically. Uh, things wear out. You can't just assume everything is perfect."

Did the team think they were going to win? "I don't want to jinx it," says teammate Antonsen, "but it's looking better than it was before."

Rainy Days

The goal of the Rainy Days automaton was to "amaze the little kids," Jae Lee reports about his team's philosophy.

Teammate Connor Chu reports that they hoped to pique kids' interest in engineering. Their target audience was kids in elementary and middle school. "We just wanted something that they could see what was happening, and they could try to understand all of the mechanisms that were going on." Plus, they made Rainy Days colorful, "So it's

Jae Lee races his team's robot, Rainy Days.

attractive to them as well, and hopefully this inspires them to go into the field of engineering."

According to teammate Elli, The hardest thing overall was the four-bar, where the lightning bolt sways back and forth. They had a big size constraint on that, and then a time constraint to finish it. She confesses that

> **"We did that yesterday so...once we got that going, everything else fell into place. I'm happy," she adds. "It worked out better than I thought it would."**

Lee shares a nugget of wisdom he learned through the process:

> **"You can't expect the hardships you will face in the course of building, and it's all about overcoming. So, engineering, I feel like it's an art that we think through and make our lives better."**

The team also learned a lot about teamwork through the project. "I felt like we did a really good job together," says Elli. "We worked off of each other, I guess."

"It was a genuine group effort," another team member agrees.

What kind of chances did Rainy Days have? According to Connor, "If nothing breaks…If nothing breaks, then I think we have a good chance of winning."

"I think we might take second place?" guesses another teammate. "Third place? Possibly first place? I don't know."

While the operator during the race had to intervene twice, because Rainy Days kept going to the left, it did win its first heat. In the championship race, it took third place. Possibly second.

The Winner!

The winning walker won it in 45 seconds. It didn't fall over, just went off course a few times, so they had to make two interventions. But while they breezed through the race, that doesn't mean they breezed through the design phase.

Nik Jacobs reports that the most challenging thing was "going through the iterations. We had to do a lot of different designs until we found one that finally worked. So it was a lot of hours working on it, mainly, and the time commitment too."

Indraneel Bhanap reports: "I learned that CADing gears and building up a drive is pretty challenging. We had to actually CAD all the way from scratch, so we just used Creator to basically CAD the gears and find the optimal gear ratio to make sure this thing walks as fast as possible."

According to Ahtesham Ali Khan, what was the most fun part of the project?

> **"The end," he explains. "The competition. Winning!"**

Van der Zande expressed his thanks for the support they received from the MechSE business office, the innovation studio, the communication office, and the machine shop staff. He also acknowledged the support from AE3 and the i-design SIIP program and faculty team.

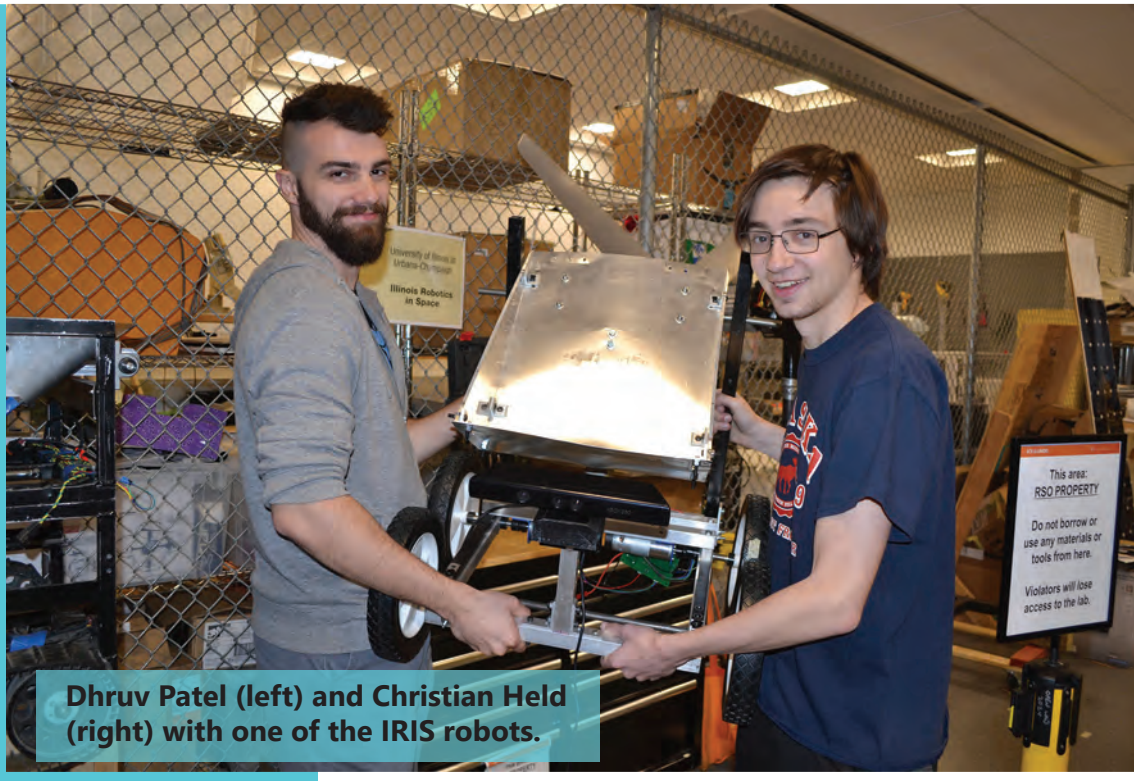
The winners! Nik Jacobs, Indraneel Bhanap, and Ahtesham Khan.

An ME370 student performs an intervention: he's picking up his walker, which keeps falling over due to the terrain.

ILLINOIS ROBOTICS IN SPACE LAUNCHES CONVERSATION ON NASA AND MEMBER EXPERIENCE

May 23, 2018

The word “lunatic” comes from madness caused by the moon, and the students here at Illinois are certainly crazy for the Illinois Robotics in Space (IRIS). A multidisciplinary RSO (registered student organization), IRIS recently participated in the NASA Robotic Mining Competition on May 14–18, 2018 at the NASA John F. Kennedy Space Center in Cape Canaveral where they were one of 56 teams this year. The goal of the competition was for the robots to autonomously mine gravel as if they were on Mars. In the future, these models could be used to mine icy regolith on the Red Planet, which could potentially help provide oxygen, fuel, and water for settlers.



Dhruv Patel (left) and Christian Held (right) with one of the IRIS robots.

Members span across several engineering disciplines, with IRIS consisting of a mechanical team, an aeronautical team, an autonomous team, and a systems team. They start preparing for the competition at the start of the school year in August, even testing their code as early as Day 1. The students constantly modify and build on existing code on the software side, while learning from their mistakes and eliminating anything that fails on the autonomous side. About 80% of their funding comes from the Illinois Student Organization Resource Fee (SORF), and the rest comprises of donations from companies that want shout outs or a sticker on the robot. IRIS also engages in community outreach by organizing events like Illinois Space Day and the Engineering Open House, and collaborating with other student organizations such as Women in Engineering, and Women in Aerospace.

Of all the benefits this organization presents to its members, perhaps the greatest for new members is that they prioritize exposing freshmen to the realities of the field instead of simply assigning them busy work. It can often be challenging for freshmen to establish themselves in competitive fields such as engineering, but IRIS provides a conducive environment for them to succeed in. Dhruv Patel, who is a sophomore in Electrical & Computer Engineering and a member of IRIS, calls them “one of the most freshman-friendly clubs on campus.” For instance, they try to get freshmen involved in building a new robot every year, instead of just having them come in to see a robot that has already been built. This in turn works as a professional development tool, with Patel saying:

> **“I've had a multiple interviews and worked for a couple of companies, and whenever I tell them of my time in IRIS, they tell me that IRIS is [what helped me get the job].”**

Another member, Christian Held, who is also a sophomore in Electrical & Computer Engineering, says that potential employers have been impressed with the accelerated learning environment presented by IRIS. He recounts an interviewer being surprised that he had worked on printed circuit boards (PCBs) as a sophomore. Held found it humorous

given that a fellow member of IRIS sitting right behind him was a freshman who had started designing PCBs. He agrees that freshmen get a leg up by participating in IRIS, citing that although some old members remain to ensure that the team does not go too far astray, 10 out of the 16 people competing in NASA's competition this year are new members. The club also offers its members a social aspect, with movie nights or making food together. Many of the members emphasize the welcoming environment, where they met some of their closest friends and future housemates.

Grant Brucker working on an IRIS robot.

On a personal level, IRIS gives its members a social support network and a safe environment for them to work in without the fear of getting fired. It also hones soft skills such as time management and working well with people in a professional context. Allowing freshmen to take on key roles gives them a foot in the door in an industry that is growing more competitive every day, while bolstering their confidence in their abilities. IRIS motivates members to strive toward their best work, with Held specifying "We don't require people to spend a lot of time in IRIS, but I do it because I want to." He goes on to say that his internship last year was about half the workload he had for IRIS over the school year.

Beyond this, IRIS serves as a tool for both professional and leadership development. Nikolay Tzankov, who is a junior in Systems Engineering and an older member of IRIS, says that it provided him with valuable leadership experience and the organizational skills that come with it. Even though his work as a systems engineer is more bureaucratic in nature, Tzankov stresses its vitality in competitions like NASA's, where they have to submit a systems paper, which is "essentially a high-definition overview of the whole project from conceptualization to execution." This goes to show the role IRIS plays in reinforcing the technical skills students learn in the classroom and how to apply them when working in the industry.

IRIS members working on their robot.

Although Illinois did not win in any of the categories in NASA's competition this year, the diligent and positive attitude embodied by its members suggests a bright future for those who participate in this club and the organization as a whole. The work these students are involved in at this early stage of their careers has the potential to inspire groundbreaking innovations in the real world. As Patel jokes, "We'd like to think that NASA is using us for free labor. They take the best of our ideas and incorporate them into designs."

BUILDING A BRIDGE TO A BETTER TOMORROW: THE 2018 NATIONAL STUDENT STEEL BRIDGE COMPETITION

June 1, 2018

Would you participate in a national competition to build bridges simply for braggin' rights? Barkin Kurumoglu, the National Co-director of the 2018 National Student Steel Bridge Competition (NSSBC) and a student here at the University of Illinois, certainly seems to think so. He claims "The unspoken goal is for schools to show who is better at civil engineering". Lafayette College walked away with that honor, followed by California Polytechnic State University - San Luis Obispo in second place, and École de Technologie Supérieure in third place. The participants of the 42 teams in this year's competition came from all over the nation, based on their scoring in the regionals. Plus, the competition should possibly be renamed the International Student Steel Bridge Competition, given that a number of teams were from other countries such as Canada, Mexico, and China, along with one from the U.S territory, Puerto Rico.

Kurumoglu himself hails from Turkey, where he organized events for his high school Model UN team. He credits that experience for landing him his current role of being in charge of administration for the NSSBC competition, which was hosted on the University of Illinois at Urbana-Champaign campus this year. He worked with the American Society of Civil Engineers (ASCE) board to handle logistics for the competition and provided an organizational perspective, while his co-director Jacob Cross was on the Steel Bridge team and worked from that standpoint.

His passion for his role is obvious, with Kurumoglu saying:

> **"I genuinely enjoy putting something together for other people to enjoy."**

He believes that while some may avoid it due to the sheer amount of responsibilities involved, he is driven by the thought that when the event is over, the 650 - 700 people who attended will look back on the occasion as a solid affair, whether they are locals from the University of Illinois Civil Engineering department or come from countries as far-flung as China or Latin America.

A judge speaks with members of the NYU bridge team about their bridge at the National Student Steel Bridge Competition.

The competition itself is sponsored by the ASCE and the American Institute of Steel Construction (AISC). In fact, the NSSBC started out as a student organization that was aided by the ASCE and the AISC and eventually evolved into the competition that has been running for at least 30 years now. The purpose is to build a bridge based on guidelines prepared by the AISC. They are usually 3 by 17 feet, which is so big that even though they're brought to the competition as parts, most schools have to use trucks to drive them down. Some even ship their bridge, or as in the case of the California State Polytechnic University, Pomona team, fly their bridge to the competition.

The participants were primarily from civil engineering programs, although students who are not studying CE but simply find the subject matter interesting are also welcome to be a part of the event. The

Barkin Kurumoglu, the National Co-director of the 2018 National Student Steel Bridge Competition.

competing teams are usually 8–10 builders, but a lot of schools bring their entire Steel Bridge team for a fun time.

In the first event of Saturday's competition, the "Speed of Construction" category, the “builders” only have their tools to aid them as they race against the clock to put them together. The actual event involved running to and back from a box containing the parts. The building time is multiplied by how many builders are on the team, so it is in the team's best interest to have the fewest builders while still ensuring they can complete the task at hand. The New York University team used just two builders to capitalize on this rule.

Also, teams could get penalized if they dropped a part on the floor because the competition simulated the bridge being built over water, in which case dropping a part would mean losing resources like the money invested in acquiring that part. Even walking on the blue tarp that denoted the river meant that builder “died” and could not help his team build anymore. Kurumoglu jokes that we should think of the water as lava like in the ‘floor is lava’ childhood game.

Other scoring categories included weight, display, efficiency, economy, and stiffness. While schools do have some leeway in terms of what grade of steel they want to use and the exact kind of bridge they want to build, it does have to be made of steel. Kurumoglu did not think that it would be too beneficial to change the grade of steel, because each kind has its advantages and drawbacks. For instance, he commended the durability of the 904L, but said that it was harder to work with than the 316L, which is basically common stainless steel. The bridges are subjected to a lateral load test to measure stiffness, wherein the bridge cannot deflect past a certain point or the team gets penalized. They also undergo a vertical load test in which the bridge has to hold 2500 pounds. For the economy score, judges made an economic calculation based on the building time, and construction and maintenance costs, as well as an analysis of the costs and benefits of the project.

The bridges were assembled twice with the first time being on Friday afternoon, May 25, 2018 on the Bardeen quad, where the teams explained their process in reaching the end-product. The judges walked among the displays, and gave points based on aesthetics and the poster board presentations brought by the competing teams. The second time was on Saturday, May 26, 2018, when the teams started early in the morning and set up to present depending on a preset competition order with assigned time slots.

A member of the Milwaukee School of Engineering steel bridge team attaches a weight onto his bridge for the lateral load test.

What is the appeal for students in participating in the competition? Paige Oursler, a senior in mechanical engineering was with the Missouri University of Science and Technology, whose team placed first of the 13 teams at their regionals, lauded the hands-on nature of the competition saying:

"You actually get to go out and do different things," she says. You get to make things; you get to build; you get to design."

The Illinois bridge team adds weight to their bridge for the vertical load test.

She believes that participating in such events gives students a leg up both in the classroom, when they learn concepts that they have worked with first-hand, and in real-life, because they begin to understand the technical jargon that engineers use in the industry every day.

Her teammate, Alex Schull, a senior in Civil Engineering and in his second year on the team, agrees, calling being on the team "an add-on to what the classroom had, a little reinforcing." He believes that not only does participating in such events garner name recognition of their school from attendees and the other schools at the event, but it also shows that students at their university can actually apply what they learn in the classroom.

This is a common theme for many participants. Jacob Harris, a rising senior in civil engineering at the University of North Carolina-Charlotte loves working with his hands and credits the steel bridge team for "a way [for me] to learn a new skill involving welding and milling."

Even Charlie Carter, who works for AISC and has been judging the competition for the past decade, cites the biggest benefit for students being that the competition is closer to real-life scenarios than anything they will face in the classroom. He points out the various innovations students have come up with, like creating special tools for this specific event or using the sliding dovetail, an old trick in woodwork that allows parts to just slide together and lock. This is another way students learn from this competition Carter says, where:

"Teams can look at each other's designs and go 'Oh yeah, we didn't think of that. That's a neat idea, maybe we'll do that next year.'"

The winners of the National Student Steel Bridge Competition, Lafayette College.

Bart Quimby, another judge at the event, has been attending the NSSBC in that capacity since 1992. He says his continuing presence is because:

"It's just fun to watch college students—the intensity with which they do things."

A professor of steel design for 23 years, Quimby realized that incorporating the steel bridge

competition into his class added some spice to the course and got the students excited. He would work with students to design bridges in class and have the ASCE student chapter vote on which one they wanted to compete with. The next semester would be spent creating the bridge and competing with it. Quimby found that the reputation of the Steel Bridge team in the local town got to the point that having an employee who used to be a part of the team meant that you had a great worker. This motivated students to participate in the team, because having that experience on their resume gave them an advantage in the local workforce.

Christina Harber, the director of education at the AISC, was also a judge. She calls the NSSBC one of the largest student events they have all year with the most reach. While she is actually an Illinois alum, she was rooting for teams who were competing nationally for the first time. Harber was particularly impressed by the University of Puerto Rico, Mayagüez team, who has competed before, but made it to nationals this year despite having no electricity for months after the hurricane and a condensed school year.

One of the teams new to nationals was from the Guadalajara campus of Universidad Panamericana in Mexico. They placed first ahead of the 17 schools that competed in their regional competition, including schools from both Texas and Mexico.

This is the first time on the Steel Bridge team for Neftali Ramirez, a third-year in civil engineering, who is one of the “builders.” She says that her most important takeaway from this experience had been learning how to work in a team.

This sentiment was shared by John Duguil, a senior in civil engineering from California State Polytechnic University, Pomona, who found that the collaborative attitude of the team transferred to the classroom. Having people to take classes with helped his academics, and he helped underclassmen in turn when they had questions. The team has become more like a family to Duguil, who calls it his community on campus.

The 2018 competition showcased the innovative perspectives of the next generation of engineers, while providing the students themselves with an outlet to explore their interests outside of a classroom without the fear of grades hanging over their heads. It shows how an extracurricular activity can go beyond augmenting classroom learning and in fact prepare students for the real world. The experience not only helped the participants develop their technical skills but challenged them to grow as creative thinkers and collaborators. Although it was only a two-day event, the days of work that went into creating the final displays show that the real achievement of the NSSBC is the spirit of determination it has instilled in its participants.

Missouri University of Science and Technology steel bridge team with their bridge.

OFFICE OF UNDERGRADUATE RESEARCH SEEKS TO CHANGE THE PERCEPTION OF WHAT UNDERGRADUATE RESEARCH AT ILLINOIS LOOKS LIKE

June 4, 2018

Exactly what is undergraduate research at Illinois? Is it one undergrad working in a lab? Is it a research-focused course with a capstone project? Is it not just a project, but a process? To all of the above, Karen Rodriguez'G, both the Interim Director and the Associate Director of the university's Office of Undergraduate Research (OUR) says, "Yes!"

Rodriguez'G wears a couple of different hats at OUR. As Associate Director, she oversees the day-to-day function of the office. But as Interim Director, she describes her role as "forward facing for the campus—I am essentially the person in the office that faces everyone on campus."

Karen Rodriguez'G, Interim Director of the Office of Undergraduate Research (center, foreground), listens as an Illinois undergrad presents her research durng the Undergraduate Research Symposium.

For example, she works with higher ups, such as the heads of the university's eleven research institutes, to discover what undergrad research looks like for them, what sort of partnerships can be put in place, and how her office can help to provide opportunities for students. Plus, she serves on several committees that address these issues as well.

At the other end of the spectrum, she and her team work with students, encouraging them to get involved in research. Even incoming freshmen. For instance, she and the OUR team participate in units' admitted-students days, where they talk to students and their families. "They're very excited," she acknowledges. "They want to participate right when they get here. And they can!"

According to Rodriguez'G, because of the size of the campus, one big plus is that there are lots of opportunities for research:

> **"The thing is that this is a very big campus," she admits. "There are eleven research institutes beyond the programs and departments and students' majors, which is great because it provides a lot of opportunity."**

Many disciplines, including the sciences, such as chemistry, and engineering have really robust programs to support undergraduate research. "Research has always been a part of their education," says Rodriguez'G.

Conversely, the minus is, "That it's a very big campus!" she reiterates, which sometimes makes it difficult for students to get hooked up with the research experience that's right for them.

So she and her team do what they can to help students figure it out. They do workshops, addressing everything from how students can get started, getting them to think about what their research questions are, and helping them to find faculty. "It's actually not that easy to find faculty on this campus," she admits. "Some departments and programs are actually better set up for that. College of Engineering is great."

OUR's workshops help students get started by breaking the process down into manageable parts. The first step is for students to identify what their research interests are.

> **"You can't just assume, 'I'm a bio student; I'm interested in biology,' she says. "Well, what does that mean?**

Biology is a big field. Are there particular things you're interested in? You want to cure cancer? Work on mosquitoes? What is it you want to do?"

So they help students come up with a small list of those.

Next they teach students how to search for faculty, both in and outside of their departments, in research institutes, or even in the research park, where OUR has connections.

Something else to consider is how students contact faculty—particularly those they don't have a class with.

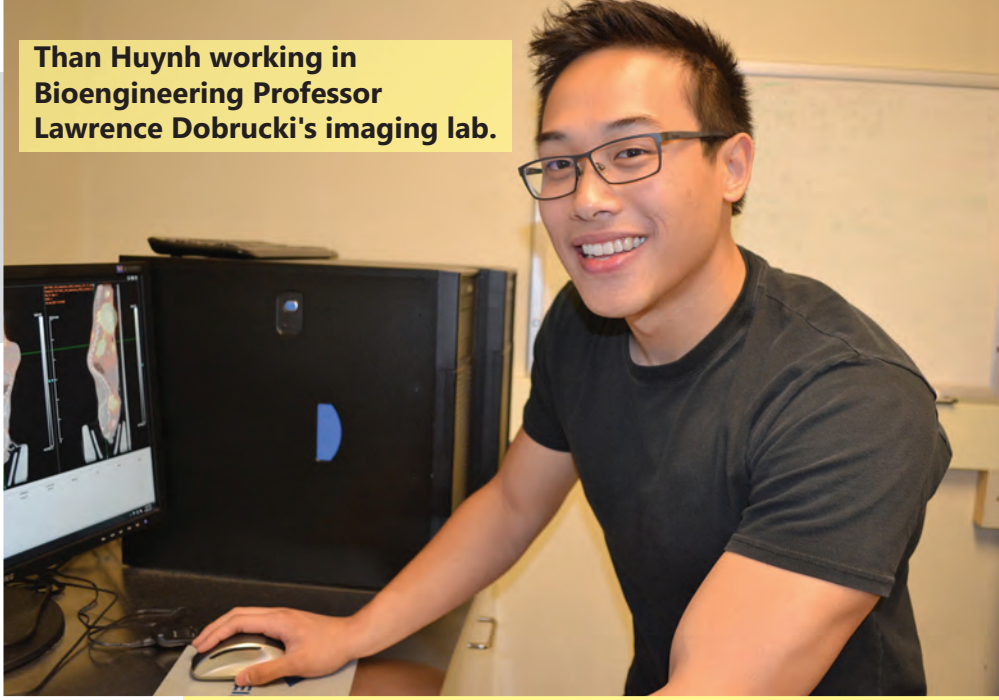
"There is an art to contacting faculty via email," she acknowledges, "being professional, laying out why students are interested. It shows they've actually taken the time to research what the faculty member actually does, instead of a generic email."

She adds that students also have to be persistent, show motivation, and exhibit commitment.

One of the keys for undergraduate students, especially those not in engineering or science, is learning how to write a research proposal—to "actually articulate what their questions are," Rodriguez'G explains.

Then, once a student gets a research project, OUR also helps support it. The office has two research support grant cycles every year and also supports conference travel grants. And they're always dreaming up ways to do more.

"We're always trying to think about, 'What's the next step? What can we do? Part of this involves having conversations with stakeholders, whether it's students, staff, faculty, even possible corporate partners." One of the questions OUR staff ask constituents regarding undergraduate research is, "What can we do to not just support students, but actually push things forward?"



Than Huynh working in Bioengineering Professor Lawrence Dobrucki's imaging lab.

One way is to get more units involved. So every year, after the research cycles are over, she and her staff re-strategize based on what they've learned that year. They identify the gaps—units not involved in undergrad research—and brainstorm with their advisory board and faculty about how to address those. They're also compiling a database of departments' faculty liaisons in order to target those without representatives. For instance, they've identified one discipline—Business—for whom they don't see a lot of students, although that's starting to change. So one strategy might be site visits and talking to people. She also hopes to get someone from the College of Business on OUR's advisory board.

Another strategy is to foster a campus-wide paradigm shift about what a research opportunity actually is. For instance, one stereotype she and her team fight is that it's always only about one or two undergrads working with one faculty in a lab. So OUR is helping to create different kinds of research opportunities, such as one where students actually learn methodology and have a research project in, say, an introductory course.

OUR's goal is building across the curriculum—striving for what's been called the connected curriculum.

"That's really our goal," Rodriguez'G admits. "That it's not invisible to students anymore. They can see a visible trajectory from introductory level course to their senior thesis or capstone project. Even between disciplines too."

"Even in STEM," she adds, "you're going to see pockets where it's not start to finish or made obvious."

This is one area that interests Rodriguez'G—the program and curriculum development aspect of their duties.

"I get excited when I see students are excited and faculty are excited about thinking and rethinking their curriculum and what that means, what can they do," she says.

Also, to foster more research opportunities, OUR is attempting to get both grad students and faculty to think outside the box in terms of what undergraduate research is. So they're trying to educate them to think about situations outside of the lab where they could use an undergraduate student. "I never thought of having an undergraduate student," or "Oh, my gosh, when I was doing my dissertation research, I would have loved to have an undergraduate student," are some of the responses they get.

Plus, Rodriguez'G emphasizes that, with the new design center going up, there's a real interest in fostering multidisciplinary projects and collaboration—design thinking.

She stresses that OUR's role isn't to provide research opportunities for students. "We don't provide any research opportunities ourselves," she explains. "We just help students find them." They also seek to "help programs and faculty provide opportunities so students have the ability to do research."

Undergraduate researcher, Elizabeth Woodburn working in the lab.

Rodriguez'G and her team encourage units to make use of what is already on campus instead of reinventing the wheel—such as resources her office and others on campus provide. For example, while OUR wouldn't be able to train an undergraduate student in a lab, one way they could encourage more faculty to apply for grants is to be a resource to help take the burden off by providing components that would be important for an undergraduate student.

For OUR, key to serving as a resource is acknowledging what their office is good at. So they've learned to assess their strengths. "What does our office already do?" Rodriguez'G asks. "What do we have expertise in? Is it programs we already run?" "So what can we actually offer faculty who are applying for these grants so that they won't have to do it themselves?" The idea is that faculty wouldn't have to do some of the more general things her office would handle. She reports some of their strengths include substantial IRB expertise; training students in the ethics of research, as well as how a student navigates their mentor/mentee relationship?

So for some units, this is where a partnership with OUR could come in handy. For instance, they could do workshops to help students to understand what an IRB is, what research ethics are, have students think about what it means to ask a research question, and then follow that through. "This sort of idea," she says, "kind of taking in a different way what we already do for our workshops. Since the office's budget is small, she admits that they've, "been more creative about encouraging partnerships with programs and institutes, so we're not the only ones that are paying for it."

Another group they've been targeting is non-academic units. For example, they've had conversations with research institutes and NCSA, asking:

"How can we help with our expertise so that your research scientists actually want undergraduates in the lab?"

One challenge they've encountered is that the structure of some institutes and labs is not already set up for an undergrad. For example, while some units might have the money to fund undergraduate

research, they don't necessarily have the infrastructure for it. Since research scientists in some of the research institutes aren't faculty, don't teach, and aren't part of the curriculum, course-based research projects might be a problem.

So their team is constantly asking themselves, "What can we help do? How can we marshal our expertise to work with these?"

One strategy is encouraging mentoring through the U-RAP Apprenticeship program which OUR is partnering with the Graduate College to administrate. U-RAP matches undergrads with advanced graduate students, who will be the next generation of scientists. First, U-RAP provides training for grad student mentors, via their "How-do-you-mentor-a-student?" workshop, which includes topics such as "How do you create a realistic timeline and a work flow?" and "How do you allow for the fact that you may actually have to train your student in what seems like fairly straightforward processes?"

For the U-RAP undergrads, OUR has taken material which used to be a workshop and created a class. "So we give them the big picture," Rodriguez'G explains, so that they understand, 'What is research in the larger sense, and across disciplines? What does it really mean?'"

"There are similarities across disciplines," she continues. "Some things are a little bit more specific, but it is all essentially the same idea. You have to learn how to ask a research question. Once you have it, how do you go about answering it? What's the methodology? What are the resources? What does it look like when you actually have your data? How do your organize it? Plus understanding the ethics of research."

Another area they're working on is something similar to U-RAP for the McNair Scholars, who already have their mentors.

Rodriguez'G reports that OUR, which was created five years ago, has grown a lot since she arrived in 2014:

"Which shows to me the importance of undergrad research. There's a real push!"

She also credits the more significant development grants they've been giving to faculty in the program, which they just started this year.

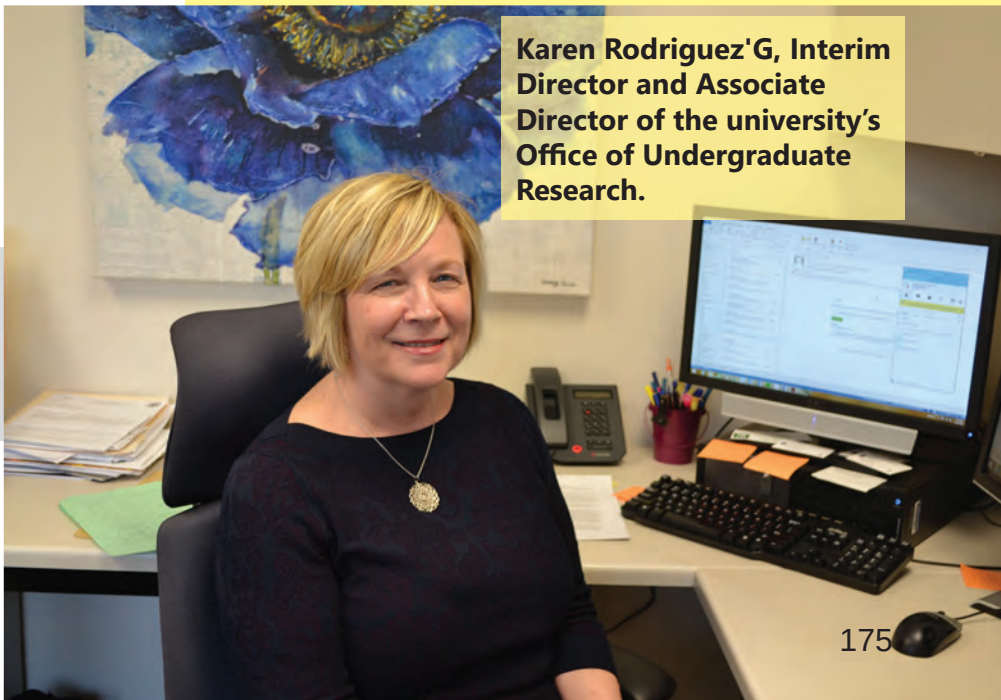
Of course, changing the face of undergraduate research on campus will also require additional funding. While in the past, most of the money given by corporate sponsors such as Monsanto, Technip FMC, the Stivic Foundation, and the News Gazette, has helped to sponsor the Undergraduate Research Symposium, their April event showcasing undergraduate research symposium. But according to Rodriguez'G, they've been thinking about soliciting funding not just for one event, but undergrad research on campus as a whole. So over the last year, OUR has been creating "what we're calling, not necessarily best practices," she clarifies, "but 'What does an undergrad researcher look like? If we actually had to come up with an idea of undergrad research on this campus, what does it actually look like?'"

Part of this is a change in the perception of what undergraduate research opportunities look like, as well as a shift from just encouraging research to promoting the research process.

"Because research process will include a research project, right? But it's a lot more inclusive, and it's actually bigger."

She hopes to promulgate creative thinking across campus about what students need to learn how to do, everything from asking questions, developing it to a research project, to the process of it itself.

"For me, that's what's big," she adds. "Thinking more creatively about what that means across campus."



Karen Rodriguez'G, Interim Director and Associate Director of the university's Office of Undergraduate Research.

UNDERREPRESENTED MINORITY UNDERGRADUATE STUDENTS GAIN RESEARCH, CLINICAL EXPERIENCE VIA THE CARLE ILLINOIS COLLEGE OF MEDICINE'S NEW REACH RCEU

July 19, 2018

There's a new RCEU in town, REACH (Research and Education for the Advancement of Compassionate Health Care), sponsored and funded by the new Carle Illinois College of Medicine. What's an RCEU? It's an REU (a Research Experience for Undergraduates) with a clinical component in addition to the research. Plus, the summer of 2018 REACH participants not only gained research and clinical exposure, but a better understanding of the breadth and interdisciplinary nature of the health care system, and research that impacts it.

Darius Carter (second from the right) explains his research to (from left to right) Lisa Goodpaster, Ruby Mendenhall, and Margarita Teran-Garcia during the poster session at the Illinois Summer Research Symposium.

Five students, all from out of state, participated in REACH's maiden voyage. Two were from the University of Puerto Rico (although one is transferring to Central Florida this fall), with one each from Howard University in Washington, DC; Michigan State; and Penn State.

Participants were mostly rising sophomores and juniors; freshmen were considered to be too young, and seniors were probably already applying to medical school. Also, the idea was that younger students would have the time to take additional math or other courses they might need that are specific to Carle Illinois College of Medicine.

Because one of the emphases of REACH is to increase the number of underrepresented students in medicine, all five of the first cohort were minority students.

"Our focus is students that are looking into healthcare or medical school. So we want to help be part of raising awareness and diversity in that population," explains Ruby Mendenhall, the Carle Illinois College of Medicine's Assistant Dean for Diversity and Democratization of Health Innovation.

In addition to steering the students toward careers in medicine, another emphasis was to recruit the students to Illinois' College of Medicine. For example, REACH held a workshop about how to become more competitive with medical school applications.

Plus, the RCEU coordinators were hopeful that participants would become ambassadors for REACH and the College of Medicine, letting folks in their networks know about both the RCEU program and the new college here at Illinois, which has a unique engineering focus.

For the research side of the experience, the undergrads worked in the labs of five campus faculty: Rashid Bashir, Jessica Brinkworth, Karen Tabb, Paul Hergenrother, and Michael Spinella.

For the clinical side, participants shadowed Dr. Teal, a neurosurgeon at Carle's Spine Institute, on both his hospital and his clinic rounds. Teal also gave them the opportunity to observe a surgery,

which many of the participants took advantage of.

REACH participant Bri Griffin, a rising junior majoring in human biology at Michigan State, indicates that it was because of the clinical exposure that she wanted to participate in the REACH program.

"I love the clinical part;" she admits. "It's my favorite part. I love everything. I'm glad I made my decision to come here."

Regarding the opportunity to shadow Dr. Kevin Teal, she reports, "It's been amazing; I actually got to go watch him perform surgery last week, and it was super, super cool...I got to stand right there while he performed the surgery. He was removing bones from the spine to relieve pressure on the back."

Did seeing the blood get to her? "No, not at all," Griffin asserts.

The RCEU participants also had the opportunity to volunteer at Avicenna, a local non-profit, community health clinic that's open only on Sundays. The experience not only exposed students to the regional healthcare system, but allowed them to see more disadvantaged patients, such as migrant workers, compared to Carle patients, who most likely have health insurance. Plus, it gave them a chance to work with other local medical practitioners and/or healthcare students.

REACH also exposes the participants to workshops taught by affiliate professors who are introducing students to other areas that tie into healthcare.

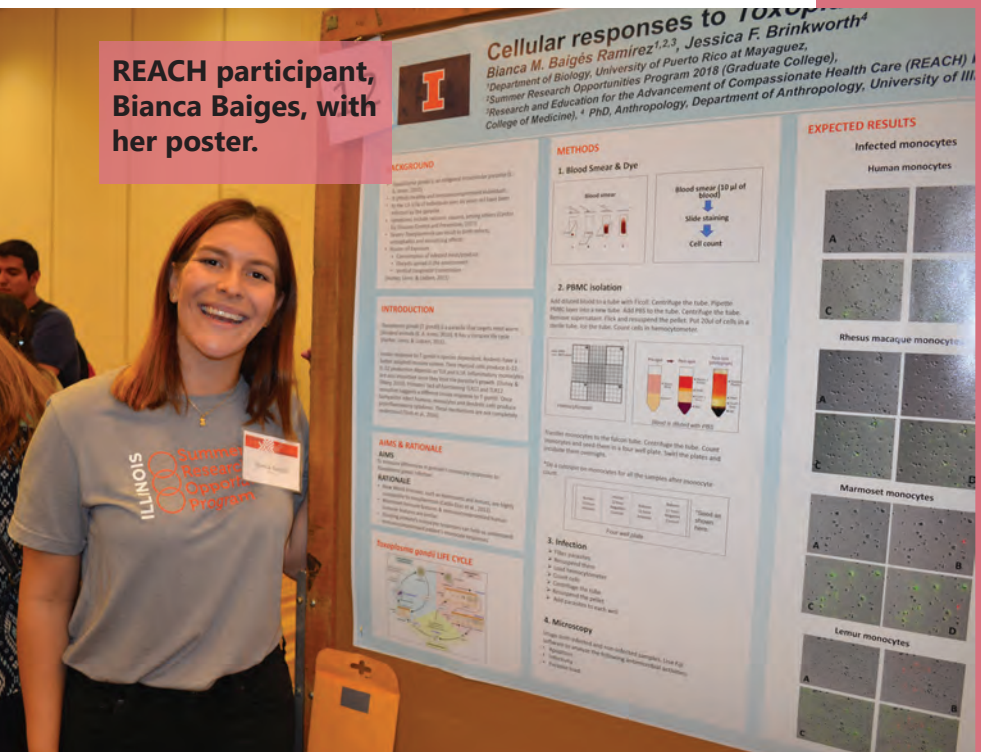
"So it's not just about research; it's not just about clinicals," reports Lisa Goodpaster, Associate Director of Project Management in the Carle Illinois College of Medicine. "It's about the holistic look of healthcare and everything that ties into it."

According to Mendenhall, one of the pillars of the College of Medicine is the humanities. So faculty whose research didn't match with any of the students' hoped-for research areas were involved as REACH affiliates, presenting their research and how it relates to medicine during workshops. For example, Diana Grisby presented about obesity and nutrition's link to health.

"So we do try to give them this broad exposure to health fields in general and research in that area," Mendenhall reports. "And as they work in their research labs, we're encouraging them to think about how to incorporate the humanities and the social sciences into the science that they do."

In fact, the program is providing an award for the student who does the best job of incorporating the humanities and social sciences into his or her end-of-the-summer presentation.

"We really want them to think how interdisciplinary medicine can be and how complex it is," says Mendenhall.



REACH participant, Bianca Baiges, with her poster.

Given the focused nature of the program, choosing this summer's five participants was a rather detailed process. Since REACH is partnering with the campus' Summer Research Opportunities Program (SROP), this year it tapped into SROP's applications for REUs across campus. The PIs narrowed down the applications to those interested in medicine. Other criteria were underrepresented minority students who were rising sophomores or juniors. Then, aiming for a mix of students, they looked at students from different majors and who have good grades (but not necessarily a 4.0 GPA). They also looked at personal statements and research statements, although having had research experience was not a requirement either.

Goodpaster, says, “We felt like that was a good mix to have to help those that haven't had the opportunity, and to build on the experiences of those that did have a little bit of experience.”

A diversity committee subcommittee then narrowed it down to about 22, then five.

Mendenhall shares what she finds rewarding about the REACH program:

“I think the thing that I love the most is giving kids—underrepresented students who may not have exposure to the field of medicine—exposure to engineering-based medicine, even exposure to some of the other social scientists and humanists.”

Goodpaster has appreciated connecting the students with resources in areas that pique their interest.

“They'll be in a workshop or come back from a clinical or research and have a new spark of something. A lot of them have reached out saying, 'Hey, can you connect me with this person?' and I've been able to do that, really giving them the opportunities to just explore healthcare, explore medicine.” Her goal is to help them determine what their interests are, then ask, “‘What can we do to help get you to where you want to be?’ And that's been really rewarding, and they're all so excited about it, which is fun to watch.”

Mendenhall’s long-term vision is to “open up the field of medicine to have different voices, different perspectives, different discoveries, and all of that.”

Building on Mendenhall’s vision, Goodpaster’s goal is to make sure that REACH achieves her goal of diversifying the field of medicine by providing opportunities for minorities underrepresented in medicine, to make sure they have equal opportunity and access to the different things that students need to or want to have in order to go into medicine.

REACH participant, Nina DeLuna presenting at the Illinois Summer Research Institute.

“We hope that's medical school,” she admits, “and we hope that's Carle Illinois Medical School.”

But even if it's another medical school or healthcare field, she stresses that the program’s goal is to make sure they have the resources and opportunities to get them there. “Because we need them in the healthcare field,” she reiterates.

Mendenhall adds: “So many students of color, underrepresented students have these barriers that they experience, and just to have one or two key people who can kind of give them resources despite those barriers so they can transcend.” She adds that often students of color don’t have the same opportunities. “Their parents aren't physicians and haven't even gone to college in many cases,” she explains, “so I think it's amazing that we can be those one or two people that can help them despite barriers.”

REACH participant, Alexis Chamorro works under a fume hood while in the lab.

WE CAN REU PROVIDES MINORITY STUDENTS AN INTERNATIONAL EXPERIENCE, RESEARCH AT THE INTERSECTION OF ENGINEERING AND AGRICULTURE

"We really tried to think outside the box to make sure they had a really unique and well-rounded experience." – Michelle Green, WE CAN Co-PI

July 23, 2018

The six minority undergraduate students who participated in the USDA-funded WE CAN (Wildlife Engineers Co-managing Agriculture in Nature) REU (Research Experience for Undergraduates) spent the summer of 2018 learning what conducting research is like. However, because WE CAN was a two-summer program, this summer's research opportunity followed on the heels of last summer's 4-week trip to South Africa where participants collaborated with South African students to do ag-related engineering projects.

WE CAN REU participant, Alondra Estrada with her poster about her turtle research.

According to Agricultural and Biological Engineering Assistant Professor and Co-PI Paul Davidson, the focus of WE CAN was to recruit underrepresented minorities and train them for careers in agriculture. Of the six WE CAN fellows, three are African American, and three are Hispanic. And it just so happens that all six are female. "That wasn't on purpose," qualifies Co-PI Michelle Green, a Research Assistant Professor in Animal Sciences, "but they were our best matches for the program."

Illinois student Alondra Estrana, a rising junior in the Department of Natural Resources and Environmental Science, shows off the 3-D printed "turtle" she used in her research.

Of the members of the 2017–2018 cohort, two are University of Illinois students; two are from Northeastern Illinois, a Hispanic-serving institution; and the remaining two are from Tuskegee University, an HBCU (Historically Black College or University). Since WE CAN is a four-year grant, the co-PIs also hope to recruit two students from Parkland College for the second two-year cohort.

According to Green, the project name pretty much sums up her collaboration with fellow co-PI, Paul Davidson:

"Paul is an agricultural engineer, and I am a wildlife biologist. So when we brought our two fields together, that's where we're working—at the interface of agriculture and engineering."

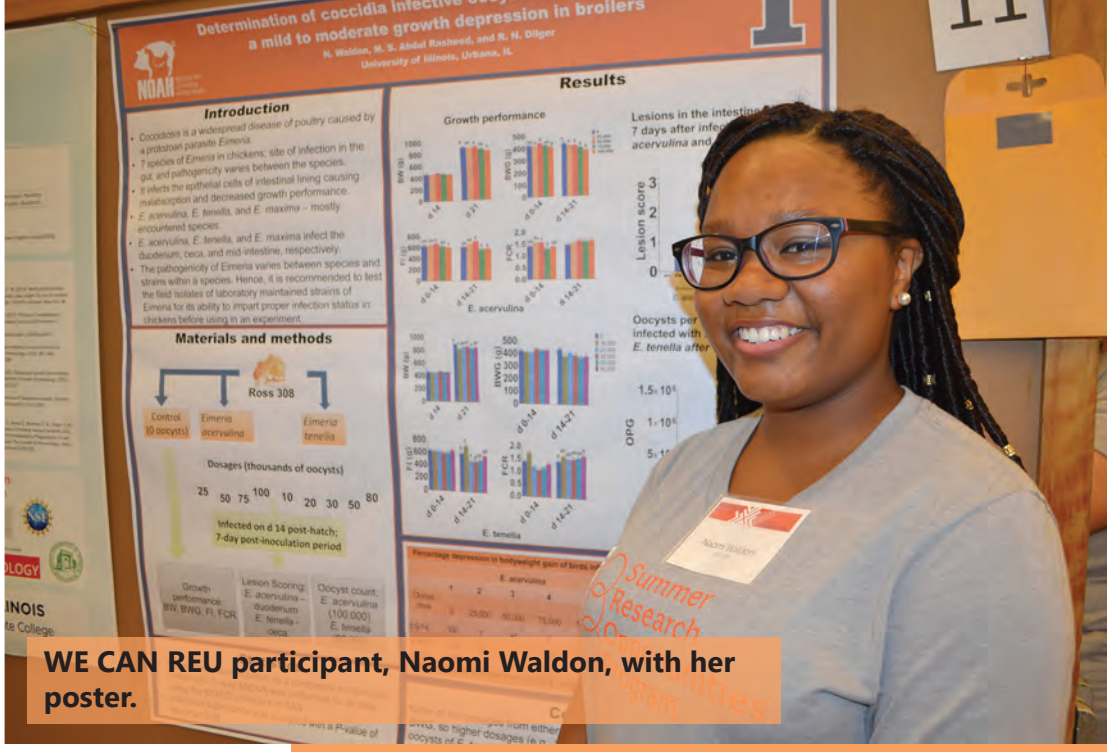
Green's research focuses on wildlife mating systems and population genetics. Davidson describes his as water quality in agricultural systems—reducing the transport of pathogens from animal facilities and nutrients and pesticides from the soil in fields via water.

Also unique about WE CAN is that it's a two-year program, which all six fellows committed to. Davidson explains that he and Green were nervous about whether the fellows would actually come back for a second summer. "So retention was a concern," he admits, "but we have 100% retention, so we think they must see value in it."

Even more unique is that for the first summer's 10-week program (2017), after the participants spent six weeks on campus for orientation and training, they then traveled to South Africa for four weeks.

Regarding last summer's program, during the participants' time on campus, the PIs tried to expose

them to as many aspects of engineering, agriculture, and wildlife as possible. So along with some labs and team-building activities, they took them on a lot of field trips, most of which were a lot further than just across town. For instance, they visited an exotic cat park in Indiana, which featured lions and tigers (no bears, oh my!), and a wolf park in Lafayette, Indiana. They visited the Fair Oaks Farm, one of the largest dairy farms in northwest Indiana. Students learned how ethanol is produced during a visit to an ethanol plant,. They did a nature walk at Allerton Park. “A lot of them are from cities—Chicago, Atlanta—so they didn’t know much about agriculture,” Davidson says.



WE CAN REU participant, Naomi Waldon, with her poster.

In fact, a lot of the activities scheduled for the first summer actually came about as a result of one-on-one meetings with participants. Davidson shares how they came up with these activities. They’d ask questions like:

> **“Coming into this, if there’s one thing you really think and expect that you’re going to do, what is that one thing?” If one of the students said, “‘I’m pretty sure we’re going to see beef cattle or something, right?’ Davidson or Green would respond, ‘Yes!’ We were thinking along the lines of what they were interested in and then would try and make the opportunity happen so they could all visit these different things.”**

For instance, one thing city kids have probably never done is drive a tractor. So they took them out one afternoon and let them drive one.

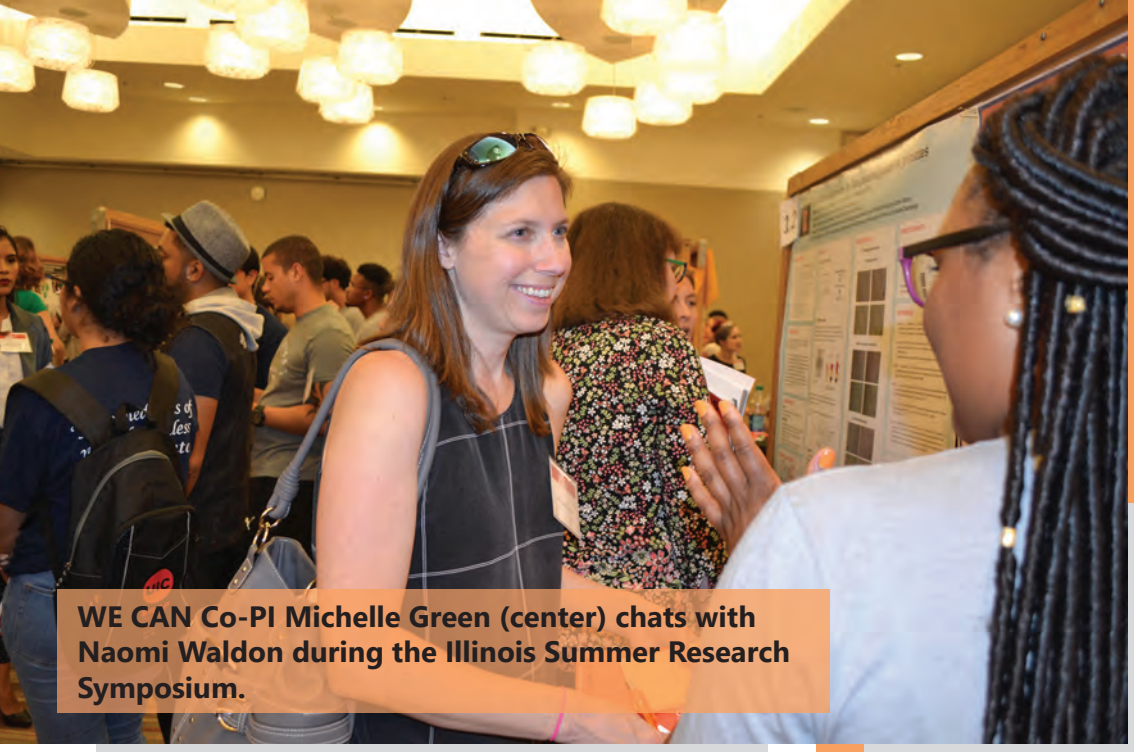
> **“So, I rode with them,” Davidson qualifies. “We didn’t just turn them loose. While I was riding with them, I found out that either two or three of them had never driven a car before. They didn’t have a driver’s license, so for them to drive a tractor, that’s pretty cool.”**

The participants also met with different faculty on campus as a way to start matching them with their advisors for the summer of 2018. Students were to investigate research areas in which they were personally interested that might help move them forward in their careers. Plus, in preparation for their trip to South Africa, participants took a course to learn about the history and culture of South Africa.

The pièce de résistance for summer 2017, of course, was travelling to South Africa for four weeks. Once there, the REU fellows were teamed up with South African students, working jointly on engineering projects similar to senior-level capstone design projects. The projects were relevant to South African agriculture—things that we in the US might consider low-tech, but are needed there, such as a pedal-powered machine to clean small grains, or a plastic bottle crusher or chopper.

While the engineering projects were the main emphasis in South Africa, it wasn’t all work and no play. On weekends, they took excursions which included wildlife and nature type things. They went to game parks, where they saw elephants, lions, zebra, even a cheetah. They went up in the mountains for a weekend, where they went hiking. “It was kind of a getaway,” Davidson admits. “I don’t think phones worked up there, so it was just a very peaceful. relaxing weekend.”

The field trips and the trip to South Africa components were added based on the recommendation of many folks who told the PIs that underrepresented students often don’t have the money to travel abroad or do day trips.



WE CAN Co-PI Michelle Green (center) chats with Naomi Waldon during the Illinois Summer Research Symposium.

“But exposing them to that actually opens up a lot of opportunity for personal growth, and their own confidence, and being able to independently navigate the world.” Green explains.

The second summer, 2018, was devoted to research. The 8-week research program ran from May 29th through July 20th and ended with each student presenting a poster or oral presentation about their research in the campus-wide, Illinois Summer Research Symposium. Unlike last summer’s South Africa projects, which focused on third-world country interventions, Davidson claims this summer’s program was “pretty high-level research.”

For instance, one fellow, Erin Holland, worked with a faculty member in Vet-Med doing more of a human health project—looking at arsenic in human health samples. Because she’s very interested in human health in extension and talking to people about health, this was the perfect project for her; in fact, she traveled to Florida to collect samples and talk to people.

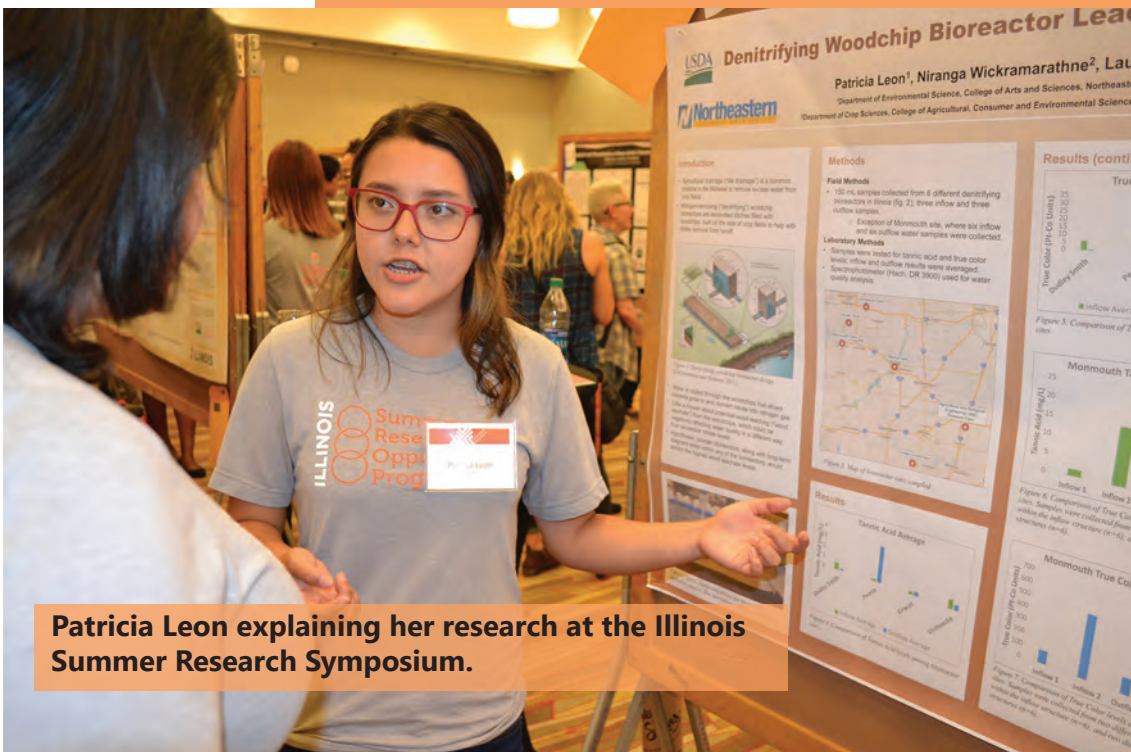
Another student, Patricia Leon, a rising senior at Northeastern Illinois University, worked with Crop Sciences professor, Laura Christianson, who was trained as an agricultural engineer, to analyze a specific type of agriculture drainage practice called nitrogen removing or de-nitrifying wood chip bioreactors.

Hoping to come to Illinois for graduate school, Leon reports:

"Because of the WE CAN program, I actually got to be in the department that I want to be applying into and got to do research with a professor."

Another WE CAN undergrad was Alisha Weatherspoon, a rising junior in Agricultural Engineering at Illinois. She’s always been interested in water quality, so working in Co-PI Paul Davidson’s lab doing a study about the retention of the herbicide Roundup in ground water was a perfect fit for her, She reports “Just seeing things in the news about poor water quality in different places, and wanting to see if I can do something about it.”

Weatherspoon reports that last summer’s trip to South Africa was amazing, calling it one of the most wonderful experiences she’s ever had. “Combining a project that I worked with hands on—my first project that I got to help plan out and then actually



Patricia Leon explaining her research at the Illinois Summer Research Symposium.

do it—and going on excursions in South Africa is a good combination!" Her South African project was a lab-scale hydropower system that used the pump as a turbine. She and her South African counterpart generated enough electricity to light up about six lightbulbs.

WE CAN REU participant, Erin Holland, explaining her research to a visitor to the Symposium.

Weatherspoon believes participating in WE CAN over the last two summers has had a positive impact on her skill set. "I think both of these summers have really developed my problem-solving skills and my skills as an engineer overall, I guess. Teaching me how to learn I guess."

In fact, based on her WE CAN experience, she's hopeful that she'll be involved in research down the road.

> **"I really enjoy doing the research. I hope that my job in the future incorporates some research into it. It was a good experience…I prefer being hands-on with research instead of just learning in a class environment," she acknowledges.**

Weatherspoon says that her dream job is to work with the NRCS (Natural Resources Conservation Service) or the EPA after she graduates.

Another unique aspect of WE CAN was the emphasis at the intersection of engineering and agriculture. How did Davidson and Green, with such disparate research areas, come to collaborate on an REU? The campus could only submit three proposals to the USDA's (United States Department of Agriculture) limited submission REU, so the nine people interested in submitting were asked to consider collaborating. "So I contacted Paul," Green admits, "and I was like, 'I know we don't know each other, but…'

Ironically, it was their somewhat disparate research which intrigued the USDA. "Which is what made the program pick us," Davidson explains.

Davidson stresses that when people from diverse fields work together, it often strengthens the research because of the diverse perspectives:

> **"Oftentimes engineers—or anybody in a single field—get blinded by their own focus," Davidson explains, adding that a person from a different discipline will often, "come in with this completely different perspective, and they actually come up with solutions for some of the projects that the engineers would never come up with.**

One of the challenges of collaborating with someone from another discipline, of course, is getting past the discipline-specific jargon. Green says this echoed everything that happened with them. In fact, she admits coming into it with a bit of trepidation. "Because when I was looking at the list of people to talk to, I was like, 'Oh boy.' He's in [agricultural] engineering; he's an engineer, we're probably not going to understand anything he has to talk about, or any of his research or anything. I'm going to go talk to him anyways, and I'll ask my silly questions."

"But then, that works both ways," Davidson adds. "It works both ways," Green agrees, adding that their project fostered cross-discipline collaboration. "So part of it is teaching our fellows that they do have something to contribute even if they're not an engineer. So there's power in a diverse group of people."

Davidson explains that generally in science and research, much of the current, cutting-edge research is at the intersection of disciplines:

"We're finding that most of the cool stuff nowadays is at the intersection of disciplines. Most of the discipline-specific work has been done, so now you have to think about how those overlapping areas work together."

What with the emphasis on the intersection of engineering and agriculture, the international service component, plus research, it's no wonder the USDA was intrigued. What's not to love?

According to Davidson, one sticking point was the small number of students impacted. "I think the hesitation was that we're not able to train a large amount of students. We're investing a huge amount of money in a small number of students, but the experiences they're getting are unmatched."

Whether or not the funder will get a lot of bang for their buck, i.e., the students will end up in grad school/careers in Agriculture-related fields, it's too early to say.

One of the six just graduated and is starting grad school here in the fall in Natural Resources and Environmental Sciences. However, the USDA wanted WE CAN to recruit fairly young students—freshmen and sophomores. "So you get them right away interested in research and show them what's possible within the field of agriculture," Green explains.

Green adds that the fellows are doing a lot of exploring right now to figure out what they're going to go into.

"Our job was to give them a lot of experiences so that they could see that what they're interested in actually does connect to agriculture, and to keep them aware of that so that they know that there are opportunities for them."

Even if they were interested in, say, human health, Green explains that what happens in agriculture can certainly influence what happens in other fields. So the idea was to help the students understand that, in hopes that down the road, they might choose a career in an ag-related field.

What were some of the other benefits for participants? On top of the field trips, traveling abroad, and the research opportunity, they also earned a stipend. Plus, to go along withal the great stuff to add to their resumes, they've been promised a couple of really good letters of reference. "So Michelle and I, either one or both, would write glowing letters at this point, because they've been phenomenal," Davidson explains.

Green cites a couple of other things have gained through the experience. "These young women, hopefully we're giving them everything they need for self-confidence, and networking, and skills to go forward with the career plans. But they are all smiles now," she adds. "It's fun to have them back for the second year."

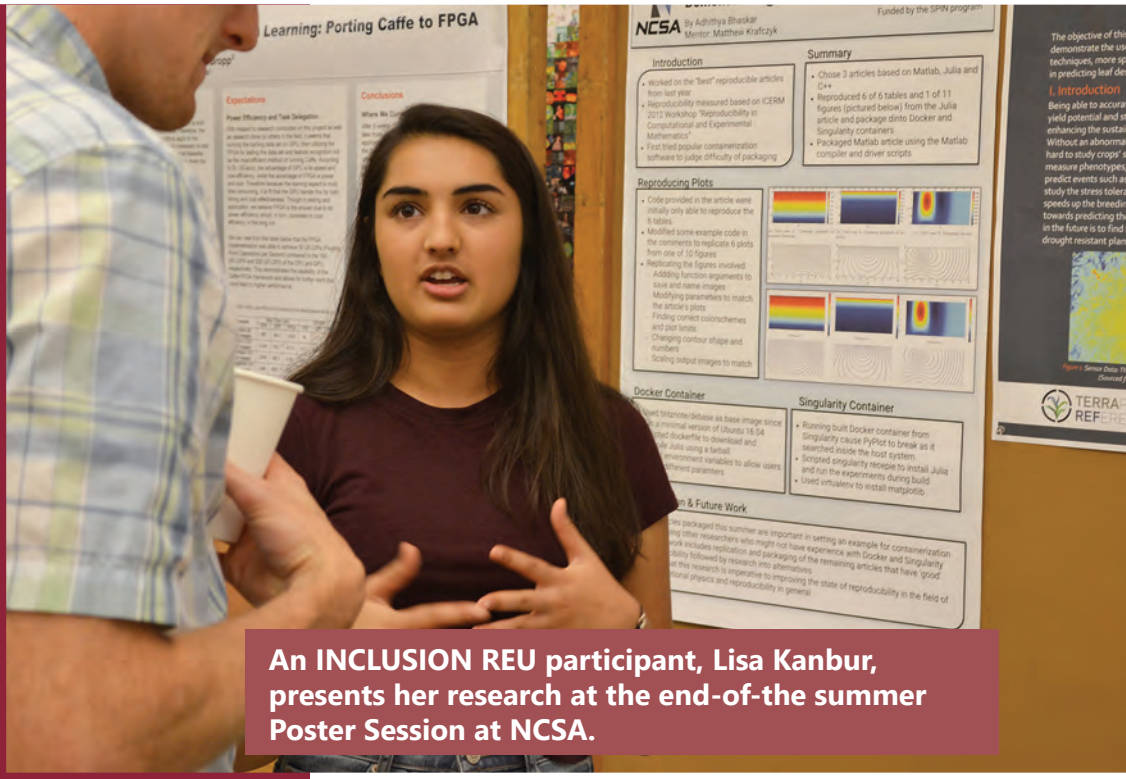
WE CAN REU participant, Alisha Weatherspoon by some of the materials she used in her research.

WE CAN student Alisha Weatherspoon micropipettes a solution in the lab.

UNDERGRADS EXPERIENCE OPEN SOURCE SOFTWARE & INTERDISCIPLINARY RESEARCH VIA INCLUSION REU

August 13, 2018

Eleven US undergraduate students participated in the second summer of NCSA's NSF-funded INCLUSION (Incubating a New Community of Leaders Using Software, Inclusion, Innovation, Interdisciplinary and OpeN-Science) REU (Research Experience for Undergraduates), which this year also included a trial of an international partnership with one international student working alongside the US students. Students gained skills they hope to employ down the road, including using Open Source Software; most improved their coding skills or learned a new programming language. Plus, they created a poster then presented their research at the Illinois Summer Research Symposium and at the end-of-the-summer poster session at the NCSA (National Center for Supercomputing Applications). Participants also made some new relationships with each other and with others at Illinois, including their mentors.



An INCLUSION REU participant, Lisa Kanbur, presents her research at the end-of-the summer Poster Session at NCSA.

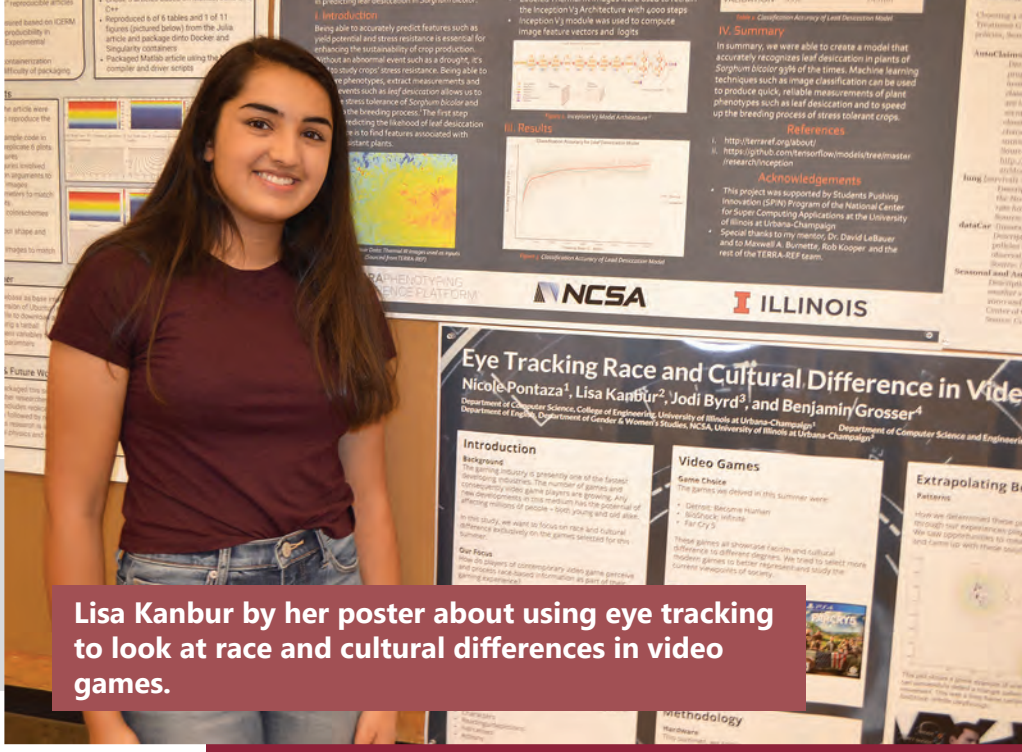
One goal of the INCLUSION REU project, according to PI, Daniel S. Katz, NCSA's Assistant Director for Scientific Software & Applications and Research Professor (iSchool, Electrical and Computer Engineering, and Computer Science), was for participating undergraduate students to develop software and/or contribute to software projects, specifically projects using Open Source Software, software that is free for users to view and modify. Another program emphasis was to foster interdisciplinary collaboration across all fields, not just computer science. Thus, the projects in which students participated were led by two mentors from different disciplines. As for the REU's third goal, its name—INCLUSION—says it all: to make the population of software developers more diverse. "While anyone can contribute to open source projects, it's important that we don't only rely on those who can afford to do so without reward, and that we provide all members of the scholarly community with opportunities to get involved," Katz said.

The participants hailed from around the country and beyond (one was an international student), while three were from the University of Illinois at Urbana-Champaign. While many of the students were computer science or computer engineering majors, a couple were studying physics and another chemistry, some minors ranging from math, to Italian, to English. Regarding increasing the diversity among software developers via inclusion of underrepresented students, most (eight) of the participants were females, plus a number were underrepresented minorities: two were Latina, one was Latina/American Indian, and one student was African American.

The participants' reasons for participating in INCLUSION varied. For instance, **Lisa Kanbur**, a rising sophomore in Computer Science at the University of Buffalo in New York, was encouraged to apply for an REU by her parents and her mentor at school. So after doing some research, she found the INCLUSION REU at Illinois. Intrigued by its "cool projects," she reports, "I figured it sounded like a good program."

What interested her the most about the REU was the opportunity to not only get research experience but to learn about the grad school process. Still in the early stages of her college career, she didn't know too much about it. But because students she knows at school have been applying to grad schools, she was curious about the process.

"So I knew this program would give me information to make a decision on whether or not I wanted to go to grad school," she remarks.



Lisa Kanbur by her poster about using eye tracking to look at race and cultural differences in video games.

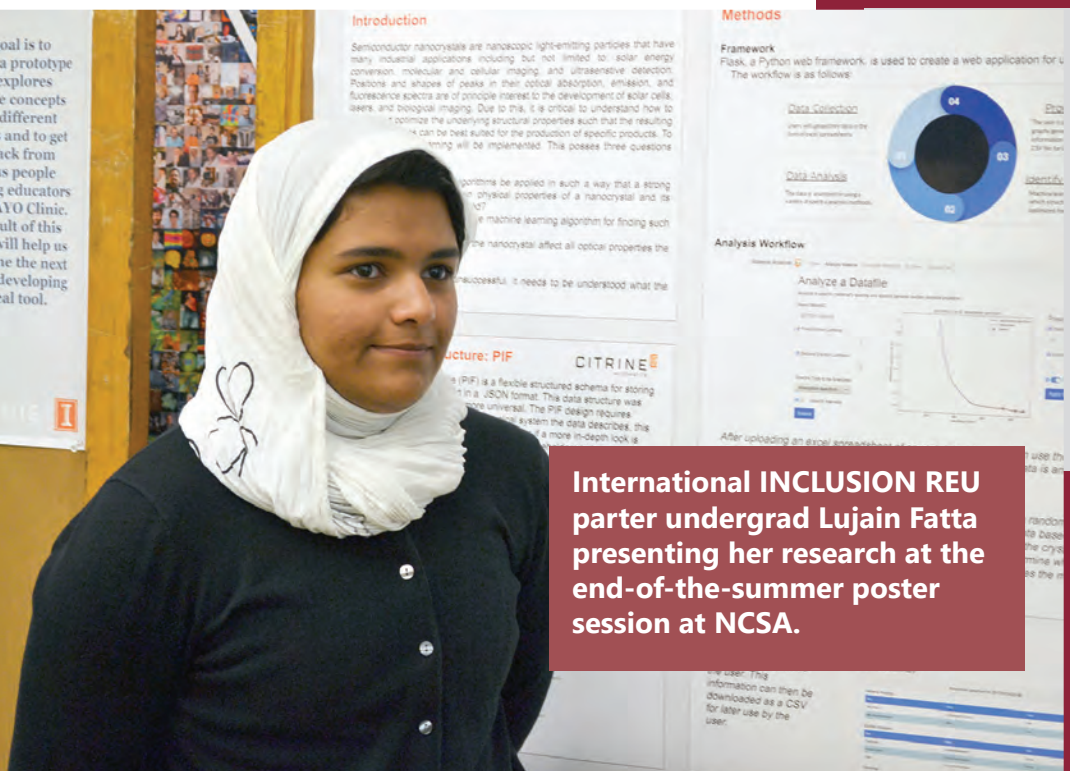
Kanbur's research used eye tracking to look at race and cultural differences in video games as a result of bias in algorithms coming from institutional racism. She and her research partner, Nicole Pontaza (in her second summer in the REU), used an eye tracker: hardware hooked up to the bottom of the computer monitor which was able to detect what a participant was looking at during specific points in a game.

Kanbur explains that by examining these data, she and Pontaza were able to extrapolate patterns at specific points in each game that they thought were important. The goal was to determine what the person was looking at in each timeframe or screenshot of the game and then, based on that, make conclusions about what decisions they made or whether something affected another decision.

summer the two focused on developing software to extrapolate patterns from the data. Kanbur says that in the future, they want to visualize the data better and look at more games and see what other controversial moments they can look at in each of three games.

Kanbur indicates that the most challenging thing this summer was learning a new programming language: C-Sharp. Plus, because the eye tracker they used came with a software development kit for Microsoft Visual Studios, she also had to become familiar with that software as well.

Kanbur says she grew personally from the experience.



International INCLUSION REU parter undergrad Lujain Fatta presenting her research at the end-of-the-summer poster session at NCSA.

"I feel more confident in myself as a student now that I have this research experience," she admits. "I think I can…talk more confidently about my experiences and make more informed decisions about what I want to do later on. So this program really helped me with that."

Plus, she may also have gained clarification regarding her future career plans. Now that she's experienced research, she might want to continue doing it:

“I definitely would like to…use some of my computer science skills and… bridge it with the humanities and see what I could do with that.”

Another participant, international student **Lujain Fatta**, a rising junior studying Biomedical Engineering at Rose Hullman Institute of Technology in Terre Haute, Indiana, says she ended up in the NCSA summer program because she’s required to do some program in the summer, and her scholarship advisor suggested this one.

A biomedical engineering major, Fatta calls ther research this summer “pretty biomedical.” She and her research partner, Patrick Shinn, were trying to reverse engineer the design of a nano crystal. She explains that the physical composition and shape of a crystal affects the position of a peak in the absorption spectrum. “So we wanted to write a machine-learning code that can learn from the existing data so it will do the reverse.” Instead of what is being done right now—designing crystals then measuring the spectra—the goal was to determine where the peak should be then have the software create the design of the crystal.

Fatta says the most challenging thing about this summer was using Python.

“I know how to program,” she explains, “but not in Python. So I had to learn Python pretty quickly.” Another challenge was that the code they were using was written without any comments, “So I had no idea what it does,” she explains. “We had to take it apart piece by piece and see what every piece does...I learned a lot.”

Besides learning Python, Fatta, who says she had the chemical background for the research they were doing, also learned a lot about semi-conductor nano crystals. “I feel like I've grown a lot,” she acknowledges. She also grew relationally: “I met a lot of people,” she adds.

Did participating in the program impact her future career plans? “Yeah, kind of,” she admits. For one, she got the message about the benefits of interdisciplinary learning.

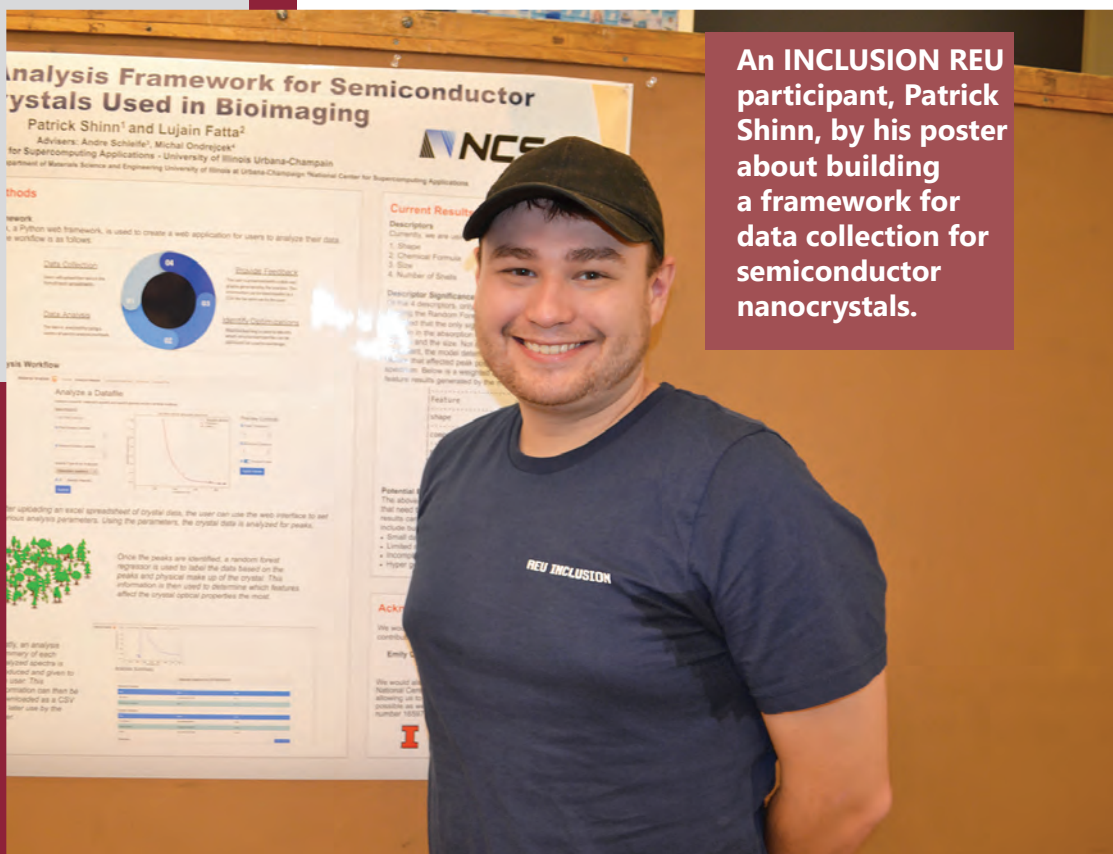
“It just made me think I need to take more computer science classes, because it goes hand in hand. You can't just be an engineer or just be a computer scientist. You need to know a little bit of both.”

Her assessment of the summer? “It's been a really great experience, and I've learned a lot,” she adds.

Fatta’s research partner was **Patrick Shinn**, a rising senior majoring in Computer Science and minoring in math at Marshall University. He found out about the INCLUSION REU when researching REU sites on the NSF website. After discovering that Illinois was ranked #10, “I was like, ‘Oh, this is a great opportunity!’ and I applied that way.”

Shinn spent the summer working with Fatta to build a framework for data collection for semiconductor nanocrystals. He indicates that one of the challenges he encountered was related to the interdisciplinarity of the project. “So I knew the CS specs, because that's my background, but the material design science aspect—I had no idea what that was, so I was kinda’ just like ‘Okay, what do I do with this? Okay, cool!’"

For one, he found the analysis aspect when creating the framework to be challenging. “So when you upload a crystal sample file, you would analyze the file, and I had no idea what to analyze it for.”



An INCLUSION REU participant, Patrick Shinn, by his poster about building a framework for data collection for semiconductor nanocrystals.

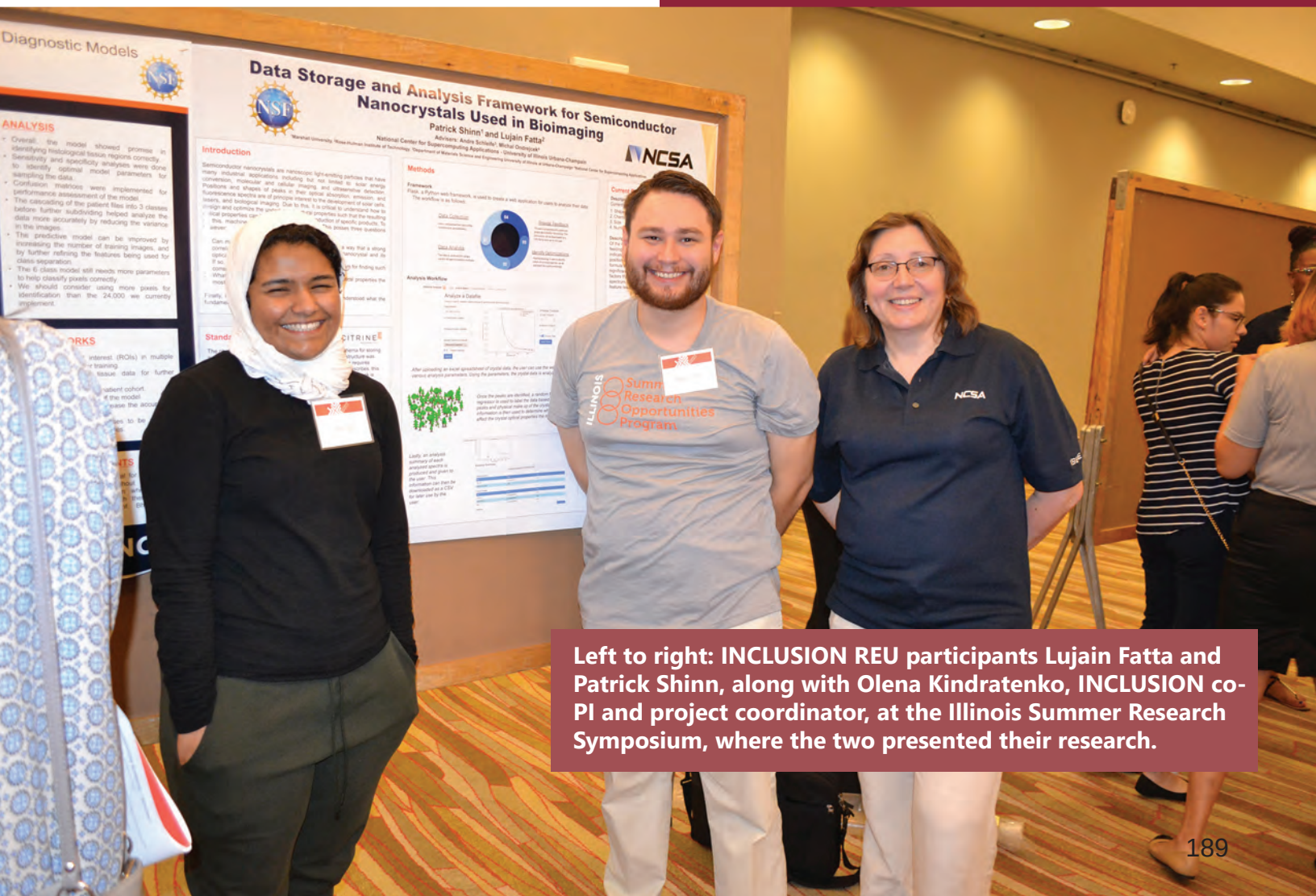
Elaborating on Fatta's comment about the code's lack of comments, he stresses that while there was already a preexisting code base, the author hadn't included any comments in the code. "The person just wrote it, and so I tried to figure out what that code was doing, but I didn't have a background in the science aspect, so trying to figure out what that code was doing and how it applied to the crystals, that was probably the biggest challenge," he explains. Having someone from the discipline, his partner Fatta, workig alongside him helped.

Shinn stresses that it would've helped more if the code had been documented. "When you look at somebody's code," he elaborates, "you look at how they think. The way you write code, all it is is logic. It's how you think to solve a problem. So unless you tell that person what your thought process is, they're not going to follow the same way because everybody thinks in a different manner."

However, despite the challenges of the experience, Shinn indicates that some of the benefits for him personally were getting to travel and coming to Illinois.

"I don't normally get a whole lot of opportunities to travel," he says, "so I got to travel halfway across the country (Marshall U is in Huntington, West Virginia) and see new places, so that was really interesting. And I got to see the campus here; the campus is absolutely beautiful. It's about four times the size of my home institution, and my whole campus fits on the main quad out here, so that was really cool." Plus, he adds, "I got to meet a lot of interesting people I'd never met before: a bunch of people from New York, California, Detroit—all kinds of cool stuff."

Katz says, "Overall, it was a great summer program for our students. They developed new research and communication skills, met new people, had new experiences, and now have new opportunities for their futures."

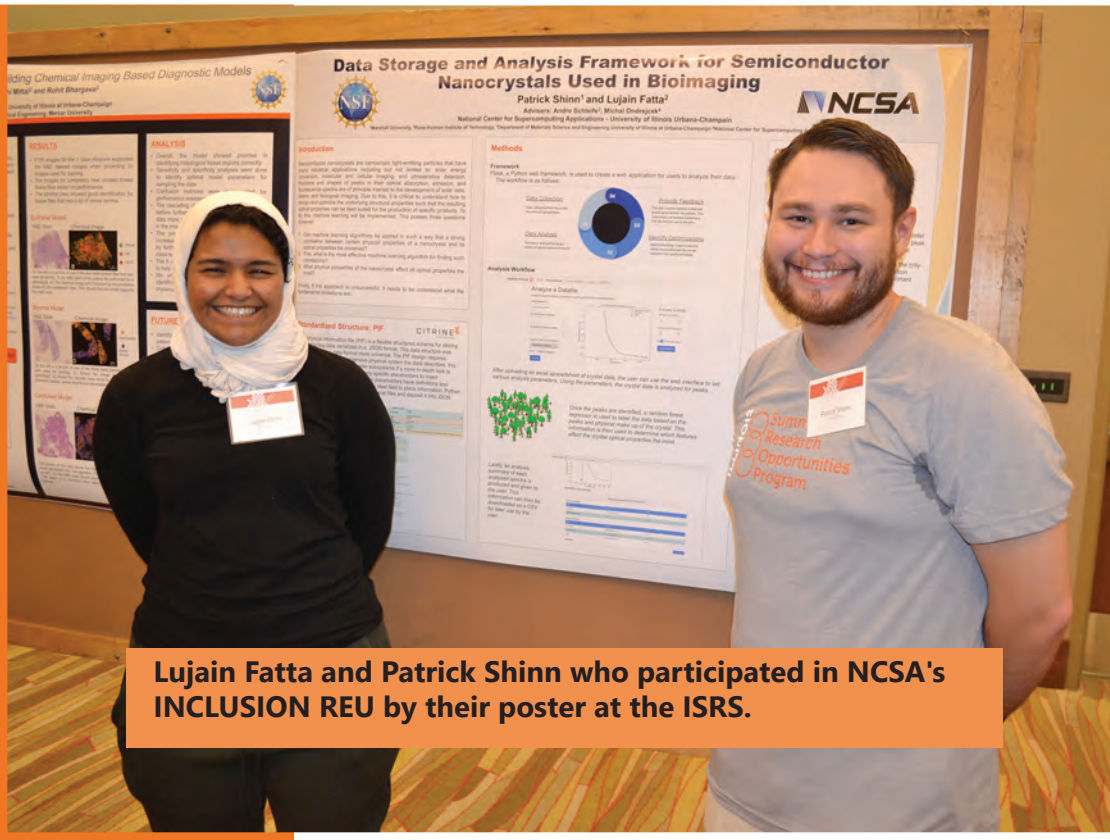


Left to right: INCLUSION REU participants Lujain Fatta and Patrick Shinn, along with Olena Kindratenko, INCLUSION co-PI and project coordinator, at the Illinois Summer Research Symposium, where the two presented their research.

ILLINOIS SUMMER RESEARCH SYMPOSIUM SHOWCASES UNDERGRADUATES' REU EXPERIENCES

August 14, 2018

On July 19–20, 2018, over 150 undergraduate students and pre-doctoral students presented posters at the 2018 Illinois Summer Research Symposium (ISRS) as a culmination of their summer research experiences at Illinois. The students not only conducted studies in the labs of some of Illinois' world-renowned researchers, but many of them were part of undergraduate programs that also partnered with SROP, the Graduate College's Summer Research Opportunities Program. This allowed the undergrads to participate in professional development activities, many of them in preparation for possibly continuing their education and research in graduate school, and also provided the students networking opportunities.



Lujain Fatta and Patrick Shinn who participated in NCSA's INCLUSION REU by their poster at the ISRS.

The 14 programs with students participating in the Symposium included REUs (Research Experience for Undergraduates), such as the Frontiers in Biomedical Imaging REU; Memerres (Mentor-Mentee Relationships in Research); INCLUSION (Incubating a New Community of Leaders Using Software, Inclusion, Innovation, Interdisciplinary & OpeN Science); POETS (Power Optimization of Electro-Thermal Systems); and SURE Tox (Summer Undergraduate Research Experience in Toxicology), to name a few. Also participating was a program which provided research opportunities for rising doctoral students, the Grad College's SPI (Summer Predoctoral Institute).

Among the many REU programs and opportunities across campus were two new programs. One was REACH (Research and Education for the Advancement of Compassionate Healthcare). Sponsored by the Carle Illinois College of Medicine, REACH has an additional clinical component (thus making it an RCEU) and aims to provide an interdisciplinary experience for undergraduates interested in healthcare.

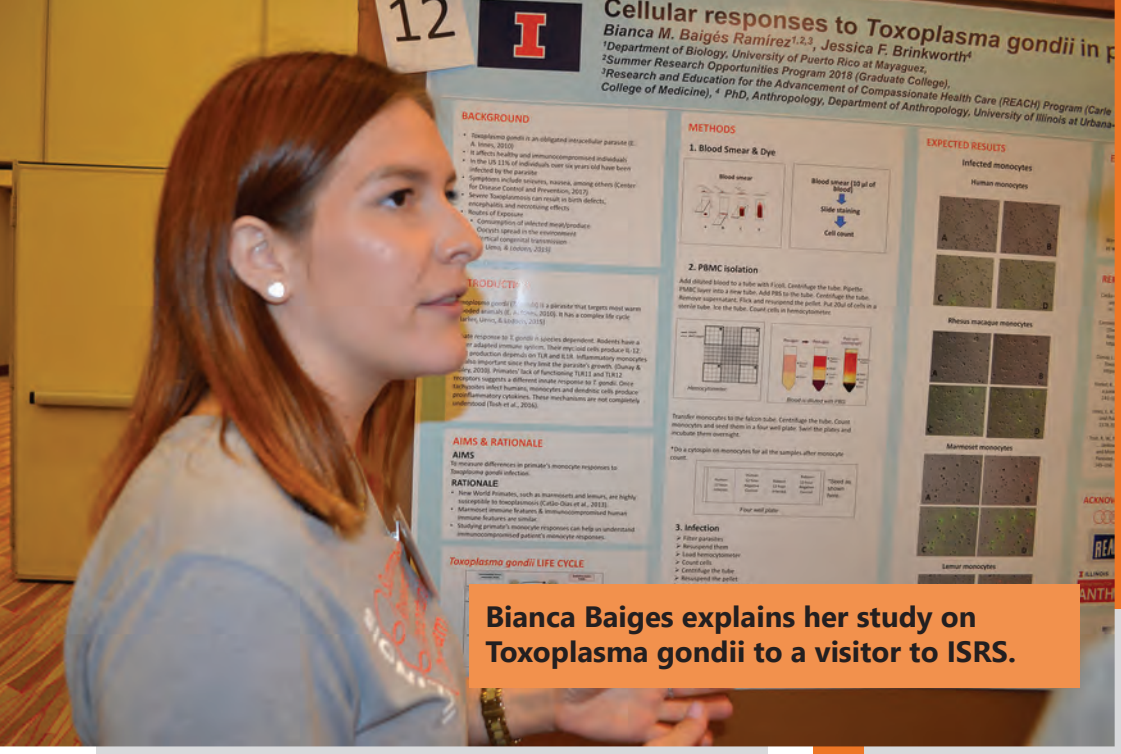
In its second summer, Wildlife Engineers Co-managing Agriculture and Nature (WE CAN), funded by the United States Department of Agriculture (USDA), is a two-summer program focused on combining aspects of agriculture, engineering, and wildlife into their research experiences. Below are synopses discussing the research and impact on several students who participated in these programs then presented at the Symposium.

Bianca Baiges

Participating in the REACH program was Bianca Baiges, a rising junior at the University of Puerto Rico, Mayaguez, who, despite applying to multiple programs, was drawn to the program because she specifically liked the REACH emphasis and diversity initiative.

She further explains:

> **"I also like that they have a focus on trying to implement healthcare and reaching different communities. I really like to help people, and I'm really**



Bianca Baiges explains her study on Toxoplasma gondii to a visitor to ISRS.

interested in medicine, so I really like that approach."

Since Baiges studies Biology and Animal Sciences, she found a fit in Dr. Jessica Brinkworth's Evolutionary Immunology and Genomics laboratory because it focuses on Anthropology, particularly Biological Anthropology.

She explained their work:

"We basically analyzed how a parasite affects different primates, and I think that's very interesting because I love to understand the connection between humans as well as different animals."

Though she admits that analyzing the data has been a challenge for her, Baiges does not currently have any results but expects to come up with promising results upon further analysis of her data in the coming weeks. Baiges plans to pursue medical school upon the completion of her current studies, and says she is interested in the Carle Illinois College of Medicine.

Patricia Leon

Patricia Leon, a 4th year Environmental Sciences student at Northeastern Illinois University, was interested in WE CAN because of its connection to agriculture and wanted to gain research experience pertaining to agriculture-related sciences.

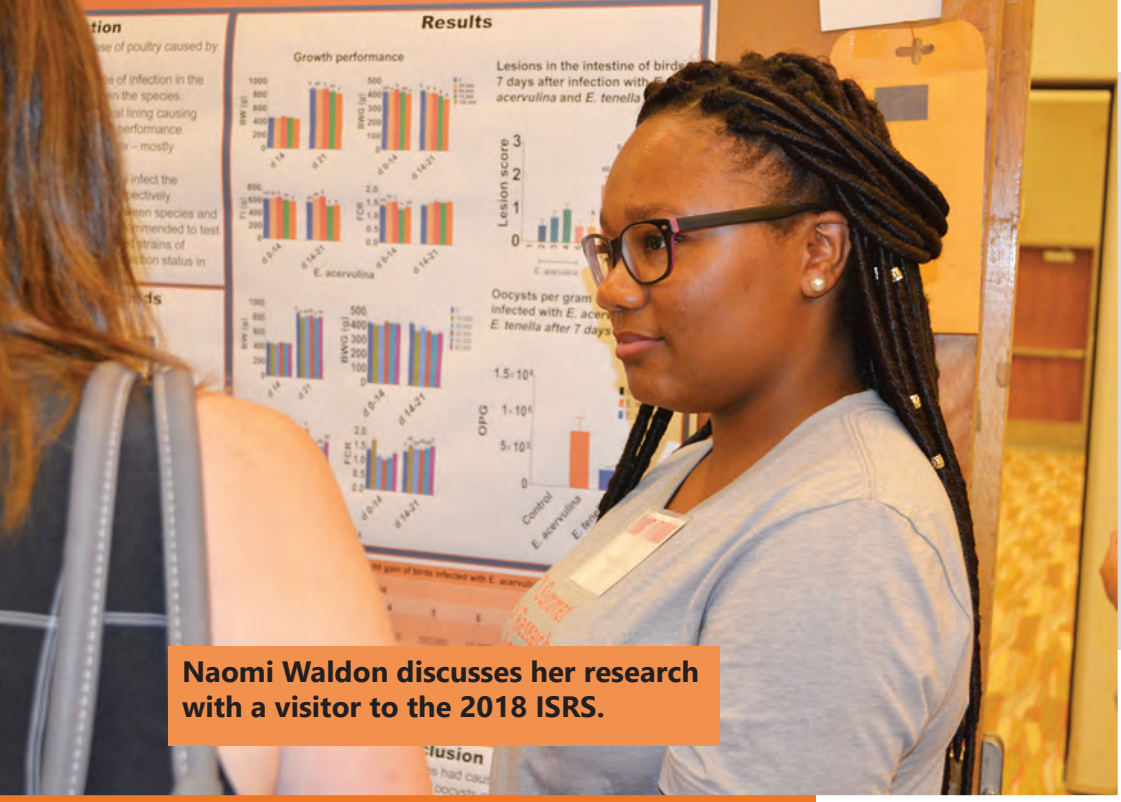
Leon worked with Dr. Laura Christianson and the Illinois Drainage Research and Outreach Program (I-DROP) analyzing woodchip bioreactor leachate through the denitrification of drainage water. She described her research as:

"the analysis of a specific type of agriculture drainage practice called nitrogen removing or de-nitrifying woodchip bioreactors."

Leon has determined that the bioreactors in the area have some levels of wood leachate present, which occurs when woodchips seep into the water. She further explains her results:

"I determined that in some of the bioreactors, when water is stuck inside the woodchips and kind of brewing within the woodchips, which allows more woodchip material to leach into the water."

WE CAN REU participant, Patricia Leon, presents her research poster at the 2018 ISRS.



Naomi Waldon discusses her research with a visitor to the 2018 ISRS.

Although Leon's research focused on the byproducts of agricultural wastewater, she said her research suggests that leaching could be possible in both well water and in soil, adding that it depends on how many woodchips are present and whether or not the woodchips are fresh. She adds:

> **"Farmers have to route the water directly through the woodchips in the first place to remove nitrates from the water."**

Reflecting on her experience with WE CAN, Leon says that she liked the research she was doing and would love to come to Illinois. She explains:

> **"I'm planning on applying for graduate school, and because of the WE CAN program, I actually got to be in the department that I want to be applying into and got to do research with a professor."**

Naomi Waldon

Naomi Waldon, a rising junior studying Animal Science at Tuskegee University, participated in the WE CAN REU after receiving encouragement from the head of her department. She elaborates on this saying:

> **[The department head] knew I was looking for an internship, and I was looking into SROP, for example, and they had just started [WE CAN] last year, and she was trying to find recruits, so she knew I was looking for a research opportunity. She was like 'Hey, this is a good idea for you!' and so I applied and was one of the two girls selected [from Tuskegee University] to come.**

Waldon's research in Dr. Ryan Dilger's Nutrition, Health, and Neuroscience laboratory focuses on finding out what the effective dose of coccidia, a parasite, is in chickens to cause a 15–20% depression in body weight gain. The results will determine what dosages will be used in a future study and she suspects that they will need to use higher doses of the parasite to induce 15–20% depression in body weight gain desired.

Though she was off to a rough start after switching labs, Waldon says research was a bit of a wakeup call for her because she was not aware of how difficult research could be or of everything that goes into it. She recalls her experience:

> **"I was actually supposed to be doing a different project at the beginning of the year, but that project got terminated because something happened to the control group, and you can't do a project without a control group. And so I ended up having to start over. I had to research a whole new topic, had to move to a different lab and stuff like that."**

So she learned how to work under pressure and deal with procrastination, which, she admits, proved to be quite the challenge for her because she found herself playing catch up for a while. Despite the initial setbacks, Waldon remains optimistic regarding her future in research and has her sights set on attending graduate school.

Reflecting back on her WE CAN experience, Waldon says:

> **"Overall, this summer was really, really fun, and I loved the experience that I had between this summer and last summer with the WE CAN group, so I'm really happy that I got this experience."**

Alondra Estrada

Alondra Estrada, a rising junior studying Natural Resources and Environmental Science here at Illinois, got involved with the WE CAN REU program because Dr. Thompson, Assistant Dean of the College of ACES, sent her an email encouraging her to apply. She was particularly excited about this opportunity because it combines many of the fields she's interested in, adding:

Alondra Estrada shows one of the 3D-printed turtles used in her research.

> **"I'm very interested in finding the connection between biology and the natural sciences with other fields, including engineering and animal sciences and all that."**

Estrada's research in Dr. Jinelle Sperry's lab was focused on turtle conservation, particularly of juvenile turtles, and determining what sort of sensory cues predators use to find the turtles. She spent her summer going out into the woods to collect data for her project each week.

Estrada explains:

> **"My project is unique in the way that it used 3D-printed turtles, which we printed here on campus, so we were able to monitor the model turtle, the plastic turtle, without having to be there. The models were set out for different weeks at a time, and so I didn't have to be there the whole time, but I was out there for a majority of the day throughout the week, different weeks, placing them, scenting them or not scenting them, and then watching the footage after each trial."**

She found that, combined with evidence found in previous studies, chemical, visual, and tactile stimuli are important cues that predators use to seek out turtles. In the woodlands where Estrada conducted the trials, predators included raccoons, possums, rabbits, chipmunks, and squirrels.

Despite the frustration from technical malfunctions and the poison ivy Estrada suffered while working out in the field, she says the experience was really fun. In fact, she's returning to the Sperry Lab this fall, and looks forward to carrying out the rest of the project and assisting with other projects.

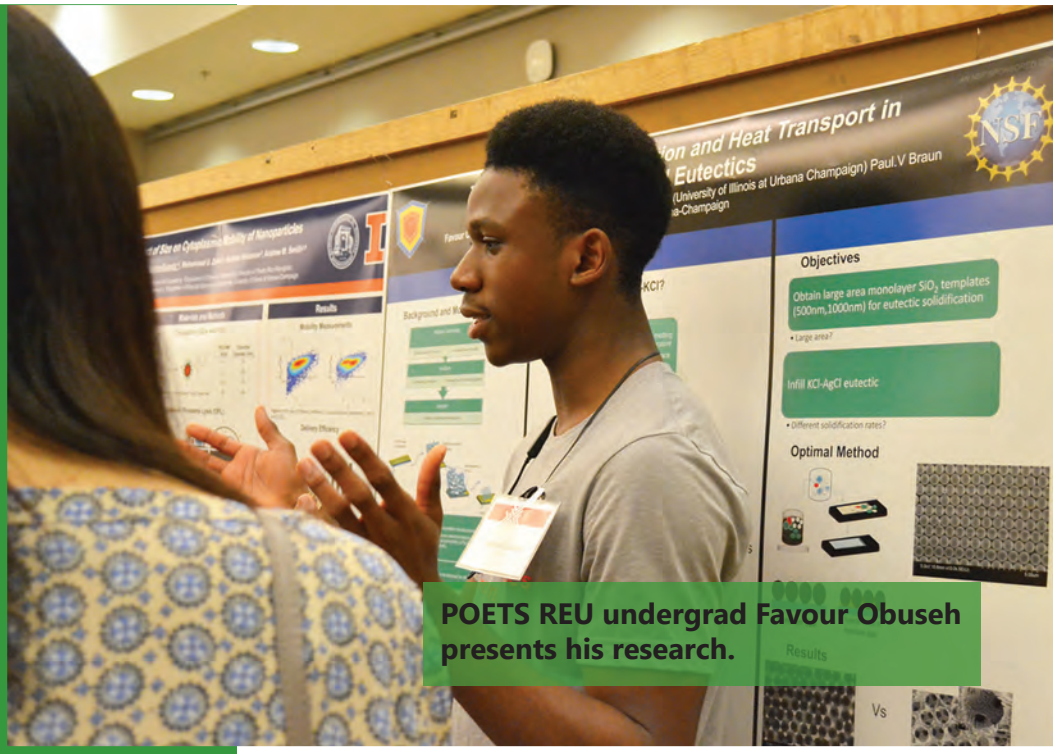
Regarding her new BFF, the turtle, Estrada admits she wasn't looking to work with them specifically, but she gushes:

> **"I definitely have become obsessed with [turtles]. I have come to love them very much."**

POETS REU FOSTERS INNOVATIVE THINKING TO CHANGE THE FUTURE OF POWER DENSE ELECTRONIC SYSTEMS

August 15, 2018

Ever wonder what the future of electronics could look like—say over the next decade? As part of the POETS (Power Optimization of Electro-Thermal Systems) ERC's 10-week, NSF-funded Research Experience for Undergraduates (REU), 15 students were able to explore the possibilities through authentic research experiences. Additionally, the students were exposed to a variety of educational programs that not only enhanced their knowledge base, and supplemented their research, but also exposed them to and prepared them for STEM careers.



POETS REU undergrad Favour Obuseh presents his research.

All of these activities supported the overarching goal of POETS' REU, which Associate Director of Education and Inclusivity Jessica Perez says was to:

> **"Provide a unique summer experience that encourages students to pursue graduate studies in engineering."**

In addition, the program also sought to encourage REU students to become part of the POETS community beyond their summer experience. The goal was to assist students in building their STEM network of both mentors and peers that will grow and mature throughout students' careers. The peer group would be comprised of students both at the undergrad's' home university and through virtual webinars.

Perez adds:

> **"We hope students return to their universities empowered by this experience to complete their STEM degrees, pursue other research-focused internships, and apply to graduate school."**

In its third year, the POETS REU has grown significantly since it was begun. In its first two years, the program had 6 and 4 students, respectively. However, in 2017, POETS was awarded a three-year, NSF REU Site grant, which allowed the program to expand in the summer of 2018 to include 15 students spread across its four partner institutions: 4 at Illinois, the POETS lead institution; 5 at Arkansas; 4 at Stanford; and 2 at Howard. Also, because the POETS program is housed in multiple universities, every student had a unique experience because each university had access to different resources. This also meant that the REU students began and ended at different times depending on their institution's schedule.

While the program's main emphasis was conducting research, students also participated in bi-weekly research seminars and professional development workshops. They also engaged in a variety of social and professional events, plus communicated their research progress at multiple venues. For instance, the REU participants at Illinois presented at the Illinois Summer Research Symposium. Participants will also get to present their research at POETS' annual meeting in October.

What impact did POETS have on the undergrads? According to Perez, she's hopeful that:

"This experience was able to build students' confidence in pursuing post-graduate STEM careers."

She reports that the teams of multi-disciplinary POETS faculty and grad student mentors who worked with the students this summer were able to expose and train students in the research process.

Below are brief vignettes regarding two POETS REU participants at Illinois and their research experiences related to improving the efficiency of electrical systems.

Alexandra Moore

A sophomore studying Electrical Engineering at San Antonio College, Alexandra Moore came to Illinois to participate in the POETS REU because she wanted to gain some research experience. In fact, Moore had previously worked on a hydrogen fuel cell vehicle and was working on how to make it run more efficiently.

She explains how her participation in POETS seemed to be the next logical step:

"We were concerned with being efficient, so now this was kind of the next step of efficiency, but on a much larger scale. I just felt like it was the next appropriate step to take because I do eventually hope to do research. I want to be a research engineer, and I would like to do it in this area of efficiency."

POETS REU undergrad Alexandra Moore presents her research at the Illinois Summer Research Symposium.

Moore's research focused on cooling down electronics for the purpose of improving power density in electrically powered mass transportation systems, which foreshadows what is to come for the industry.

She elaborates:

"It's looking very much to the future. What [POETS] is trying to do is electric planes, electric buses, any mass transportation that can be electric. They're looking forward to the future and predicting, 'Okay, one of the biggest issues is going be power density.' And where that threshold of how much power density it can handle is going to be based on how effectively can you cool down the electronics.'"

Moore has not yet had the chance to take any introductory engineering classes, so she admits that her experience was quite tough at first, as she often found herself reading numerous articles and doing extra research in order to get caught up in comparison to everyone else who had already taken those engineering courses. She continued:

"It was really cool, because I had to teach myself there and learn so much just so we could make a decision. I would say that was the hardest, but it was also the most exciting, because after a few weeks, I found I was able to get through the articles with a lot less struggle."

While it is too early for Moore to decide whether she wants to go into the industry or to attend graduate school, she is absolutely certain her future will involve electrical-engineering-related research.

Ian Rivera-Colon

A super senior studying Mechanical Engineering at Interamerican University of Puerto Rico, Ian Rivera-Colon got involved with POETS because after participating in a different REU at Boise State University, he knew he wanted another research opportunity.

In fact, he knew he had to act quickly in order to be in the candidate pool for POETS and recalled his experience:

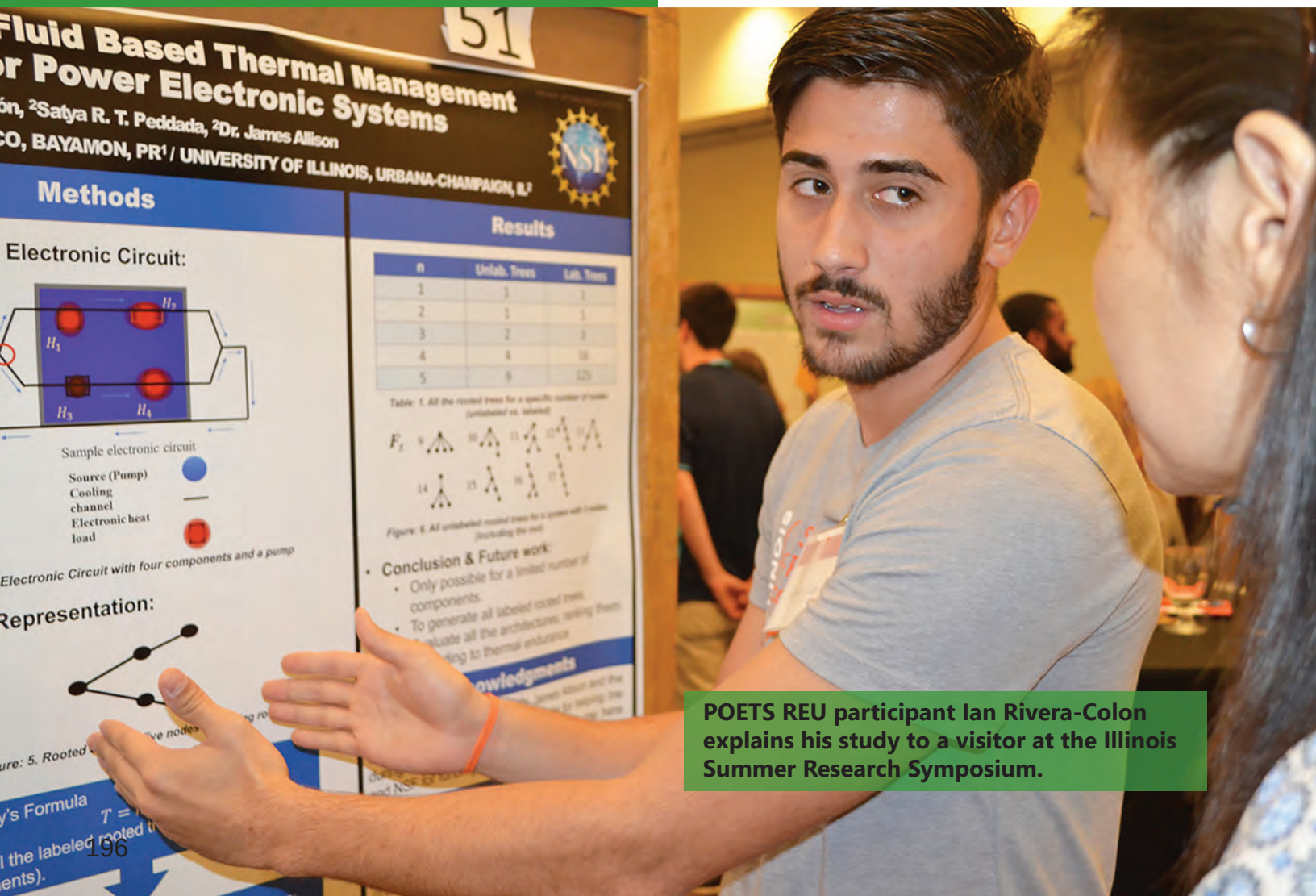
> **"The funny thing was, I saw the ad like five days before the deadline, and I did it really quickly. I called my professors and said, 'I need a letter as soon as possible!'"**

Rivera-Colon's research was focused on determining the best way to cool a power dense system by figuring out how to optimize its components. Despite not going into depth with thermal analysis, which he says is the last step, he learned a lot about power dense systems.

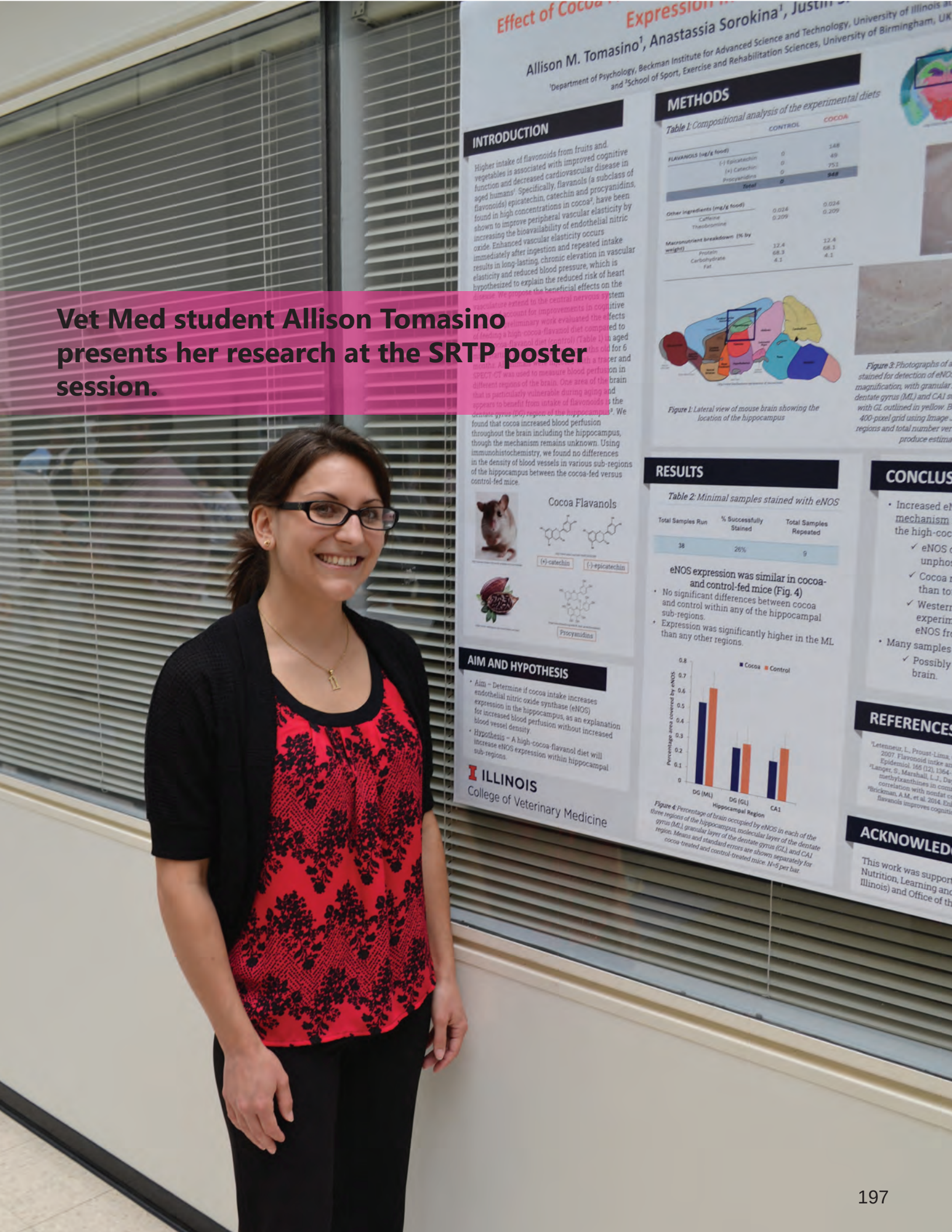
Regarding his experience, Rivera-Colon says that it was difficult because he initially faced a language barrier. Plus, he had to learn how to work efficiently and independently since his graduate student mentor was busy defending his thesis. Despite these challenges, he maintains that he enjoyed his experience saying:

> **"I really like the campus, the facility, and the POETS group has been great. They're really nice, and I really enjoy it here."**

For now, Rivera-Colon will likely go into the industry, but Illinois will definitely be on his radar when he applies for graduate school regarding a future involving engineering-based research.



POETS REU participant Ian Rivera-Colon explains his study to a visitor at the Illinois Summer Research Symposium.



Vet Med student Allison Tomasino presents her research at the SRTP poster session.

VET MED STUDENTS EXPERIENCE VETERINARY RESEARCH DURING SUMMER RESEARCH TRAINING PROGRAM

August 23, 2018

Nineteen Vet Med students participated in the College of Veterinary Medicine's Summer Research Training Program (SRTP) this past summer. They not only conducted research, but made a poster and got a chance to present it, including at SRTP's July 31st end-of-the-summer poster session.

According to the director, Lois Hoyer, SRTP is intended to be a pipeline into veterinary research. Its goal is:

> **"to identify the students who have a potential interest in a research-focused career or a career that has some research component to it, and then start them out early."**

Because many SRTP students are just finishing their first year of the veterinary program, they can find another research opportunity next summer to continue to build their research credentials.

In fact, some SRTP students continue working with their mentor to further explore the area they researched this summer.

> **"It happens very frequently," says Hoyer, "so that's just fantastic for me, the student, and for the mentor."**

She adds that Illinois' SRTP is part of a national program found at every veterinary school in North America, and is even expanding into Europe. Part of a whole culture of veterinary medicine programs nationally, Illinois' SRTP hosted the July 31st poster session in order to allow the students to practice presenting their poster before going to the National Veterinary Scholars Symposium hosted by Texas A&M this year.

Funding for Illinois' SRTP program comes from several sources. Hoyer is PI of an NIH (National Institutes of Health) T-35 grant. She also has a grant from Boehringer Ingelheim, an Animal Health Company, which she says has a 25-year history of promoting veterinary practitioners and scientists in the country. "That's in their own interests," Hoyer says. "They also think that this is really an important thing to have people who have clinical skills and people who also have some research skills." Plus, the College funds about three students in the program every year. Some funding even comes from the researchers/mentors themselves, who see the value of having a veterinary student join their research lab for the summer.

Vet Med student, Mary Kate Feldner, discussing her poster.

Jessica Kerr

One 2018 SRTP participant was third year vet med student Jessica Kerr, whose research was a study about dogs that accidentally ingest the drug

Metformin. The top treatment for Type 2 Diabetes, Metformin is everywhere, Kerr reports, so this happens a lot. Humans accidentally drop it, or leave out on tables, or the dog gets into their owner's purse and tears the bag.

Kerr's research found that whether or not a dog developed hypoglycemia wasn't based on the dosage they imbibed, but was possibly a genetic issue or dependent upon their breed. Unlucky breeds were Maltese, Doxens, Shih Tzus, and Schnauzers, adding that "Miniature Schnauzers and Chihuahuas were actually our big kiddos for the development of hypoglycemia."

Jessica Kerr discusses her research with a visitor to SRTP's end-of-summer poster session.

Since the two breeds most susceptible were so small, did size impact the results? Kerr says no; they took body weight into account, actually measuring the mg/kg of the dog. "So whether it was a big dog that ate a lot of pills or a small dog that took a few pills, it's the exact same average dose in the end," she explains.

Kerr was quick to report that the dogs in the study were not test subjects. "No, no test subjects. Never. Not for me!" she asserts. She explains that their study's data were obtained from people who called into the ASPCA's animal poison control center, lamenting, 'Oh no, my dog ate this pill! What do I do?'"

Kerr shares that SRTP this summer was a precursor to doing research in her own clinic some day. "So I want to be a general practitioner and work with all sorts of animals," she says.

This wasn't Kerr's first research experience. As an undergrad at Milliken University, she reports having "an amazing time" with their summer research program. The doctor she worked for did a lot of pain studies and incorporated research into his clinic. "And that's what I want," she admits.

So while she had already made her career decision, she says her experience this summer pretty much confirmed it. "It just reaffirmed that I can do it. I did a big study with about 5,000 dogs in the course of 10 weeks, so it just kinda' showed me that I can do it."

Vet Med student, Ivanna Levy, explains her poster.

Danielle Schneider

For third year veterinary student Danielle Schneider, SRTP was her first research experience. "It was really great to get to do clinical medicine and see how that interacts with the research world," she says.

For her study, she helped develop a program to train Illinois State Police K9 officers to do emergency procedures on their K9 companions. She and her research mentor looked at the major injuries dogs sustain in the field, for which having officers give emergency care

Danielle Schneider explains her research about training policement to do emergency treatments on their K9 companions.

would buy enough time to get the dog to a veterinarian.

Of the 12 categories they came up with, one condition important for the officers to learn to treat was gastric dilatation-invovulous. This is when a dog's stomach becomes overstretched and rotated by excessive gas content; if the air isn't released in time, it cuts off the blood supply to the stomach, and the animal can die.

Another job-related injury common to K9 dogs is opioid overdose—just by sniffing. In fact, Schneider says the K9 Corps has been having an overdose epidemic. For example, the drug fentanyl is so potent that it can be on a table, and an officer doesn't see the residue, but it's enough for the dog to sniff and overdose.

What were the conclusions of her research? She found that hands-on training works great with K9 officers. By the end of it, 100% of them were comfortable administering these emergency procedures.

Schneider chose this particular project because she used to train service dogs and has a passion for working dogs. When she heard about this research program, she said to herself, "Whoa, what if I could do my two passions—veterinary medicine and working dogs!" Luckily, she got matched with her mentor who was working on this project, and indicates that it had been a great experience.

Her dream job is, of course, working with working dogs. "I would kind of love to make working dogs a specialty of their own. There are such intricacies with working with them that people don't think about that. I think it's a whole field of veterinary medicine to go into, so it's something I might keep looking into."

Her biggest challenge this summer was learning the writing process. "So it's very hard to write this awesome paper to submit," she says. Luckily, she had lots of resources from the program about writing, plus, her mentor was very supportive.

"I've never written a research paper before, so that was very interesting," she continues. "And I had a great mentor that just said, 'Take a shot at it, and then we'll sit down and go over it together,' which was great to do that on your own and then get feedback afterwards."

How'd her paper turn out? They're actually going to be submitting her paper to JAVMA (Journal of the American Veterinary Medical Association), which she calls, "Very exciting!" Even more exciting? She's first author, "Which is great!" she admits.

Along with publishing a paper, she also gained skills using PubMed and doing poster sessions. "I never thought I would need a lecture on how to use PubMed for researching old papers," she admits, "but when the librarian came in and gave that to us, I was like, 'Whoa, there's so many things I didn't know about using PubMed!' So now I'm really good at that." Plus, they also got lectures on how to do poster presentations. "I've never done a poster before, so that was a learning experience," she adds.

Her big takeaway from this summer, however, was:

"That you can combine your passions," she indicates. "I want to be a veterinarian, but I want to give back to working dogs still, and I learned that I can do that in this profession and make a difference."

Allison Tomasino

Allison Tomasino, a rising second year vet med student partnered with Justin Rhodes from the Department of Psychology, conducted a study looking at the effect of cocoa flavanols on endothelial nitric oxide synthase expression in the brains of aged mice.

Regarding any challenges she encountered this summer, Tomasino said that—as with any

research—there were challenges with the study in general. They had a little bit of frustration within immunohistochemistry, plus some of their samples were staining while others were not. “But that's science!” she admits.

In fact, she and her mentor would laugh because during the bi-weekly reports, Tomasino kept telling her, “We've got to redo this; we've got to redo this. This didn't work." Her PI said she reminded her of somebody from her past: “This person ended up putting on a bench top, 'The art of repetition!' because that's basically what my summer was.”

“But even though it was a bit frustrating at times,” Tomasino adds, “I'm happy with what we got, and we definitely found something interesting that can be used later. So it doesn't matter if you have negative results sometimes. What happened is the most important.”

When it comes to research, Tomasino has a stellar resume thus far given her young career. For example, in addition to this summer's research experience, she's also worked at the NIH (National Institutes of Health) and the Navy Medical Research Center.

She started off as a caretaker technician, not directly involved in research, but maintaining the rooms. After spending a year or so watching everyone else doing research, she said to herself, "I really want to be the one that is doing the experiments and making a difference!"

So she got a research assistant position working under orthopedic surgeons at the Navy Medical Research Center. Her work there was with animals, mainly rats, pigs, and nonhuman primates. “They were all animal studies,” she explains, “so they were the first steps in the research process because you start with animals and then go a little bit further, and then to humans after.” At the Naval Hospital in Bethesda, Tomasino worked her way up in that structure to the point where she was running research teams.

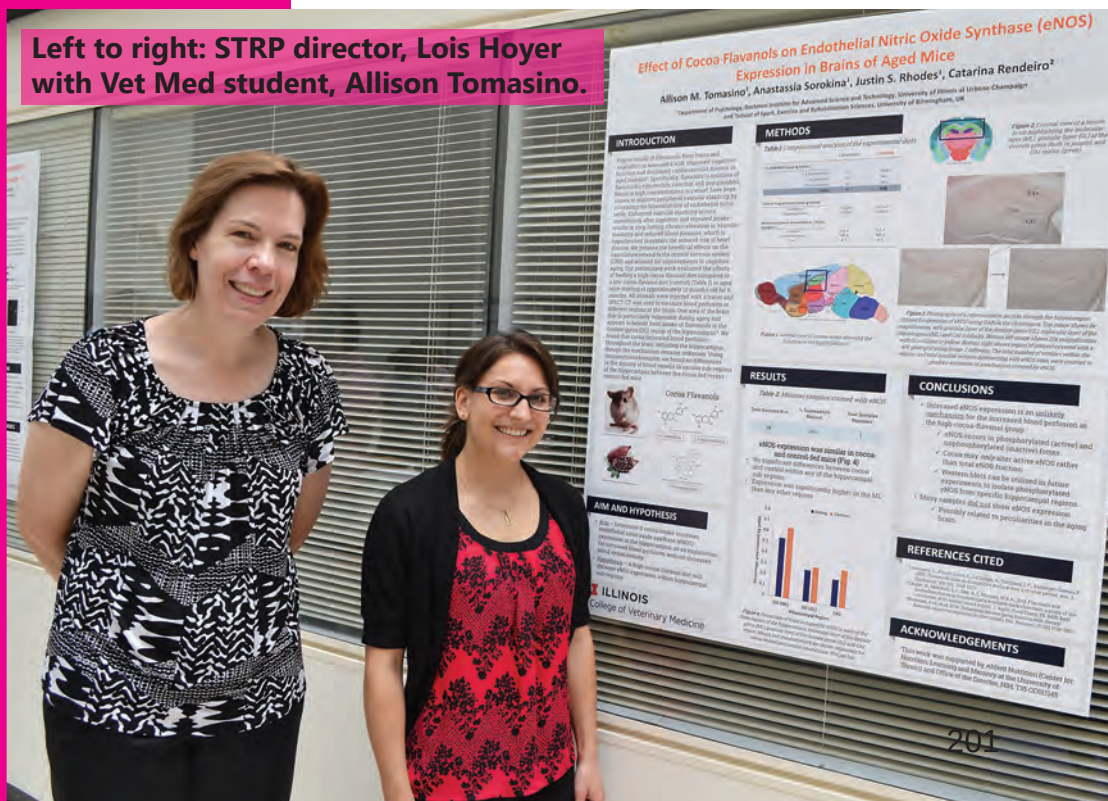
“It was probably one of the best experiences I've ever had,” she asserts. There for three years, she had a hand in a lot of orthopedic surgery research. In fact:

“One of my research projects is in clinical trials right now,” she reports, “which is pretty amazing. It was an amputation study. We developed a new prosthetic for the military, and it was amazing. Just knowing that even though you're a small part of research, just knowing it could get somewhere and make an impact is just such a great feeling, and I love it.”

Tomasino’s career goal is to work in a research facility setting with lab animals. “That has always been my passion ever since undergrad,” she reports. “Any way that we can improve animal and human health has just been a life goal for me. Obviously research kind of triggers that, so I did this program specifically to keep my research spirit alive.”

Her dream job is to be a lab animal veterinarian. So after her four years here at Illinois, she’s going to try to get a lab animal residency. She has a few programs in mind right now that are definitely the right steps to getting a residency in that field.

“I thought maybe after one year, there's so many different aspects of veterinary medicine, maybe I'll get a different mindset and do something else. But no, this is definitely where I want to be. I like research. I like pathology.”



Left to right: STRP director, Lois Hoyer with Vet Med student, Allison Tomasino.

ILLINOIS SPACE SOCIETY PROVIDES MEMBERS STELLAR TECHNICAL AND LEADERSHIP EXPERIENCES TO PREPARE THEM FOR CAREERS IN SPACE TECHNOLOGY

September 11, 2018

For the 150 or so members of the Illinois Space Society (ISS), the organization forms a community on campus where, according to ISS Director Sarah Legg, the "rocket nerds" from Aerospace Engineering (Aero) and beyond can get to know each other: "I've made my best friends here," she acknowledges. "They're all rocket nerds." In order to prepare members for careers in the field of space exploration, ISS also offers professional activities, including the opportunity to attend national conferences. To give its members hands-on, technical experience in rockets and space technology, ISS sponsors several different projects, many related to national competitions. Finally, to ensure that the next generation gets as excited about space as the ISS members are, its educational outreach experiences allow members to share their passion for space and rockets with interested youngsters of all ages. One of their biggies is coming up on October 6—Illinois Space Day.

Regarding the sense of community and relationship-building ISS fosters, several Executive Board members claim that ISS has been key in helping them develop relationships. For instance, Aero sophomore Shivani Ganesh, the Educational Outreach director, says she not only made friends, but gained older and wiser mentors through the society.

Ganesh describes the small town she grew up in as "in the cornfields." Thus, her high school was also really small (her graduating class had 12 kids!). "I had a really small-town feel my entire life, so when I came to U of I, I was really afraid of jumping into the crowd and hoping to find some friends. Then I did…through the Illinois Space Society."

Besides friends, ISS has also provided Ganesh with some ready-made Aero mentors: "wonderful women that are also in my major that can teach me so much about developing not only professional skills, but social skills," she says. "So that's very important in your future career, because you always want to get along with people."

(In an aside, Ganesh shares an anecdote about how she met senior Sara Legg. In spring of 2017, Ganesh participated in a SWE (Society of Women Engineers) Little Sister's Weekend—an overnight event for high school senior girls. Legg was Ganesh's "big sister" (the undergrad she was paired with to live and hang out with over the weekend).

Aerospace Engineering sophomore, Shivani Ganesh, the Educational Outreach director for ISS.

"That was the program that made me decide to come to Illinois for Aerospace," Ganesh admits.

But the story gets even better. Upon arriving on campus in fall 2017, Ganesh attended WIE Orientation. Guess who turned out to be her WIE counsel-

or?! Legg, of course, who encouraged her protégé to join ISS, which she promptly did.

Another goal of ISS is to provide resources to help its members find jobs once they graduate. Christine Mehr, Assistant Director in charge of Professional Development, claims that ISS has “very much impacted my ability to get jobs and internships.” Plus, through ISS, she’s gotten amazing networking opportunities at the two American Astronomical Society space symposiums that the group goes to.

“I've actually been able to talk to the administrator of NASA, one on one, about being a female in aerospace engineering, about our college, about what we can do to get better—which is really cool!” she acknowledges.

Beuause of the registration fees and transportation costs, only around 16 members can go. “But we've had over 30 people apply before,” Legg explains, “So there's definitely a high demand, and we try our best to get them out there.”

She also appreciates networking opportunities with corporations gained through ISS:

“We're also able to talk to executives, like from Lockheed-Martin and all of these other amazing corporations, and just network and understand current technologies and how we play a bigger role. For me, that's been the best experience because it's really able to develop you as a person.”

In fact, the group is planning a trip to St. Louis to talk to Boeing and other corporations there. “So we can hopefully bring more members and give them that experience,” says Mehr.

Another emphasis of ISS is Technical Teams which help members gain expertise in space technology. The three ISS members elaborate on the many benefits of the teams that they’ve experienced personally.

For instance, in her sophomore year, Mehr led the Hybrid team, which involves designing an experimental rocket fueled by a solid fuel comprised of air and wax, along with an oxidizer like nitrous oxide. Combining those two fuels causes combustion and ignites the rocket.

Christine Mehr, Assistant Director in charge of Professional Development for ISS.

“So we actually just successfully hit 200 pounds of thrust,” she brags, “which is really big. This has been an ongoing project. So, overall it's been really exciting.” This year, they’re actually putting that engine into a rocket and launching it at the annual Space IREC (Intercollegiate Rocket Engineering Competition), the world's largest rocketry competition, held in Las Cruces, NM.

Only about 6 years old, this extremely experimental hybrid rocket technology has one minor glitch—it can explode at any time. “So we actually have to be behind a bunker when we test it,” Mehr confesses. So most likely, until some of the kinks get worked out, NASA or SpacEX won't be using it any time soon. “But it's really exciting for us,” she continues, “because we're able to actually go into these innovative procedures and techniques.”

Sara Legg’s sophomore year, she led ISS’s Micro-g team, which is part of NASA’s Micro-g NExT (Neutral Buoyancy Experiment Design Teams). Not a competition, it's a tool design program. “So if you

ever see the astronauts on the outside of a space station trying to fix things," Legg explains, "they use certain space tools." She stresses that they can't just take regular wrenches or scissors like those found in a tool box and use them up in space. "They design them specifically for astronauts to use so that they don't cut their space suit," she explains, "and that way they don't die!"

Members of ISS's Micro-g team confer with a NASA diver while testing the ALMA at the Neutral Buoyancy Lab. (Photo courtesy of Sara Legg.)

Her team designed the ALMA (Adaptable Low-Cost Modular Anchor), an anchoring device for micro gravity applications. For example, if an astronaut were on an asteroid or any other celestial body very close to 0 G (weightlessless), they would need a tool anchor that could hold at least 15 pounds of force. So her team designed one, manufactured it, tested it here at Illinois, then took it down to NASA's Neutral Buoyancy Lab, which simulates 0 G environments, where NASA divers tested the tool out.

"It was a very cool project," Legg says. "The testing we did down there proved that it was able to stand more than 15 pounds of force," she says. "And we got really great feedback from the divers. They really liked using our tool, and they gave us feedback if we were to continue doing it."

In her freshman year, Ganesh had the chance to lead the team that participated in the NASA Space Grant Midwest High-Power Rocketry Competition in Minnesota. The team not only launched the rocket they'd designed and built, but also got to see other teams launch their rockets too. "It was such a fulfilling experience," says Ganesh.

How'd her team do? First place! "It was very remarkable," she admits. "I got the news at midnight, and I was crying. It was probably the most rewarding part of my freshman year." Even more amazing was that Ganesh says they competed against much "older and wiser" students—advanced rocketry clubs and even grad school groups. She claims the technical experience she gained was quite rewarding: "I don't think I've ever gone from 0 knowledge to that level of knowledge within that timeframe as far as rocketry goes. And overall it has benefited me in every way that I can imagine."

The seniors, her biggest fans, chimed in: "She was also up against senior design groups from other schools. And it was an all-freshman team, led by a freshman!"

(In another aside, to underscore the depth of the relationships formed in ISS, as the three leaders shared stories about their teams' achievements, each was as excited about her friend's achievements as her own, and would sometimes postpone sharing to encourage another to boast about her exploits, or interrupt to praise her friend's accomplishments.)

ISS offers additional technical projects: the NASA Student Launch, a national competition where teams build then launch rockets; the High Altitude Balloon pilot project, an effort to launch a weather balloon up to 100,000 feet; and RASC-AL (Revolutionary Aerospace Systems Concepts Academic Linkage), a national competition that challenges teams to develop mission concepts critical for the future of space exploration.

Every fall, campus gets a crop of Aero newbies who haven't taken a course and, thus, probably know little to nothing about aerospace. ISS recognizes that these newcomers might not have the confidence to join a tech team, so it has several resources to help them acclimate. In fact, Legg maintains that these resources clinched it for her as a freshman.

> **"I think having multiple resources to help encourage you and give you the confidence to join a society and work on technical projects is so important, and that's what got me my freshman year."**

For instance, because getting involved with technical projects is difficult when students don't know anything, Legg says they offer workshops. "That's

one thing that we specifically stress here," Legg insists. "We start at ground 0. Everyone here starts at ground 0. So in order to help mitigate the number of people that are too scared to jump in on a project because they feel like they don't know anything, we offer workshops to get kids going on understanding certain skills that they need."

They're also offering a class to introduce students to high-powered rocketry. "It's meant to be a very hands-on class. It's worth credit, but there are no exams. Homework is supposed to be easy. It's meant for them to start learning what everything is."

ISS's rocket launching and soaring into first place. (Photo courtesy of Shivani Ganesh.)

Also fairly unique among RSOs, ISS encourages freshmen to get involved in leadership immediately by offering three different freshman positions on the Executive Board. Instead of the usual 10 or so freshman applicants, this year they got 33—the most ever. Freshmen may also apply for the technical manager positions, so they can get real-world experience and start managing a team.

Ganesh, who served in one of the Executive Board positions last year as a freshman, recalls, "So I applied for one of the freshman positions on a whim at 11:58 PM the day they were due," she admits. "And the rest is history!"

Another important ISS goal is education and outreach—getting the next generation interested in space exploration and rockets. "Getting kids involved so we have more members for the future is a priority," Ganesh explains. So the group conducts education and outreach activities both on campus and in the community, including schools.

For example, one of ISS's biggest fall campus outreach events is Illinois Space Day, coming up on October 6th, which features exhibits, demonstrations, and hands-on activities. The biggest activity in the spring is EOH (Engineering Open House), where teams present a number of exhibits, including current technical projects. In fact, ISS has won best exhibit for the Hybrid Rocket Engine two years in a row! Other activities include classroom visits in local schools; a 5-week program called BLAST taught in the Mahomet School District on Tuesdays and Thursdays; providing mentors for the Lincoln Trail Elementary School's Science Olympiad team; as well as Boy Scout Merit Badge clinics.

ISS also implements some pilot projects, "stealing a name from our technical realm," Ganesh wisecracks, and hopes to try out some new things in the future. For instance, passionate about recruiting more women into the field, Ganesh and her cohorts envision creating an outreach that targets young girls. "We'd really like to get into creating workshops for middle school girls, who may be losing interest at that time," she explains. "That is what the statistics show nowadays. And we don't want to lose them, because we need all the people that we can get."

Plus, ISS envisions teaching global classes for its parent national organization, SEDS (Students of Exploration and Development of Space). Because SEDS has chapters all over the world, ISS would like to connect to those places and hopefully teach classes about what the society has learned.

Even rocket nerds who are passionate about space need to take a bit of time to relax. So ISS also schedules some social events. For instance, on their calendar is a pool party, Nachos and Muchachos, a camping trip, and a barbeque—and that's just in September.

Armed with the many skills they've gained through ISS, the three Executive Board members are aiming high when it comes to their career plans.

For example, Legg, who is passionate about systems engineering, claims that many startups are "trying to build the next best spaceship, but they're trying to do it quickly. But if you don't have systems in place to check reliability, to make sure you're testing it correctly, to make sure you aren't endangering the lives of others...you [need] have to have the systems in place to make sure that your vehicle isn't going to explode on the launch pad." So she's interested in making sure space companies are testing correctly and that their processes are done

right. Her dream job is to work on a human factors team for SpaceX or another company, focusing on equipment needed for interplanetary missions or to space station.

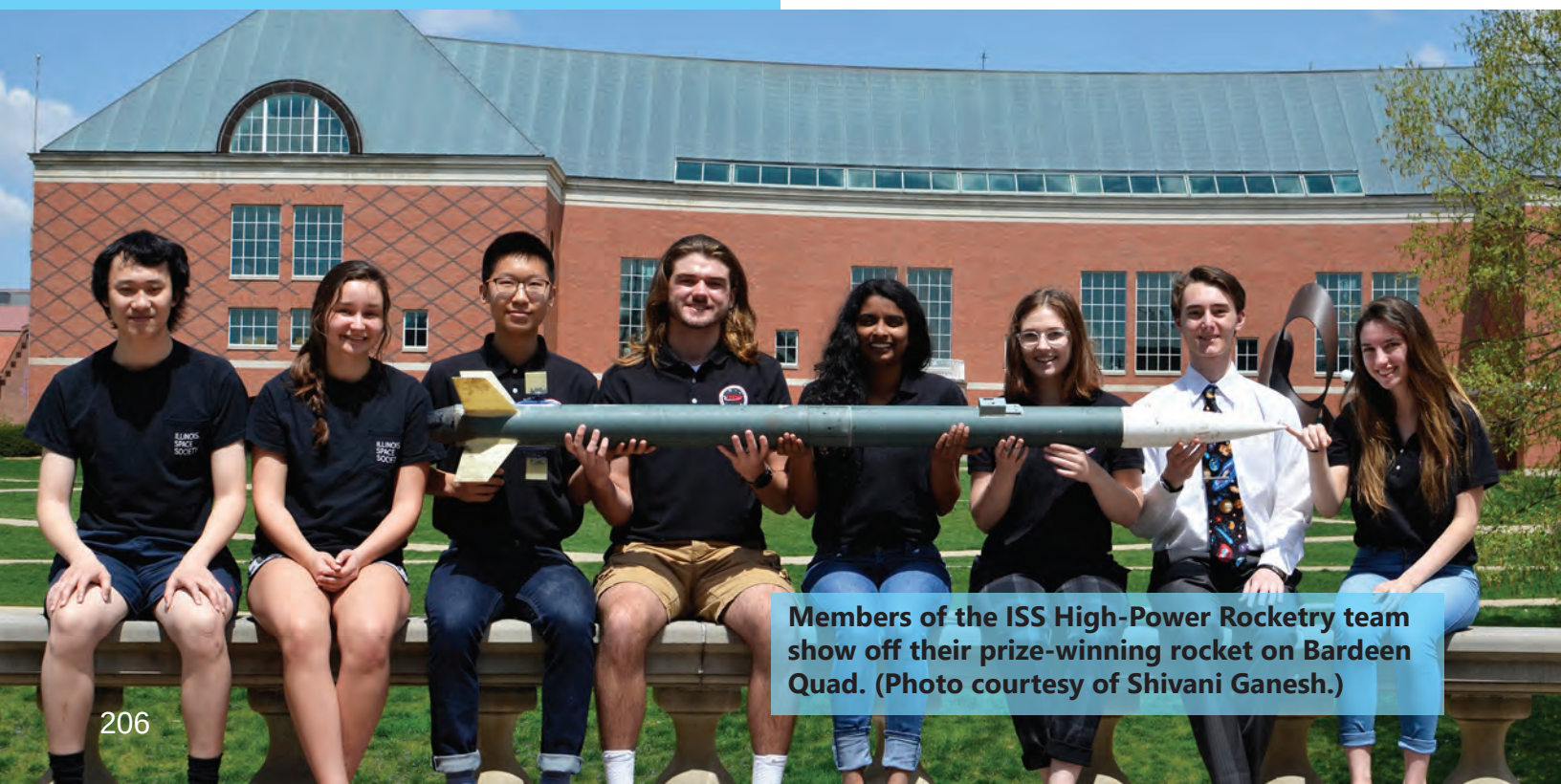
Ganesh says she came to Illinois to pursue aerospace engineering because she's always been interested in space exploration. Her dream job ever since she was six has been to be the flight director for a human space flight mission. How would a six-year-old even know there's such as thing as a flight director? During a trip to Disney World, she and her parents stopped by Kennedy Space Center, where she had an epiphany. "Most of the time I was an uninterested kid," she explains. "I just wanted a souvenir. Then they took me into the control center. It was dimly lit, very ominous. As soon as I saw the title of flight director, I felt as if that title was very important for me. Ever since then, it's just been figuring out what that entails and what I need to do to get there."

Regarding her goal, she adds, "I think I have a very romantic outlook on space exploration. So I really hope that we can make the human species an interplanetary one, and I think this is the way if you want to do that."

During Mehr's internship with Spirit Aerosystems this past summer, she figured out something unique about herself: She loves to break things! A career that would allow her to do that is a composites test engineer. "I found out freshman year that I was obsessed with composites of all types," she explains. So as a test engineer, people would give her different types of composites they'd developed, which she would break, then tell them what broke, how, then work with them to improve them. "Not only did that satisfy my technical love of aerospace," she explains regarding her stint as a test engineer, "but that also allowed me to communicate with all types of engineers and business people. So I would relay information from research and design engineers to project managers." So her dream job would be to find a test engineering lab that she really loves, do test engineering for a few years, then advance into the project management level. "So then I'll be able to work with higher ups to get us more time and equipment. And then just relay information back and forth within the aerospace area."

Regarding benefits gained from being a member of ISS, Legg claims that it has been "one of the most important things of my college career," she says. "I came in as a freshman and wanted to join everything. Over the years, I've realized the amount of value this club has." For instance, while some RSO's offer either professional or technical opportunities. ISS does both.

"Illinois Space Society has definitely given me experiences. I interned at SpaceX last summer. If it wasn't for the projects that I worked on with Illinois Space Society, the people that I met with Illinois Space Society. I don't think that I would be in the position that I am today," she says.



Members of the ISS High-Power Rocketry team show off their prize-winning rocket on Bardeen Quad. (Photo courtesy of Shivani Ganesh.)

A team member works on ALMA at NASA's Neutral Buoyancy Lab prior to testing. (Photo courtesy of Sara Legg.)

FALL 2018 CAREER FAIR IS A WIN-WIN, BOTH FOR ILLINOIS' ENGINEERING STUDENTS AND INDUSTRY RECRUITERS

September 13, 2018

Armed with a list of companies they were interested in working for, a list of questions they intended to ask, and probably a revised resume, a steady stream of Illinois engineering students—dressed to the nines—made their way across campus to the ARC for the Engineering Career Fair on September 11–12. Their goal: network with company representatives and land an internship, or even more importantly, a job for once they graduate. For the recruiters, their goal was to romance the coveted Illinois engineering students, possibly attracting the best and the brightest to their companies.

Students from all stages of their educational careers attended the fair. Freshmen, acknowledging that they probably didn't know enough about their field yet to land an internship, showed up just to get their feet wet and overcome some first-date jitters. Sophomores with a year under their belts sought internships for the following summer, and many obtained them. Juniors who were more serious about job hunting, hoped to explore different areas of their fields, as well as network with companies. And seniors hoped to land the big one—an interview for a job. Even graduate students in various stages of their degree process sought internships that would help further their careers.

For instance, Chemical Engineering (ChemE) sophomore Niya Mitchell particiated in the fair for the second time. Hoping to go into research and development, she's interested in foods and packaging, so some of the booths she intended to visit included companies like BP, Proctor & Gamble, and Kraft. Hoping for an internship this summer, she says, "I feel better prepared this year. I didn't bring my resume last year. There's more opportunities for sophomores."

Another engineering student who participated in Engineering Career Fair was Charles Wennerstrum, a junior in Industrial Engineering. "I'm here to find a job, hopefully," he admits. Interested in doing consulting this summer, he hoped to visit a couple of companies each day of the career fair. "Hopefully I can land an interview and go further in the job procedure," he reports.

Industrial Engineering junior Charles Wennerstrum waits in line to chat with some company representatives during ECF.

Some questions Wennerstrum hoped to ask recruiters were related to what he'd be doing for their company: "I want to know the type of work I'll be doing at the company, and also whether I'd be working with other interns or if it'd be more a job shadowing thing. For me, I would like to do real work rather than walking around with someone."

He assumed some questions they'd likely ask him would be related to why he thinks he's qualified, or why he has the skill set that matches their job.

"I've researched these companies fairly intensively," he admits. "This is definitely my most prepared year, as a junior."

Mechanical Engineering student Niya Mitchell (left) signs up to chat with one of the recruiters.

For Mechanical Engineering junior Moira Iten, this was her 3rd time at the career fair. She reports that going as a freshman more or less served to help her get over her nerves. “I went as a freshman. I didn’t get anything,” she admits, “but it was super overwhelming, and I didn’t know what to expect.” But she says that as a sophomore, she knew what to expect. “So I’m much more comfortable going in when I actually have a chance of getting an internship from it.” Which she did this past summer.

This time, going in, she hoped to get something a bit different from last summer’s more design-based internship. “So I’m looking at more of a manufacturing internship, so I can look at the two and see which one I like more,” she says. So she’s visiting both Ford and Honda Research and Development with regard to manufacturing.

Citing the benefits of the career fair, she explains: “It’s a good opportunity. It’s great that engineers are able to have this, because I know a lot of majors don’t, so that’s good.”

Aerospace Engineering senior Samantha Paige, who was waiting in line to chat with a Boeing representative, reports that it was her 4th time to attend the career fair. She indicates that, coming as a freshman, “It was a really good experience just to see what recruiters were looking for in terms of resumes and to just get the opportunity to break the ice and talk to people, because you don’t necessarily get those soft skills from your Engineering 100 class. There’s no pressure. But sometimes freshman do get lucky.”

IIn fact, she reports knowing a number of companies who are looking for younger talent, “so they can get repeated internships, that way they can tender a job offer and groom them in their company ways.”

Paige says she’s worked at GE innovation twice, and did a summer abroad, so she didn’t work that year.

She discusses one of her questions for the recruiters:

“'Why I should choose their company over others.’ I think that’s a really important question, just to see what kind of company culture they have.” She’d done her research and already knew she was interested based on the online job description. “I meet some of the qualifications,” she continues, “But for me, I want to know more about the people that work there, company culture, that sort of stuff.”

Paige reports that her dream job is anything that makes her excited to come in to work every day. “I don’t know if I could choose my career for the next 4 years right now, but I’m obviously interested in space. So anything that really furthers space exploration and makes a difference.”

It wasn’t just undergrads who attended the fair. Zonghao Wan, a second year Master’s student in Computer Engineering, indicated that this was his third time at the career fair. Last year he had an internship in Chicago as a result of the fair. But since he’s considering going for a PhD, he figures he’ll be attending several more in the future.

Wan's three main targets this time were three internet-based, technology mammoths: Google, Amazon, and Nvidia. While his dream job is probably to be a researcher, he hoped to gain some wisdom in addition to a summer position: "I want to do an internship next summer, but this is also definitely a good chance to do some networking with recruiters and get to know the industry." Plus, he hoped to "talk to those recruiters, and get their suggestions for my career paths.

The engineering students weren't the only ones who came to the fair armed with a list of questions. The recruiters, like the students, were shopping around for students whose resumes and qualities would make them the perfect fit for their companies.

For example, on hand was Prapti Neupane, a recruiter from Schlumberger, a software engineering company, which produces software as well as embedded programming involving programming machines. Neupane shares why her company likes to recruit at Illinois.

"We recognize the U of I as one of the top colleges, and I think you guys have a really good Computer Science program, so we like hiring Computer Science grads from there. And all other disciplines as well, you guys have a good reputation. And we have great employees who graduated from here."

Schlumberger was not only at Illinois for the two days of the actual career fair, but came early for the corporate after hours with computer science grads.

Schlumberger recruiter Prapti Neupane (left) chats with an Illinois engineering student.

She explains what her company looks for in a recruit:

> **"We like to see that they do well in school, that they have leadership qualities," she explains. "Just the way they talk, we like to see that their passion comes across. We like to see that they're actually passionate about what they do. Not so much what their skills are, because in the real world, you can never have all the skills you need. When you graduate, you can learn all those things in your job, but we want to see that they actually have the capability to learn, so that's what's important."**

Two Illinois engineering students (left) chat with recruiters from Texas Instruments.

Many of the recruiters were Illinois alumni, many who had graduated fairly recently and who seemed to quickly connect with the current students and to speak their language.

For instance, recent Illinois grad Dan Margulis, who graduated this past May in Food Science, indicates that he volunteered to return to his Alma Mater to represent PepsiCo at the career fair. "It's really nice to come back," he admits, "especially so soon. I feel like I was just in school yesterday, so it brings back some memories of working hard on my program. The

food science program is great, so it brings back some really good memories." Margulis has been in the saddle at PepsiCo for two and a half months.

He discusses his priorities as a recruiter:

"I'm looking for a candidate that's well rounded and shows interest in research and development," he says, "that has good communication skills as well as the academics, and good experience in past fields. I think good experience correlates well with moving forward in our industry so they'll have a baseline of knowledge. So we'll know that we're getting something good out of a candidate."

Two Illinois engineering students (left) chat with recruiters from Texas Instruments.

Another PepsiCo recruiter was Lauren Zelaya, an Illinois alumna who majored in ChemE and minored in Food Science.

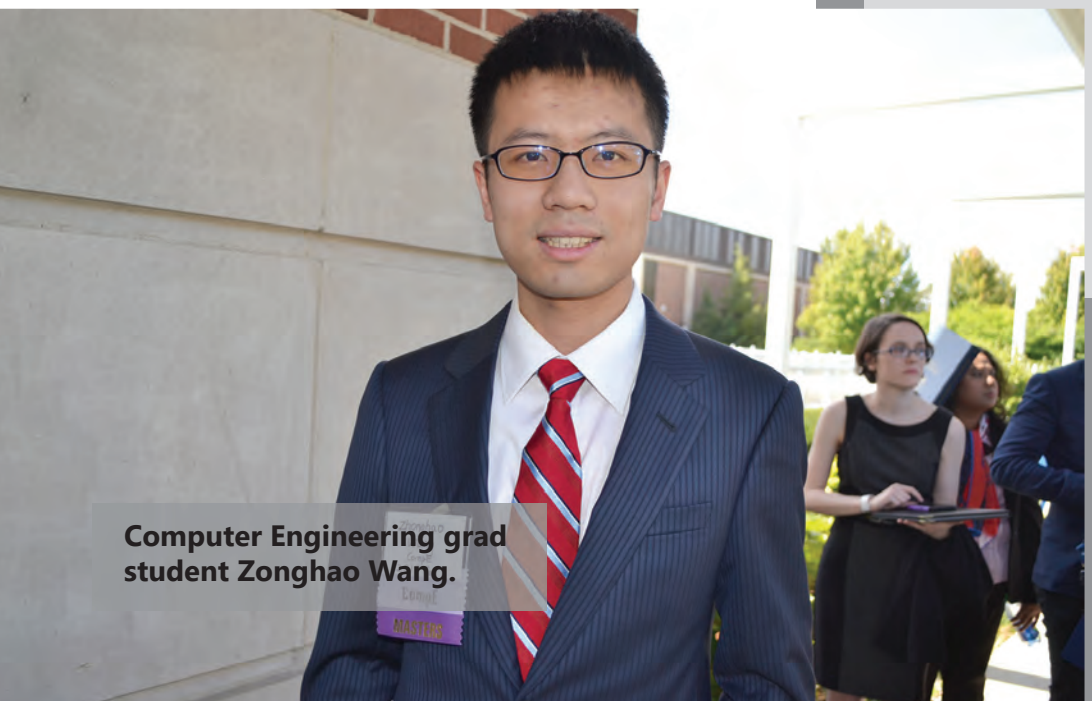
Zelaya, who works in PepsiCo's Quaker Oats division, reports that for her current job, she's used the food science portion of her degree the most. However, while she hasn't used her ChemE skills as much in terms of what she does, she's found the problem-solving techniques she learned as an engineer to be quite helpful.

Zelaya indicates that she and her fellow recruiters are "looking for leaders. We're looking for people to come in and solve problems confidently. People who can work with people." She says they're also looking for "people who can influence people to make the right choice. We need people to be people leaders."

While many alumni who come back to the career fair as recruiters find returning to Illinois a big deal, for Zelaya, who still lives in Champaign and commutes to her job in Danville, revisiting old stomping grounds wasn't as much of a draw, but it was more to see the students—the potential her company is hiring.

Zelaya admits:

"I enjoy getting to see all the influx of talent. I'm not exactly going to be there to see where they go, but I think it's interesting to see who we're taking in and what as a company we're looking for."



Computer Engineering grad student Zonghao Wang.

Also, unlike many other recruiters, for whom the fair might be a mini vacation away from the grind of work, Zelaya reports, "I'm actually working on my days off, to be honest!"

MECHSE'S LEON LIEBENBERG, SIIP TEAM USE PLAY-IN-LEARNING ELEMENTS TO ENGAGE STUDENTS, FOSTER LEARNING

September 19, 2018

"It's stuff that the kids can associate themselves with much, much more easily, because that's the language they talk." – Leon Liebenberg

We've all seen toddlers learn about shapes by trying to place a round object into a toy's square hole, and vice versa. We've also seen children learn basic structural engineering principles by building a tall tower of blocks or Legos with insufficient structural support, only to have it crash to the floor. If small children can learn through play, couldn't much older students, such as undergraduates in Illinois Engineering courses? Leon Liebenberg, a MechSE Professor, and a team of colleagues who are part of his "Play-in-Learning: Cognition, Emotion, and Playful Pedagogy" SIIP proposal all seem to think so.

However, Liebenberg reports:

> **"Not everyone is convinced that play belongs in engineering…Some people are cynical or suspicious about the prospective benefits of play in engineering."**

So, starting Fall 2018 semester, supported by funds from the College of Engineering's AE3 (Academy for Excellence in Engineering Education) Strategic Instructional Innovations Program (SIIP) and matching funds from Mechanical Science and Engineering (MechSE), Liebenberg and a team of cohorts intend to collect data and construct a matrix that explains what was effective and what wasn't in a number of their engineering classes implementing various play-in-learning techniques. Their goal is to determine if play-based learning activities indeed foster higher-order thinking and problem-solving skills.

In addition to Liebenberg, the SIIP team includes a number of professors, plus experts in curriculum, teaching and learning, and evaluation: Geoffrey Challen (Computer Science); Patricia Franke (Electrical and Computer Engineering), Chad Lane (Educational Psychology); Shelly Schmidt (Food Science and Human Nutrition / Agricultural and Biological Engineering); MechSE professors Elif Ertekin, Emad Jassim, Blake Johnson, Alex Pagano, and Sam Tawfick; as well as Robert Baird and Ava Wolf from CITL (Center for Innovation in Teaching and Learning). The courses include: CS 125, FSHN 101, ME 200 (previously ME 300), ME 270, ME 310, ME 320, and ME 370, impacting ~1500 students in total.

MechSE Professor Leon Liebenberg.

Exactly what is Play in Learning? Rather than a learning style comprised solely of rote memorization or poring over textbooks hour after hour, the idea is to encourage students to explore engineering principles about something they're interested in, then report on it using a medium that speaks their language, like animation; augmented, virtual,

or mixed reality; online graphic novels; role-play; game-based response systems; and/or low-fidelity prototyping. Students literaly "play" with their ideas!

Liebenberg explains why the SIIP project is needed:

"No one knows what the benefits are of using playful elements in class," he admits. "We know the students enjoy it; we know the lecturers enjoy it. When I have fun, I relax more and learn easier, faster. I retain stuff longer. I don't need a neuroscientist to tell me; this is just the experience I've had. But neuroscience does back it up."

So the goal is to gather data regarding the impact on students of the playful methodologies they're investigating—a matrix that says: "This playful element is typically suited for that, that, and that," Liebenberg suggests. "It's certainly not applicable for that. Do not even try it; it's not gonna' work."

This matrix will hopefully enable folks in Engineering to say, "Ok, games are effective. They're not a magic silver bullet, but they can help in certain areas of the curriculum," Liebenberg adds.

So as part of his data collection process, Liebenberg has developed an emoji questionnaire and a "Live Tweet" assessment to assess students' emotions during playful, in-class activities. "Even the student assessment forms are in playful format," he admits. "If you're working with people's emotions, then I guess it makes sense to use tools that are emotive!"

Liebenberg's goal in using play in instruction is to get students to connect at an emotional level with the subject contents.

"'What do you feel? What are your emotions?' If I can get a student to connect at an emotional level with a subject content, I sleep like a baby at night," he says, then adds, "If people are happy, they connect emotionally much better with the topic than someone who's highly stressed, which blocks positive emotions."

So Liebenberg is implementing learning through play in the two MechSE courses he's teaching this fall. ME 200, Thermodynamics, which he calls a theory-rich course, has no labs. However, students will be taking a number of field trips: Harley-Davidson in Champaign, Mac's Recycling Yard, and Abbot Power Plant, where they will learn principles about thermodynamics. They will also visit Professor Emeritus Ty Newell's "green" house that's totally off the grid. It has thick walls made of recycled foam, solar panels, direct solar heating, and also heat pumps. Plus, Newell not only produces most of the electricity his home uses from the sun, but sells some back to the grid. Students will also visit Newell's factory, which manufactures the world's first integrated air conditioner/ventilation system which automatically brings in fresh air to address gray building syndrome. Students will analyze the systems both in Newell's house and his factory from a thermodynamic point of view. Then the students are to develop a final project related to one of the above field trips. They will develop virtual or augmented reality apps or online videos.

His second course, ME 270, Design for Manufacturability, has 15 labs in total. The idea behind this course is to design things that are simpler, use fewer parts, are easier to assemble or disassemble, can be made more inexpensively, and are easier to recycle. (Whether or not Liebenberg would term himself as "green," he is quite conscientious regarding making sure the engineers he's training take into consideration making things better for the environment.)

Liebenberg's teaching pedagogy for the two courses is as easy as A, B, C: Autonomy, Brotherhood, and Competence. "This is what works for me in my teaching environment and learning environment," he stresses.

Professor Leon Liebenberg teaching his ME270 course.

Two ME270 students discuss a solution to a manufacturing issue presemted during class.

The idea behind autonomy is to allow students to choose from among a number of projects that he's described briefly, which he calls defined, but also ill-defined.

> **"Because I want the students to throw in their flavor," he stresses. "'Bring me your passions; bring me your interests, your skills.'"**

His goal in regards to giving students so much autonomy is to give them self-directedness:

> **"I'm literally giving the ball back to them and saying, 'Ok, I want the game to be played like this. Stick to the rules. play the game however you want.' And they're happy doing it, and they love it."**

He underscores the importance of student autonomy: "You have to make sure the students take charge," he explains. "If you want to do your thing and play the puppet master, it's going to fall flat."

To emphasize the brotherhood aspect of his teaching pedagogy, Libenberg uses teamwork:

> **"They're working in teams, as brothers and sisters together," he explains. "They learn from each other…'I see things a certain way; you see things another way. We learn things from one another.'"**

Plus, he attempts to construct effective teams comprised of students with diverse thinking styles by administering a learning preferences questionnaire, on which students must circle three attributes that best describe themselves, plus answer the open-ended question: "What important truth do very few people agree with you on?" Based on the results of this questionnaire, he structures teams, ensuring that each has a mix of students who have different personality types—analytic, innovative, procedural, relational—but may be passionate about similar things. In fact, one team's responses to the open-ended question may possibly hint at each student's personality type:

- "People would live in a virtual world if it was better." (Innovative?)
- "Sometime it's important to let things go." (Relational?)
- "I'm good at learning things that I'm totally unfamiliar with." (Procedural?)
- "Aerospace is cooler than Mechanical Engineering and SpaceX is the best ever! (Analytic?)

Liebenberg admits:

> **"This mix-up of personalities works like a bomb to get the creative juices flowing."**

He explains how it also leads to some friction in the first few weeks of team meetings, until students

> **"learn the value of really listening to others, valuing others' opinions, and respecting others."**

Students look at different mechanical parts.

Regarding his third tenet—competence—how do his students show it, either individually and/or in groups? Because of the demoralizing effect a bad grade can have on students, Liebenberg is not a big fan of tests (although he does administer them). While he scores their projects, he says even more important is the sense of fulfillment gained by a job well done.

"Because if I give you a test, and you get 10%, you're going to feel very, very bad. But if I give you a project which you can cover in your own way, but with your friend's help, and if you produce this really cool, mind-blowing virtual reality app, or graphic novel, or whatever, you're going to feel so good about it."

He also believes his students find braggin' rights to be much more rewarding even than a high score on their project. "If I give you 90%, that's gonna' mean something. But the thumbs up you're gonna' get on social media, that's gonna' do better than a check box about competence—much more than any exam can do, I believe."

This is not to say that Liebenberg doesn't use conventional scoring methods; he administers assessments, but with a fun twist. For instance, he uses technology to administer quizzes. But rather than using iClicker, he's been using Kahoot, which makes quizzes a competition. "People want their names at the top of the list, but you can only see the top 5 students," he says. He gets all the data, and at the end of the semester, he'll give an award to the student who's the best quizzer.

He also employs technology to compensate for the large class sizes, which, at times, he finds daunting. "I get it, 40,000 students, it's hard!" Then he goes on to acknowledge, "We're so out of touch with our students. I can't even remember my students' names. I can't deal with 320 students. I remember really good ones and really bad ones."

So Liebenberg has discovered that playful elements, like Kahoot, help him connect with students.

"We are at such a state of disconnect with our students," he admits, saying to himself, "What can I do to reconnect? Can I use technology? I bet I can. If I can use a game like Kahoot

Students check out a Harley Davidson motorcycle.

to make students a little bit happier, I would. It motivates them, makes them feel good, with purpose."

And of course, the technology pièce de résistance of his courses is virtual or augmented reality. Why virtual reality? Liebenberg claims that his students like apps. "They're totally into VR and AR. They use words and terminology I haven't even heard of. They are so comfortable with these media."

He believes that because his students are passionate about the medium, they're going to learn.

"But if it engages them here, and if I can use artificial or augmented reality or virtual reality as a means of connecting with them as the heart level, to teach them about thermodynamics, I've reached my goal. Because at the same time, I can

ME270 students learn about different manufacturing methods.

help them appreciate things about the environment."

To help with some technology aspects, he's partnering with PNX labs in Germany, which will use the students' ideas to make the AR and VR apps for free—as well as with CITL's Virtual Reality lab.

Regarding the benefits for all the partners of this collaboration, Liebenberg claims, "It's a win-win, really, for everyone."

For example, the University is interested in the collaboration for intellectual reasons—to help students learn—and is also "happy that industry is willing to offer to open their doors for our students." Plus, as an added bonus, all apps and online graphic novels will display the Illinois logo, to promote the branding. Engineering, of course, will get data regarding the instructional benefits of learning in play.

PNX Labs will gain name recognition and new apps. A fairly unknown new startup, it doesn't currently have any engineering apps, and is trying to get into the market. So they're offering free services now so they can get their brand established, plus they get fully functional apps that they can make available in their library to sell to clients.

"They're using us; we know this," Liebenberg admits, regarding the start-up. "They're using us and the university's good name to get into the playing field." Again, it's a win-win for all.

What's in it for the students? They not only learn the subject matter, but they get to interact with industry—the local companies, but also with the engineers at PNX Labs. But even more important are the braggin' rights. They get to boast to their family and friends, "I was part of this team!" He reports that his Chinese students were particularly excited about working with Harley Davidson. "That's the cool American brand where they come from!"

Regarding his liberal use of the various playful elements and technology, he claims:

"It's just stuff. It's just a medium," says Liebenberg. "But it's stuff that the kids can associate themselves with much, much more easily, because that's the language they talk. We want to get closer to the skateboard language and less to the other stuff that intimidates students. More about things that they perceive as being cool."

Professor Leon Liebenberg shows off a small Stirling engine that is powered by a tea light candle. His students are now playing with the idea of using such an engine to lift a quarter a height of 2 m in 10 minutes, using only a tea light candle.

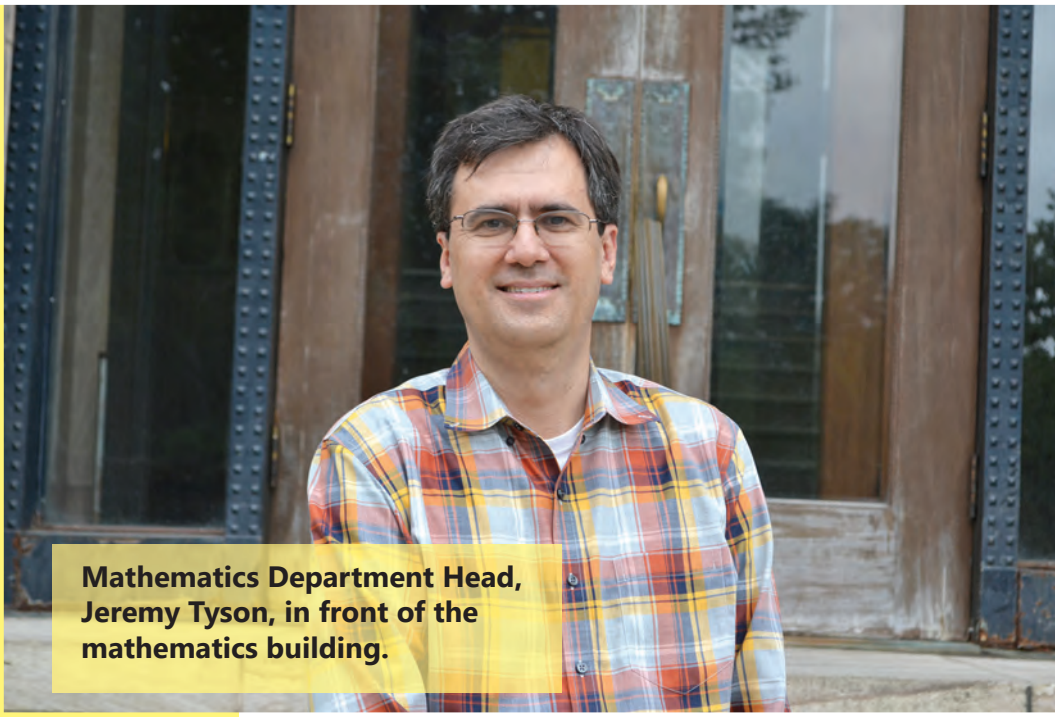
A 2018 GEMS participant shows off her origami creations.

NEW MATH DEPARTMENT HEAD FACES CHALLENGES: FOSTERING COMMUNITY, MATH PIPELINE RETENTION, AND MAKING SPACE

October 10, 2018

In his 17th year at Illinois, first as a Professor, then as Interim Head, and now the new Head of Illinois' Mathematics Department since August of 2018, Jeremy Tyson is pretty familiar with both his department's achievements as well as the challenges it faces.

As with most newly installed heads, he's made some plans for down the road. But before addressing areas that could use improvement, he first takes stock of the department's strengths. For instance, he's proud of the faculty's work to date, and lauds their instructional expertise.



Mathematics Department Head, Jeremy Tyson, in front of the mathematics building.

"I am really impressed with all of my colleagues and the efforts that they put into their teaching and into their mentoring of students," he shares. "There's a lot of good things going on in this department already."

Such as their work with undergraduate students. But while he's proud of their programs to date, he also thinks there are things Math can do to make the situation better for undergrads. "Certainly there are a lot of issues related to undergraduate education that I am pretty passionate about," Tyson says, adding that, "There certainly are things that can be changed and improved."

For instance, one challenge he's addressing is the significant growth in their undergraduate math major population—which he finds both rewarding and at the same time challenging.

"It's a good thing," he acknowledges. "We're very pleased that there is so much interest in mathematics and mathematical sciences as a profession," then cites the one big drawback: logistics. "It does make things challenging to have so many students," he admits.

Up about 50% in the last decade, the department currently has 1,200+ math majors, with about 300 freshmen joining the department every year. Given the classroom size restrictions of Altgeld (the castle-esque structure on the corner of Green and Wright that provides a picturesque backdrop for Alma Mater and houses the department), they have a hard time finding large enough rooms to teach in, so math classes are taught all over the place. For example, most intro courses, usually taught in large sections, can't really fit in Altgeld.

Another challenge Tyson faces is coming up with ways to make the experience more personalized for students in their program. He elaborates on his goal:

"[Giving the students] a better sense of a cohort, so that math majors coming into the program feel like they are part of a community and part of a group from the beginning."

This can be especially challenging when they're in a class of 300, where only a small percentage of students in those classes are actually math majors, but are physics, engineering, or science majors. In fact, his students may not meet fellow math majors in their classes until they've been here for some time, maybe their junior year. So he's been devising ways to provide social, professional, and/or academic experiences for students early in the program to "help them to see that there is a community of math majors."

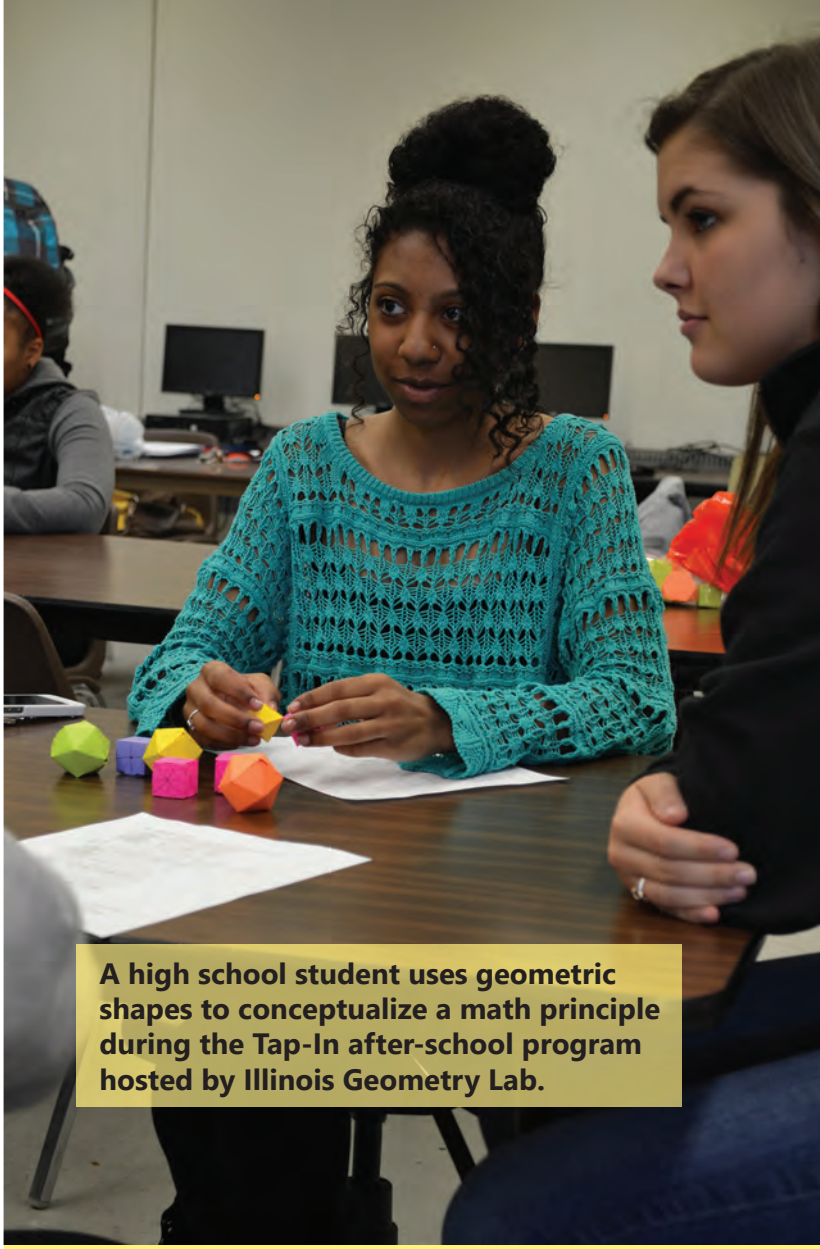
For instance, one academic strategy he's been implementing is a 100-level math course, MATH 199, Intro to Undergraduate Mathematics, which he taught in Spring 2018 semester and will offer again in Spring 2019. He had developed the course before becoming interim chair and decided he wasn't going to give it up even though he's now the head.

About 35 students participated in the pilot course, which met once a week for an hour and a half. Around 10 different faculty members gave 40-minute lectures on interesting mathematics topics appropriate for high school seniors or first year undergrads but not necessarily related to calculus, which they're getting already. "I want them to see that mathematics is much, much more than calculus," he explains. During the second half of the class period, a 40-minute active learning collaboration, different grad students visit every week to talk about various opportunities for undergrad math majors at Illinois: study-abroad programs, summer internships, summer research experiences, etc.

While Tyson hopes to eventually increase the number of students in the course, he says one challenge related to this is to still maintain the close focus and level of involvement. Regarding possible changes in the Spring 2019 edition, he didn't target specific areas professors should address during the pilot, but gave them free reign. However, next time, he may try to have a common theme around issues of computational mathematics, quantitative methods, or possibly statistics. "We're still thinking about what the focus might be," he explains.

In regard to using social events to foster community, several of Math's student groups are interested in promoting social interaction between undergraduates and graduate students in order to help provide cohesiveness within this large math major population.

Another challenge Tyson and company face has to do with ensuring the flow of students along the math pipeline so they end up choosing math careers down the road. The pipeline is comprised of



A high school student uses geometric shapes to conceptualize a math principle during the Tap-In after-school program hosted by Illinois Geometry Lab.

getting young children interested in math, keeping their interest piqued through the middle school and high school years, recruiting students into math (hopefully at Illinois), then fostering the retention of undergraduate math students once they're here to ensure that they stay in math.

Tyson says improving retention—plugging the leaks in the pipeline as students move through the program—is one issue the department is addressing that is probably common in many institutions.

He admits:

> **"The percentages when the students enter, I'm sure, are not the same when we get to graduation.Students drop out along the way."**

Tyson believes attrition may affect certain populations more than others, especially underrepresented populations, due to several reasons: lack of

support, lack of mentoring, and a lack of camaraderie and sense of cohesion among peers in students' interest areas so that they lack cohorts to rely on for study aides.

In terms of retention of women in math, Tyson says around 35-40% of the grad students are women, which he calls "pretty high up there nationwide." However, the percentage of undergrads is a bit lower; around 33% of those are women. In fact, the percentage has remained in the mid 30% range for a number of years.

He explains:

"Increasing the numbers of women and underrepresented minority students within our major population, and retaining these students in the major throughout their time at Illinois, are priorities for me." For Tyson, this issue motivates several of the ongoing initiatives the Math Department has instituted.

Illinois sophomore Emily Alameda does the Crossing the River acitvity with a local youngster at the Riddle Mania station during the Math Carnival: Gathering for Gardner.

One of those is Mathways, which is designed to give underrepresented undergraduate students research experiences early on. Often done in small teams, these experiences build cohesion within a group, allowing students work on interesting, engaging problems and see mathematics in a very different way.

Mathways partners two successful groups within the department: the longstanding Merit program, which provides support for underrepresented populations, including minority students, women, and first-generation college students, in their early years in math, and the Illinois Geometry Lab (IGL), Math's primary undergraduate community for research. Merit program courses run up through Calc 3, the minimum requirement to participate in IGL's undergraduate research.

According to Tyson, Merit serves to "get students ready, and encourage them, and incentivize them to get into research...We have seen an increase in the number of Merit students that have applied to the IGL to participate in IGL projects," Tyson says. He further explains:

"We have concrete evidence of students very much succeeding. They give talks, they give posters and presentations at undergraduate research conferences here on this campus and elsewhere. We've seen a lot of engagement with that program."

Of course, enticing young people into the STEM pipeline (which includes math), should begin quite early. As such, the IGL is designed to act as a sort of Pied Piper, using brightly colored geometric shapes and fun and engaging hands-on activities to pique youngsters' interest in math. So in addition to their research, undergrads who are a part of IGL participate in outreach activities, hoping to spark young people's interest in math via various educational activities in local schools as well as the community.

In addition to IGL, the graduate AWM (Association for Women in Math) chapter has done a number of outreach events, including Saturday workshops, such as Sonia Math Day and Girls Engaged in Math and Science (GEMS), as well as their summer camp: Summer Illinois Math (SIM) Camp. Plus, the department has opened its doors to the public, encouraging elementary school class field trips, as well as large-scale, community open houses, such as the Gathering for Gardner event in recent years.

In terms of recruiting high schoolers to math at Illinois, the department's undergraduate office works closely with the University's admissions office to partner on various admitted students days and orange and blue days, when students and their families visit campus, giving students who are interested in math the chance to come here, tour the building, and talk to advisors and current students.

Tyson shares another upcoming challenge/opportunity that he believes has the potential to really transform education in his department—the potential renovation of Altgeld. He believes the significant renovations that are in the works could have a tremendous impact on the student experience. For instance, he envisions big, new interactive rooms which will allow students to work in different configurations, not just desks and a blackboard but more interactive, collaborative spaces for students to gather and work in different contexts. "So I think there's huge potential for really transforming the way students interact with the department and the new facilities," he shares.

Tyson's philosophy or goal for math department is simple: to "make sure that we as a department are highly visible—both on campus and within the community—where people can see the breadth of what we do here and the real interest in applicability of mathematics. What we work on in this department really is applications across the sciences, across society in many different ways." He explains that some of the IGL's research projects have looked at the mathematics of social science, of human systems and human interactions, and of the internet, so he'd like to provide opportunities for people to see the different kinds of things that go on in the department. He adds:

"The IGL is an organization in the department that's really charged with being a public face and being the face of the outreach and engagement of the department, so that's certainly something I want to continue."

A recent IGL training session in October, 2018. (Photo courtesy of the IGL website.)

LIEBENBERG'S ME 270 END-OF-SEMESTER MAIN PROJECT PRESENTATIONS SHOWCASE STUDENTS' MANUFACTURABILITY REDESIGNS

December 18, 2018

On Tuesday, December 11th, the top five teams in MechSE Professor Leon Liebenberg's ME 270, Design for Manufacturability course presented their final projects before the entire class, as well as special guests, including some both current and emeritus professors and staff who contributed in some way to the students' projects. Attendees then voted on their favorite redesigned product.

Professor Leon Liebenberg (second from the left) awards certificates to members of Team ABF-2 following their presentation of their redesigned Monkeypod.

The idea behind the course's main project, Redesign for Manufacturability, was that teams of students were to purchase a product for less than $40 then redesign it so that it was simpler, used fewer parts, was easier to assemble or disassemble, could be made more inexpensively, and/or was easier to recycle. They were to test and evaluate their revised products and report their results in an e-portfolio. The top five teams were selected based on the following criteria: content and creativity, subject knowledge, composition, and contribution.

All students pretty much followed the same procedures regarding their product redesign. First, they would reverse engineer the product—disassemble it to see how it works in order to improve or enhance specific aspects of the product. In addition, they would perform a QFD (Quality Function Deployment) analysis, which would include developing a list of customer requirements and narrowing those down to the most important design requirements, then improving one or more of those areas with their redesign.

To help teams decide which areas were the most important to address, some students completed a Pugh matrix, or decision-making model, useful for choosing between a list of alternatives. Another helpful tool some used was a DMFA (Design for Manufacturing and Assembly) analysis to assess the speed of assembly; a shorter assembly time would thus lower the cost. Other DFMA critera would be higher quality and sustainablility, increased reliability, or safety.

The next step was for students to create a CAD (computer-aided design) model both of the original product/component and for each redesign element. Using the 3D design, students then manufactured the part(s) via one of several manufacturing methods the course covered. Finally, to analyze whether the redesign would make sense financially, students used aPriori software to conduct a Product Cost Management analysis to determine whether the redesigned product could be manufactured more inexpensively than the original.

For instance, Team ABF-2, comprised of Kamil Nocon, Kevin Tuscher, Sitao Zhang, and Tim Culbertson, sought to improve the quality and function or to reduce the cost of the Monkeypod, a traveling mini tripod for cameras. After investigating online

customer reviews, each of the four team members came up with three ideas, then narrowed the 12 ideas down to four: reducing the number of parts, a flashlight holder, redesigning the legs, and increasing the camera compatibility. So in response to a common consumer complaint about the numerous fasteners and parts necessary to attach/detach different cameras, they decided to reduce the total number of parts, which would most likely improve functionality while minimizing costs.

The next step involved creating a CAD model of the original product, then of the revised model, which had eight fewer parts than the original design, then 3D printing it. After analyzing their redesigned Monkeypod using aPriori, they determined that they had netted a 17% decrease in fully burdened costs and saved 32.5% in total capital investments.

Team AB7-1, Joey Bennett, Deandre Frisbie, Kevin Liu, and Joshua Wrobel, chose to redesign a crank-action, hand-crank drill. While they greatly improved the quality, the increased functionality was based on an increased number of parts, thus a greater fully burdened cost of $78.53, compared to the cost of the original hand-crank drill, $27.54. Thus, while their product would be of higher quality than the original product, it would be done with a much higher cost and longer manufacturing time due to the fact that their redesigned drill had many more parts. However, the original drill didn't have as many advantages and as much functionality as the redesigned drill.

Regarding what the students learned through the class, in Deandre Frisbie's reflection on ME 270, he calls it:

Deandre Frisbie explains the processes his team went through when redesigning the hand-crank drill.

"one of the most difficult classes that I have taken so far during my college career. However, it has also been one of the best learning experiences that I have ever had the pleasure to go through. The entirety of the class was filled with interesting and useful topics which I have no doubt will continue to be useful throughout the rest of my college and professional career."

Team AB9-2, Korkut Eken, Henry Feldhaus, Leah Groven, Karen Karapetyan, Jack O'Donnell, and Sathvik Rajgopal, redesigned a Spieltek VR Headset. After disassembling the original product, they decided to create a more cost-effective design by combining the two-part face rest sub-assembly into one piece, and producing the lens adjustment pieces from the same mold.

One other important change was to remove the mechanical fasteners in order to improve the assembly efficiency of the product. Thus, they decreased the number of parts by replacing the initial product's 13 screws with snap fits. This greatly decreased assembly time and therefore assembly cost, and also reduced the number of standard parts that needed to be purchased. The total number of parts were reduced from 38 to 24 (around 37% decrease), and the Fully Burdened Cost decreased by $1.20 (around 22% decrease).

Regarding using what they learned in the class in the future, one team member, Henry Feldhaus, who is a member of the Illini Solar Car dynamic team, indicates that he intends to change the way he and his teammates design parts by making them more efficient both to use and manufacture. He reports:

"It is quite obvious to me how useful this type of thinking can be applied in the industry, and I thoroughly enjoyed the hands-on learning style this course employed."

Another team, comprised of Mary Ponicki, Theresa Ponicki, Frances Ponicki, and Isabel Rivera-Ruiz, redesigned the Tipeye 3D pen. First, they disassembled the pen and made a list, including the name, quantity, manufacturing process and material of each part. Then, based on their QFD analysis, they came up with twelve ideas for improving the pen, then narrowed them down to the following three:

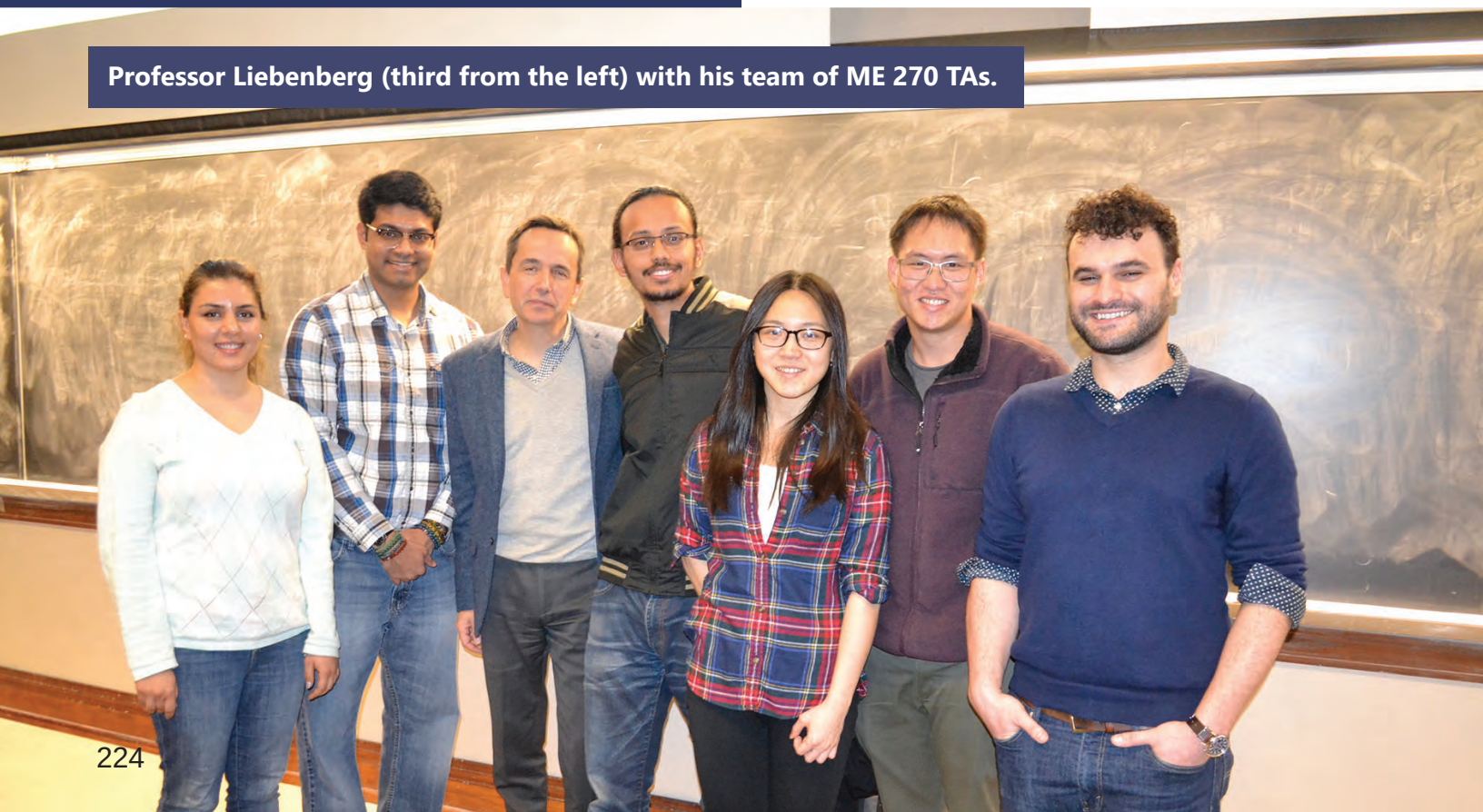
1. using snap fits for the outer shell pieces, instead of screws;
2. using ceramic instead of ABS plastic for the heater nozzle, a safety issue which would help to reduce user injury via burns;
3. add a laser beam drawing guide to make the product more user friendly. While this design would increase the total number of parts, it might also make the product more competitive. The team ended up implementing the snap fits

While the aPriori analysis indicated that manufacturing the modified pieces would cost more than the original design, the assembly time would decrease because three screws were eliminated from the product. Plus, the snap fits would reduce the weight of the pen, making it lighter and easier to handle.

Team ABD-3, comprised of four MechSE (Mechanical Science and Engineering) students Rafael Cicogna Santos, Matthew Stoll, Isabel Ugedo Perez, and Maria Pilar Galainena Marin, redesigned a Kikkerland Wind-Up Toy. To determine how best to redesign the toy, they disassembled it, then analyzed every piece and material, conducting cost analyses, plus manufacturing quality tests. Based on a QFD matrix, they came up with the best ideas for an improved product.

First, they sought to improve the leg mechanism by creating one easy-to-manufacture piece to replace he current leg, comprised of seven different components, with the goal of improving assembly times. They also improved the main body, by creating a protective case which will increase the product life expectancy, and also improve its aesthetics. For example, the case would be see-through in certain areas, allowing customers to see the gears move, which the team members claim is “a really cool feature of our product).” Finally, they created a new prototype using CAD software then 3D printed the redesigned components.

According to Rafael Santos, in his reflections on ME 270, he reports learning the following about some manufacturing methods. Regarding additive manufacturing, he learned “about new methods of 3D printing which I did not know existed, as well as…better design practices when designing a product for 3D printing.” For metal casting, he learned about, “gates, pouring speed and pressure, cooling time, and many other concepts.” For injection molding: “I was able to physically understand how the entire process works and how each variable (such as gate diameter) plays a role in the quality of the final product.” For welding, machining, sheet metal work, and tolerance analysis, he was able to “review all of the concepts which I learned throughout my internship during the summer, as well as learn some new tricks.” Finally, he reports that for statistical design of experiment, he learned “how to approach problems with an experimental methodology of testing and statistically drawing conclusions, mainly using the ‘2k Factorial Design’ method.”



Professor Liebenberg (third from the left) with his team of ME 270 TAs.

INCREASING REPRESENTATION OF WOMEN IN STEM

CHRISTINE SHENOUDA STUDIES IMPACT OF GENDER STEREOTYPE THREAT ON GIRLS' PERFORMANCE AND INTEREST IN MATH

January 22, 2018

"I'm a girl, so I'm not very good at math."

This gender stereotype is a common misconception that's pervasive in today's society. According to Christine Shenouda, in her Ph.D. dissertation entitled, The Effects of Gender Stereotypes on Children's Beliefs, Interests, and Performance, this gender stereotype can have a devastating effect on girls when they're reminded of it just before taking a math test. This is called gender stereotype threat. But while this stereotype—girls aren't good at math—isn't true, girls who have always done well in math—even those whose favorite subject is math—can still fall prey to its insidious influence.

Christine Shenouda, Psychology Department Teaching Assistant Professor

What are some common gender stereotypes? Shenouda says our society has lots. Girls wear makeup, paint their nails, and have long hair. Boys don't. Boys like all sports; girls don't. Girls play with dolls; boys don't. But one of the most sinister stereotypes out there is this: boys are good at math; girls aren't.

Surprisingly, research has shown that children begin inculcating gender sterotypes at an alarmingly early age. According to Shenouda, by one and a half to two years, "Certain behaviors are associated with men and women." For instance, kids are surprised to see a man putting on makeup or doing stuff in the kitchen.

Stereotypical puppets: A male mechanic and a female nurse

One of the first things Shenouda addressed in her research was this question: How do gender stereotypes affect children's beliefs? "Do kids think that, if you are a man, you automatically know to do things and know not to do other things? Or if you're a woman, same thing."

To discover the answer, she did a fun study with 3–5 year olds using two puppets, a nurse and a mechanic. For the first group of kids, the puppets were consistent with stereotypes: the woman was a nurse, the man was a mechanic. In addition to wearing the appropriate outfits, the gender of each was clearly defined. For instance, the mechanic puppet was wearing a mechanics outfit and was clearly male; he had short hair, a moustache.

First Shenouda asked job-related questions, like, "Who do you think would know how to fix a car?" and "Who would know more about the body?" However, she also asked about other areas not associated with the job, such as interests or pastimes. Some questions were about neutral activities, like watching TV; others were about activities typically

Two fourth graders ready to share their answer.

stereotyped as more for men or for women: sports, arts and crafts, etc.

The second group of kids was shown different puppets—atypical versions when it comes to stereotypical male-female roles: a male nurse and a female mechanic. Shenouda reports receiving quite interesting responses when the roles were flipped. While youngsters associated professional expertise to the right character (the male nurse would still know more about the human body than the female mechanic), "Somehow they made the connection in their mind that, 'If you are a man, but you want to be a nurse, then you can't like football!'" she shares. "So if you're doing a profession for women, then you're also more likely to not be interested in typical male things outside of the profession."

In addition to children's beliefs, she also sought to find out how gender stereotypes influence interests and performance. In other words, "What are the kids interested in and, also, how do they perform on tests, as affected by gender stereotypes?"

The performance area is where stereotype threat comes in. A huge buzzword right now in the literature, it has consistently been found to negatively impact girls' scores during testing. Shenouda explains how the phenomenon works:

> **"When you belong to a certain group (say your gender is female, or you're an African American, or any type of group), she says, "and that group is stereotyped as being not as good at whatever it is (such as gender in math), if you're somehow reminded of that stereotype, than you're going to perform worse on a test than if you're not reminded of it."**

Shenouda shares a scenario that illustrates how stereotype threat works. Suppose a group of female students, say math majors (ostensibly pretty good at math), was recruited and divided into two groups, with one group being told, "Men do better on this test than women do," but the other group either being told nothing or that, "Women do better than men do." According to Shenouda,

> **"The results when you say something positive are not as strong as when you remind them of that negative attribute, because they've been reinforced to believe the negative one all the time."**

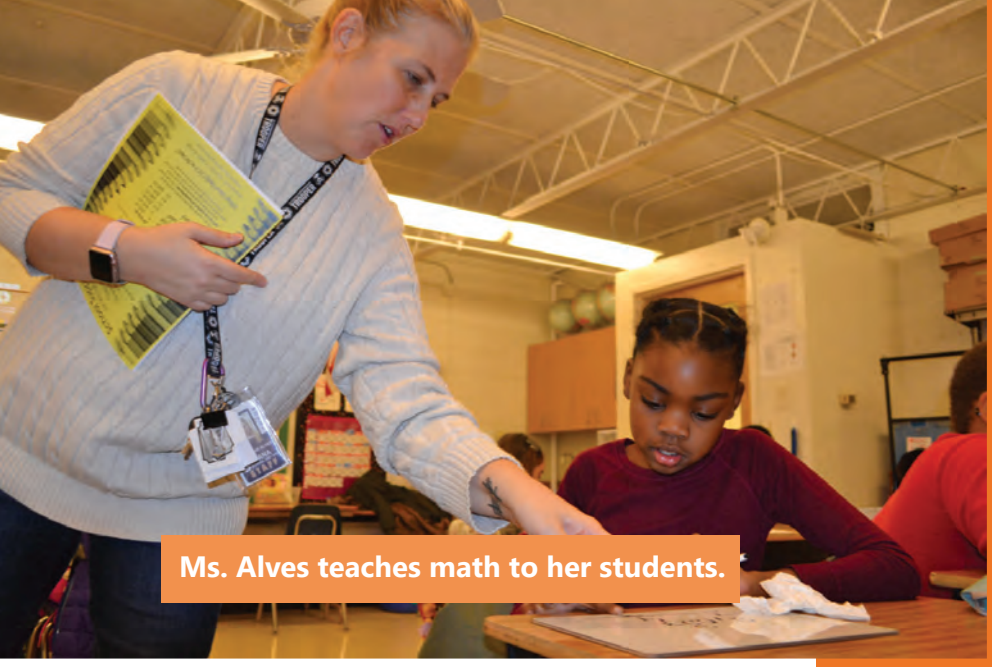
"It's scary, in a way, right?" Shenouda observes. And it also sounds rather like Pavlovian conditioning.

She adds that this subtle brainwashing is also true of other stereotyped groups…such as African-Americans who are often stereotyped as not being as intelligent in general as other races.

Regarding the impact combined gender and racial stereotypes can have, Shenouda shares another study—one about first–fifth grade Asian girls—that got her attention. Dealing with two conflicting stereotypes about themselves, these girls were faced with a real dilemma:

> **"Asians are stereotyped as being good at math," Shenouda acknowledges, "but then girls are stereotyped as not being good at math. So there's this conflict!"**

In this study, researchers randomly assigned girls into three different groups who, before doing a math test, were subtly reminded of a stereotype. Researchers gave the subjects one of three different



Ms. Alves teaches math to her students.

pictures to color, not telling them that coloring the picture was part of the test; they just said, “Here’s something to color while I set some things up.”

For one group, the researchers activated their gender identity by giving them a picture of a girl holding a doll. Researchers activated the ethnic identity of subjects in the second group by giving them a picture of Asian kids playing with chopsticks. The third, the control group, they gave a picture of trees, which activated no stereotype at all.

What were the results of the study? Across the board, girls whose gender identity was activated did the worst; girls reminded of their ethnic identity did the best; girls in the control group (given the picture of a tree) scored in between.

While some might argue that laboratory testing is very artificial,

> **“When you think about the kinds of messages that girls are exposed to every day, it kind of becomes this priming effect, or this gender activation effect, over and over again,” Shenouda shares. “Some studies, including my dissertation, argue for continuous threat. So there’s always that continuous stereotype threat; you’re continuously reminded that, ‘You are a girl; you’re not good at math,’ therefore you aren’t doing as well.’”**

Shenouda also wanted to see if stereotype threat affects ages even earlier than first grade. Since preschoolers don’t do math yet, she had them play with Legos or construction toys, which are great for spatial skills. (Spatial skills are associated with better math and science skills, and there are consistently significant differences between men and women on spatial skills: men are better than women across the board.)

Shenouda admits that there may be an innate gender difference regarding spatial skills because studies done with 3-months-olds have shown a slight difference. But while there might be a slight difference starting out, Shenouda believes we exaggerate it by the kind of toys we give youngsters.

So she did a study with 4-year-old girls, giving them pictures of either a girl holding a doll or trees to color. Then she had them assemble a specific Lego design and would time them. The girls who colored the girl with the doll were slower than the girls who colored the trees.

For grades K–3, the coloring didn’t have an effect, but overall the girls were slower than the boys. “I think that there is this continuous threat, so girls see blocks and automatically think, ‘This is not for me. This is not an activity for me.’”

A fourth grader works at solving a problem.

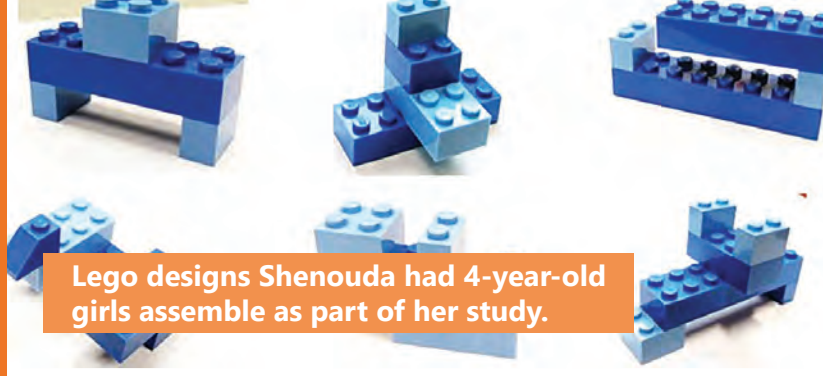
So we've learned that this insidious seed—the notion that girls aren't good at math—gets planted and starts to grow at an early age. But how does it get planted, and who does the sowing?

Shenouda claims toys are one of the culprits and that toy manufacturers are partly to blame, in that their perception of who their market is and the types of challenges boys can overcome in comparison to girls have been shaped by—you guessed it—gender stereotypes. Think about the images plastered all over construction toys' boxes—they're mostly pictures of boys, not girls.

Shenouda also takes issue with the color pink—especially when it comes to pink (girls') Legos. "It's a marketing strategy," she complains, "because they want to sell more! Because if you have a boy and a girl, and you buy just one set, then they're not making as much profit as if you buy the pink set for the girl and the all-color set for the boy."

Family budget issues aside, her bias against pink Legos is not unfounded. She originally used primary-colored Legos for certain tasks during her dissertation research, but then switched to pink to

"See if the girls, once they see pink, feel like, 'This is for me; I can do this!' But I couldn't find all the parts in pink and purple Legos," she grumbles. "And I looked at the sets, and they all seemed much simpler than the ones that are more blackish-blueish, presumably for boys."



Lego designs Shenouda had 4-year-old girls assemble as part of her study.

In other words, toy designers had said, "This is for girls; we shouldn't make it quite so challenging. They probably can't get this, so we'll make it less complicated!" which just compounds the gender stereotype issues for girls.

In addition to toys, Shenouda believes another possible source is children's books. In order to make books something kids can relate to, children's authors tend to put the book's protagonist into the middle of a dilemma based on stereotypes depicting middle school as terrible: "But I feel like they plant the seed in kids' minds that this is what things should look like or what to expect," Shenouda explains.

But although toys might play somewhat of a role, Shenouda claims the two biggest suspects are teachers, and especially parents.

"There are studies showing that kids' perception of and self- confidence in math is more affected by their parents' expectations than it is by their own performance," she asserts.

In regards to the stuff teachers and parents do to foster the "girls-are-bad-at-math stereotype,

Two fourth graders work together to complete thier worksheet.

"It's really subtle. It's not intentional; they don't specifically say, "You're a girl; you can't do this," Shenouda says. But she shares some scenarios illustrating how it might happen. Perhaps a girl is doing well, but senses that her parents believe her brother is going to do a better job on math than she does.

A fourth grader works through her math worksheet.

So her parents encourage her brother when he gets a good grade in math, or when he's struggling, tell him, "You can do this problem; I know you can do it!" However, they tell her, "It's ok; you like history as well," when she doesn't do as well in math.

Teachers are guilty too. Perhaps when a girl raises her hand in class but gets it wrong, the teacher says, "That's ok. That's ok," but if it happens to a boy, the teacher will say "Try harder! I know you can do this!"

How else do parents and teachers contribute? "You're so smart!" is a phrase teachers, parents, and even grandparents (mea culpa!) use to praise or affirm children. Shenouda says that, according to research, it's a no-no. She goes on to explain about a fixed mindset vs. a growth mindset.

In these non-gender-specific concepts, someone with a fixed mindset believes, "I only have certain abilities and can do certain things." However, a growth mindset says, "The harder I work, the better I'm going to get."

Shenouda exhorts us to encourage children using a growth mindset type of praise: "Wow, you did a good job; you worked so hard!" Fixed mindset praise is telling kids "Wow, you're so smart!" She elaborates on the drawbacks of the fixed mindset:

"If you think you're smart, that's great. But then there's a limit. You're going to think that there's something you aren't smart enough for… It's counter intuitive," she says, "because we want kids to know that they're smart. But they know that smartness isn't something you could necessarily change. But they know that hard work all depends on what you put into it."

She describes a study based on these concepts. Children were given an easy puzzle and after completing it, were told either, "You're smart!" or "You worked hard!" Then they were given a harder puzzle, and those who had been praised for hard work persisted longer on a challenging task than those who were told they were smart, whose mindset was: "Maybe I'm smart, but I'm not smart

A fourth grader in the midst of the problem set.

enough for this," whereas the growth mindset group had thought, "If I work harder, maybe I'll get it."

Girls' self-confidence as they mature is another issue. For instance, around 4th grade, girls start to become less self-confident, which has a bearing on how this article actually came about.

(In an aside, I [the writer] had already encountered this 4th-grade phenomenon. My granddaughter, Ella, who had previously loved math, excelled in it, and wanted to be a math teacher, hit fourth grade, and all of a sudden, had started saying things like, "Math is hard; I can't do this." Upon mentioning this to Christine Shenouda, her rejoinder had been that she too had encountered similar, self-confidence issues with her 4th-grade daughter. Thus, after briefly mounting her gender-stereotype-threat soap box and imparting enough of her wealth of wisdom regarding the subject to pique my curiosity, the seed for this article was sown.)

Regarding self-confidence, Shenouda says girls typically have more issues with it than boys do, especially prior to and during the teenage years, when they become more aware of things like body image and how they look. This lack of self-confidence can affect areas they had previously felt they were good at. While it doesn't usually effect their performance yet, it does affect their self-confidence.

Who/what else might help to foster gender stereotypes? Schools and, obliquely, teacher education programs, may also unwittingly be playing a role. For instance, teachers in younger grades are predominately female; however, math and science, or the more difficult math and science sections in middle school and high school are predominately taught by men, which sends a subliminal message about females' ability in math.

A teacher's self-confidence could also play a role. Since the majority of teachers in early grades are female, if she has insecurities about her math performance, that will trickle down to her female students. (If it were an insecure male teacher, it would probably trickle down to the boys, but most early teachers are female.)

While Shenouda assigns some blame to teachers, she acknowledges that her field is also somewhat responsible.

"Researchers do not do a great job at sharing all they know with teachers," she admits. "There's this gap of, 'We know all of this about teachers!' but then the teachers don't know." So teachers miss out on much of the information researchers uncover.

What can be done to enlighten teachers regarding gender stereotypes they're propagating? For one, the teachers who teach the teachers (teacher preparation programs) should be made aware.

"In an ideal world, we would want teachers to be taught about that sort of thing," she says. For instance, teachers are already being taught about growth and fixed mindset. But Shenouda acknowledges that there are some barriers that need to be broken down:

"Some teachers believe that boys are born to do certain things and girls are born to do certain things. So challenging that is pretty hard."

Shenouda's advice for teachers is this:

"Encourage boys and girls to participate equally in activities. And don't let your own biases get in the way of how you treat boys and girls. Because it does affect their behavior, interest, and performance. It has a huge impact on them."

Another piece of advice for teachers, including pre-school teachers?

"Be mindful of what kind of messages you are sending to boys and girls… What teachers do early on affects girls and boys and can have a long-term effect," she warns.

Regarding pre-school teachers' long-term influence, Shenouda shares about a day-care study with 1½-year-old kids. Teachers responded to girls more when they were speaking softly, but didn't respond to boys until they were angry, whining, or crying, which, of course, encouraged the boys to behave more aggressively than the girls. In this longitudinal study, a year later, the boys were more aggressive and the girls were more gentle when asking, because the teachers hadn't been responding until the boys became aggressive.

In a similar vein, Shenouda alludes to another dangerous trend: schools that separate girls and boys due to the belief that they learn differently and hear differently—that girls need to be spoken to softly and boys need to be shouted at.

Ironically, the folks promoting these trends that Shenouda emphasizes are without theoretical basis are much more able to reach people than researchers with real research.

"Partly because we have been socialized all our lives to think that men and women are different," Shenouda explains, "so it's easier for us to accept this kind of notion that they are indeed different. It's better to prove that theory as opposed to just saying, 'You know what, everything you've believed since you were a young kid is wrong."

A fourth grader eagerly showcases her answer.

Does Shenouda have any advice for parents to help prevent or to counteract stereotypes that happen in preschool and on up? Be a role model, for one.

"If you want your kids to do certain things, then you should be modeling that. If we're dealing with a two-parent family, try to split the work evenly in the house, don't make comments about what men and women should and shouldn't do."

She also cautions parents:

"Don't automatically assume that if your son or daughter does something specific, that it's because of their gender. For example, if a boy is doing something that happens to be masculine, don't be like 'Oh, it's because he's a boy.'"

She claims that parents often make assumptions regarding what their child can do based on their gender, which she calls a feedback loop that sets certain expectations for their kids.

She also encourages parents to provide their kids with a variety of resources, regardless of gender.

"Let girls play with Legos, or boys nurture dolls. Boys need to learn how to nurture too. Try to encourage girls to get out of their comfort zone and do things like science and engineering. There are so many opportunities for girls, and I've actually had parents complain that there aren't as many opportunities for boys as girls."

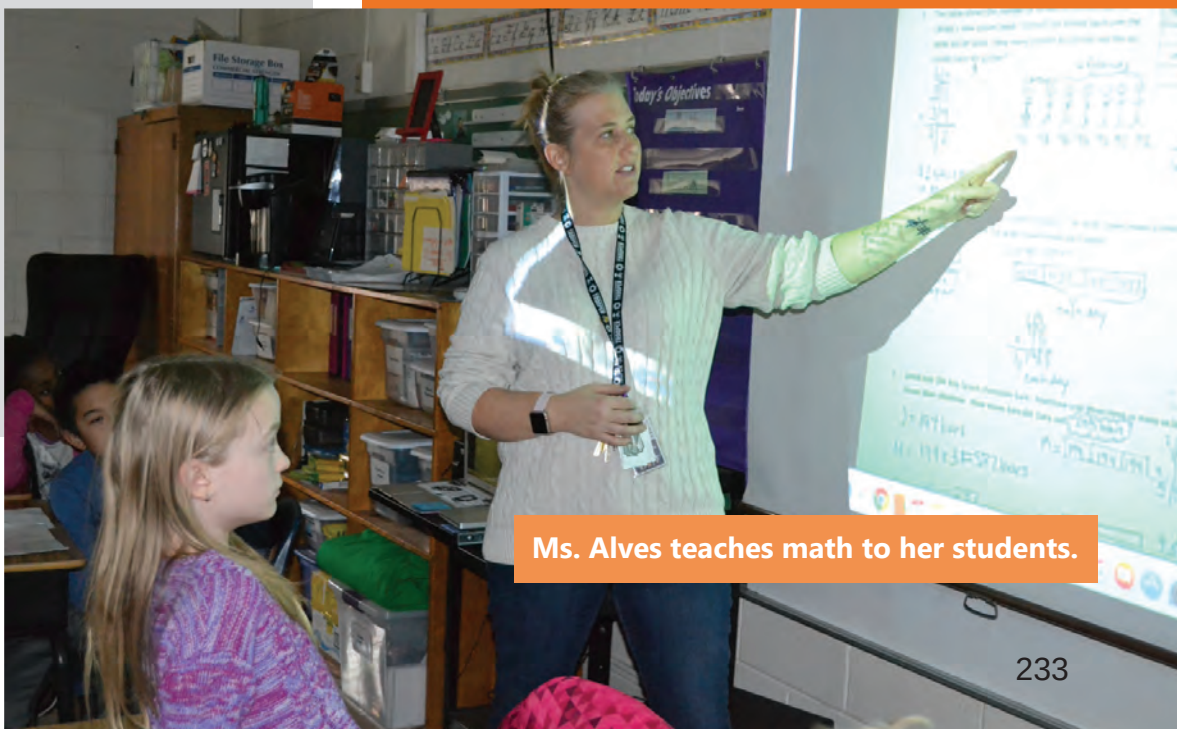
In the face of such dismal prospects regarding girls and math, Shenouda says there's good news. "There are no differences between boys and girls in school performance in math and science, at least until high school, where differences show up on standardized test performances, such as ACT and SAT" (which she claims is another issue altogether).

But here's the bad news. Shenouda says gender stereotype threat does play a key role in terms of her other focus: girls' interest in math.

"Where there is a difference is in the interest part," she admits, "so the girls do not identify with science and math fields as much as boys do." Even among boys and girls who perform equally well on math, "The girls do not identify with math fields as much as boys do," she adds. "They don't feel like it's a field for them." Which means that despite society's need for more workers in STEM fields, girls are less likely to choose careers in those fields.

While Shenouda has painted a somewhat bleak picture regarding how gender stereotypes impact the number of women in STEM, Shenouda says we should take heart.

"There has been a lot of progress, we shouldn't ignore that. If we think about STEM fields 50 years ago with women, it's a completely different world. We know so much more now, and that knowledge shouldn't discourage us, it should empower us. But now we know, and we need to keep moving forward. We are doing a great job, so I think we should be optimistic that things are only going to get better.



Ms. Alves teaches math to her students.

AT INTRODUCE-A-GIRL-TO-ENGINEERING DAY, HIGH SCHOOL GIRLS LEARN ABOUT ENGINEERING—AND THAT THEY CAN DO IT

March 1, 2018

On Saturday February 17th, 2018, around 70 high school girls and their families converged on Illinois' Loomis Laboratory for Introduce-A-Girl-to-Engineering Day (IGED), sponsored by SWE (Society for Women Engineers). And on hand to introduce these girls to their field and their respective majors were dozens of engineering students, members of the different engineering RSOs (Registered Student Organizations) who helped with the event. However, SWE not only offered the girls a chance to learn about the different engineering disciplines they could specialize in, plenty of female role models were on hand to inspire and boost the confidence of these budding engineers.

"Engineering Everywhere, Engineering Everyday" was the theme for this year's IGED, which is always the largest outreach event that SWE sponsors all year. In light of the theme, organizers Chelsea Wong and Saloni Nagarkar, co-chairs of IGED, stressed that engineering is not some fancy concept that can only be learned in the classroom. Nagarkar commented:

> **"We want to show how engineers have a real impact on the world and how everything they do is related to everyday activities. It is practical problem solving that can be applied in any situation at any time. What the University of Illinois offers its students is not just a phenomenal classroom education, it also teaches the correct mindset to be an engineer."**

SWE's goal for IGED was to provide female high school students a chance to test if they enjoy learning what an engineer does and thus want to become one—not just in the classroom but possibly for their entire lives.

According to Wong, the day's goal was to focus on the STEAM movement—Science, Technology, Engineering, Arts, and Math. Participants were given seven to eight disciplines from which to choose for their three morning activities. Representing their specific disciplines, members of the different RSOs designed fun, hands-on activities for the girls. RSOs involved in IGED 2018 included:

A high school participant 3D prints an object during ASME's Mechanical Engineering session.

- ASME (American Society for Mechanical Engineers)
- BMES (Biomedical Engineering Society)
- ISS (Illinois Space Society)
- Material Advantage
- SWIP (Society for Women in Physics)
- WECE (Women in Electrical and Computer Engineering)

- WEF-AWWA (Water Environmental Federation- American Water Works Association)
- WIN (Women in Nuclear)

Activities the RSOs designed ranged from ISS's balloon races; to 3D printing courtesy of the ASME; to using a Geiger Counter with Women in Nuclear; to exploring the material, chocolate, with Material Advantage; to WECE's LED circuit building; to designing then building a water filter with WEF-AWWA; to experiencing the human brain via virtual reality with BMES.

For example, ISS's activity was what they called "Balloon Rocket Races." Elena Kamis, ISS's Educational Outreach Director, explains how the activity worked. Participants were given a bunch of craft supplies, then had to:

> **"figure out how to get the balloon from one end of the room to the other, but without human power. So they have to set up a thing to get it all across the room just using the propulsion of the balloon, or weighting it, or having the string on an angle, and other stuff like that."**

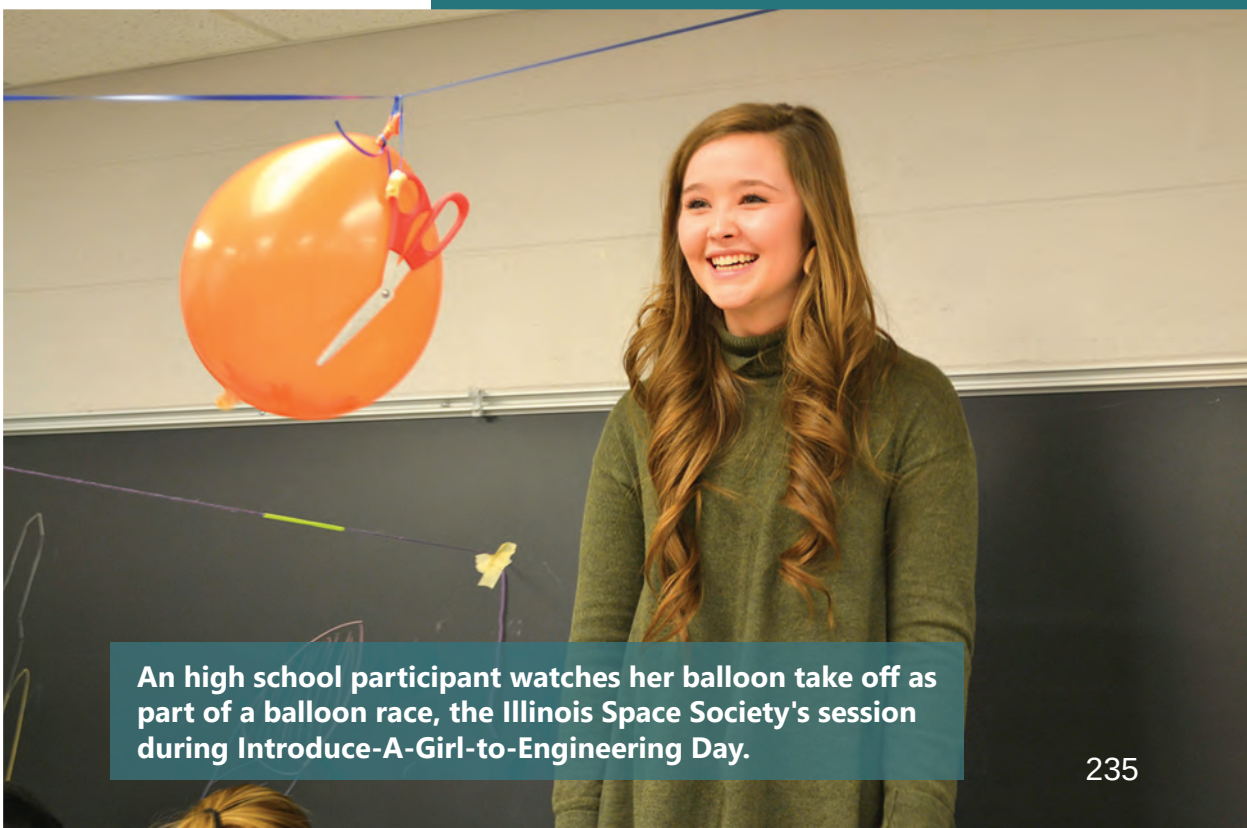
The girls accepted the challenge. Perched atop tables, they attach their balloons to strings to test their design, during which their excited chatter to teammates was peppered by the occasional loud noise of a popping balloon.

An activity related to Environmental Engineering was led by members of the WEF-AWWA, during which participants constructed water filters from low-cost materials commonly found in third world countries. The teams' designs were then put to the test as engineering students poured detritus-filled dirty water into the filters. The WEFAWA sought to emphasize the global outreach of engineering and how working with poor-quality materials forces ingenuity and creativity to blossom.

Over pizza, the high school students interacted with a panel comprised of four current engineering students. The younger students got to pick the older students' brains regarding what it's like to be an engineering student at Illinois, things they should know about the admissions process, and opportunities they should take advantage of at Illinois, like the different RSOs.

In fact, some of the many campus RSOs showed up for a Mini RSO Fair in the afternoon, to share with the girls and their parents about the variety of activities that would be available for the girls once they arrived on campus. And while many, like the Physics Van, were related to engineering, many weren't. SWE wanted to include as many RSOs as possible to show prospective students that their activities don't have to be limited to their major, but that a well-rounded person explores all her different interests, not just those that will net a college credit or two.

In the afternoon, the high schoolers took on a design challenge. This year, since SWE wanted to include the arts into the STEM field, the design challenge featured the girls' drawings and sketches of the ideas for their projects. They were to design the ideal city of the next decade which is comfortable to live in, functional, safe, while minimizing the environmental impact. Some things students were to consider while laying out their ideal neighborhood were how they could save water, reduce



An high school participant watches her balloon take off as part of a balloon race, the Illinois Space Society's session during Introduce-A-Girl-to-Engineering Day.

The 2018 IGED co-chairs, Saloni Nagarkar and Chelsea Wong.

noise, integrate sustainable energy, deal with waste. The challenge itself was also more design focused so that the girls could explore their creativity and the engineering skill of problem solving.

This day was not just for daughters however. Parents were invited to attend and had a parallel schedule to the girls. In the morning, Angie Wolters, Director of Women in Engineering, spoke to parents about the admissions process, plus different Women in Engineering programs. She also suggested summer camps that could potentially help their children narrow down what field they want to major in.

Then, after lunch, parents met with the same student panel their daughters had talked to in the morning. There, they discussed pressing concerns such as the cost of tuition and the availability of jobs in the real world for specific majors. The RSOs at the event also provided a couple of members to discuss their specific organizations and how they help incoming students.

Parents then rejoined their daughters for the mini-RSO fair in the afternoon, had a tour of campus, then proudly watched their daughters present their design projects once they were finished.

So why did the high school students participate in IGED? One visitor, Olivia Vikolette, hoped to get insight into what she wants to do careerwise.

"I like bio, and I like math, so I'm really interested in engineering, and I want to be a bioengineer."

A freshman at Fremd High School, she reports that she came "to really see if I'm really interested in this type of field or other fields." Plus, she admits, "I really just want to do hands-on activities to challenge myself."

The student who probably won the award for having traveled the farthest was Veronica Boddy, an 11th grader from West Bloomfield High in Michigan. She and her mom had traveled down for Engineering Day the day before, and since the two events were back to back, had stayed over to do IGED as well.

"I'm really interested in math," says Veronica. "I've been taking honors math classes since 9th grade, and I love physics, and I'm taking engineering classes, and I love building stuff and using AutoCAD."

A high school student experiences the human brain via virutal reality during BMES's session at IGED 2018.

Has she chosen a discipline?

"I'm not positive yet—I'm leaning more towards the mechanical side, but there's so many options," she admits. "That's mostly why I came here, to see which one I really want to go into."

Even though it was a long trip, Veronica's mom, Michelle Boddy, saw the value of bringing her daughter to IGED: "I have two older kids who are both graduated from college," she reports, "and I realize how important it is for her. You can't just look on a website, can't ask other people. You have to really come and get a sense of the atmosphere and the people and the kids and the program. So I wanted to take her to the place she was interested in and really get a feel for it."

IGED participant Veronica Boddy (right) and her mom Michelle.

An high school participant uses an instrument to take a reading during the WIN (Women in Nuclear) organization's hands-on activity.

Several Illinois engineering students share why they got involved with IGED—some had gone to similar events as high schoolers that set them on their engineering path—others hadn't, and therefore wanted to give girls the opportunity to do something they themselves would have found helpful when in high school.

For instance, IGED Co-Chair, Chelsea Wong, a junior majoring in civil engineering, first got involved in engineering through a program much like IGED. She recollects:

"In middle school or high school, my mother signed me up for a very similar event at my local community college. I think that through those activities, I really got inspired by the college students who were holding those events and teaching us. It really inspired me to do engineering."

The other IGED 2018 Chair, Saloni Nagarkar, a Mechanical Engineering freshman, had also gone to a similar event that had impacted her career goals. She reports having no interest in engineering or any STEM field in high school. She recalls:

"My mom put me into a program that was meant to teach girls about engineering. Initially, I was reluctant to go, but after being in the program for a while, I realized, 'This something I can see myself doing in the future as a career!' Events like these really helped me realize that I wanted to

Illinois Material Science freshman Stephanie Lin.

pursue engineering in college. I want to be able to host events that can empower the next generation of female engineers."

Another Illinois engineering student, Elena Kamis, Educational Outreach Director for the Illinois Space Society and a veteran at these sorts of events, says she still enjoys working with kids of all ages to get them inspired to become engineers. She had not worked with high school-age girls in a long time, and was very excited to get to do so again.

Another Illinois student, Stephanie Lloyd, a Material Science freshman and member of Material Advantage, got involved with IGED in the hopes of recruiting more girls into engineering.

"It's a really good idea to get people, especially girls, more motivated and more interested in engineering at a younger age."

An out-of-state student, she couldn't attend IGED or Little Sister's Weekend, another SWE outreach event for high school girls.

She admits:

"But I really wish that I could have because then I feel like I would've gotten more interested in engineering earlier on."

Another Material Advantage member, Materials Engineering sophomore Andrea Perry, says she came to a similar event in high school, SWE's Round Robin. She reports, "They do a similar thing where girls go around to a bunch of different stations and compete in different design activities and projects and then they get to talk to current students here. Since I was so influenced by the first event, I wanted to give back by doing this."

Not only did Perry go to Round Robin as a junior, but she had pretty much decided on materials so she also came to GLAM GAMES camp over the summer. She says:

"Between those two things, talking to current students about what they do and what they study and all the fun classes they got to take as a materials engineer influenced me towards that major."

High School freshman Olivia Vikolette waits with her father for IGED to start.

Theresa Riles, a freshman in Industrial Engineering, Riles indicates that as a sophomore, junior, and senior, she didn't know what industrial engineering was. "If you can introduce all these different majors and let girls pick what they want to study, that's amazing," she adds. She reports helping out with IGED because:

> **"As a high school student, I wish I could've gone to events like this or known about them. Now that I know what opportunities there are, I want to help other young girls be inspired to be engineers. It really gives you a hands-on ability to see what engineering is if STEM is not very big at your school. It also opens up your mind to the different possibilities of things you could study at U of I."**

So exactly what is it that an industrial engineer does? She "takes a process and makes it as efficient as possible, saving the company a lot of money. That's what my curriculum is," Riles explains. "I'm taking courses from basically every major throughout my four years."

Another IGED participant, Illinois student, Palovi Narianhan, is a freshman in ECE's Computer Engineering. Because both of her parents are software engineers, they encouraged her: "You should try it; maybe you'll like it!" While she was lucky to have a lot of opportunities to expose her to software and computer engineering, she had no idea about what the other engineering disciplines did. So through IGED, she hopes to help some of today's girls to find out. She explains:

> **"I think it's really important for girls to know how many options they have in engineering. Everyone has this idea of engineering being only coding or building things. They don't see how wide a variety there really is."**

Plus, she hopes to help girls discover that they can, indeed, do engineering.

She elaborates:

> **"So people come in with a preconceived notion that they can't do engineering; they're not good enough. When I tell people I'm a computer engineer, they're like, 'Oh, wow, I could never do that.' Then I say, 'Yes you can! Anyone can!' I just think it's really important for girls to know that they can, especially in such a male-dominated field. Girls can feel like we're not good enough or that we don't compare just because of the way we've been treated as girls regarding engineering. I want girls to know that they are good enough and that they should do engineering and show other people that we are the same or even better than our male counterparts."**

Judges (standing) listen as a team of students present their design project of an ideal cityscape.

AT NGS' SCIENCE SOCIAL CAFÉ, MCBEES WOMEN SERVE AS ROLE MODELS, EXEMPLIFY CAREERS IN SCIENCE

March 19, 2018

On Thursday March 8th, six MCB PhD students briefly put the work in their labs on hold to drop by the Science Social Café at Next Generation School's STEAM Studio in Champaign. There, while a group of 11 middle school girls ate their lunches, they served as role models, explained a bit about how they ended up in science, shared what doing research as an MCB graduate student at Illinois is like, and described their career goals and other possible careers in their field. Plus, they were available to answer any of the younger students' questions. The goal of the event? According to STEAM Studio Director Angela Nelson, it was to "break the boundary of 'You could be a doctor, an engineer, or a lawyer,'" and open the youngsters up to the myriads of possible careers, such as in science and research.

The six, all PhD students in Illinois' School of Molecular and Cellular Biology (MCB), are all also members of the MCBees GSA (Graduate Student Association). Passionate about their fields and about research, these women are also passionate about sharing their love of science with students younger than they; in fact, most have been actively participating in many outreach activities, including those organized by the MCBees'. So they all made time in their busy schedules for this particular outreach; however, their primary motivations varied.

Most acknowledged that they came to the Café to serve as role models for the girls. For example, MCB PhD student Andie Liu says that when she was little, her aunt, who is a scientist, was her role model. So her goal in participating in the Café was to possibly be a role model for some of these girls.

> **"I came today because when I was young, I was hoping that I'd have the chance to interact with a more senior female scientist. I hope this is a good chance to tell the girls here's my story."**

Liu studies small molecules produced by bacteria to fight each other, which she indicates are often

An NGS student interacts with the MCB students during the March 9th NGS Science Social Café.

times antibiotics, and sometimes antifungal. "It's a nice reservoir for people to find new drugs," she reports.

Jessica Kelliher, another Ph.D student in MCB, states that she came to the event in order to share about her journey:

> **"About how I've been interested in science and following my passion for science since grade school."**

Plus, she admits that she hoped to "inspire young girls do the same on this international women's day."

Kelliher, who studies how Staphylococcus Aureus survives in the human body, more specifically studies how staph competes with the human host for nutrients like iron and zinc.

Along with being role models for the girls, the ladies also came to share with the middle schoolers the idea that there are lots of different, exciting career possibilities in science.

For example, Katie Frye was another MCB PhD student who, growing up, had no idea that she could choose a career in science.

MCB PhD student Mara Livezey explains to the NGS students how she ended up as a grad student in MCB researching cancer.

She confesses, "I liked science all along, but I didn't think it was a career. I didn't know that graduate school even existed."

So Frye hoped to "help other little 'me's' that don't know that science is an option and that there's actually things you can do. Not just, "Oh, I like science; I'm going to do it in school,' No, you can actually pursue it for your life."

Like Kelliher, Frye also studies Staph aureus in Thomas Kehl-Fie's lab.

Also underscoring the idea that there are lots of great career possibilities in science was PhD student Kristen Farley, also hoped to convey to the girls that if they like science, it would make a great career.

"I came for a lot of the same reasons that Katie came, says Farley. "When I was young, I was interested in science but I didn't know that you could actually make it your career. I'd like to share that with these girls and give them a role model also."

MCB PhD student Kristen Farley shares her personal path to science with the NGS students.

Farley's research involves the study of a microbe that's not a bacterium, but an Archean, a member of the third domain of life that was actually discovered here on campus by Carl Woese fairly recently. She adds that the microbe is completely anaerobic, which means it's killed by oxygen and produces methane as a bi-product of its metabolism. She specifically studies microbes that live in the human gut, trying to develop genetic tools to study those organisms.

Like Farley, Pritha Rao also hoped to influence some of the girls toward careers in research. And although she agrees it can make a great

Katie Frye shares with the Café club participants her personal history and how she ended up at Illinois.

career, her main motivation was to recruit some additional help in the field solving some of the problems that need to be addressed. “I came today not only to be an inspiration to them, but to show them that there’s a career in science that [they] can do. There are a lot of unexplored questions out there that we still don’t know the answers to.”

While Rao wanted to be an inspiration to them, she also hoped that they might inspire her as well.

“Because these are young girls,” she explains, “they haven’t explored anything, but they are full of energy to explore what is all there. Sometimes as we get older, I think we lose enthusiasm for everyday life. When we get into contact with the young girls, it brings back the enthusiasm. What we are doing is worthwhile, and it’s worth it to spread the message and encourage them.”

Rao, whose research is about how DNA is managed inside the cell, reports that if a cell’s DNA is not duplicated or repaired properly, there are little consequences. “So we are studying how these little consequences can be manipulated in terms of designing new drugs for curing cancer.

Like many of the other ladies, MCB PhD student Mara Livezey participated in the Café for many of the same reasons that these women already stated; she wanted to be a role model and encourage each youngster that a career in science is possible. But she had an even loftier hope—that maybe some of them might end up increasing the pool of female science faculty in higher education.

She acknowledges:

“There really aren’t that many female faculty, maybe because they never had women as scientific role models. I think something that’s really good is to expose young girls to, ‘Yes, you can be a scientist.’

So Livezey also hoped to sow the seed that another possible career they might aspire to is to become a faculty member. “This is something that women can do as well. So hopefully, over time, the percentage of faculty scientists who are women increases to become more equitable.”

Livezey believes that this shortage might be due to a lack of female role models. “I think some of the past, it wasn’t because there was some bias against women in science. It’s good just to have that strong female role model.”

Livezey, who researches breast cancer, indicates that in her lab, they do two different but related things. One is to study the pathway that protects cancer cells and helps them grow. “We want to understand how that works, how it helps them grow, and how it supports things that we already know about breast cancer.”

Her lab is also seeking to develop a drug that actually uses this same pathway, hijacking it and turning it way up to toxic levels in order to kill the cells that way. “My project is studying the drug and seeing how exactly it kills the cells,” she reports, “trying to understand this better and why it works so well.”

MCB PhD student Andie Liu shares her story with the NGS students.

MIDDLE SCHOOL GIRLS EXPERIENCE MATH'S ROLE IN ART DURING GEMS WORKSHOPS

March 27, 2018

What do origami, tessellation, and string art have to do with math? Hoping to find out, a number of local 6th–9th graders participated in the GEMS (Girls Engaged in Math and Science) Workshops which ran for four Saturdays in a row early in the spring semester (February 10th through March 3rd). Held in Altgeld Hall in the heart of the Illinois campus (and the Pottery Place in Champaign), GEMS allowed a group of girls to experience first-hand some of the ways math can play a role in art. And besides teaching participants that math is more than rote memorization and repetition, the goal of GEMS was to show the girls that math is all around them, to help them meet other local students interested in math, and to expose them to female mathematicians who might serve as role models.

Emily Heath (left), AWM's Outreach Chair, working with a GEMS participant during the string art workshop.

A GEMS participant shows off her origami creations.

Hosted by AWM (Illinois' chapter of the Association for Women in Mathematics) and also sponsored by Illinois' Department of Mathematics, IGL (Illinois Geometry Lab), and Office of Public Engagement, along with the National Science Foundation, the GEMS workshops were free for participants. Girls could register for as many sessions as they wished provided there was room. Eighteen girls participated in GEMS over the four-week period, with 14 participating in at least one or more sessions; two attended all four events, while other girls attended two or three.

During this fourth iteration of the GEMS series, the participants got a chance to dabble in a number of art forms that incorporate math concepts. For example, on February 10th, the girls tried their hand at origami, the Japanese art of paper folding, using geometric folds and crease patterns to create three-dimensional paper figures. During this workshop, the girls learned about polygons and polyhedrons, plus used origami to create cubes, stellated octahedrons, and stellated icosahedrons.

A math grad student, Brian Shin, watches as a middle schooler participating in GEMS makes origami.

On February 17th, the students created tessellations, the tiling of a plane using one or more geometric shapes, called tiles, with no overlaps and no gaps. Using tiles, participants created colorful tesselations of their own, exploring shapes that can be used to create regular tilings of the plane, plus learning about monohedral tilings.

During the third workshop on February 24th, a field trip to the Pottery Place in Champaign, each student got a chance to put to use what they'd learned about tilings in the previous workshop as they painted a piece of pottery to take home.

Finally, in the string art workshop on March 3rd, students worked in groups to create different designs using strings and push pins on corkboards. In this workshop, they learned how curves can be approximated by straight lines, plus they also explored more complicated curves using colored pencils and templates.

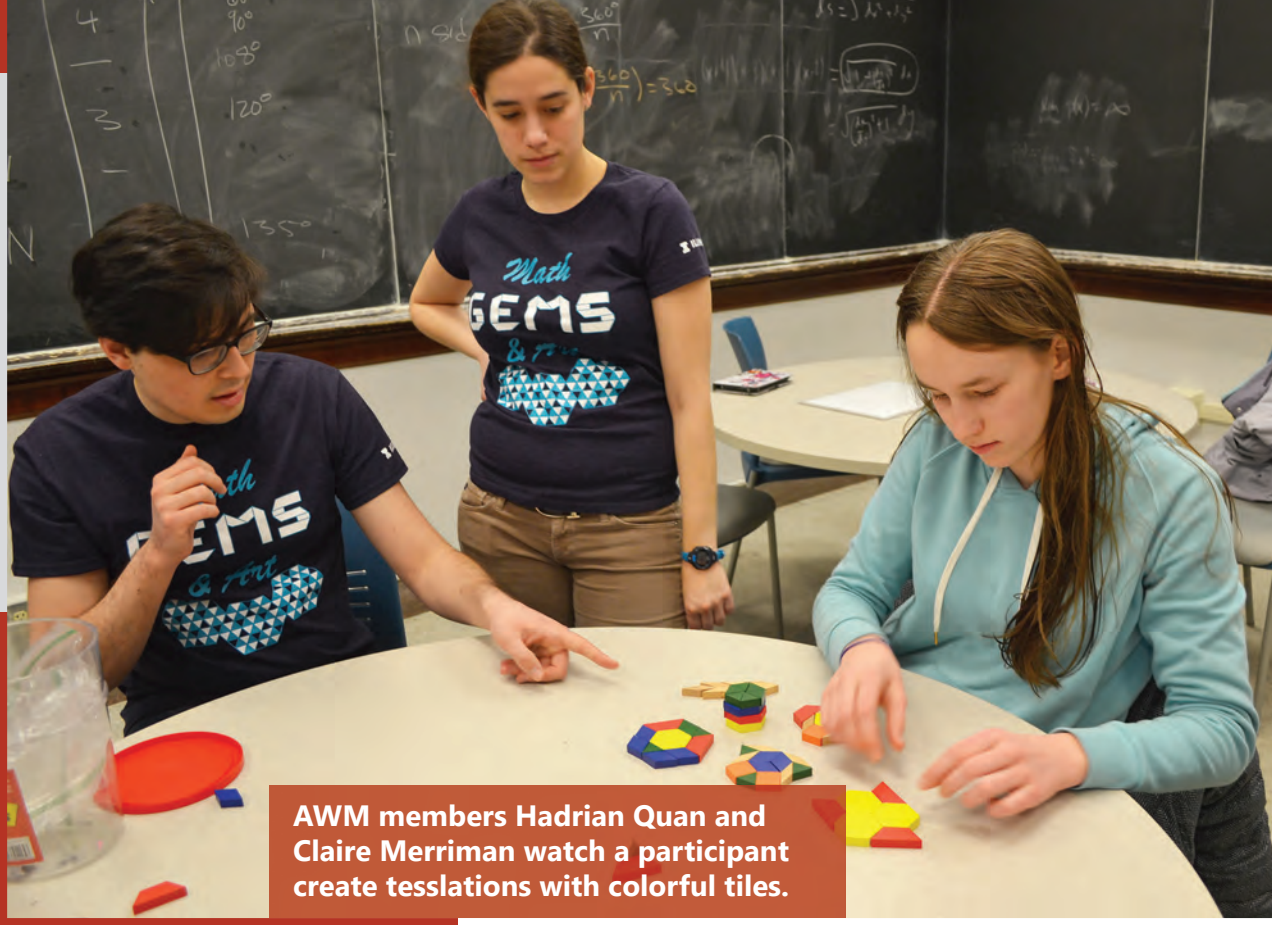
So why bring girls onto campus for an outreach event like GEMS? Emily Heath, AWM's Outreach Chair, reports that by inviting these girls into Altgeld Hall, where she and her fellow math grad students spend so much of their time exploring their own math problems, "We hope to help the students to visualize a future in math and feel that such a path is a possibility for them as well." Heath explains why the GEMS outreach specifically targeted 6–9th graders, particularly girls. She says:

> **"Many students, especially young girls, find that middle school is a turning point in their relationship with math. They may begin to find math boring or to believe themselves to be 'not math people.' By offering these GEMS workshops and showing the girls a different side of math, we hope to maintain their enthusiasm for math and empower them to continue their studies by providing role models with whom they can relate."**

Heath indicates that the goal of the GEMS Workshop program, which was begun in 2014, is to introduce middle school girls to the "exciting, creative side of mathematics." She reports that in these sessions, they are replacing traditional classroom lectures by collaborative exploration, "which we hope will demonstrate to the students that math is more than memorization and repetition; it's about innovation and creativity!"

Emily Heath works on origami during the first GEMS workshop.

She adds that the workshops are also intended to show the girls "how math appears all around us in ways they might not expect."



AWM members Hadrian Quan and Claire Merriman watch a participant create tesslations with colorful tiles.

For example, while this year's series addressed the interplay of math and art, GEMS 2019 will look at the many ways that math shapes nature.

One final goal of GEMS has to do with participants seeing other girls, both their peers and older women, doing math.

Heath shares that GEMS seeks to "serve as a space for budding female mathematicians to bond with their peers from other local schools."

But even more important is the idea that participants rub shoulders with older women who have chosen math as a career, who might serve as "female role models that can inspire them to continue to study math in the future."

In fact, Heath stresses that, rather than training a small subset of graduate students to lead their programs, AWM's focus this year is to invite a large number of different graduate volunteers to participate in their events. Their goal? To ensure that the middle schoolers meet a wide variety of female mathematicians and, thus, hear about the different paths they've taken to get to their PhD studies in math.

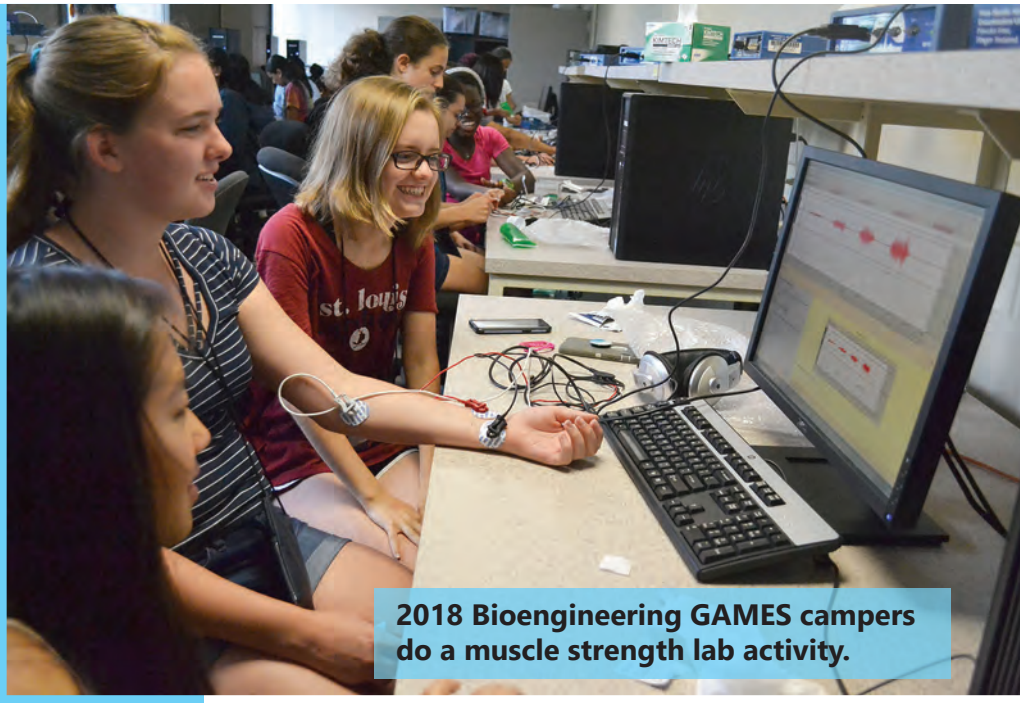
A third-year math PhD student studying graph theory, Heath shares her outreach philosophy and how she ended up being the current AWM Outreach Chair. Over the first two years of her graduate study at Illinois, she had volunteered for several AWM outreach events. She reports that while leading youngsters in hands-on activities like Torus Tic-Tac-Toe and math magic tricks, she was "thrilled by the excitement the girls showed as they experienced the discovery-driven side of mathematics."

She continues:

"So I jumped at the chance to serve as Outreach Chair for the AWM this year, to ensure that these experiences continue to be offered to the students of Champaign-Urbana and that the young women of our community know how fun math can be."

In her role as AWM Outreach Chair, Heath is also focused on ensuring the sustainability of the group's programs. She plans to develop detailed instructions to help guide future chairs through the process of planning successful outreach events. She also intends to document the different activities the group offers this year "so that these events can be repeated and improved in the future."

BIOE GAMES CAMP USES CYBORG THEME TO INTRODUCE HIGH SCHOOL GIRLS TO BIOENGINEERING



2018 Bioengineering GAMES campers do a muscle strength lab activity.

June 28, 2018

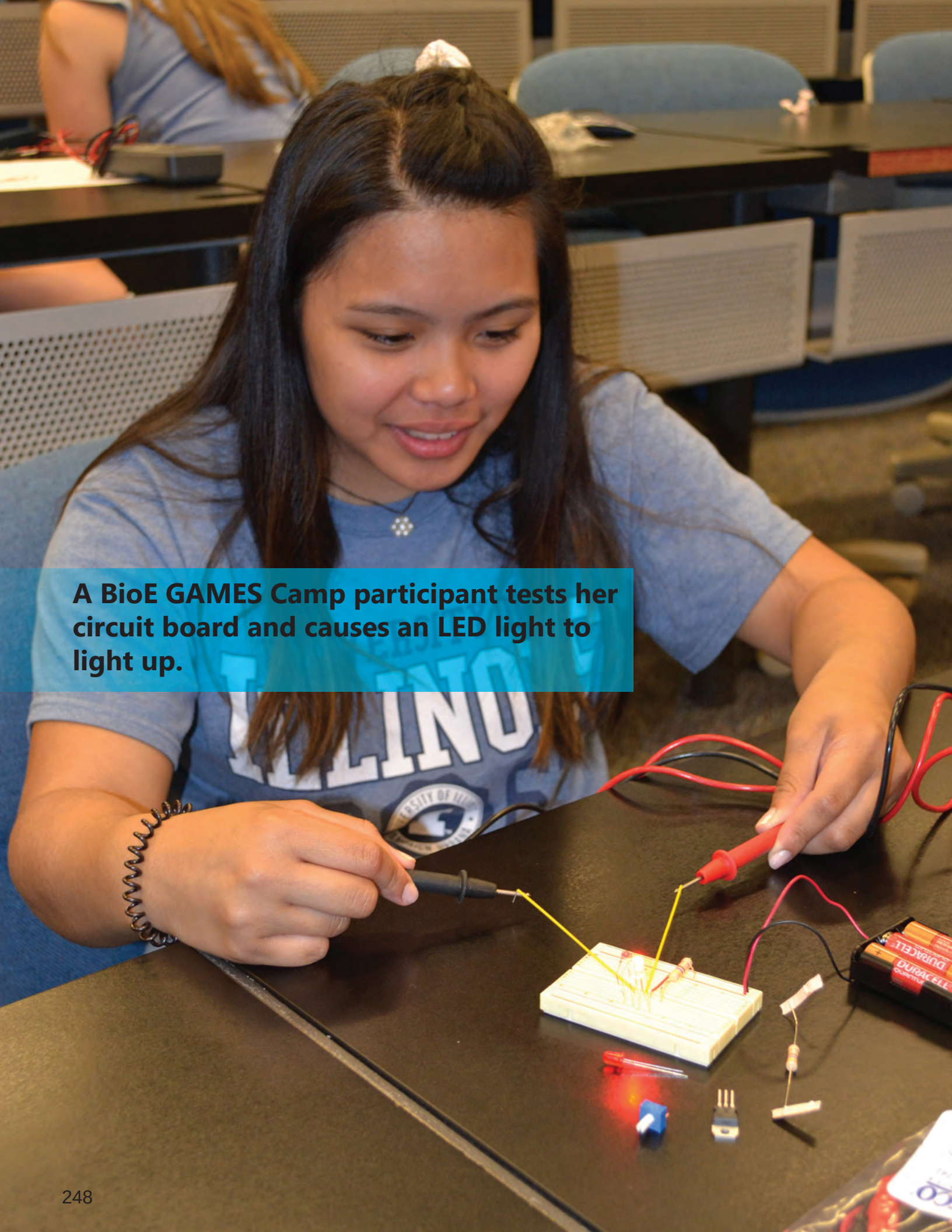
Cyborgs! Most of the 24 high school girls who participated in the Bioengineering GAMES (Girls' Adventures in Math, Engineering, and Science) camp from June 17–23, 2018, had no doubt seen movies about them: human beings, like Wolfman of the X-Men, whose physical abilities have been extended beyond normal human limitations via mechanical elements built into their bodies. But the girls' adventure during the week-long, BioE GAMES camp wasn't just the stuff of sci-fi movies. They were introduced to some of the real science behind the notion. But participants were not only exposed to a variety of opportunities available to bioengineers. As they rubbed shoulders with role models who look like them—both female and an African-American— they were also exposed to the idea that they, too, could be Bioengineers Plus, they discovered what it might be like to be BioE student or even a medical student at Illinois.

This year's BioE GAMES camp had a bit of a different look. While some of the experiments and activities were the same as in previous years, the camp director, Bioengineering Associate Professor Jenny Amos, also added some new things this year. She explains that because Bioengineering was set to move to its new location in Everett Hall, a lot the equipment wasn't around. "So I had to be really innovative this year," she admits, "and think about ways to use what we have available." So, in keeping with some of BioE's research emphases, this year's theme was cyborgs.

"Which is very fitting for Bioengineering," she acknowledges, "because we get to talk about ways that Bioengineering is really pushing what it is to be human, and how we can repair or replace and regenerate different parts of the body to make even superhumans!"

BioE GAMES campers do an activity about sight sensors.

In light of the theme, during the camp, the girls participated in lectures, demonstrations, and lots of hands-on activities on related research currently taking place in BioEngineering: 3D printing, muscle control, biomimetics, and sight sensors; they even explored biobots and discussed ethics issues surrounding them. Also, campers took an all-day field trip to the JUMP Simulation Education Center in Peoria, Illinois. At this simulation and training center for doctors, campers saw how bioengineering affects medicine. Plus they got to practice life-saving techniques themselves and learn about



A BioE GAMES Camp participant tests her circuit board and causes an LED light to light up.

the anatomy of animals by examining up close the heart and lungs of a pig.

The girls were also given the option to be participants in an extracurricular evening Anthropometry activity related to Dr. Kathryn Clancy and Dr. Carla Hunter's research. The goal was to help them understand what it's like to be research participants and also to help them make ethical decisions should they one day complete research.

While the goal of the camp is to use activities designed to pique the girls' interest in Bioengineering, Amos says the thing she most loves about the camp is that she's empowering women to do STEM. And she's succeeding: some of these young women are choosing engineering. Some of them are even coming to Illinois.

"Every year," she admits, "I look through my admissions for BioEs, and I find a few girls who used to do GAMES camps."

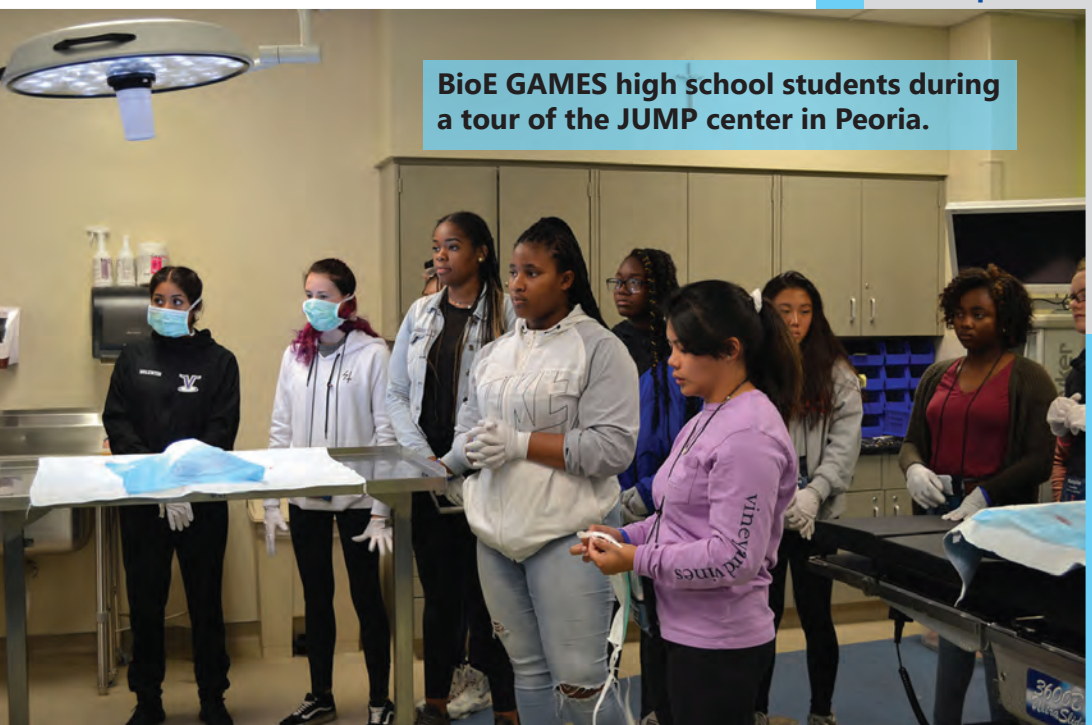
And when she interacts with them, she says, "A lot of them say that's what motivated them to actually join Bioengineering and to come to school here—the GAMES camp experience."

Amos, who's been running the Bioengineering GAMES camp for eight years, says that while she's eased out of some other summer camps she'd been running, GAMES is too important. "But never GAMES, 'cause GAMES is so special to me."

So what's the benefit of bringing high school girls onto campus? According to Amos, who says BioE used to do a camp comprised of science activities targeting middle school girls, they changed their emphasis to high school girls because they're on the cusp of making choices about college and career goals.

A BioE GAMES camper shows off the networking diagram she made during the evening Anthropology activity.

For these young women, "Being on campus is a whole other experience," she explains. "Being able to interact with current college students and college professors really helps fuel their, 'Ok, I can do this; I can go to college; that could be me some day.'"



BioE GAMES high school students during a tour of the JUMP center in Peoria.

Plus, in addition to getting more girls in general into BioE, the camp was also exposing more girls of ethnicity to the discipline. Amos indicates that they've been specifically targeting girls of color.

“We try to maintain at least 30% underrepresented within the camp,” she explains, “and it's something we are really passionate about. Our camp, in particular, likes to talk about differences in race and gender in science.”

She adds that having an all-girl camp is:

> **“A great opportunity to talk about women in science, and the climate around women in science which has been in the news a lot lately. So that's something that we openly talk about here in camp, and tell these girls, ‘Hey, you can do it. You're going to be the one who changes the way that science treats women.’"**

GAMES campers find out a bit about what being a surgeon might be like as they get up close and personal with a pig's heart and lungs.

To underscore that women can do science, Amos had a number of female BioE graduate and undergraduate students helping with activities, who also served as role models. The lone male among her assistants was Gabriel Burks, a BioE post doc who works for Amos. Though a male, he too, as an African American in STEM, served as a role model so the girls of color in the camp could see an African-American in science.

Burks loves that he’s serving as an example for young women of color. He says:

> **“Yes, I think it’s inspiring for me to have the opportunity to share my face and to hopefully be of inspiration to students of color like myself. I think assimilation is most definitely a strong tool to get others to follow in their footsteps in that pathway.”**

Like Amos, Burks also sees GAMES as a great way to recruit more women into STEM: “Oh this camp is an awesome opportunity to inspire the next generation of ladies to be scientists, technologists, engineers.”

Having just arrived on campus recently, Burks was excited to be involved.

He says:

> **“This is my first year here with GAMES, and I’m jumping right in. It’s a lively experience, a lot of energy; it’s exciting for me to have the opportunity to work with a new camp, new institution, and a new community.**

Excited to be able to do the BioE GAMES camp every year, Amos considers it her own mini BioE pipeline for girls.

She explains:

> **“The girls are amazing and it really helps inspire me to see all these girls coming every year and how excited they get, and it really helps keep my own kind of motivation going because I see them being exciting and then they end upcoming here to bioengineering, and then it's like this cycle of happiness.”**

A BioE GAMES Camp participant practices CPR on a test dummy.

GLAM GAMES USES COMMON—AND NOT-SO-COMMON—MATERIALS TO INTRODUCE HIGH SCHOOL GIRLS TO MATERIALS SCIENCE

"We get materials out there, and make people know what it is, and that it's an option, and that it's fun. It's so much fun!" – MatSE Assistant Professor, Jessica Krogstad

June 28, 2018

Sweet, yummy chocolate. What girl doesn't crave that? The ubiquitous polymers. Wild and wacky non-Newtonian fluids. Biomaterials. Composites. Crystals. These are just some of the materials 16 girls dabbled in during GLAM (Girls Learn About Materials) GAMES (Girls' Adventures in Math, Engineering, and Science) camp from June 17–23, 2018. Plus, a design project allowed the young women to explore the characteristics of a commonplace, everyday material, such as cardboard, malleable metal (tin foil), tape, or plastic, to come up with a use that's different from how it's normally used. All of these activities were designed to give the girls a glimpse into what materials engineering is and what a materials engineer does.

A lab assistant teaches a GLAM camper how to use a piece of equipment during the biomaterials session.

In her 4th year running GLAM GAMES, Material Science and Engineering (MatSE) Assistant Professor Jessica Krogstad reports that the 16 girls who participated in 2018 were mostly from the Chicago area. However, one camper hailed from Iowa, one from Michigan, and one came all the way from Istanbul, Turkey.

Krogstad indicates that only a handful of campers who come to GLAM year-in, year-out really know what materials engineers do; the vast majority have no idea.

"We get a lot of campers who kind of like chemistry, and kind of like physics, and kind of like engineering, but aren't sure which direction to go. But this sounds like it might be some sort of combination of all that. And it really is. It's kind of the perfect mix of all those different things."

So one goal of the camp is to give the GLAM participants perspective as to what an actual materials engineer might do via a week-long design project.

"So it's really difficult to describe what a materials engineer does," Krogstad explains, "because there's such a diversity of application spaces that they work in that it's no one thing. This gives them the ability to explore what they might actually do in a job on their own."

Krogstad says GLAM didn't have a design project when she took charge of it four years ago. It's something she and her team have integrated into the camp to give it "more cohesiveness." It was also designed to give the campers "more ownership of their learning and to be able to apply it directly to their own creative thinking."

One thing that was different about the camp this year was the changes they made to the project. The idea was for the girls to come up with a novel application of an everyday material: either a paper-based product; a malleable metal, like aluminum foil or paper clips; tape; or plastics, like milk

A camper learns about how to work with biomaterials during one of the camp's hands-on sessions.

jugs and saran wrap—all of these come out of the recycle bin or they're things one can buy easily in the store. Then, at the end of the week, they presented their designs to visitors at a poster session.

Indicating that the design project has always been very popular with students in the past, Krogstad reports that they're also doing a study in order to understand how it "improves [the campers'] confidence and their understanding of the material in camp." The study also involves comparisons to the design projects some of the other camps do in different ways.

What is it that the campers were to design? "It's up to them," Krogstad says. The goal was to give them materials they're very familiar with, so they're also familiar with how the material is usually used. She gives the example of cardboard, which is pretty much always used as a box. She explains:

> **"Are there other things you can do with the box to solve a different problem? So we kind of put that on the teams to come up with a need or a problem that could be addressed by the properties that are discovered from the materials."**

First, the girls performed various tests on a number of materials at different stations the GLAM team had set up for testing. These were to help the girls come up with other ways a material, such as cardboard, might be used—ways that were different from how they've seen it used before.

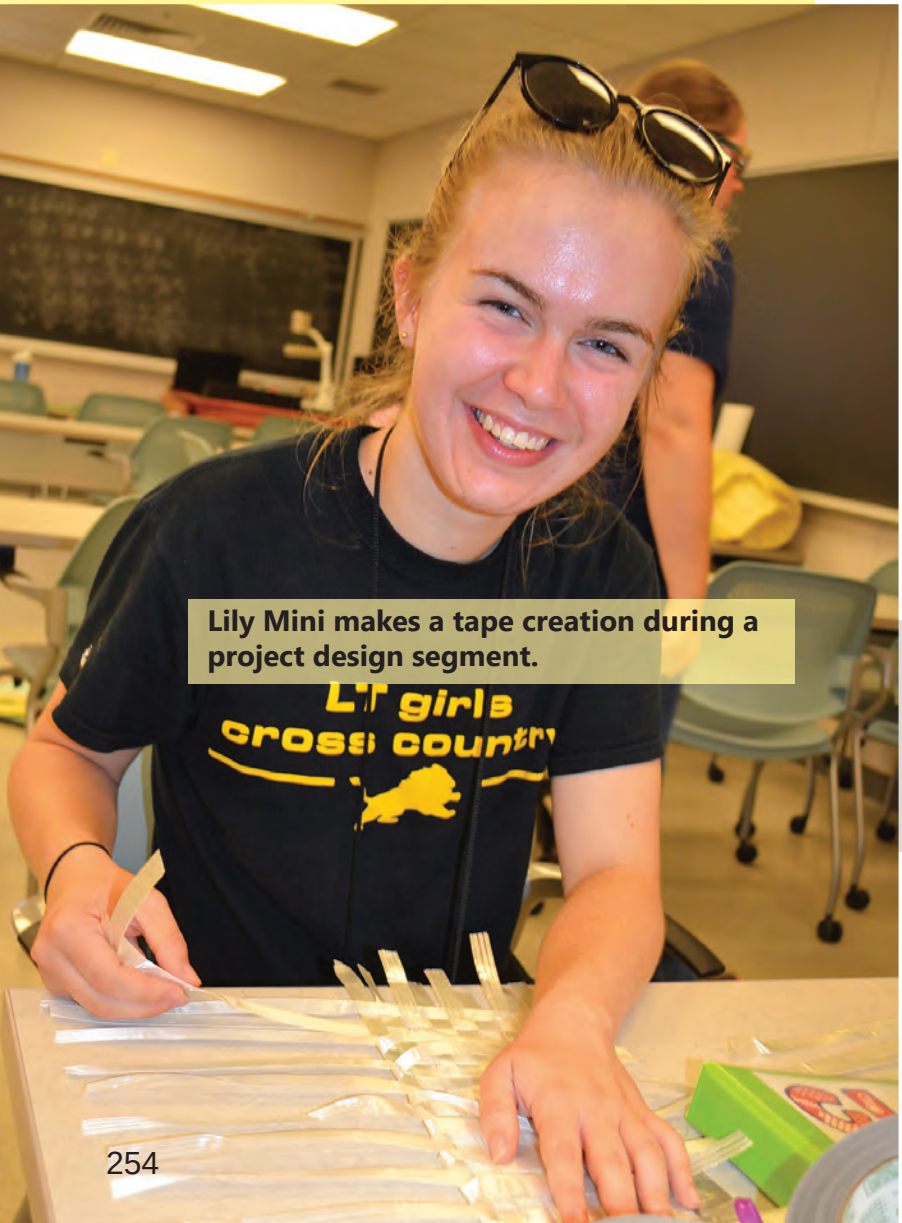
She reports that as a result of the testing, for instance, "The plastic team was really surprised by how strong the plastic bags were in some configurations, but then they were able to break them in other configurations. So they're learning about the design of the materials and why they're used and made the way they currently are for current applications, but also coming up with new insight they can use for their final, novel application space."

Why would Krogstad and her team take a break from their research to do a camp for high schoolers? Krogstad says she had done outreach activities similar to this when she was in high school which introduced her to materials science, so she took on GLAM to pay it forward.

A GLAM participant uses a pipette during the biomaterials session.

“I didn't know what materials science was. I was going to be an aerospace engineer or a chemical engineer, and I think I would've hated both of those. They wouldn't have been a good fit for me. And through outreach activities like this, I discovered what materials science and engineering was in high school, so the whole trajectory of my career is activities like this. So it's really important for me to be able to give students these sorts of opportunities.”

Two high schoolers work on their design project with their material: saran wrap.



Lily Mini makes a tape creation during a project design segment.

One participant who discovered what materials engineering is like at GLAM was Lily Mini, a rising junior at Lyons Township High School in Western Spring, Illinois. Mini shares why she came to GLAM this summer and the impact it had on her:

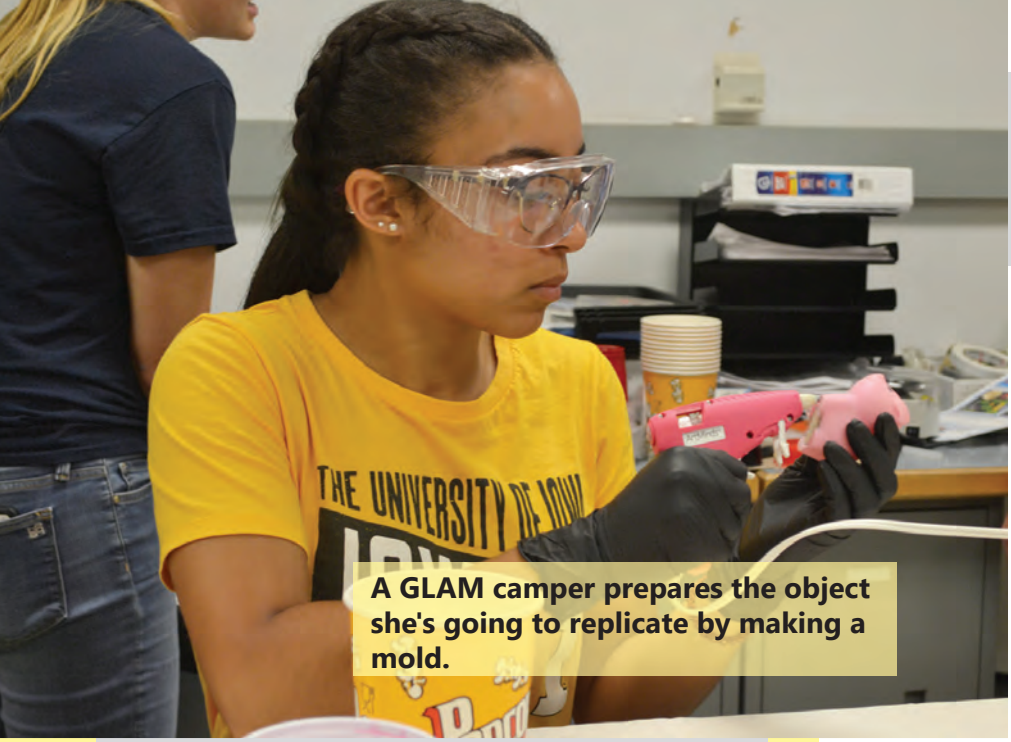
“I’m interested in engineering, and my dad went to the University of Illinois, so there’s legacy here,” she admits. She also participated because she’s a junior, and is starting to think about college.

“It’s becoming real, and I saw this opportunity, and I thought, ‘It’s a great opportunity to explore my options as a woman interested in engineering.’” She says it was also a great opportunity to “spend time on a campus that’s near and dear to my family.” She indicates that her impression of the campus was very positive:

“I could definitely see myself here,” she acknowledges, “and it’s nice to just spend time on campus rather than just going on an hour tour—actually getting to live here.”

Regarding materials engineering, she says, “I really like how inter-disciplinary it is. I like how connected to everything. I’m really interested in how materials connect to how we do things.”

While she indicates that she might be a little bit more interested in how to do things rather than the materials one does them with, she adds:



A GLAM camper prepares the object she's going to replicate by making a mold.

“I think it’s a really important part of the process, and it’s allowing me to use the engineering process to explore different things, so I’m glad that I’ve taken this camp and had the opportunity to do it.”

Another GLAM participant, Mayher Matharu, a rising junior at Evanston Township High School, shares why she participated in the camp.

While she says she really loves art and has loved it all of her life, she admits that, “Lately, science has been more and more interesting to me. I feel like I have a lot of catching up to do with people who’ve been involved with science all their life or for a really long time. So I’m trying to get an idea of what science is like, and what life in science would be like.”

Matharu confesses that she has a bias against engineering that she’s “trying to eliminate.” Because her dad is an engineer, and because her family is Indian, she had initially rebelled against the three main career choices expected of Indian children: an engineer, a lawyer, or a doctor.

“My mom especially tried not to do that,” she confesses regarding the three career expectations, “but I was still aware of it, and so it made me push away from science and STEM.”

Ironically, she has since realized that:

“I do like it. I have a passion for it, and I have a talent that doesn’t just come from something that you learn, it comes from actually caring about something, and I realized that I care about this, and I enjoy doing science.”

She says she chose the GLAM camp because she loves ceramics. Discovering that there are ceramic engineers, “who look at everything from toilets to rockets and what’s in a rocket. ('Because you can’t just put plastic in there,' she explains. 'It’ll melt!') So ceramics is a big part of that and has a wide variety of applications. So material sciences is what ceramics engineering is under and it made me consider other materials that I use every day and how those can be applied.”

A GLAM camper pours polymer into a container to make a mold.

GLEE GAMES CAMP SEEKS TO SPARK HIGH SCHOOL GIRLS' INTEREST IN ELECTRICAL ENGINEERING

June 28, 2018

Ever flip a switch and marvel at the magic of electricity accomplishing a task? During the week of June 17–23, the 17 high school girls who participated in GLEE (Girls Learning Electrical Engineering) G.A.M.E.S. (Girls' Adventures in Mathematics, Engineering, and Science) camp not only learned about Electrical Engineering, but they did some engineering themselves. And helping lead the activities were several female ECE students—role models who demonstrated that girls can become electrical engineers.

The camp activities involved a number of teaching sessions where the girls were indoctrinated into the mysteries of how circuits and electrical current work. These were followed by hands-on activities where they actually built what they had just learned about. So throughout the weeklong camp, the girls built a circuit, soldered a radio phone, and designed then built an LED calculator. Along with hands-on activities, the girls toured labs in several facilities, including Beckman and MNTL (the Micro Nanotechnology Lab).

Of the 17 girls who participated this year, 12 were from Illinois, three from California, and one from North Carolina and one even as far away as Mexico City, Mexico.

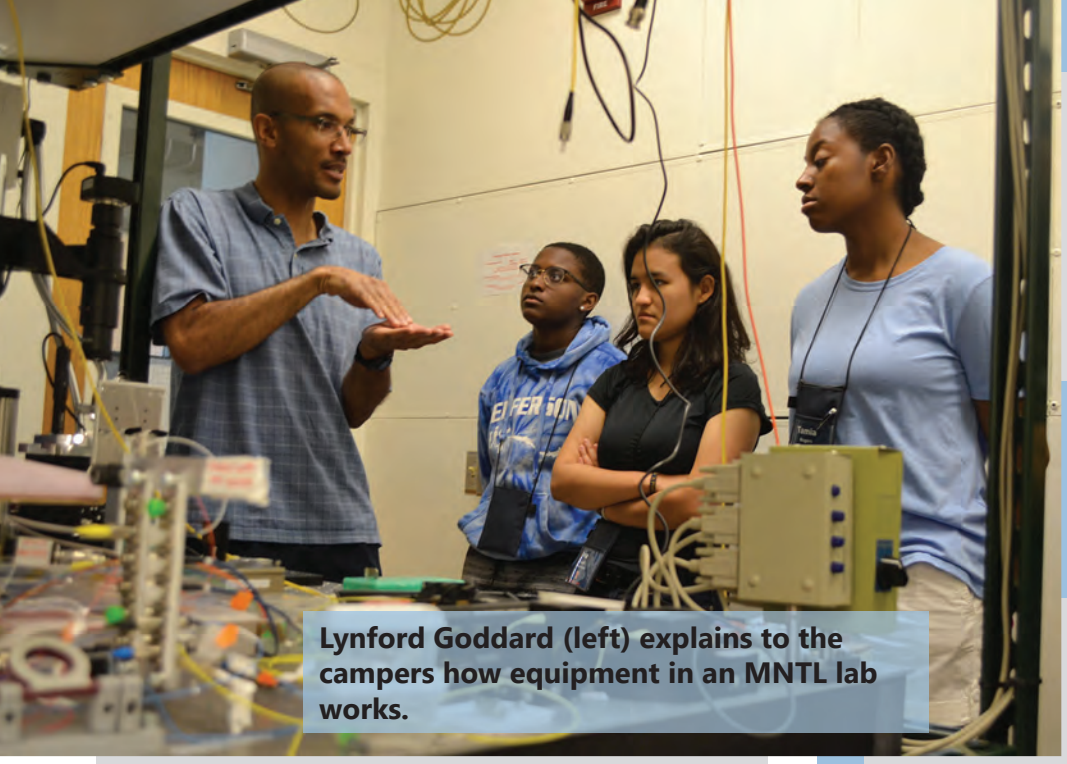
Electrical and Computer Engineering (ECE) Professor Lynford Goddard, GLEE GAMES coordinator, believes that the benefits for the girls are numerous:

"They have had a unique opportunity to learn what college and the ECE major is like and also how engineers impact society and the types of problems researchers are working on. They have made friends from across the country who share similar interests, as well as university contacts for mentoring. On the technical side, they have also learned some key fundamental concepts about engineering, all while doing fun projects."

Wynter Chen helps a GLEE camper working on her LED calculator.

So is GLEE having an impact? Yes. And not just the students, but the field of engineering itself is benefitting from the camp. Plus, GLEE is not only contributing to the diversity of the engineering workforce, but some of those students are studying engineering at Illinois.

Goddard stipulates, though, that the timeline from being a camper to becoming a student is "rather long." It takes at least 3-4 years before the rising 10th and 11th graders who participate in GLEE become college students.



Lynford Goddard (left) explains to the campers how equipment in an MNTL lab works.

"Nevertheless," he explains, "in the past few years, we are starting to see a significant number of these students complete their BS degrees at Illinois, some in ECE, but many in other engineering fields."

He's also aware of two students who have completed MS degrees (both in other fields) and a few who are currently working on their MS degrees in ECE, including one at Illinois.

Because another important emphasis of the camp is exposing the girls to female role models in Electrical Engineering, Goddard enlisted as lab assistants a number of female ECE graduate and undergraduate students, whose goals were to pay it forward and to increase the number of women in electrical engineering.

For instance, one ECE undergrad who wanted to give back was rising sophomore Wynter Chen. She volunteered to be a lab assistant, hopeful that the camp might have the same kind of significant impact on the participating high school girls that it had on her when she attended GLEE GAMES in 2016.

"So I actually went to the same camp when I was in high school," she explains, "and it was one of the things that made me decide to go into ECE here at Illinois. So I hope that the girls here also get to get that same experience. And I want to give back, so they can also learn what it is like at Illinois."

No doubt speaking from personal experience, Chen shares why it's beneficial to bring high school girls onto campus to do something like this.

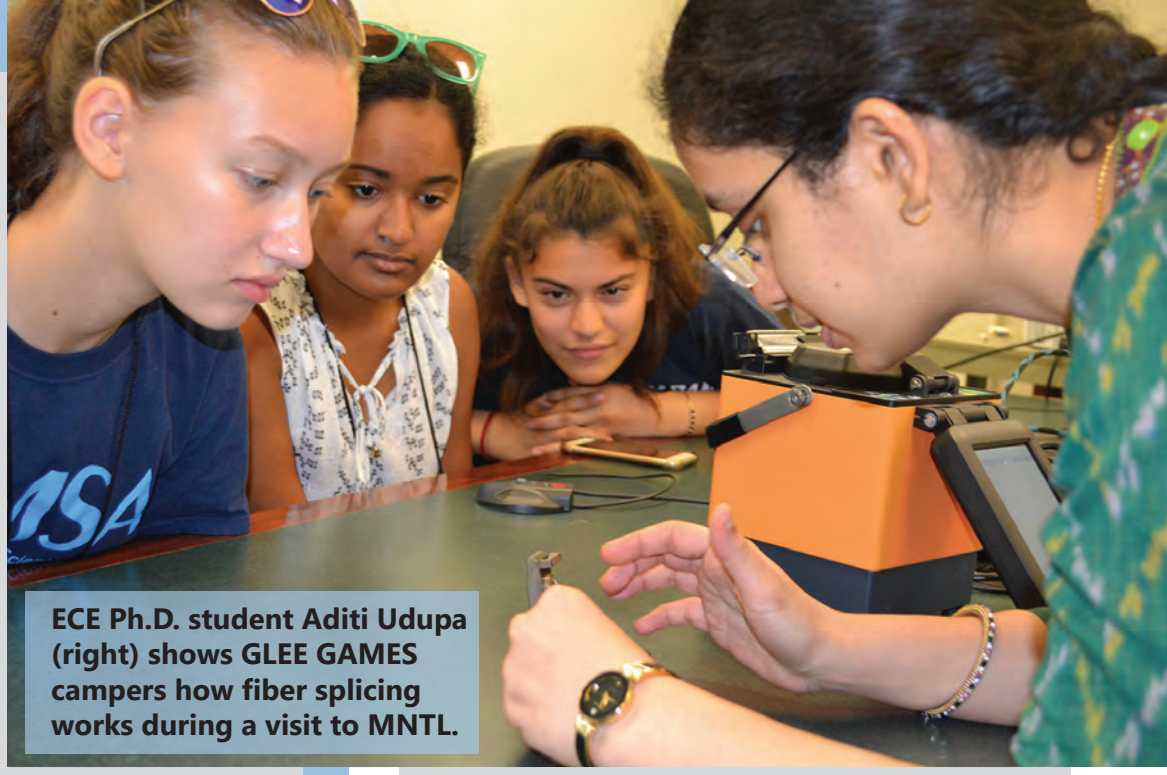
"In high school, they just don't have a lot of opportunities to do things in labs directly," she reveals, "whereas when they come to Illinois at the G.A.M.E.S. camp, they can have lab experience, go visit the campus, and also work with the professors here and get a sense of what college life really is."

Another lab assistant, Madison Wilson, a rising senior in both ECE and Chemical Engineering, reports that she decided to help with the camp because she hadn't really had a chance to give back to girls in engineering…and wanted to.

"I feel like my experience here [at Illinois] has been really great. I've learned a lot, and the school has

Madison Wilson (left) works with a GLEE camper who's building a circuit.

really made me feel empowered." A TA doing a dual degree, she adds, "I feel like there's nothing really I can't accomplish here. So, by leading girls this summer, I really hope to encourage them to pursue engineering—hopefully here—but also just in general to find what interests them and go after it."



ECE Ph.D. student Aditi Udupa (right) shows GLEE GAMES campers how fiber splicing works during a visit to MNTL.

Wilson believes some GLEE participants may end up in engineering, based on the fact that some intend to participate in other GAMES camps in the future to explore other engineering disciplines.

"I feel like a lot of them are really excited. Some are returning, so that's great to see, that they're pursuing other disciplines within engineering, that this is definitely something they want to do. Also, I think the creativity aspect is really apparent in the girls, whether it's applied to engineering or just in their lives. You got a lot of potential out there, it'll be cool to see where they go."

In his 9th year running the camp, Electrical and Computer Engineering (ECE) Professor Lynford Goddard says he finds it very rewarding "to see the joy that the students have when building projects and when learning about our field.

Regarding faculty and students who were instructors for the camp, Goddard enjoys collaborating with them to run the camp: "Their time, effort, and energy has made it possible for us to offer the camp for so long," he explains.

One GLEE camper who iscovered what college life at Illinois really is like was Aliyah Bryant, a rising senior at Evanston Township High School in Evanston, Illinois. Bryant shares why she attended GLEE camp.

"I haven't taken any engineering classes, and that's something that I've always wanted to explore."

She adds that it was also a way for her to stay on campus for a week at a campus that she's thinking about coming to.

Regarding the camp's impact, she says, "It's really cool. I've learned a lot and built a lot, a lot of things that I never saw myself doing and discovered some more career paths and classes and labs and studies and research, so I learned a lot."

Does she think electrical engineering is in her future? Maybe. "I'm still going to explore my options," she adds, "but I'm definitely going to consider it."

Another participant, Lydia Hong, a rising sophomore from Minooka, a small Illinois suburb, shares why she came to GLEE: "I'm just kind of exploring my options before going to college tours and declares that the camp impacted her significantly:

"I honestly think this camp has been a life-changing experience for me. I haven't been this hands-on in any of my classes, and I'm really liking this." Hong adds that engineering is "definitely a possibility" down the road.

Professor Lynford Goddard helps a GLEE GAMES Camp participant with her circuit.

CHBE GAMES CAMP INTRODUCES HIGH SCHOOL GIRLS TO CHEMICAL AND MOLECULAR ENGINEERING

A ChBE GAMES camper works on an activity to make oobleck.

July 3, 2018

It is time to change the status quo in the male-dominated STEM fields, and Illinois is definitely impacting chemical engineering in this regard through the Chemical and Biomolecular Engineering (ChBE) GAMES (Girls' Adventures in Mathematics, Engineering, and Science) camp. So with the goals of increasing the number of women in chemical engineering, and of helping participants understand what chemical engineering actually is, the ChBE GAMEs camp brought 24 rising high school freshmen through seniors to campus from June 17–23, 2018. The camp not only helped the girls to explore concepts in chemical engineering, but was the deciding factor in some choosing careers in the field as a result.

In the 2018 camp, about 80% of the participating students were from Illinois, in particular the Chicago suburbs. About 15–20% of the cohort were from out of state, coming from as far as California and Florida. However, one of the attendees came from even further away—all the way from India.

The girls who took part in the camp participated in a variety of activities, including demonstrations, presentations, fun hands-on activities, and tours which exposed them to the breadth of chemical engineering. For example, they participated in six experiments led by Professor Diwakar Shukla, who is in his second year as the Director of the ChBE GAMES camp, and his lab team. The experiments involving distillation, polymer extrusion, acid rain, starch straining, foaming face wash, and continuous distillation. The campers also participated in a number of other fun experiments. For instance, the Professor Diao and his lab led the campers in activities making chocolate shapes, drying them, and discussing how chocolate crystallizes. The experiment ended, of course, as one would have hoped—the students got to eat the chocolates! In another session, Professor Mary Kraft and her team led the campers in an activity about gold nanoparticles, during which the students aggregated a gold colloid. Another popular activity was the hydrogel demonstration led by the Kong lab, wherein the hydrogels run after each other on top of water. The students also enjoyed making oobleck courtesy of the Rogers lab team.

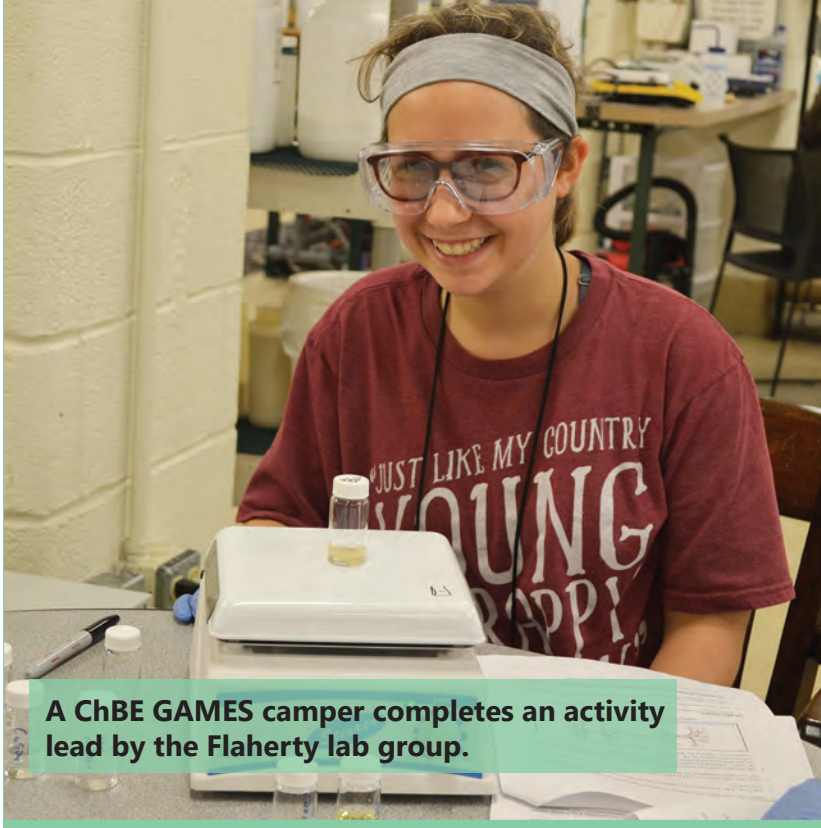
Another activity Shukla and his group led was called computational games. This involved a software program that teaches students about proteins and how they take shape, thus showing the students a type of engineering about microscopic parts of their own bodies instead of that of a physical object. The exercise, which runs like a quiz, had the high school students input the protein structures and get scores, gradually moving on to tougher problems. Shukla believes this activity instilled confidence in the girls, saying, "It tells them that women can be computer scientists!"

To supplement their experience, the students toured the Abbott Power Plant near the Illinois campus, which meets 88% of the energy demand on the Urbana-Champaign campus. But Shukla, in his second year as Coordinator of the ChBE GAMES

camp, was even more excited about the opportunity to take participants to see the LyondellBasell plant in Tuscola. Because it's an actual chemical plant, the students were able to see products being manufactured, and even participated in some hands-on activities the folks there had planned. Shukla boldly states that his goal in running the camp is to increase the number of women in STEM, especially chemical engineering. He appropriately cites the reason Illinois' Chemical and Biomolecular Engineering Department hosts the event in chemical terminology, calling it "backward integration." The undergraduate study body in ChBE currently is at 32%, which Dr. Shukla calls "better than a lot of programs, but still not where we want it. The program is a way to attract more women to the field of chemical engineering, be they faculty, graduate students or undergraduates."

Thus, Shukla cites his reward for organizing the event as "more diverse groups, a more diverse research community, a more accommodating academic environment." He also has a more personal motive behind arranging the camp: his wife is also a professor in ChBE and he wants her to feel more at home in the department and the academic community at large.

Shukla leads by example in regards to increasing the number of women in his field by maintaining a gender balance in his own lab. Although most labs in the field of computation traditionally have around 20% women, his current group of students is 50% women. Plus, of the three undergrads working in his lab right now, two are women, one of whom was a TA for the GAMES camp last year and is now headed to Northwestern University for graduate



A ChBE GAMES camper completes an activity lead by the Flaherty lab group.

school. He also has another female student joining his lab this summer. He calls his personal interactions with his female students "tremendous," adding, "I have extremely hardworking students."

In light of his gender equity goal, one of the major changes he sought to effect this year was having as many as possible of the lab assistants, and TAs involved be women. He reasoned that they "serve as a good role model for these high school students." He also sought to ensure that all the female professors in the department participate this time. These includee Dr. Deborah Leckband, a Professor of Chemistry and the Reid T. Milner Professor of Chemical Sciences; Dr. Mary Kraft, an Associate Professor and Robert W. Schaefer Faculty Scholar; and Dr. Ying Diao, Assistant Professor and Dow Chemical Company Faculty Scholar. Their areas of expertise range from biology to designing solar cells and materials.

ChBE's Mary Kraft says she got involved in the camp because she believes that we need more women in engineering. She explains that the disparity in the number of female engineering students versus those who actually work as faculty leads her to feel that there is much room for improvement. Plus, she echoes Shukla's sentiments regarding a more diverse scientific community.

ChBE GAMES campers listen to professor Mary Kraft as she explains the gold nanoparticles activity.

ChBE GAMES campers work on making oobleck.

"We need all different points of view for solving problems," she acknowledges. "There's different ways of thinking about it, and having students from different backgrounds—and that includes male and female—it's very important."

Another goal of the camp included piquing students' interest in science. For instance, Matthew Wade, a first-year grad student in chemical engineering, phrases a major benefit of the camp by saying, "You get to show these kids 'Hey, look! This is the sort of the stuff you can do in science!" Although these may not be the exact experiments done in labs, such as his, he feels that the activities expose the students to the "kinds of materials people in these fields look at and the type of questions they ask. It allows students to understand these materials from a scientific standpoint and translate them to an industrial perspective."

According to ChBE postdoc Jun Park, outreach events like the camp help students differentiate between what people believe chemical engineering is and what it really is.

"Most people, when they think of chemical engineering, they think about beakers and chemicals, but sometimes the things we work on in reality are the physical property of materials which is important in the industry and in our daily lives, like cosmetics or medicines."

While the deeper-seated issues relating to the gender disparity in STEM fields cannot be completely eradicated by programs such as the GAMES camps, they prove a great first step in involving more girls in such disciplines from a younger age, which might lead to their choosing the discipline as a career. For example, Sydney Nelson, a rising junior at Tri-Valley High School, came to GAMES camp to see if she liked chemical engineering before committing four years of her college career to it. Excitedly describing the discussion during her favorite experiment, which tied in biology, she says, "We talked about how viruses can infect cells and what chemicals could be added. That's what I'm interested in, drug manufacturing and viruses." After experiencing the camp, Nelson seemed convinced that chemical engineering would be in her future.

Another participant, Kayla Epstein, a rising senior at Glenbrook North High School, came to the ChemE GAMES camp after hearing about it from a friend who had participated in it the previous year. Science and math have always been Epstein's favorite subjects, and she credits the camp with showing her a potential career path. She now plans to apply to schools that have a strong chemical engineering program, saying, "I'm going to try and major in it."

Another rising senior, Tiffany Yen, from Lake Zurich High School, was similarly convinced to pursue chemical engineering in college. Although she did not know what chemical engineering entailed when she first came to the camp, she now plans to make it her major and says that participating in this camp gave her the final push to make the decision. Yen had also participated in the computer science and aerospace camps over the past two years, but didn't believe they were the right fit for her. Having taken an AP chemistry class, she actually understood what was going on in this year's camp, which she believes played a big part in her enjoying it the most. These students demonstrate why programs such as the GAMES camps are essential in inspiring young girls to discover a love for STEM that they may not have known they had before.

ChBE GAMES students completeing the polymer extrusion activity.

MID-GLAM CAMP EXPOSES MIDDLE SCHOOL GIRLS TO MATERIALS SCIENCE AND ENGINEERING

A Mid-GLAM camper shows off her now colorful piece of titanium.

July 11, 2018

What better way to get a bunch of middle school girls excited about Materials Science and Engineering than to let them explore color and making things pretty? That's exactly what Mid-GLAM, named after its sister camp GLAM (Girls Learn About Materials) did by exposing them to different hands-on activities and design challenges.

Mid-GLAM is a summer day camp for middle school girls interested in learning about Materials Science and Engineering. It made a second annual debut from June 25 – June 29 and served students from all over the state.

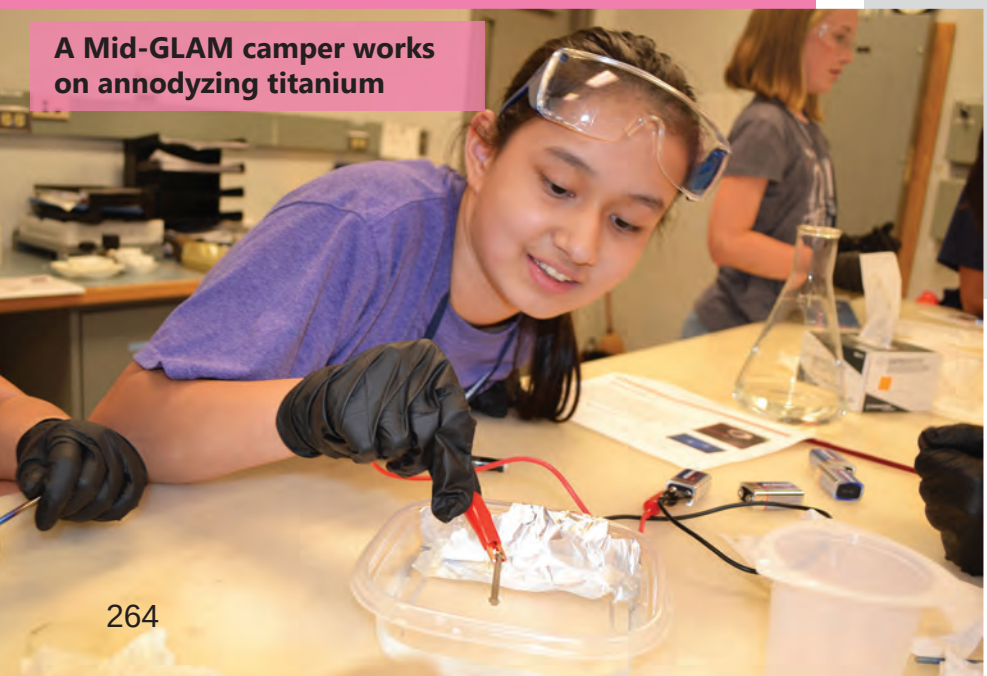
Instead of admission being on a first come, first served basis for local area middle school girls, it was opened up to include 20 girls from middle schools across Illinois and was also based on a paragraph written by the students about why they wanted to participate in the Mid-GLAM camp.

The theme of this year's camp was how to make things better. The topics included were Making Stuff Stronger, Making Stuff Smarter…Cleaner…Faster…Safer…Prettier…and Colorful.

Each morning, students were able to see demonstrations, videos, and participate in hands-on activities pertaining to the selected topic of the day. After lunch, they participated in design challenges that focused on that subject and learned how to make them better. This year, Making Stuff Colorful and Making Stuff Prettier were added to the camp's schedule.

One of the Co-Directors, MatSE (Materials Science and Engineering) Assistant Professor Cecelia Leal elaborates on this saying:

"Last year we did making stuff stronger, cleaner, smaller, and smarter. This year, based on feedback and how it worked last year, we are including a whole new day that is called making things colorful. Color is pretty and fun, but it is useful too, so we wanted to tap into that concept, [and add] a whole new day of color."



A Mid-GLAM camper works on annodyzing titanium

Making Things Colorful was added to the agenda when Professor Renske Van der Veen joined the Mid-GLAM team because she does a lot of work with color.

Students were able to figure out how to change the color of materials to make them pretty, but they were also able to

learn about why color is important in materials science. The main takeaway, Leal says, is that:

"Color is very important in our lives."

Color coding is used in stoplights to associate red and green with stop and go, an example of how color is used in our everyday lives. Another way color can be used is for sensing. A device can be programmed to change color when you sweat to tell you that your blood sugar is low or that you may have cancer.

How do you get these young girls interested in the applications using materials science? One way to do that is to broaden one piece of a concept and apply it to something fun and engaging for the students. Jill Carbone, a rising junior in MatSE who also helped out with the GLAM camp, acknowledges this idea by saying:

"In high school, [the students] have had backgrounds in biology. They've had backgrounds in chemistry, to an extent. They probably haven't taken physics yet, but for the most part they have some sort of small foundation of science to build off of so we can explain the concepts to them and get them really interested. In middle school, they don't know a lot yet about the building blocks of science, but we can get them excited and exposed to it which is the biggest thing."

Assistant Professor Cecelia Leal (second from left) speaks with Mid-GLAM campers about their gumdrop structure.

This is exactly what was done during the Making Stuff Prettier activity.

The girls explored the concept of thermochromics during the activity when the slime they made changed colors as it was cooled. This activity was especially favored by participant Katie Delaney, who came to Mid-GLAM because she thought it would be fun and could meet new friends.

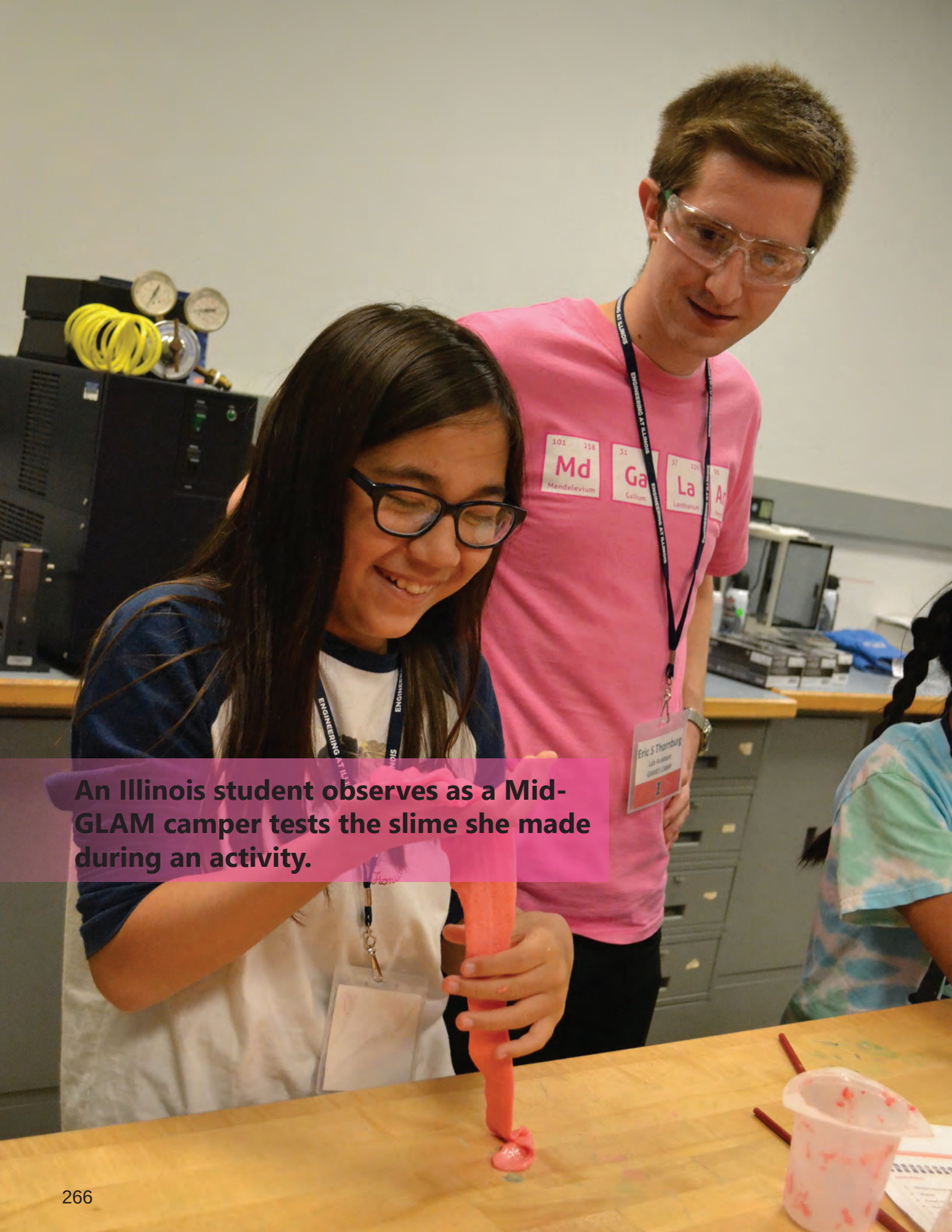
Earlier that day, the girls got involved in another hands-on activity related to Making Stuff Colorful, which piqued the interest of one of the other participants.

Although she hadn't read the Dr. Seuss book that popularized the non-Newtonian fluid, participant Gianna Cannek said her favorite activity was making ooblek. Like Delaney, Cannek said "[Mid-GLAM] sounded fun. I'd get to learn and do a lot of experiments."

Even though Leal said she has a lot of other commitments this summer, she's happy to do the Mid-GLAM camp because:

A Mid-GLAM camper plays with the color changing slime she made.

"This is really a passion– something I truly believe in. For me personally, I benefited so much from my teachers early on in middle school– even elementary school, and that sort of helped develop my passion for science. I want to give back. I want to do this now for [the students] and we have the infrastructures [to do it]. We have everything we need. We have the students,



An Illinois student observes as a Mid-GLAM camper tests the slime she made during an activity.

we have these amazing labs, we have a very supportive department head and faculty, and we have the National Science Foundation that supports this effort, too."

Jill Carbone (right) helps a camper add glitter to her slime.

In addition to the support of the National Science Foundation, the MatSE department at Illinois, and its faculty members, current MatSE students also supported the cause by getting involved in Mid-GLAM because they see the importance of outreach to younger girls.

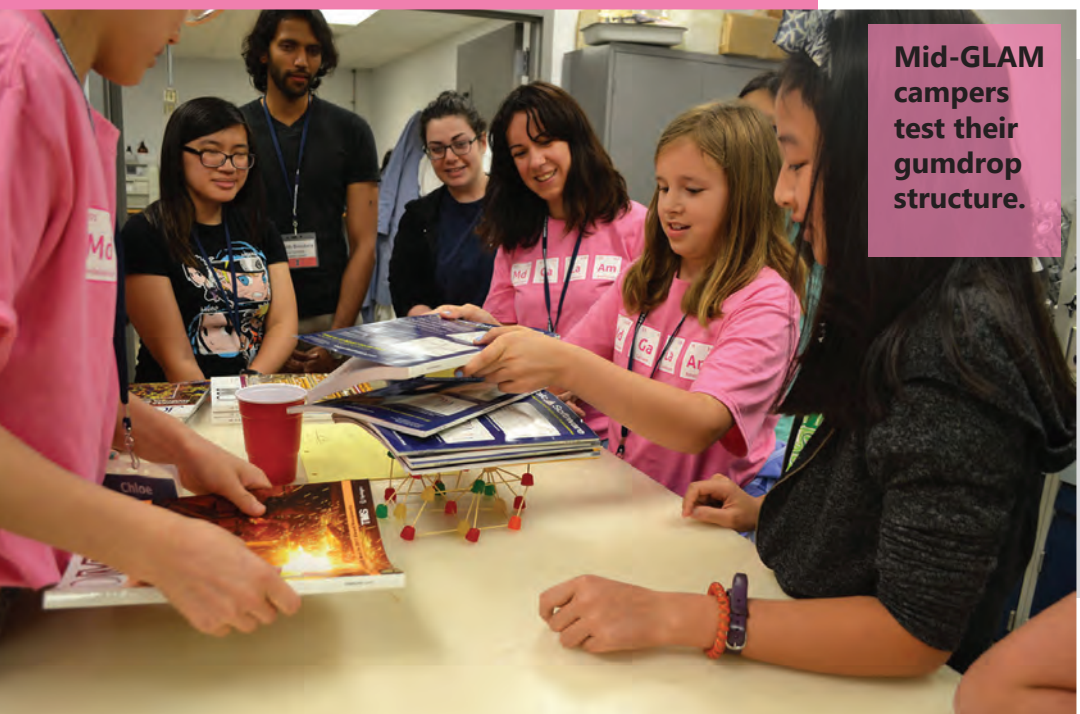
Carbone, admitted that she had no idea what materials science or engineering were when she was a kid because she didn't have the opportunity to attend a camp like Mid-GLAM. She elaborates:

"I had no idea what materials science was when I was a kid. I had no idea what engineering was when I was a kid and so by showing them, by opening up the tiny little part of their mind that could be possibly interested in these things later gives them the opportunity to have that as an option. I didn't even know that was an option. I would've gone to one of these camps if I could've."

In fact, Carbone says she grew up on a different path. She was set to go to Juilliard because she played piano for 15 years; however, this all changed after her sophomore year when she fell in love with STEM, which came as a surprise to her family since she was always known as the artistic one while her brother was the scientist.

Carbone leaves us with an important message:

"I just feel like these girls, whether they were into a completely different thing before, or they were pigeonholed, or they decided that because they were females they shouldn't be in engineering. They should be able to change this just like I did during my sophomore year when I decided to go into STEM."



Mid-GLAM campers test their gumdrop structure.

AEROSPACE ENGINEERING CAMPS SEEK TO IGNITE HIGH SCHOOLERS' INTEREST IN AEROSPACE, STEM

July 17, 2018

Remember building and flying a kite as a kid? Remember the exhilaration you felt as you watched it soar way up high? Even more rewarding is the feeling participating 9–12th grade high school students are getting this summer as they launch the gliders and rockets they designed and built during Aerospace Engineering's (AeroE) three residential camps: Aerospace Engineering GAMES and two Illinois Aerospace Institutes (IAI). Eyes focused heavenward, the campers watch them soar (or let's be realistic—"crash and burn!") during the end-of-the-week launch event—all courtesy of the coordinator of the three camps, Brian Woodard, and his AeroE team.

An aerospace GAMES camper flies a simulation plane.

More than 100 students are participating in AeroE's three camps. For instance, 26 high school girls ranging from incoming freshmen to incoming seniors and mostly from Illinois (plus one from Florida and one from Texas), got a chance to explore aerospace engineering and aviation during the 7th GAMES (Girls' Adventures in Mathematics, Engineering, and Science) camp, a one-week camp for girls only from July 8–14. Plus, 80 more participants (40 each) are participating in the two coed Illinois Aerospace Institute (IAI) camps on June 17–23 then again on July 29–August 4, 2018.

Two aerospace GAMES campers show off their rockets they've built.

While the highlight of the week is launching one's aircraft on Friday afternoon, before students can even begin to design them, they must first learn some of the principles of flight during sessions about flight mechanics, aerodynamics, aerospace structures, orbital mechanics, and propulsion systems. Add to that the hands-on experience of building and launching their own aircraft, and by camp's end, participants hopefully have a better understanding of the forces that keep airplanes up in the air during flight; composite materials used to build aircraft; satellites, such as how they stay in orbit; plus how

to launch rockets and satellites into space.

In addition, during the Wednesday field trip to Parkland College's Institute of Aviation, students get to experience a flight simulator, a control tower, and ride in a fire engine. Plus, GAMES campers got to fly a small airplane. According to Woodard:

"To go on a small airplane is a really unique experience, because the feel in the air is way different, and you can see everything."

Brian Woodard with GAMES campers as they test their rockets they built.

Piloting the students through these hands-on opportunities at the Institute of Aviation is Chief Pilot Don Talleur and his team of instructors. He shares why he and his team do camps like these—to hopefully get some students intrigued with aviation.

"First, it's good for the student to have exposure to different careers, opportunities, and of course, it's good for us, too, because we're planning for the future within the career field that we teach," Talleur says. He indicates that a small number of these campers will at some point "return to this field or decide to pick up flying as something they want to do on the side." While he says it's good for the campers, he admits, "But it's also good for us in terms of marketing for future students. All around, I think it's a win-win for everyone involved."

Like Talleur, Brian Woodard, who coordinates the camps, also believe they're good for the campers. In fact, he's so sold on the positive benefits for campers, that he's had some role in AeroE's camps for the last 13 years. While it's his 7th GAMES camp, Woodard's been involved with IAI for even longer—he began helping out as a grad student at Illinois, way back in 2006. Why so many years devoted to these summer outreach camps? For one, because of the unique experiences they offer students.

"Seeing these students have these experiences that they would not have normally have had is so exciting," he explains. "The GAMES camps especially—I feel like a lot of these girls have never been given the opportunity to build stuff and do these projects. We build model rockets and gliders, and a lot of these students seem to spend a lot of time on their computers or devices and so they have not done a lot of building stuff. So we cut, glue, and tape to get all these models together. Just giving them the opportunity to do it and show them

An aerospace GAMES camper flies a similation plane.

that they can be successful at doing it, I think is great."

And while for some students, attending one of AeroE's camps is just a fun but educational learning experience, for others, the experience actually helps to set them on a trajectory leading to their future career. And some have chosen to prepare for that career at Illinois. In fact, Woodard is aware of a number of undergrads, whom he calls "little success stories," who ended up in AeroE at Illinois after participating in one of their camps. And for the first time ever, one little success story—ex-GAMES camper Suzanne Peterson—will be working alongside Woodard this summer as part of the GAMES staff.

A rising senior in Aerospace at Illinois, Peterson, who came to one of the first GAMES camps Woodard ever led, took a one-week break from her research this summer to help him with GAMES. She volunteered to help because of the impact GAMES had on her. For one, she says it opened up the possibility of studying engineering.

A GAMES camp junkie, (Peterson had attended five, including Aerospace), as a high school senior, looking back at all of her GAMES camp experiences, she said to herself, "If I were to pick one of these tracks to go into for the rest of my life, it would have to be aerospace."

Jessica Hart (left) watches as a aerospace GAMES camper tests her rocket.

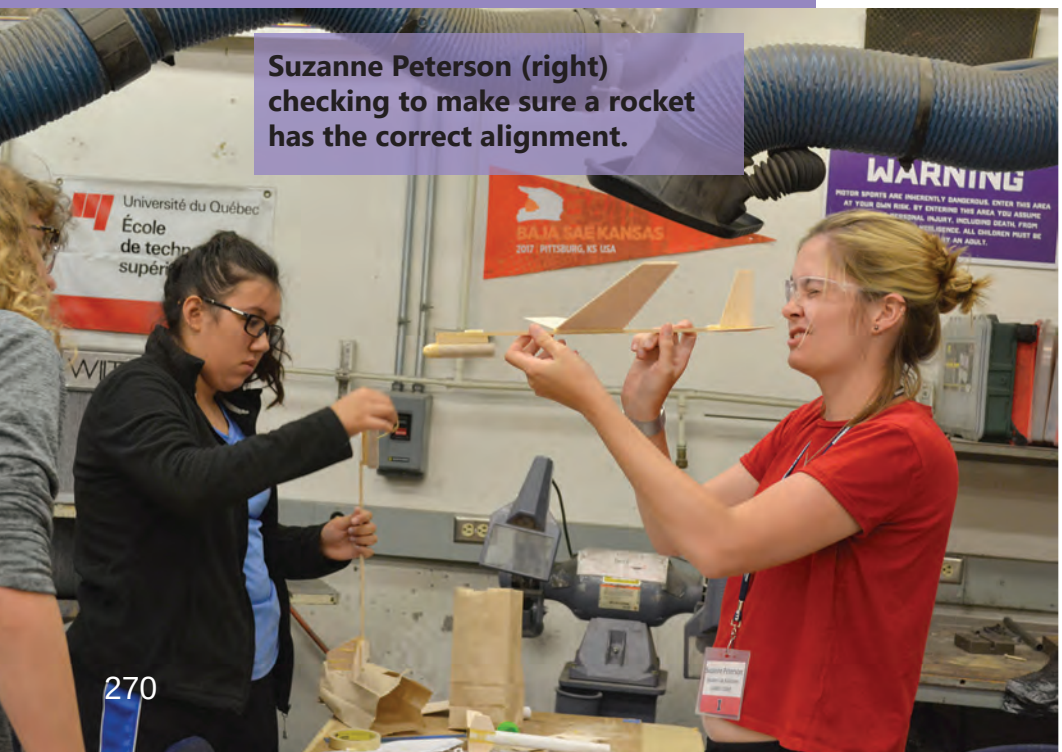
Based on the impact Aerospace GAMES had on her career choices, she hoped to have a similar impact on some of today's students.

"I really enjoyed my time at GAMES camp and I feel like I learned a lot from the lab assistants that taught the classes and sessions, and I'm really passionate about outreach and I would like to, maybe, be that for somebody else."

Another camp instructor, Jessica Hart, who just graduated from Aerospace Engineering in May, also agreed to help with GAMEs camp. Hart had worked the camp for the last two years and really enjoyed it. "So I kinda' knew what it was going on already, and Dr. Woodard asked me to do it again since I was already here, and I said 'Sure. I love it.'"

What's Hart's dream job, now that she has her degree? "That's tough," she admits. "The big dream is to be an astronaut, right?" she says.

Should that not pan out, Hart, whose specialization was space theory design, which included research with optimization code for small satellite systems, would also enjoy working with small satellite systems or some kind of rocket compulsion at Orbital ATK.



Suzanne Peterson (right) checking to make sure a rocket has the correct alignment.

Hart says bringing high school kids onto campus for camps is “a great opportunity to get them exposed to a little bit of what college life is like. So it maybe makes their decision a little easier to come here or not…Then it also gives them a little exposure to the different engineering fields we have here at Illinois, depending on what GAMES camp they do. And I think that's pretty great.

Hart believes she’s seen some engineers among the GAMES girls. “Some of them are pretty bright,” she acknowledges. “I'd say, yeah, they definitely all have a very creative side to them. I've seen that just within the last two days of their model-building sessions, and a couple of them asked some really good questions during the lectures. So definitely.”

In addition to the activities scheduled throughout the day, another exciting learning opportunity takes place on Tuesday evening of all the Aerospace camps. Two years ago, Woodard added visiting Illinois’ Observatory to the agenda so he could spend more time with the participants——and it’s turned out to be a big hit with the students.

“All the students love it,” says Woodard, “and they think it is so cool. Usually during that time of year, Saturn is in the southern sky. Through the telescope, you can see Saturn! With the rings and everything! We added that, and the students have really gotten a big kick out of it!”

One student who particularly enjoyed the observatory visit was GAMES camper Bailey Vincer, a rising freshman at Hononeghah Community High School, who called visiting the observatory “awesome!” She adds, “We got lucky because it had just rained earlier in the day, but it cleared up. So we saw Jupiter and four of its moons, and we also saw Saturn and its rings.”

Bailey Vincer (right) gets to explore the inside of a plane at the Aviation Institute.

Vincer has been passionate about astronomy ever since she was in 4th grade. “I never knew exactly what it was I wanted to do, but I've always had this passion to work for NASA.” Then, a couple years ago, she found out about astronautical engineering, which she found “really interesting.” So when her mom told her about this aerospace camp, they decided that it would be a really good experience for her to get exposed to aerospace, which could eventually lead to astronautical engineering.

Her dream job? “I really want to build, design, and test spacecraft—which is really what astronautical engineering is—there's many jobs within it, but that's what I want to do.”

Vincer’s favorite thing about the camp has been the hands-on activities—building the model gliders and the rockets. “Not only are you building it,” she says.

An aerospace GAMES camper takes photos while they test their rockets.

“You're applying what you learned in the classroom to a hands-on project. It teaches you a lot while still having fun at the same time.”

Another Aerospace GAMES participant, Evelyn Ashley from Bethany, Illinois (about an hour south of Springfield), a rising freshman at Okaw Valley High School, is pretty sure that she’s going to do some type of engineering. She participated in Aerospace GAMES camp to learn more about aerospace and aeronautical engineering. “I am just trying out different aspects of engineering,” she says. “It's been really fun, and I've learned a lot.”

Subha Samaskadan, a rising junior at Stevenson High in Lincolnshire, Illinois, has always been interested engineering, “but not really with aerospace,” she explains, “so I just wanted to try it out.”

Samaskadan was pleasantly surprised by the number and variety of the activities. “We're talking aerodynamics, and we’re actually getting to see it when we’re building gliders and rockets. We're gonna go fly in a plane. That's actually really awesome! I didn't think we were going to do as many hands-on activities.”

She was also pleased with the amount of exercise she got, reporting that, “We walk almost every day!”

While she really liked the hands-on stuff, she indicates that her favorite was learning about orbitals: “For some reason, orbitals really interested me, and we spent about an hour talking about it, and I really enjoyed it.” Some of the things they discussed were satellites, how to identify orbit shapes, and different types of orbits.

Aerospace GAMES camper, Subha Samaskadan with the rocket she built.

She also appreciated that, because the camp was residential, she had a good dorm experience, which she felt was “a really good experience to have in my opinion.”

Her overall assessment of the camp?

“I was not expecting this camp to be this fun,” she continues. “There's a stigma going around an engineering camp rather than an outdoors camp, and people will call you a nerd, but it's worth it, I don't care what people call me because it's really fun being out here.”

Aerospace GAMES campers get ready to test their rockets.

An aerospace GAMES camper, Sanjana Babu building her rocket.

CS GAMES CAMP EMBRACES CREATIVITY IN HIGH SCHOOL GIRLS THROUGH COMPUTER SCIENCE

July 25, 2018

Computer Science is a lot more than just sitting in front of a computer and coding. This is what 19 high school girls from Illinois and beyond discovered when they participated in the Computer Science (CS) GAMES (Girls' Adventures in Mathematics, Engineering, and Science) camp from July 8–14, 2018. So, according to camp Co-Coordinator Dot (Dorothy) Silverman, the main emphasis of the camp was not just software and hardware, but encouraged creativity.

"It's software, because our world is run by software now, and it's not just CS. It's CS + X. Scratch block coding is a great way to get people into coding because it's intuitive, much more intuitive than the way I learned. So we're teaching people coding because it's becoming, for instance, as necessary as writing. We're teaching hardware because you need to know how your software is going to affect the world."

Dot Silverman (right) helps out a CS GAMES camper with her LED lights.

So the girls were introduced to some basic computer programming, using several applications, such as Scratch, App Inventor, and Circuit Playground. They were also introduced to some of the basics of a computer, a circuit board or motherboard— as they learned how to solder, then made copper tape circuits. "We've got hardware like textiles, Silverman adds. "Tangible, right?"

Regarding the last camp emphasis, creativity, Silverman clarifies, "Because we can't innovate unless we have creativity. That's why we're tinkering. That's why we're having fun. That's why we're doing these unusual kind of activities that you don't necessarily see in standard courses."

Encompassing all that the participants had learned or experienced during the week was the main focus of the week: a capstone project. Free to design a final project of their own choosing, the girls exhibited a great deal of creativity, with projects ranging from a night light, to e-textiles (a light-up bag, hat, or stuffed animal; to purely electronic, such as a websites. One girl, who reported that she couldn't "think of a project," created what she called "The endlessly pointless game."

A CS GAMES camper shows off the LED game she made.

AA CS GAMES camper works on coding her LED lights.

“It's immense,” says Silverman regarding the camp’s benefit for high schoolers. “It's so immense. I would say it's actually less about learning hard skills, because there's only so much that you can do in a week, but it's really about developing an identity.”

Regarding the capstone project, Silverman says, “They can choose that, so they'll have to learn how to design, and they'll have to understand how to integrate code with an actual project that does something. I think that's what a lot of kids don't get to do in school, and that's what they get to do here and they get to do that because we have the resources too. The issue with a lot of schools is they don't have the money to actually invest in good hardware, so that's what we can do here.”

So what are some additional benefits of bringing high school girls onto campus like this? Jana Sebestik, the Assistant Director of STEM Curriculum Design in the College of Education and CS GAMES Camp Co-Coordinator, indicates that it exposes them to the campus:

“It gives them a chance to see our campus at some kind of extended visit rather than like a half day or high school visit, and allows them to see what the various fields of engineering offer. It lets them do stuff, meet people from other places, stay in the dorm.”

Her fellow Co-Coordinator, Dot Silverman, adds that the camp is extremely beneficial, because it helps participants understand that they can do CS and that there’s a place for them in the field.

She goes on to explain that activities like the camp are about creating good social-emotional experiences. “So it's kind of like if you have a good experience doing something, you'll want to keep doing it.”

She clarifies that sometimes students, especially girls, often have bad social-emotional experiences with math, because it's hard, plus the way it’s taught, if a youngster fails once, they feel like, personally, they are a failure. “And no one wants to feel like a failure; no one wants to feel embarrassed,” she admits. So very early on, because girls have had bad social-emotional experiences, they tell themselves, “Oh, I'm not good.” And based on these experiences, society ingrains into girls: “Oh, you don't look this way. You're not supposed to be this person. You're not welcomed here.”

A CS GAMES camper shows off her card she made that lights up when you press a button.

Jana Sebestik (right) listens as a CS GAMES camper explains what she made.

“So what I'm saying is that these social-emotional experiences early in life develop an identity,” Silverman continues, “and a lot of people create a personal narrative that they follow for life based on this identity. We want to change girls' identities. We want to say to them, 'You are welcome here. You're supposed to be here. This is for you!’ and it is.”

Silverman reports doing the CS GAMES camp because last summer, she helped with two other GAMES camps, which she reports were “super fun. It was the highlight of my summer, and I was like, 'I have to help again!'”

So when Jana Sebestik sent out an email searching for a co-coordinator for this camp, “I was like, 'Oh my God, totally!'” she reports. “I've always had a passion for outreach and women in science”.

In fact, she thinks that there aren't enough female science teachers, so that's her goal. “The more experience I can get teaching, the better at it I will be,” she acknowledges.

Silverman is the perfect person to serve as a role model for girls, demonstrating that they too can do STEM. She did her undergraduate work in physics with an emphasis in engineering; she worked at AutoDesk; she did bioengineering at another company; then she came here to Illinois, originally in Materials Engineering. “And then I realized, I don't like sitting alone in front of a computer, she admits. “I love talking to people, so I was like, 'Maybe I should be a teacher!'”

So, because she’s so passionate about teaching, she’s back in school, working on a Master’s in Curriculum and Instruction at Illinois.

Silverman achieved the camp’s goal of showing the participants that CS is more than just coding. For instance, Sophia Zhuang, a rising sophomore at Stevenson High School, which is close to Chicago, shares why she came to the camp and the impact it had on her.

Zhuang was honest about why she came to the CS camp this summer: her parents told her to, but she

A CS GAMES camper works on her copper tape circuit.

CS GAMES campers work on coding their LEDs on the computer.

admits to being really interested in the subject. She says her parents have always assumed that computer programming is literally just for the job.

“But then, when I started experimenting on my own,” she confesses, “I started realizing you could make your own creations, and it's a lot more than just the job. It's more like being able to create anything that you want to and being able to change something and make it better. I learned a lot from the camp, and it's been really fun so far.

So does she think she might go into computer science? Yes.

She concedes:

“After taking this camp, I realize it's a lot more than coding and typing on a computer all day. I've learned that it takes a lot more than that, and you can incorporate a lot of different products. You can even make bracelets or just create your own interests and make something you actually enjoy.”

However, it wasn’t just the students who benefitted. Sebestik says the different camps benefit the greater campus as well. For example, they give folks in the various disciplines practice bringing their research down to a level younger students can understand.

“There's a lot of development, not just this camp, but all of the camps where there's a lot of curriculum development, a lot of thinking about how to portray the work that the researchers or the professors or the engineers do in a way that's meaningful and valuable for high school kids and their families.

Did Sebestik you see any engineers among the group of campers? “You know, I do,” she affirms. “It's a little early to tell, but I see some good engineer-like problem-solving skills, attention to detail, the ability to try again if it doesn't work the first time.”

GBAM GAMES CAMP GETS HIGH SCHOOL GIRLS GEARED UP FOR MECHANICAL ENGINEERING

May 21, 2018

Lots of times, engineering is kind of this abstract sort of thing where someday I guess I'll be an engineer, but I'm not sure what they are, or what they do, or whatever, and I think it might be interesting. It's great to get [students] here and get them doing and seeing what [engineering] really is and how impactful it can really be. – Joe Muskin, MechSE Educational Coordinator.

That's exactly what 24 high school girls experienced when they attended the 6th annual GBAM (Girls Building Awesome Machines) GAMES (Girls' Adventures in Mathematics, Engineering, and Science) camp from July 8–17, 2018.

The week-long camp, hosted by the Mechanical Science and Engineering (MechSE) department, was primarily led by six graduate students which, according to Muskin, contributes to the camp's impact, "They're kind of the role models," he explains, then jokes, "I'm an old guy. [The students] are not trying to emulate me."

What motivated most of the grad students to volunteer to help out with the camp? According to one second year MechSE graduate student, Sameer Muckatira, he thought GBAM GAMES camp was a good opportunity to work with young minds and kids that probably haven't yet decided what they want to do later on in life.

He stresses the importance of an outreach like GBAM GAMES:

> **"I think a program like this is going to be really great to show them what engineering can be like. It's not books and physics and math. It's more fun; it's building things—it's about problem solving, and we show them how to have fun doing it."**

This camp did just that, by exposing the girls to various aspects of mechanical engineering during daily workshops and hands-on activities addressing subjects like Arduino programming, computer-aided design (CAD), 3D printing, and polymer composites.

A GBAM GAMES camper uses a drill while working on her team's capstone project for the week: a 3D printer.

In fact, one of the main activities this year revolved around incorporating many components of mechanical engineering into a capstone project. Over the course of five days, the girls designed then built a stereolithographic 3D printer. That's right, you read that correctly—they built a 3D printer.

Sarah Schoenbaum, a rising junior hailing from Southern California, was particularly excited about this activity because, although she has had some experience with 3D printing, she was not expecting to actually make one.

“I was really impressed earlier with the 3D printer, ‘cause I didn't exactly know how we were going to build one,” she admits. “But I thought it was really cool; it was with the resin and how it solidifies for each one.”

In addition to the workshops and hands-on activities, campers went on tours and field trips to different locations, such as mechanical testing laboratories; the cleanroom; as well as Caterpillar and a new start-up company, Psyonic, both at the Research Park. They also had socially engaging activities in the evening, such as participating in a scavenger hunt, navigating escape rooms, and hanging out in the campus recreation room.

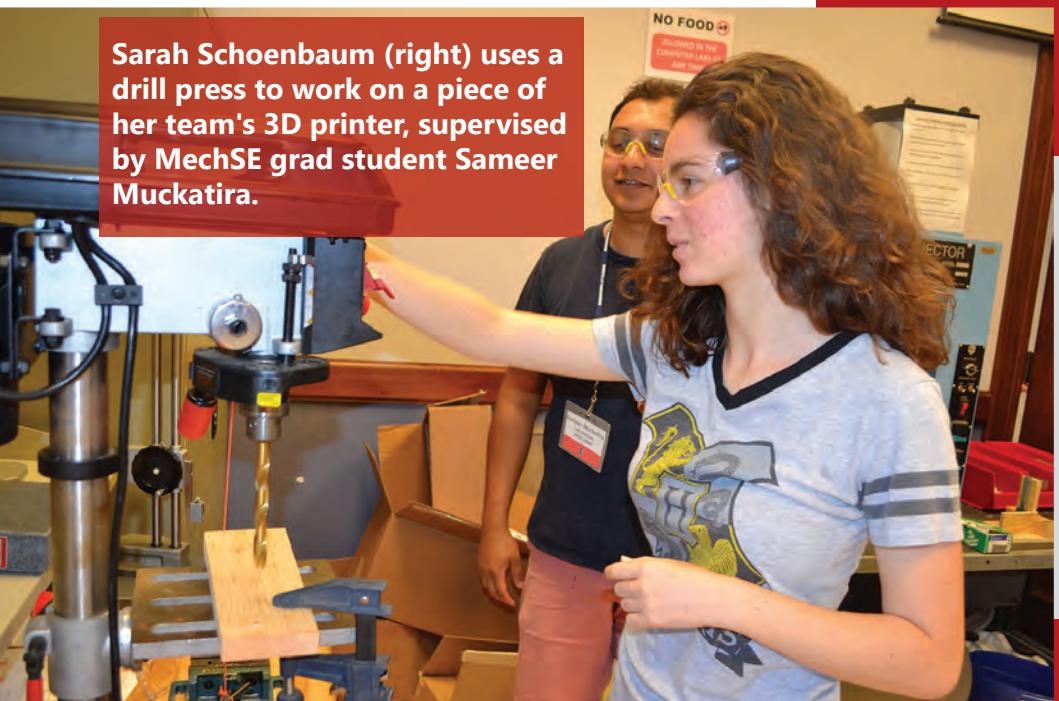
A MechSE student (center) works with GBAM GAMES campers learning CAD (computer-aided design).

“It’s great working with students like this, especially seeing that they can do it, and suddenly engineering becomes a real-life possibility,” says Muskin. “They see that, yes, they can save lives, they can help society, they can do cool things, and they can actually make a difference, and they can do that.”

One way the girls discovered that they can help society was by making pneumatic prosthetics, which are operated by air or pressurized gas. This activity was related to their field trip to Psyonic, which makes prosthetics that allow people to feel and sense. In fact, this activity encouraged Schoenbaum to consider pursuing mechanical engineering with an emphasis in biomedical engineering.

Below, she shares why she got involved in the GBAM GAMES camp and what she enjoyed most about participating in it.

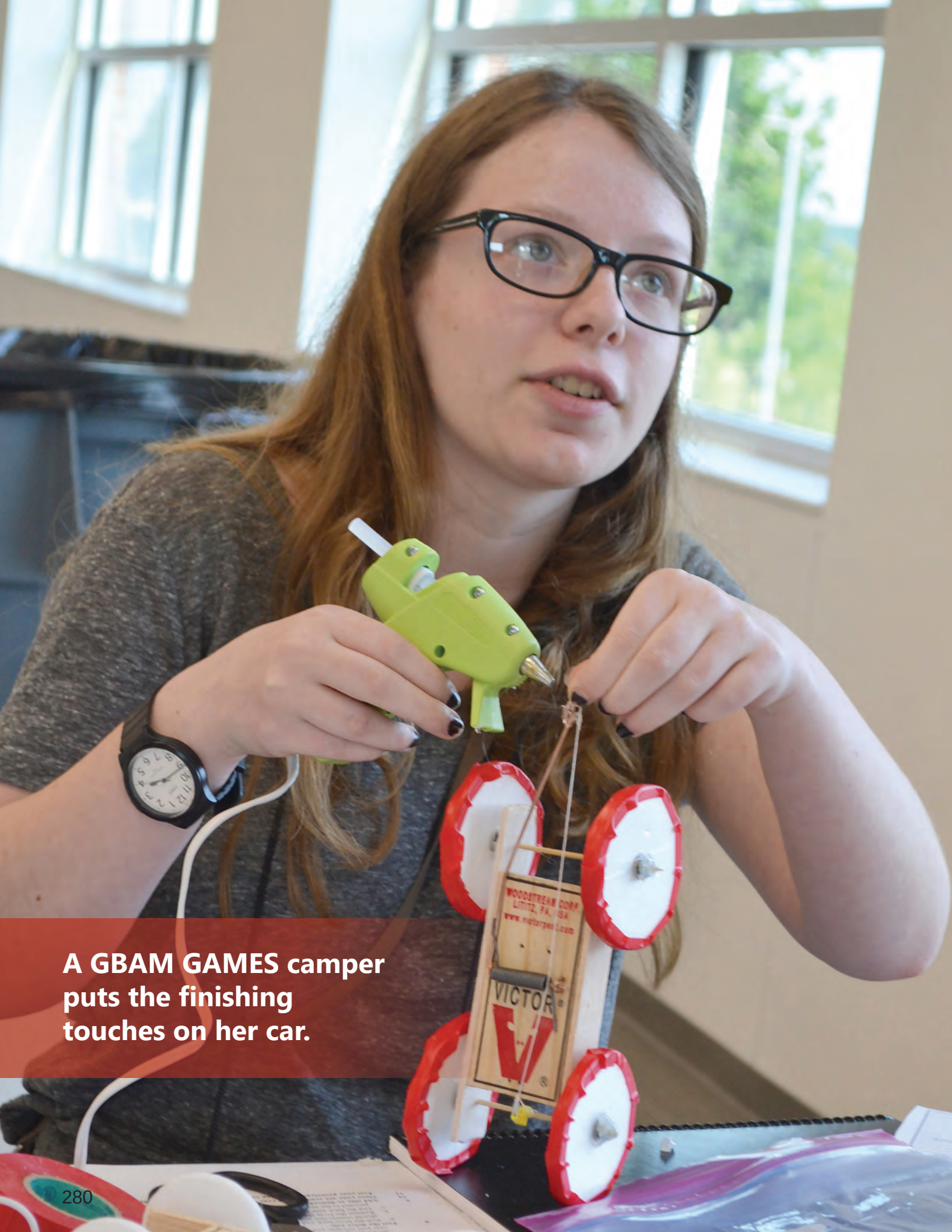
Schoenbaum reports that she wanted to come to Illinois to get more hands-on experience, plus see what part of engineering she liked the best. “I came to this camp because I didn't really know what type of engineering that I wanted to do,” she explains. Her first engineering camp, GBAM swayed her to consider pursuing mechanical engineering in the future.



Sarah Schoenbaum (right) uses a drill press to work on a piece of her team's 3D printer, supervised by MechSE grad student Sameer Muckatira.

While Schoenbaum was thoroughly impressed with Illinois and all it has to offer, she liked meeting engineers at Caterpillar and Psyonic.

“Getting to talk to engineers at a big company and a small company,” she says. “Because I know that I want to go into a career for engineering, but it's good to actually talk to people that have that career and be able to see what they're able to do with their background from college.”



A GBAM GAMES camper puts the finishing touches on her car.

Another participant, Julia Tung, a rising senior from Naperville, came to this camp because "[Illinois] is a really good program, and it's close to home." She also wanted to see what mechanical engineering was actually like and explore it as a possibility for her future studies.

Despite wanting to get out of the state of Illinois, she enjoyed the camp and made a new friend along the way. Reflecting on her experience, she recalls her favorite activity:

Sameer Muckatira (upper right) works with GBAM campers during the copper-tape-circuit activity.

"The first day we built this contraption... we put water balloons down a zip line and you had one go through and then stop the other. It was the first activity we did and it made a real true friendship."

She was referring to the friend next to her, Kristin Vose, a rising junior from Bloomington. Vose mentions that while she wasn't sure which engineering discipline she was initially interested in, she had a hunch that it could be mechanical engineering so she wanted to get a feel for what it would be like.

She really enjoyed her GBAM experience because of how hands on the program is and said her favorite activity was programming the Arduino boards.

She admits:

"I wasn't super familiar with coding and it was something I was kind of worried about. I found with this that it isn't so bad."

Unlike the other participants, who weren't really sure what mechanical engineering is, Madison Olms, a rising junior from Gurnee, reports coming to GBAM because she has always been interested in mechanical engineering and wanted to get a more hands-on experience to further explore her passions.

Part of why she enjoys mechanical engineering so much is because it's creative and hands on, but she admits that actually getting to experience teambuilding exercises, along with building different contraptions and machines, will help her decide whether or not she actually wants to pursue mechanical engineering in college.

Olms reflects fondly on her experience at GBAM GAMES camp saying:

"I've met a lot of great people, and the activities that we have been doing are just awesome—how hands on it is and how much we get to work together and see our progress as we move on."

The four teammates proudly exhibit the 3D printer they designed and built.

FRESHMAN WOMEN IN ENGINEERING GET AHEAD OF THE CURVE AT WIE ORIENTATION

Engineering freshmen play a game of Kahoot during the first morning of Orientation.

August 28, 2018

Avoiding the chaos of campus move-in day, 275 female freshman engineering students participated in the 16th annual WIE (Women in Engineering) Orientation on August 21st–23rd. Sure, moving in early was a nice perk—they got to avoid being stuck waiting with mom and dad in a long line to unload their car at the dorm. However, most girls would admit that wasn't their main reason for coming. They hoped to get acquainted with campus, find out about their major and resources available to them, and to start building community so they might see a familiar face the first day of class.

Up from the 262 participants last year, the 275 attendees were part of the largest group of incoming female engineering students ever to enroll at Illinois: 25% of the freshman class. Helping to make the event possible were the sponsors: Texas Instruments (TI), Abbott, Caterpillar, and Brian and Sophie Leung.

Hosted by Engineering's WIE program, the event was organized by three co-coordinators: Siobhan Fox, a rising senior in Systems Engineering and Design; Elizabeth Sanders, a fifth year Chemical Engineering senior on track to graduate in December, and MechSE junior Samantha Moran, along with help from WIE Director Angie Wolters, Academic Advisor and WIE Program Coordinator Brooke Newell, and Engineering Assistant Dean Sue Larson.

Why attend WIE orientation? Co-coordinator Sanders says seeing a familiar face is the #1 benefit:

> **"Just being able to form at least one connection. You'll know at least one face that you can recognize on campus, and they'll probably be in your health class, or your physics class."**

While Aerospace Engineering freshman Zoe Zuzzio admits that, "Early move-in was a really nice bonus!" She acknowledges:

> **"I just wanted to connect with some classmates before I came to school so I'd be a little bit more comfortable within my classes and within my major."**

Reporting that she made a couple of friends during orientation, she says, "It's been really nice to meet everyone. And since we have a small major too, you can instantly meet everybody there." Her favorite thing about orientation was probably the first day. "We ate pizza, and then we sort of talked together, just learning about everyone, and where they came from. It was just a really neat experience."

Industrial Engineering freshman Briyanka Balakumar wanted to "meet some really cool people who are in my major so they'd be like kind of along the same schedule as me, and it'd be fun to kind of explore college before all the chaos got here."

Megan Bardee, a freshman in Mechanical Engineering, reports:

WIE Orientation Co-coordinators: (left to right) Samantha Moran, Elizabeth Sanders, and Siobhan Fox.

"I knew that women are a minority in engineering, and I thought it'd be a fun experience to meet a lot more people in my degree and just get to know campus a lot more." Bardee says her favorite thing was just walking around campus and seeing the huge groups and a lot of diversity. "Getting to experience that for the next four years is going to be a lot of fun!" she admits.

Co-coordinator Siobhan Fox believes the #1 benefit of attending WIE orientation is:

> **"Feeling comfortable on campus… just coming on campus and giving yourself a few days to relax and remind yourself, 'It's all going to be ok!'**

Key to helping newcomers feel comfortable was getting to know upperclassmen— women who had been in their shoes not that long ago. So from the moment orientation began to the final hours, "older and wiser" female engineering students in the freshmen's majors showed the newbies the ropes. Plus, the hope was that these mentors would remain a resource once orientation was over.

> **"I reached out to my mentor when I was signing up for classes," Sanders shares. "So I think that's really important, that you know one person who is an upperclassman, so you have support; you have advice, you know where you can go to get advice for your major specifically."**

> **"Four years in a place that you've never been before, all alone, can be kind of intimidating for a lot of people," adds Fox. "But having three days where there are so many upperclassmen telling you, 'You're going to be ok, and we're going to help you get through this, and everybody in this room, everybody in this first lecture hall is going to get through it together,' I think, is a really reassuring thing to hear as a freshman."**

So to start developing those relationships, mentors had dinner with freshmen the first night, escorted them to the different venues, and even shared tips about their major during the Departmental Breakout Session, a new event added in 2018 based on feedback from last year's participants who felt they hadn't gotten a chance to really dive into their major.

"They still felt really confused about a lot of different things, or there were questions that they didn't get answered," Fox explains. So this year's mentors presented a summary of highlights about their majors: classes/professors that were really enjoyable; popular RSOs (Registered Student Organizations) in their departments, etc. This session was intended to feature the mentors—upperclassmen who could give the freshmen the scoop from a students' viewpoint.

> **"We want the students' perspective," Sanders says. "I think it's really beneficial for incoming students and prospective students to get a student perspective of what a major is, and what the classes are, because there's a different kind of relationship there."**

The idea was that the freshmen could relate to students a little bit more, or just in a different way, whereas the newcomers might be more nervous with faculty.

“So we really want to create a more comfortable space to discuss how to be really successful in the major… coming from a student. I think that's something the freshmen will really latch on to."

MatSE mentor, sophomore Abbey Nkansah, thought the major breakout sessions this year were a great idea:

“just to give the girls the opportunity to bond, have some close-knit time with the mentors” who could “answer their questions and kind of ease their anxiety and some of their nervousness about this year.”

Nkansah, who did WIE as a freshman last year, reports that she found it very useful in finding friendships with the girls, so she “wanted to help facilitate and try to give that same experience to the girls this year."

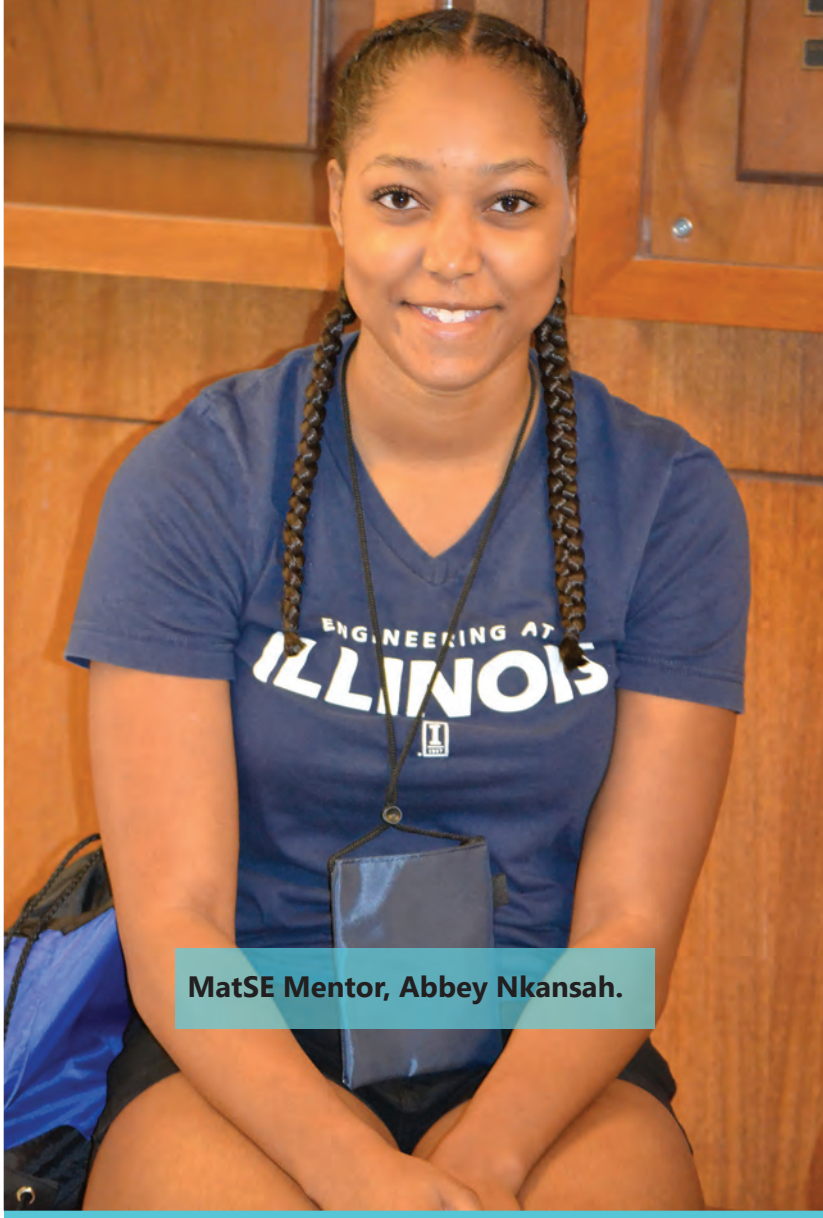
Interacting with the mentors was Industrial Engineering freshman Briyanka Balakumar’s big takeaway from orientation: “ Honestly, what I think I'm going to take away most is just the mentors; they're really helpful, and I think gaining the knowledge from them, that's going to help me. Because honestly, before coming here, I didn't know a lot about U of I and what to do in all of these situations.”

Having shared their wisdom at the breakout sessions, during the closing minutes, mentors then encouraged the freshmen to jot down two questions to ask when they relocated to their departments for the next activity—lunch with faculty and staff.

The departmental lunch was particularly meaningful for computer engineering freshman Stephanie Tancs, who called it:

“a really good way to meet people, make connections with staff and other people I’m going to be working with in the future.”

Regarding the overall benefit of WIE orientation, Tancs says, “I felt like it was a really good way to make friends early on and to get experiences that I'm going to need to be successful in the College and to help with the transition.”



MatSE Mentor, Abbey Nkansah.

Peppered throughout orientation were guest speakers who currently work as engineers in industry, including a couple of alumnae who shared from their perspectives as former students. For instance, one Keynote Speaker was Amy Doroff, who graduated from Systems Engineering and Design (previously called General Engineering), and currently works for Whirlpool. Frequently involved with WIE throughout her years as an alumna, she was back on campus to encourage newcomers to be relentless during their time at Illinois, citing three instances where it had paid off when she was a student.

For instance, Doroff encouraged newcomers feeling overwhelmed during class to stay in the room and count to 10 (even if they must do so continually to get through the period). Regarding relationships, she advised the freshmen to not just tolerate those who are different, but relentlessly embrace new cultures and experiences, and especially to try new things that matter to someone else. The third piece of advice was this: your time on campus is not just about studying, but being a whole person.

Don DeCoste and Gretchen Adams ignite a gas-filled bubble during the chemistry demo.

Another alumna, Athena Lin, who graduated from MatSE and currently works for TI, presented a workshop about taking charge of one's own education.

Also at WIE orientation were representatives from corporate sponsors, so freshmen would learn about the companies, view college from their different perspectives, and also interface with some companies right off the bat. These folks shared during plenary sessions, at the Company Fair during the Resource Tour, and during Thursday morning workshops. For instance, Kristin Brown from Abbott shared the Thursday morning Keynote, at the Company Fair, as well as a workshop session, "Making the Most of Your Internship."

Advice to new students was even couched in chemistry-flavored slapstick. New students got a big bang, both figuratively and literally, out of the Chemistry Demo by Chemistry Professor Don DeCoste and Gretchen Adams (presently Associate Dean of Applied Health Sciences). Their show featuring numerous chemical reactions that burned, glowed, or even exploded—garnering lots of laughter. Then, while the freshmen's mouths were open in hilarity (or even incredulity), the two would insert sage tidbits of wisdom about how to make it as a college student—gleaned from years of watching new students make rookie mistakes. Their recommendations included some no-brainers. Go to class! Go to office hours if you're struggling! Even more down-to-earth advice included: eat, get enough sleep, exercise, and…don't neglect grooming!

Another new activity was the College Resource Exploration Tour on Wednesday afternoon. During this tour, groups of students rotated through five different resources. Sanders says the goal in having the girls visit these locations was that, hopefully:

> **"physically going to these locations, they'll maybe have less anxiety or less nervousness about going the first time, because they've already been there, and they've met the people in these places."**

At ECS (Engineering Career Services), students learned about job fairs, meeting recruiters, and getting help with their resumes. At CARE (the Center for Academic Resources in Engineering), students learned about getting help academically, such as via tutoring, and study spaces. In fact, CARE was one resource Briyanka Balakumar, a freshman in Industrial Engineering, believed she would use: "Definitely the CARE tutoring center in the Grainger Library. I think that's something I'm going to utilize a lot."

The third resource was a company fair featuring representatives from Abbott, TI, Caterpillar, and Whirlpool, so freshmen could hear straight from the horse's mouth what companies are seeking in interns and later employees. To learn about study-abroad options, participants visited IPENG (International Programs in Engineering). The final resource was the Office of Undergrad Research, where freshmen could learn about getting involved in research during their tenure at Illinois.

Regarding undergraduate research, freshman Emily Kyle found the information gleaned during orientation "really interesting, and…really useful because, prior to what we heard during the lunch, I heard, 'Ask your professors about research.' But I like knowing I can just go on the faculty website and just find it that way."

Sandwiched in between these learning opportunities was a stop at the Illini Union for some refreshments—frozen lemonade from Einsteins—one of the highlights of the day for the co-coordinators (and hopefully, the freshmen too!).

Thursday morning's workshops featured how-to's about campus life, such as how to get involved (RSOs, Undergraduate Research), how to communicate (All Things Google, Awesome Apps), and how to find a job (Making the Most of Your Internship, Why Freshmen Should Attend Recruiting Events, and Internships). Plus, how to get around campus was a popular topic, featuring the standing-room-only "Bus System" presentation. Also during the workshops, Angie Wolters, Brooke Newell, and Dean Sue Larson were on hand to do a workshop about advising.

With freshmen's brains stuffed full of information, resources, and advice, the coordinators tried to schedule numerous social events too. According to Fox, the goal was to:

> **"have an even balance between, 'Ok, sometimes you gotta' work and learn things, but sometimes you gotta' relax and have fun!'"**

Tuesday night at the Union featured bowling, pizza, crafts, and board games. On Tuesday and Wednesday, there was fun with technology: During the Tuesday morning session was a trivia contest using the Kahoot website. On Tuesday and Wednesday, WIE had permission to take over the University's Snapchat account.

At Wednesday night's bonfire, the girls tie-dyed their Texas Instruments t-shirts (purchased by money very generously donated by TI). Plus, girls could make s'mores, play sports and try out several "minute-to-win-it games. One game involved the participant somehow getting an Oreo cookie from her forehead and into her mouth—without using her hands. Regarding the Bonfire, Fox says the idea was:

> **"You've learned a lot about college today. But ultimately, you don't need to be stressed about it all the time. Yeah, you're going to have to work hard here, but you also have to enjoy yourself and hang out with your friends and meet people along the way!"**

A mentor shows off her tie-dyed Texas Instruments t-shirt.

Another goal of orientation was to help the girls become familiar with the campus:

> **"I think there's so much benefit for the students to be interfacing with their departments and interfacing with the upper-class mentors in the space that they're going to be at," shares Sanders. "So that way, when they're done with orientation, they feel like they know where they are, and they know about the space and this community that they have in the physical location."**

Getting familiar with campus was a motivation for MechSE freshman Emily Kyle from Arlington Heights, who shares some of her main reasons for coming to orientation:

WIE orientation mentors Diana Slate and Heather Zelko.

"To get to know the campus more and really get to know about my support network when I'm down here, and just so I'd feel more comfortable with the campus before classes start." As a result of attending, she reports feeling a lot more comfortable. "I do. I feel like I'm starting to get a grasp of the huge campus, and I kinda' know where I am. I'm not quite there yet, but I'm getting better."

Most mentors signed up to participate because they wanted to give back. For instance, Diana Slate, a rising senior in Bioengineering, shares why she did Orientation:

"When I was a freshman, I came to campus, and I was really scared. There were just so many people… opportunities. I came from a small high school. So I was really looking forward to making connections in a smaller community. Being able to be a mentor now, I can help facilitate those communications, look out for girls who are scared and need a little extra help and be there. Because everyone deserves to have someone who cares about them here on campus."

Another mentor, rising BioE junior Heather Zelko, wanted, "to give girls a chance to ask questions of upperclassmen. "I remember when I came to WIE orientation I was so scared. I didn't even know we were actually going to get to meet upperclassmen, and I had so many questions about what Bioengineering was like...what campus was like… So I felt it was just a chance to give back and do the same thing that a lot of people did for me to help me be comfortable on campus."

She admits one of her big questions was, "How do you NOT act like a freshman so people don't look at you weird when you're walking around the quad and things like that!" Did she learn how to not act like a freshman? She responds yes, and indicates, 'Don't ask where the Illini Union is when you're standing right next to it, and things like that!"

Like the mentors, the co-coordinators received so much through orientation as freshmen that they too wanted to pay it forward.

"I think it helped me to find a very strong community here when I was first a freshman," Fox admits. "And I think the way that they welcome new people to campus is really inspiring and has helped me to remain motivated in college and helped me connect to the resources that I needed." She adds that since Women in Engineering has provided her so much, she wants to give back to it: "Orientation was one of my favorite activities that I attended, so this is the perfect activity to give back to."

Similarly, Sanders wanted to "Hopefully provide an event where these freshmen can find someone they can sit by in class, or find someone they can do their first homework assignment with, and ask a questions. I think it's really important for freshmen to have that really great experience coming in to make their transition a little bit stressful."

The two also agree that one huge benefit of orientation is the sense of solidarity it gives newcomers.

Fox acknowledges:

"Having all of these incoming women show up at an event where there are 300+ women engineering students coming, they kind of see that, and they're like, 'Wow! There is a really big support network, and there are all these women in Engineering!'"

"It's very empowering!" adds Sanders.

HAHN AND WOLTERS' NEW BOOK ABOUT WOMEN ENGINEERS AT ILLINOIS POISED TO INSPIRE, RETAIN, AND RECRUIT WOMEN ENGINEERS

August 30, 2018

Several years ago, Laura Hahn (currently the Director of Engineering's Academy for Excellence in Engineering Education [AE3]) stumbled across the book, Men and Ideas in Engineering: Twelve Histories from Illinois. On her way to show it to Angie Wolters (currently the Women in Engineering director), she had an epiphany, and determined, "Oh, I know what we have to do: we have to write a sequel!" So she asked Wolters, "Do you see this?" and at that moment, the idea for Women and Ideas in Engineering: Twelve Stories from Illinois was born.

Laura Hahn (left) with the book Men and Ideas in Engineering: Twelve Histories from Illinois and Angie Wolters (right) with their book Women and Ideas in Engineering: Twelve Stories from Illinois.

The original book was published in 1967 for the university's centennial celebration. Since at the time of their discussion, the university's 150th anniversary was imminent, they thought, "What better thing to do than to write the sequel," Wolters confesses.

She continues:

> **"In reviewing the book itself, there were no women celebrated within the cover of Men and Ideas, so it was our chance to say, 'Hey, let's tell their story!'"**

The goal was to have the sequel ready for the university's upcoming Sesquicentennial in 2017.

So the two began to brainstorm, then crowd source regarding women who should be included in the book. They approached numerous university folk for suggestions, including departmental communications specialists familiar with present day women; archivists, who were particularly knowledgeable about the early years of the university; even university retirees.

After chatting with numerous enthusiastic people from the College of Engineering and beyond, it quickly became apparent that the book should be written by more people than just the two of them:

> **"The stories were going beyond us," Hahn explains. "We realized that all of these people had great voices to contribute."**

So while the two are named as authors, they say they're more like co-editors, and credit the university community for the book. Key people in the college and the university archives who worked with them substantially were Celia Elliot in Physics, Bethany Anderson from the university archives, and Cinda Heeren, formerly in Computer Science.

How did they determine whom to include in the book? As Hahn and Wolters chatted with more and more folks, the names of certain women salient in their fields were reiterated over and over and emerged as frontrunners. "We talked to several retirees, some administrators from the college," says Laura, "and just started listening to what they had to say. And we heard common names after a while: Judith Leedman, Nacy Sotos, Roselin Yalo," says Hahn. So they started an excel spreadsheet.

Wolters discloses that in the beginning, they were concerned that they would struggle to find 12 stories. But then the list of names of women whom they felt should be included quickly grew beyond the twelve male engineers documented in the

original book. Having unearthed so many women that they couldn't possibly leave out, they devised a better way to organize the book. Rather than just telling the stories of 12 different people like Men and Ideas, they decided to organize the stories in chapters with different themes. For example, the chapter on women in computing tells multiple stories.

So they settled on chapters emphasizing important areas, citing several women whose stories stood out. Their main criterion in choosing the women to be included was balance—early pioneers, present-day leaders, the different engineering disciplines, as well as other relevant emphases. Then chapter themes were crafted to describe the many relevant women engineers they'd found during their search.

For instance, the first chapter, "Engineers Who Happen to Be Women: The First 150 Years," mostly focuses on "those first 100 years that didn't get noticed in the [Men and Ideas] book," Hahn says. The "Early Inspiration: Faculty Pioneers" chapter highlights our first female faculty pioneers. Other chapters include "Research Orientations," "Relentless Innovators," "Acclaim in Bioengineering and Medicine," "Touching the Sky (aerospace), "Women's Work: Computing," plus how Illinois' women engineers are facing "Global Challenges" and finding solutions.

They also have a chapter, "Do Engineers Have to Engineer?" about women engineers who went on to do things a little differently than just the standard engineering design or research. There's a chapter on "Mentors and Mentoring," and the "Inspiring the Next Generation" chapter includes women who are doing just that. This chapter is where Wolters and Hahn tell the story of Sakshi Srivastava (a former Illinois Engineering grad student) and her pivotal role in the creation of the female engineer statue, The Quintessential Engineer. The final chapter, "Foundations for the Future," features a cohort of five female faculty members in Mechanical Science and Engineering (MechSE) who all started at the same time in the fall of 2014. "So they're paving the way for the future," says Hahn.

Angie Wolters promotes the book during the recent WIE Orientation.

The two say that the makeup of each chapter is unique and may include multiple voices. For instance, the chapter on women in computing includes the story of a woman from the past written by Laura Hahn. However, one of the stories of a woman from the present was adapted from an essay written by one of Electrical and Computer Engineering's communications staff. "So their voice is in there," Hahn says. Many of the chapters end with a first-person reflection. In the case of the women in computing chapter, it ends with a section by Cinda Hereen, a Computer Science (CS) stalwart who was devoted to encouraging women in CS during her time at Illinois. "So Cinda's voice is shared there to help tell the story of women in computing and her version of it," Hahn explains.

More than four years in the making, the sequel, besides, of course, giving equal play for women, was intended to motivate and inspire women. The two see the book as

Dean Sue Larson (right), who added the Reflections section on the "Mentors and Mentoring" chapter (photo courtesy of Angie Wolters).

Laura Hahn working on her computer.

viable to not only contribute to the retention of female engineering students, but also as a recruitment tool.

> **"When it comes to recruiting students here, when it comes to recruiting faculty, keeping students, or keeping faculty, the whole nation is looking to have more women in STEM. So we're all competing for this current finite pool," says Wolters. "But we want to keep growing that."**

So that's really what they envision the book doing, inspiring and motivating current students reading their book.

She continues:

> **"That's why we did this. From my perspective with Women in Engineering, this is not only a retention piece, but it is also a recruitment piece."**

Not content to rest on their laurels and eager to broaden the book's impact, this fall, the two are also teaching a class based on the book, ENG 298, where they hope to expand its inspiration, retention, and recruitment potential. So during the course, they'll share the stories of these inspiring women a chapter at a time, inviting someone featured in or who contributed to the chapter to be a guest speaker for the class.

As a writer who's never met a quotation I didn't like, I consistently struggle with too-long articles. (Note the length of this one!) So how were Hahn and Wolters able to pare the work down to a reasonable size? How difficult was that, knowing there were all these people contributing and all these amazing women who deserved recognition?

"We made some hard decisions," Hahn admits. She says there were some people that they thought should probably be in the book that they had to leave out. "We went for a balance of departments as well as of eras, so we had representative women from all of the departments in the college as well as across time. There were some departments where they could have a whole book in and of themselves, so I think a lot of it was going for balance."

Ironically, they haven't really left anyone out. While the book is officially in print, like the Energizer Bunny, it keeps going and going and going—rather growing, growing, growing, as the two are still adding to the book virtually. For instance, they're developing a companion website featuring women they couldn't fit into the book. Hahn indicates that of the women listed in that initial Excel spreadsheet, she and Wolters were probably only able to highlight about a third of the women in the book, so they've continued writing those stories while the book was in publication, which are published on the Women in Engineering website. In fact, every Wednesday is Woman Crush Wednesday on the Women in Engineering Facebook page, where they release another story of one of the women.

Additionally, as part of the final project for their class, students will interview a woman engineer, faculty member or alum and write a vignette, which will be posted on the website.

As a further extension of the entire project's recruiting potential, the two envision this website to have a burgeoning impact as a tool to help recruit women into engineering. For instance, the extra stories they and the students will be writing will be organized on the site by majors and available for potential students who are curious about what a

career in a given discipline might be like.

> **"Quite often when a prospective student comes to campus and visits," Hahn explains, "they say, 'Well, how do I know about these majors? What would I do with this career?' So now we have actually created a spot where these students can go and say, 'I've heard about mechanical engineering. I'm interested in this,' and they can actually see and click on mechanical engineering and the five different stories we have there of different students, different alumnus, different faculty relative to the major."**

Angie Wolters working at her computer.

In addition to their own list of women, they're also highlighting things other communication departments (including I-STEM) have written. "Wherever the stories are being told, we're kind of cataloging those and continuing to add to it," Hahn says.

What Hahn found most rewarding about the book was the enthusiasm and ownership of the various contributors.

She says:

> **"We had a lot of contributors and a lot of people really enthusiastic about the book and the project, and that's what energized me about it —working with everyone and seeing everyone's excitement."**

Of course, the two most enthusiastic about the project were Hahn and Wolters themselves. "Laura and I just got so excited!" Wolters admits. "We would write about one woman and be like, 'You've got to read what I just put together!' Like when I wrote about Barbara Crawford Johnson, and all that she did, it was something! I was like, 'Laura has got to read it!'"

Barbara Crawford Johnson was the first woman to get a degree in General Engineering before it became Industrial and Enterprise Systems Engineering. Wolters shares a further anecdote related to the ISE pioneer. "The cool thing about this story…" Wolters continues, then relates how they'd been in contact with the ISE communications office about one of their young alums highlighted in the book. In telling them the story of Barbara Crawford Johnson, ISE discovered, "That's a woman that they hadn't highlighted. The department hadn't ever really told her story. So now, in their alumni newsletter, they're going to be sharing excerpts from the book of her story to share it with their alumni."

This type of cross-inspiration has occurred regularly as a result of the book. "It's worked both ways," Wolters reports. "Their stories inspired us. Our stories are inspiring them to share others, and there really has been a collaborative effort."

The two admit that writing the book has been an emotional experience. In fact, contrary to the style of its predecessor, Men and Ideas, it's much more personal.

> **"We focused on referring to all of the women by first name," Wolters acknowledges, "because we were not only telling their engineering story, we were telling their personal story, and so it's a bit more personal…We wanted our women students that read it to be able to relate to the women in the book and our feedback."**

While women are sterertypically pegged as being emotional (who wouldn't "get teary-eyed" when reading about female Illinois engineering pioneers

who have paved the way?), Wolters says one emeritus engineering professor admitted that he too had “found himself emotional…while reading these stories and realizing the challenges that these women had.”

Despite the years of hard work, the two admit that they’ve found the entire process quite meaningful. As Hahn mentioned earlier, she tremendously enjoyed the collaboration. “Part of the rewarding part for me was working with people across the college on the project and seeing their excitement about it. I really liked that part.”

She also appreciated being privy to all of the women’s stories. “Hearing specific stories and anecdotes that really reflect what Angie said about the challenges that women have overcome is very inspiring. Things that we almost take for granted today—that women have an equal place at the table, things to contribute—that hasn't always been the perspective. Having that be reinforced by actual examples and stories is pretty neat.”

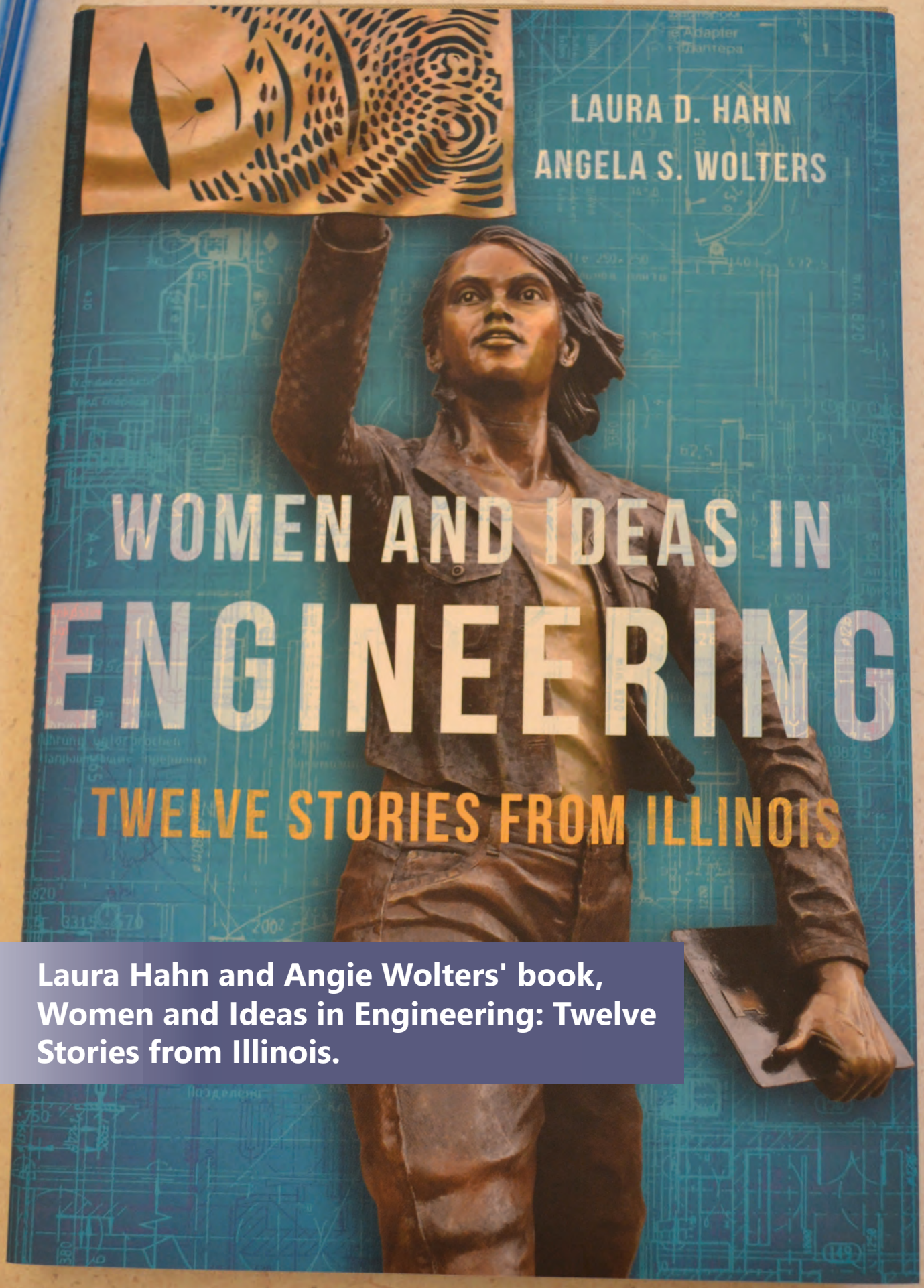
Wolters says one of the most rewarding things about writing the book was collaborating with Laura Hahn. “Being able to collaborate with Laura who had such strengths in writing to compliment my engineering background. I think what I really took away from this project is…how meaningful a collaboration can be.

She also enjoyed experiencing how the project brought the entire College together as a community: “We had all of this positive feedback,” she says. “This is the one project I've worked on that I don't think I ever heard a negative comment, and that was amazing…Anyone we've talked to about this project was enthused, and so it was reassuring to know that our community would be that supportive and that positive.”

In celebration of Women and Ideas, there will be a special unveiling on September 19th from 7:00-8:30 pm at the university Archives, where the two will give an overview of the book. Author Amy Bicks, who wrote Girls Coming to Tech and reviewed the book will be there to introduce the event.

Finally, underscoring their passion for increasing the number of women in engineering, the two are putting their money where their mouth is—they’ve decided to donate the proceeds of the book to Women in Engineering programs.

Laura Hahn (left) and Angie Wolters (right) with their book in front of the Quintessential Engineer statue.



Laura Hahn and Angie Wolters' book, Women and Ideas in Engineering: Twelve Stories from Illinois.

ALUMNA AMY DOROFF GIVES BACK TO ILLINOIS' WOMEN IN ENGINEERING

September 4, 2018

Being a freshman woman in engineering at the University of Illinois is not an easy task. Not only are the classes challenging, but their populations tend to have more males than females, which can be quite intimidating for freshman girls. This is exactly why Illinois alumna Amy Doroff, currently an engineer at Whirlpool, decided to return to the university as a keynote speaker at the Women in Engineering (WIE) freshman orientation this fall. Doroff's college experience certainly wasn't easy, but she received support from various people to help her push through it. Now, it's her turn to be the one giving support to students. "I'm three years out of college now, and I want to remind people that I made it to this point, but also that it wasn't because there weren't any challenges. And I want to be part of their story now."

Amy Doroff in front of the Quintessential Engineer statue.

Doroff majored in Systems Engineering and Design (General Engineering when she was in school), and she claims that the most challenging subject for her in that discipline was definitely physics. She had a very limited background in the subject and found it incredibly difficult. Six weeks into the semester, Doroff was ready to quit. She marched into the undergraduate advising office and told them, "I can't do physics. I can't be an engineer." However, her advisors would not let her quit. They told her that if she really wanted to be an engineer, they could provide her with the support and guidance to get her there. Initially, Doroff was upset because she had already made up in her mind that engineering wasn't for her. In hindsight, though, Doroff is very thankful for her advisors, because she wouldn't be where she is today—a systems engineer at Whirlpool supervising a team of engineers who are cranking out thousands of washing machines per month—without them.

Doroff was heavily involved in WIE during her time at Illinois, which she cites as one of the biggest sources of support for her. Former director Susan Larson and current director Angie Wolters were her two major support systems.

"There were times I didn't feel like I was capable of getting an engineering degree, but their words and their help kept me in the program," she says.

Other resources that Doroff accessed were CARE tutoring, the deans in 206 Engineering Hall, and the advising in the Industrial and Enterprise Systems Engineering Department, especially chief academic advisor Heidi Craddock.

"It's one of those things where they always say that it takes a village to raise a child," says Doroff. "Well, in Urbana and Champaign, it takes two. It takes both of those places to get someone like me through engineering!"

Another major reason why Doroff is so passionate about providing support to women in engineering is because they can offer perspectives and ideas to the male-dominated field. Many women and other diverse individuals don't get the support they need, and when people don't feel like they have support in a field they have recently entered, they often don't stick around for very long. Regarding the need to increase retention in the field, she states:

“I just have this fear if we don’t bring everybody to the table, that we’re going to lose out on these incredible ideas. Because we have gotten so far in technology in the 150 years that the University of Illinois has been around, but we only brought some of the necessary innovators to the table to do it. Think about all the ideas we could have had if we’d have had support for women and other people in engineering.”

Often times when people are scared and want to quit something, people let them quit. However, Doroff wants to be one of those people telling students “No, you can’t quit!” in order to have more diverse innovators in engineering.

Doroff also had some things to say about students who may have never faced academic challenges in the past. When these students encounter challenges at Illinois, they're not used to it, get afraid, and some even leave the program.

“Try hard to get through that knee jerk reaction of not being confident when things get difficult, because things will get difficult, but you can also get through them.”

Doroff also believes that sometimes this requires students to redefine what success means to them. “Maybe in high school it was that you got straight A's and never had to study, but maybe success in college means that you learn the material as best as you can and pass the class. It's a different definition of success and you have to stop that knee jerk reaction of trying to leave in order to get to that definition [of success].” During her keynote speech, Doroff mentioned that if students are ever lacking confidence and starting to feel overwhelmed while in class, they should stay in class and count to ten, even if they have to do so multiple times just to get through the period.

Another piece of advice Doroff gave during her keynote speech had nothing to do with academics, but instead involved embracing new cultures and experiences. She stated that despite the high level of diversity at Illinois, many people (including herself!) choose to surround themselves with people who are similar to themselves because that’s what feels comfortable. However, once she realized what she was doing, she broke out of her comfort zone and put herself in scary situations of trying new thing. She encourages others do the same because

“You gain so much from actually trying to be a part of someone else’s interests and customs. Tolerance isn’t enough.”

Doroff pushes women in engineering to not just focus on studying and getting good grades during their time at Illinois, but to also work on improving themselves as a whole person. She loves that there are more women in engineering at Illinois than ever before, but they will not be able to formulate and share their ideas properly if they aren't the best all-around person they can be.

“I can’t wait to see a time in our history where we have everyone at the table and we’re truly bringing out everyone’s ideas,” Doroff proclaims.

Amy Doroff speaking at WIE Orientation.

ILLINOIS' SWE HELPS SHAPE WELL-ROUNDED FEMALE ENGINEERS VIA A PLETHORA OF OPPORTUNITIES

October 5, 2018

According to Abby Pakeltis, president of the Illinois Chapter of the Society of Women Engineers, SWE is "a one-stop shop in a student organization." Through SWE, its membership of more than 200 female undergraduate engineering students can grow professionally, including networking with companies and their representatives; technically, through Team Tech; personally, and socially. "We have a lot of committees that can satisfy everything you're looking for," she continues.

Helping SWE members grow and get connected professionally is SWE's **Professional Liaison Committee**, led by its director, Jenny Marten. This committee's job is to connect with companies in order to bring some of their representatives to campus for workshops, talks, and other events which help SWE members both grow professionally and network with the companies.

For instance, on September the 27th, SWE held its "Be Professional" event at the Illini Union, which it co-hosted with the Society of Hispanic Professional Engineers. Several companies, the Aerospace Corporation, Fermi National Accelerator Lab, Capital One, John Deere, and BP helped to sponsor the event, which featured a dinner and a talk by keynote speaker, Kara O'Donnell, Associate Director of The Aerospace's Corporation's Space Architecture Department. Plus, break-out sessions featured representatives from the various companies who spoke on different professional development topics. Also, SWE's "Night of Networking" in the spring has similar activities, but with different sponsors.

MechSE junior Jenna Kummerer says she came to Be Professional for the good food and because it's a good way to talk to other SWE members as well as professionals in corporations. She explains:

> **"Last year I was an officer for SWE, so I came and just really enjoyed it. It's a good way to network, and the keynote speaker is always really inspirational. I like hearing women in STEM talk about their experience. It's always something interesting for me."**

MechSE junior Jenna Kummerer at SWE's Be Professional night.

SWE works hard to ensure that all female engineering students on campus are welcome in SWE—including those not in the College of Engineering. One such SWE member who took advantage of the Be Professional event was Kimya Buckner, a junior in CS & Linguistics. Students in the CS+ program in LAS (Liberal Arts and Sciences) can take CS+ Linguistics, Statistics, or Astronomy, to name a few. Regarding her major, Buckner takes most of the core classes CS Engineering students take, but in addition, takes linguistic courses that give her the foundations plus allow her to integrate natural language processing with computing. Buckner shares why she got attended the Be Professional night:

"This is my first year being a part of SWE," she acknowledges. "I decided I wanted to do something that was a bit more professionally oriented and I felt like this was a good opportunity to get to know other SWE members as well as do a bit of networking."

Open to meeting people from different companies, she likes to see what their experience is like. "A company's culture is very important to me, so those are the type of things that I tend to speak to companies about."

Helping SWE members grow in the more technical aspects of engineering is **Team Tech**, led by co-directors Olivia Barron and Savni Nagarkar, who while excited about SWE in general, are especially passionate about their area. During this national competition hosted by Boeing, participating universities form interdisciplinary teams of undergraduate students who work throughout the year on projects from various sponsoring companies, which Pakeltis calls more of a "year-long internship."

The idea is for the collegiate teams to create products that their corporate sponsors can use within their companies to solve problems. For example, this year, Illinois' Team Tech is partnering with John Deere to build adaptive technology for their compact tractors. They recently began the project for this year and will be working on it until October of next year, when they'll be presenting their work at the SWE 2019 National Conference in California.

Barron and Nagarkar report that, so far, the fall 2018 Team Tech has gotten a great start, with 20 new members of various majors and ages working on the project. "Our goal is to have a project that everyone can contribute to and learn from," says Nagarkar.

According to the **Membership Enrichment Committee** director Nika Steffen, her overarching goal is to:

"Create events that celebrate growth and diversity and challenge our members to push outside their comfort zones."

For this upcoming school year, she and her committee members are focused on doing more cross-committee events so SWE members are able to "Meet and Eat" (one of the events they host) with each other and grow their networks.

Membership Enrichment Committee director Nika Steffen at the recent Be Professional event.

academic year will be a Fall Workshop where participants will be decorating pumpkins and relaxing over cups of cider. Towards the end of this semester or next, Steffen plans on co-hosting a Multicultural Meet and Eat where members from all engineering societies can share their backgrounds and cultures (dances, holidays, foods, etc.).

Steffan adds that as her Committee's Intramural Chair last year, she was responsible for organizing sports games for SWE members. They ended the year with Archery Tag: a game similar to dodgeball, but with face-masks, real bows, and foam-tipped arrows. "We reached the maximum team capacity and even took home a few wins!" she brags.

The big event of the year for the **Recruitment Committee**, led by director Claire Samojedny, is Little Sisters Weekend to be held in April 2019. Once students have been admitted but before they've officially committed to Illinois, they're invited to visit campus for a weekend (Thursday–Saturday). Paired with SWE members, the visitors stay

Involved in a SWE outreach at Leal school during her freshman year, Abby Pakeltis interacts with a kindergartener about the best way to build her marshmallow-toothpick structure.

with Illinois students in their dorms or apartments, go to class with them, plus attend any departmental meetings or fun events going on. The idea is to expose potential students to the many support systems available at Illinois. With a SWE membership of over 200, quite a few prospective students can be expected to show up for the event.

According to Berat Gulecyuz, Director of SWE's **Community Service Committee**, her goal is to promote a service-oriented mindset in the SWE membership.

"Volunteering and giving back to the community is one of the most important ways to have a positive impact, not only on our campus, but the world. Therefore, this year, we are looking to encourage and inspire every member of SWE to get involved in something they are passionate about, whether it be animals, outreach, science-related activities, or anything else."

For instance, during the recent iHelp, the campus' largest day of service held on September 22nd, SWE organized Project Paplet, with the goal of goal of reducing paper waste and educating people on the environmental benefits of recycling. The project involved reusing paper to make notebooks.

One event Gulecyuz is super excited about hosting is the Girl Scout Workshops, which are completely run by SWE. In years past, around 60 girls hoping to earn their science badges have attended. "It is amazing to see the direct impact we can have on the community while having our committee chairs learn about what goes into planning events with large-scale organizations such as Girl Scouts of Illinois."

Gulecyuz is hopeful that her committee can help SWE members to "grow and become the best version of themselves."

The **Information & Marketing** (Info Mark) committees, led by directors Dana Sim (Information) and Melissa Doyiakos (Marketing), work to promote SWE and its events via a variety of media, including electronic, such as through social media like Facebook, and printed matter, such as flyers. Comprised of engineering majors, Info Mark also welcomes students from other majors as a way to bring in different skill sets. For example, in the past they've had a few graphic design majors or students from similar majors.

With the goal of sharing their passion for and knowledge of STEM in order to inspire the next generation of scientists and engineers, especially targeting underrepresented populations such as girls and minority students, SWE's **Outreach Committee** is headed up by co-chairs Simran Vinaik and Micki Rentauskas. Outreach activities include both larger, one-time, day-long events on campus, a couple each semester, as well as recurring weekly or monthly events with community partners, such as local schools. SWE's large fall events include: Introduce-a-Girl-to-Engineering Day (IGED), scheduled for 10/27/18; and Mommy Me and SWE, a day-long event for middle school girls and their moms, to be held in November. Spring outreach events include Engineering Round Robin, which

will be in February 2019, and DADDS (Dads and Daughters Do Science), scheduled for some time in April. In addition, SWE does numerous STEM outreach activities at Engineering Open House.

Also, to ensure well-rounded engineering students, SWE's **Social Committee**, led by director Amanda Batista, schedules fun social activities like the October 6th semi formal Barn Dance, and happy hours. Pakeltis calls these events, a "fun way to get to know people."

Left to right: Fundraising Committee director Vera Liu, SWE member Isha Tyle, and Outreach Committee Co-chair Simran Vinaik prepare to enjoy the evening at SWE's recent Be Professional event.

Also serving as a member of SWE's Officer Board is graduate student Meredith Richardson, who serves as a bridge to foster collaboration between **GradSWE**, an entirely separate organization for grad students, and SWE. GradSWE serves in more of a mentoring role. For instance, its members give talks geared towards undergraduate students considering graduate school, as well as sharing their wisdom with SWE members individually through coffee chats. In addition, GradSWE hosts a huge conference every year called WE STEM which is for graduate students, but undergrads are also invited.

Busy engineering students with a vigorous course of study, many SWE members admit that they take time to serve as directors or members of SWE's various committees not only to gain leadership experience and hone their skills, but also as a way of giving back. For instance, Abby Pakeltis indicates that that's why she serves as SWE president. "SWE has been all encompassing in my college career," she says. "I started as a freshman, and it was how I found good people to go to for helping me figure out what I wanted to do in engineering. It gave me opportunities that I don't think I could have found anywhere else."

One opportunity in which Pakeltis participated early on was Team Tech. According to Pakeltis, it gave her technical experience as a freshman, which she says, "is hard to come by. It's a really cool project and opportunity."

She reports that becoming the director of Team Tech her sophomore year enabled her to "get more involved and give the opportunity to other people, find a good project, and be a good leader. And also give back to what the directors gave me."

In fact, it was basically as a result of participating in Team Tech that she landed a job once she graduates in May 2019.

Here's how it happened. When she was director of Team Tech her sophomore year, her team worked with John Deere. "That helped me learn about them as a company," she explains. "And now I'll be working for them. I interned with them twice. Because I was working with them in Team Tech, I was led to pursue that opportunity." From that experience, she says she learned "the importance of reaching out to corporate sponsors and seeing how they can support our members."

Pakeltis indicates that SWE also gives members the opportunity to connect, not just with professionals and other undergrads, but grad students as well. For instance SWE holds grad school coffee chats to help students successfully navigate the application process, as well as learn exactly what it is you want to do in grad school.

She explains:

> **"That's why I love SWE, and why I wanted to be president. Just to have the opportunity to provide opportunities for people, because the officers before me did a great job at providing them for me."**

SWE'S INTRODUCE-A-GIRL-TO-ENGINEERING DAY ENCOURAGES HIGH SCHOOL GIRLS TO EMBRACE STRANGER THINGS—SUCH AS A CAREER IN ENGINEERING

October 30, 2018

Embracing the Stranger Things!—this was the theme (based on the popular Netflix TV series: Stranger Things!) for the fall 2018 Introduce-a-Girl-to-Engineering Day. So, hoping to do just that, around 80 Illinois 9th–12th grade high school girls, mostly from the Chicago area, showed up at Loomis Lab on Saturday, October 27, 2018, with their parents in tow. Some of the stranger things the girls hoped to explore were finding out what engineering is like, what different engineering disciplines do, and whether engineering might be the career for them.

So the all-day event, sponsored by the Illinois chapter of SWE (Society for Women Engineers), exposed the girls to hands-on activities in various engineering disciplines, gave them a chance to pick the brains of current engineering students as to what being a student at Illinois is like, and during the Design Challenge, discovered what working with a team of engineers might be like.

According to IGED co-chairs Karolina Urban and Kylie Burkett, both juniors in Civil and Environmental Engineering, the goals of the IGED outreach were to: "Definitely show young women that they can do engineering just like anyone else can," Burkett explains. She goes on to discuss how their goal—related to the day's theme—was to:

> **"Kind of get them to get out of their comfort zone a little bit," she continues, "and that's our whole thing—stranger things, right? Exploring things that are unknown and no one else has done before and giving them the tools to be good problem solvers."**

One key IGED goal was to help participants find out about some of the different engineering disciplines offered at Illinois. So during the morning, participants rotated through four different activities. One exposed the girls to Civil Engineering. During this activity, participants used paper and tape to construct a tower that could withstand heavy winds (a fan).

A high school participant works on her team's catapult as part of the design challenge.

During the Electrical Engineering/Computer Science activity, which involved Arduino microcomputers, the girls learned how to use code to spell out words with a string of lights. During a Physics-related activity, participants discovered how to crush a can using just water and a hot plate. During the final activity about Mechanical and Bioengineering, the girls created prosthetic "hands" out of paint stirrers and brass fasteners.

In choosing the four activities and which disciplines to feature in the morning rotations, the organizers tried to find activities to fit their theme, but their

main goal was to incorporate at least a couple of majors into an activity: “We wanted to get ECE in there, because that's big,” Burkett explains, “Not a lot of girls are in ECE, and also it's very interesting, I think, to a lot of them. It also ties in with CS.” And of course, since both Burkett and Urban are in Civil Engineering, she adds, ”I feel like the aspect of building for civil is cool, so we wanted to throw that one in there.”

A team of Illinois engineering students serve as judges during the testing of the teams' catapult designs.

To help the girls discover what it’s like to be Illinois engineering students, during lunch, they got to interact with a panel of engineering students from many of the different Engineering departments. Some questions involved how the panelists ended up choosing their discipline, what their career goals are, and things the younger students can do now to prepare for college.

Participants also found out that Illinois engineering students do more than just study. After lunch, four different RSOs (Registered Student Organizations), including one non-engineering-related organization, gave presentations to inform the girls about the variety of opportunities available for students should they matriculate to Illinois. The featured RSOs included: Engineers Without Borders (EWB), Concrete Canoe (CC), Alpha Omega Epsilon (AOE, an engineering sorority) and the Rube Goldberg Society (RG). Each group gave a short presentation explaining about the benefits of being involved in their organization.

The last big activity for the day was the design challenge, which was related to the Embracing the Stranger Things! theme. In the TV series, the kids in the show fight off fictional creatures called Demagorgons. So, for the design challenge, the high schoolers were split into groups to design catapult-systems capable of fighting off “Demagorgons.”

The teams were charged with using the limited materials they were given to create a catapult that would shoot a ping-pong ball at the target. Judges were on hand to rate the projects based on creativity, teamwork/ communication, accuracy, thought process, and the overall product. The girls presented their designs in front of judges and parents as the last activity of the day.

Recognizing how important parents are when making important life decisions such as choosing a career and deciding where to go to college, IGED planners invited participants’ parents to stay for the day as well. They attended some events with the girls, such as the introduction and the end-of-the-day activities, but also participated in activities designed just for them.

For example, parents really enjoyed the student panel, asking questions like: What extracurricular activities do they partitipate in? Does the ratio of guys to girls in most engineering classes bother them? Can students switch majors? How did they end up choosing Engineering? Illinois? Quite candid and humorous, students seemed to enjoy the session just as much as the parents.

In addition, parents had a chance to become more familiar with Illinois during a tour of the campus. Also, SWE Outreach Director Micki Rentauskas spoke to the parents about how to encourage their daughters in their decision-making processes. Of course, at the end of the day, parents proudly watched their daughters present what their team had come up with for the engineering design challenge.

Several parents share why they brought their daughters to IGED. For example, one Chicago area mother, Angie Patel, says: “She's interested in some science-based career, potentially. Maybe not engineering, but I just wanted to expose her to it, and she's thinking about coming to U of I, so this will get her around people—students, girls—that are in academically minded things.”

Patel particularly appreciated when engineering students in the student panel session were “talking about their prep—what things helped them get ready to be in engineering. I liked the one girl that was talking about the whole idea of pressure and how do you help your kids to not feel the pressure. Because she talked about her score on the ACT when she had a lot of pressure and stress and then when she went in relaxed and how much it changed. So I thought that was interesting.”

A Lombard Illinois father claims he was just along for the ride. “I'm here because she took me here,” he admits. “I don't know what my daughter is interested in, and I don't think she knows, so just to get her exposed to different things and see what's out there.”

Another parent was Maricela Carillo from Hinsdale Illinois, whose daughter is a sophomore interested in architecture and engineering. “She heard about this,” mom explains, “and anything that she's interested in and is going to help her develop herself and her interests and, of course, focus her studies, I'm going to encourage.”

Carillo particularly loved the student panel. She explains:

“A lot of times, you don't know what to expect. You don't know if your experience is at all relevant to someone else's experience coming here, and then you hear a lot of points in common. And since they've already experienced it, they offered a lot of advice. I liked the fact that they brought it down to Earth so that you could see what their road has been like and get a little guidance that way. I don't know if my daughter has already heard this, but I'm definitely going to share what I heard here.”

Jason Senese from Orland Park (background) watches his daughter Sophia and her team making their catapult.

Another father, Jason Senese from Orland Park, didn’t necessarily encourage his daughter to come to IGED. He claims it was her Idea to come. “She encouraged herself. She wanted to come.”

He says Sophia, a junior at Orland Park High, is considering a couple of engineering fields, bioengineering and chemical engineering, and wanted to come to IGED because it looked interesting. Senese thought the student panel was great. “I learned a lot of things today since, officially, I didn't go to a state college.” What impact did IGED seem to have on his daughter? “I think she seems comfortable here, so we'll see how it goes," he reports.

Helping with the event were around 40 SWE volunteers, plus volunteers from Chi Epsilon (Civil Engineering Honors Society) and Aerospace Outreach, who were delighted to pass on some of what they'd learned during their studies at Illinois. Several volunteers shared why they got involved.

For example, Kylie Burkett shares why she and her fellow coordinator, Karolina Urban, helped coordinate the event:

“I think we both just really have a strong passion for outreach. We think about it, and we're like, "Wow, we could've just changed a girl's mind to do engineering!" I can speak for both of us when I say that's why we do what we do.”

“It's incredible having these opportunities to get all these girls engaged in engineering and STEM activities,” adds Urban. “It's really fantastic!”

Another SWE member who's passionate about outreach is Jenna Kummer, a junior in Mechanical Science and Engineering who likes to help out with all of SWE's different events in order to pass on her love of engineering to the participants.

She says:

> **“I like working with younger students and getting them excited about engineering because I'm really passionate about engineering, so I really want other young girls to get excited about it and want to go into the field.”**

Kummer thinks IGED is a great event because the girls “get to see the different types of engineering and get to work with them and see what they like and what they don't like when they're in high school.”

Helping out with the structural engineering activity was Claire Samojedny, a Civil and Environmental Engineering major who’s specializing in Environmental Engineering. One thing she appreciated about IGED was meeting and interacting with Illinois students, especially in the Civil Engineering activity. “I don't know any of my other fellow volunteers,” she admits, “but working together just to help people show engineering. I like it a lot.”

Of course, her favorite part about IGED was connecting with the girls and learning about what they’re interested in. “So just going around talking to the girls makes me feel happy,” she says.

She also liked giving them opportunities she hadn’t had when she was their age. For instance, she didn't go to anything like this when she was in high school. “I didn't even know this was a thing,” she acknowledges. However, her mom took her to museums, the zoo, and “fun little science things. So I think that's what got me into engineering was because of my mom loving science.”

In addition to her mom’s influence, she shares an anecdote about another interacton that might have planted a seed that engineering might be a viable career for her.

"When I was in high school, I didn't even know what engineering was,” she admits. In fact, she originally wanted to do veterinary medicine. However, in her sophomore year, when solving a chemical balance equation, she had exclaimed, “Oh, this is a puzzle. This sounds fun!'" to which her chemistry teacher had remarked, “'Oh, you sound like an engineer!”

She adds why she believes events like IGED which expose girls to engineering are really important:

> **“Because a lot of girls don't even consider engineering as their first choice. A lot of them, if they do think about STEM, it's more of medical or specific science like a biologist, a chemist, but they never really think about engineering and what opportunities that opens up for them.”**

The idea of introducing high schoolers to engineering to give them a head start also resonated with IGED's co-coordinators, who hadn’t done events like IGED in high school either.

> **“Personally, I think we didn't really go to many outreach events when we were kids,” Kylie admits, “and I lived in the suburbs so it's not like it wasn't there. It was just unheard of, usually.”**

Karolina Urban and Kylie Burkett, the Fall 2018 IGED Co-Coordinators.

Urban adds:

> **"I never heard of these events while I was in high school, which is something I was really sad about when I came here and started working with outreach. All of these high school and elementary events and no one told me about them!"**

Based on their experience, the two admit that they'd been "Trying to spread the word," and had emailed almost every high school in Illinois to get girls to come. And their efforts paid off. About 80 girls and their parents showed up for the fall 2018 IGED, up 10 from SWE's March 2018 IGED outreach.

Burkett shares some of the benefits of girls finding out about engineering in high school versus what the two of them did, which was to apply to college based on their love of math and science and hope it worked out. She indicates that when applying to college, she knew she liked math and science, and that she wanted to be an engineer, but she had no idea which one and had randomly applied to civil engineering.

"Thankfully, I love it," she confesses. "I love it so much!" But she admits that maybe if she had gone to an event like this, it might have helped her decide that she liked bioengineering because of an activity. She explains:

> **"You get a little background about what the engineering disciplines do, and it definitely gives you that step forward of 'This is specifically what I want to do in engineering,' not just, 'Okay, I like math and science. Where do I go from here?'"**

Many of the high school participants would probably agree with the two about the importance of participating in events like IGED in order to narrow down which engineering discipline to choose. For instance, Lindsey Serlovsky, a junior from Orland Park, whose favorite activity of the day was the physics can-crushing project, shares why she participated in IGED:

> **"I really love engineering," she admits. "and I want to do it as a job when I'm older. I probably want to do material engineering, but I wanted to learn more about different types of engineering."**

No stranger to outreach at Illinois, IGED was Serlovsky's third engineering outreach at Illinois. Along with another SWE outreach event, she had participated in GLAM GAMES camp, and, of course, had most likely impacted her decision to do Materials Engineering. Does she think she wants to come to Illinois? "Probably, yeah," she says.

Of course, the main goal of the day was to pique the girls' interest in engineering. Urban shares why it's important to increase the number of women in engineering: "I think it's very beneficial to have diversity in the workplace, making sure that there's a lot of points of view working on different projects. Getting that diversity is important."

So, did the volunteers see any future engineers? Co-coordinator Karolina Urban's response was a resounding "Yes!"

"These are all engineers. Honestly, any one of these girls can be engineers," she affirms, then shares an anecdote:

> **"I walked into the civil engineering activity where they're designing towers to withstand the wind, and the first round we walked in, the volunteers were like, 'Oh, we couldn't knock them over because they're all too good!' Then we were like, 'Well, these are all civil engineers in this room!**

A high school participant works on her team's catapult as part of the design challenge.

A high school student utilizes a VR (Virtual Reality) headset for one of the experiments.

MAKERGIRL SEEKS TO EXPAND THE STEM PIPELINE BY GETTING MIDDLE SCHOOL GIRLS INTERESTED IN STEM

November 2, 2018

Excited about having some pre-Halloween fun with STEM, six local middle-school girls showed up at the Armory's Innovation Lab on Tuesday, October 30th, for MakerGirl. During the two-hour session, the 7–10-year-old girls learned how to use Tinker-CAD, a computer-aided-design application for kids, discovered how 3D printers work, then 3D printed Halloween-related designs they'd made. Plus, currently all the rage and completely apropos for Halloween, they made some ooey-gooey slime.

MakerGirl is a STEM education outreach program whose mission is to inspire girls to be active in STEM, to "live and dream as unstoppable forces that say yes to the challenges of the future." Its ultimate goal? To channel more girls into the STEM Pipeline in order to foster "gender equality in all workplaces," especially the STEM workforce.

Current CEO, Stephanie Hein, who studied molecular biology at Illinois, is quite passionate about the group's mission. She admits:

> **"Women in STEM is close to my heart, and I love giving little girls an opportunity to explore different STEM fields. I would've loved to do something like this as a kid, and I didn't have it. Just providing that opportunity to anyone else is so fun."**

MakerGirl sessions, are usually comprised of 6–10 girls, ages 7–10. Mary Hadley, a senior in chemistry at Illinois and currently the group's managing and curriculum director, explains why they're targeting that age group. "So we really want to reach that age range right before middle school," she says, "because we found it's right around middle school when girls start saying 'No!' to STEM activities and also just feeling discouraged in their classes." So MakerGirl picked middle school girls to start with, to try to make a difference with that age group.

One local youngster who took to the evening's activities like a fish takes to water was eight-year-old Éireann Byard. Although it was her first time

Mary Hadley watches a young visitor draw out her design.

at MakerGirl and she had never been exposed to the technologies, her TinkerCad design was quite impressive. According to her mother, Jennifer, she and her husband, both engineers:

> **"are really encouraging of all of our kids, but especially our daughter, to get involved with science and math and technology."**

Evidently their four children are really excited about the 3D printer at the Urbana Free Library and all

A young MakerGirl learns about the 3D printers.

want to try it. So when they heard about MakerGirl, they thought it would be a great opportunity for their eldest to

> **"get started with CAD and 3D printing and get some more exposure. Because the earlier the better!"**

MakerGirl CEO, Stephanie Hein shows young girls the 3D printers.

In addition to the original site at Illinois, another full-time academy was begun at Northwestern University in Spring 2018. Regarding the Northwestern academy, which uses a maker space in one of the campus' libraries, Hein reports that it's going really well. "I went to their first session, which was a couple weeks ago, and it was great. It went super well…They're great with the kids, I was very impressed." Plus, MakerGirl is holding a pilot session at Harvard on November 3rd.

In addition to the new academies, in 2016, MakerGirl added a van, which does summer road trips. The first summer outreach, #MakerGirlGoesMobile, put over 10,000 miles on their newly acquired vehicle. During the 8-week-long, cross-country road trip—all the way from California to New Hampshire—they introduced 3D printing to over 1,000 girls in rural and underserved communities across the country. The summer of 2017, a shorter, Midwest version exposed 500 girls to 3D printing. MakerGirl took the summer of 2018 off in order to get Northwestern set up; but are planning an East Coast road trip in summer 2019. During the rest of the year, the van is used to transport 3D printers, laptops, etc. to school or community outreaches.

In addition to the regular sessions, other outreach activities include at least 2–3 visits a year to mostly Champaign-Urbana schools (they've actually visited a Chicago school too). The challenge regarding scheduling mobile sessions is that sometimes team members, mostly college students, after all, aren't available during the times schools are in session. The group also does sessions at Champaign's Orpheum Children's Science Museum periodically.

MakerGirl has had a significant impact on the current CEO Stephanie Hein, who began her journey with the STEM Ed outreach program her junior year at Illinois while working on a degree in Molecular and Cellular Biology. In fact, working with MakerGirl so inspired her that she went on to get a Master's of Education degree at the University of Michigan.

"I just fell in love with STEM education," she admits, regarding her stint in MakerGirl her junior and senior years. "Especially when it comes to girls. That's kind of what inspired me getting my masters, and then I came back here."

As the program's CEO, seeking funding via corporate sponsorships is one of her big roles. "It's definitely a learning curve," she acknowledges, "but people are pretty open and excited when they hear about our program." She reports that setting up initial meetings seems to be going pretty well, but that the follow up takes some time. Currently, the three biggest supporters are Johnson Controls, who supported their road trips in the past, along with Abbot Labs and Parker Hannifin.

Regarding funding, MakerGirl's first big fundraiser, Chicago Charm, is coming up on November 29th in Chicago. It will be their first time ever trying to raise $10,000 in one night. Those interested in participating can register here. To find out more, see the MakerGirl website or Facebook page.

Hein explains why she tackled the role of MakerGirl CEO:

> **"Personally, I'm doing it because I love MakerGirl, and I wanted to come back."**

She also considers working with a new startup to be a really unique opportunity:

> **"It's something that only comes along once in your life. So being able to run a startup with a group of university students is...we're going to learn so much from it. I'm really excited about everything I'll learn. And I love leading the team of girls here; they're all great, and I love working with them."**

Another member who is passionate about MakerGirl is Chemistry senior Mary Hadley. As the managing director, she oversees the directors over five key areas: academies, curriculum, finance, marketing, and internal. As the curriculum director, she's in charge of all the curricula that's created. She develops then shares the template for their presentations and sessions with the other academies, who then have freedom to pick the themes and come up with some of their own activities to do during the sessions.

What does Hadley envision for MakerGirl down the road? Her dream is to see it expand to multiple academies. In addition to the one at Northwestern, she thinks it would be great to set up five more over the next year. "I think just bringing MakerGirl to even more people through this same process that we have here on campus."

As part of their expansion, key stakeholders plan to continue targeting universities as academy sites, because they think their model at Illinois works well. For one, usually a university has a space with 3D printers or one that would share space in order to acquire 3D printers. (The Illinois site has just such an arrangement with the Innovation Lab, which allows MakerGirl to use its space for its activities in exchange for using the group's 3D printers.) Plus, key to MakerGirl's strategy is having college students who are closer to the kids' age and are passionate about STEM serve as role models.

"We just think that having a college-age woman or man working with younger girls just lets them see that role model: "Oh, they got there, I can get there too!" So that's why we like that relationship."

Plus, the mentoring aspect is a win-win, not just for the middle school girls, but for the college-age volunteers as well. In fact, Hadley reports that it significantly changed her college experience. That's why she hopes to provide a STEM education outlet for more college girls, as well as being able to reach more younger girls. She explains:

"I think just bringing us to campus and being a place that girls in STEM or girls that are passionate about teaching girls in STEM, have a place that they can talk, kind of throw ideas around, and create something as cool as our MakerGirl here. That's something I'm really excited for other people."

Hadley's dream for MakerGirl is that its name becomes synonymous with STEM outreach for girls, at least in the Midwest: "I think that we would be really strong in the Midwest where people would know more about us, so when people come to campus, they want to find the MakerGirl. I think that's kind of what would be really cool."

She adds that this happens with a lot of different clubs or RSO's on campus, and she hopes the same becomes true for MakerGirl—that high school students learn about them, so when they're seniors, they're

"really excited to go off to university to be a part of MakerGirl. I think that would be my goal, just to be a name that's known so we always have a flowing number of new women that come in and help us."

To help establish that MakerGirl pipeline, Hadley also envisions expanding to target older girls as well:

"So we have our younger age, our older age, and you go off to be a university student and help out. So I think that step program would be really cool, but we really, really want to focus on our 7–10 age group first to make sure we're really strong in that aspect, because it's not a really saturated after-school program yet."

Olivia Cole watches as a young MakerGirl participant works on her design on the computer.

LOCAL GIRLS MAKE STRIDES IN MATHEMATICS DURING AWM'S SONIA MATH DAY

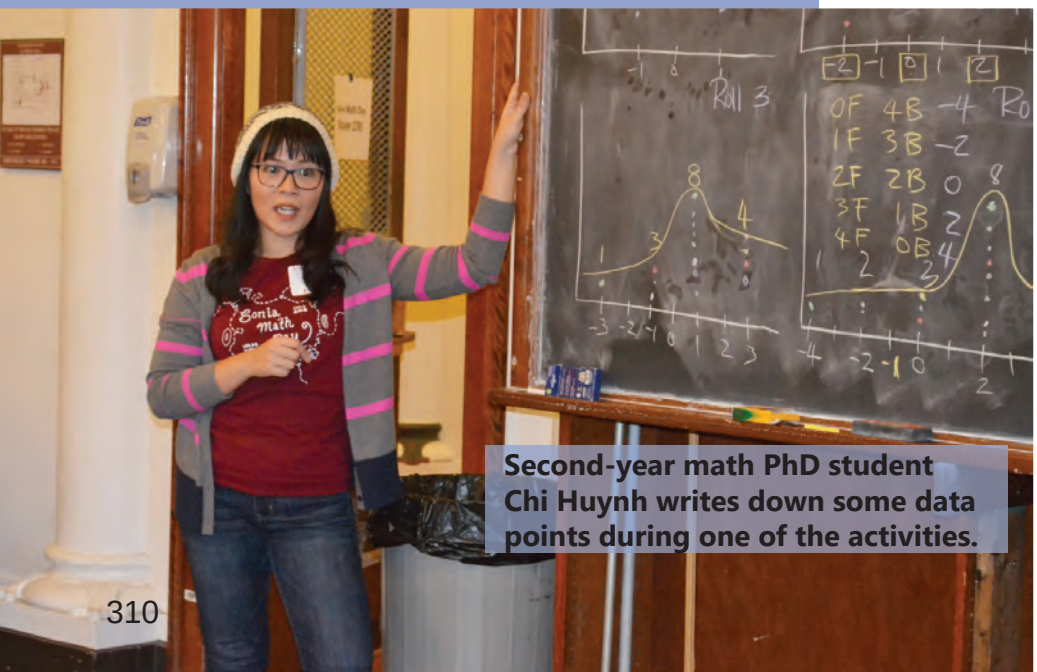
December 3, 2018

On Saturday, November 10, 2018, during Sonia Math Day, a number of math grad students from the Association of Women in Mathematics (AWM) put into practice the "Say what you know" idea, taken from the life philosophy of Sonia Kovalevsky. The annual event celebrates the life of Kovalesvsky, the greatest female mathematician prior to the twentieth century, and her impact—that women can succeed in and contribute to the field of mathematics. Benefitting from the AWM women's wisdom (and that of some male students who support women in math), were five local girls who did some unique, math-related activities probably quite different from what they normally are exposed to in school. Plus, they not only met other local girls also interested in math, but networked with some role models during the event, women who are currently on a trajectory to careers in math.

Sonia Math Day participants watch as one of the instructors add their "random walk" data to graphs on a white board.

Organized by Dana Neidinger, a math PhD student and AWM Outreach Chair, Sonia Math Day featured not just hands-on activities, but some that had the girls, mostly 8th graders, along with a high school junior and a couple of freshman, up and moving around, in addition to drawing on paper, as they exercised not just their brains but their bodies as well.

For example, the 1st activity, centered around graph theory, introduced the girls to Eulerian paths, Hamiltonian paths, and the traveling sales-man problem: (What is the shortest possible route to visit each of a number of cities then return to the city of origin?) During these, the girls not only worked on paper, but followed paths delineated by masking tape on the floor.



Second-year math PhD student Chi Huynh writes down some data points during one of the activities.

Participants also took "random walks," where they would flip a coin, step forward or backward, flip a coin again and so on. Then after recording the sequence of coin flips, they'd find the probability of where they would end up.

A third activity dealt with mazes on topological surfaces and how the surfaces changed the paths available to follow.

According to Neidinger, the goal of

A Central High freshman at Sonia Math Day for the third time enteres data during the "random walk" activity.

Sonia Math Day was to get the girls:

> **“very excited about doing math, and to say ‘Math is fun!’ and have it be something that they're really interested in looking at further.”**

Neidinger, whose research involves graph theory and number theory, organized the event, including recruiting math grad student volunteers to help out with the different activities.

For instance, one second year math PhD student who helped with the event was Ran Ji. She claims that it has been important for her, personally, to be in an environment where she could:

> **“be surrounded by other women doing really cool and awesome things.”**

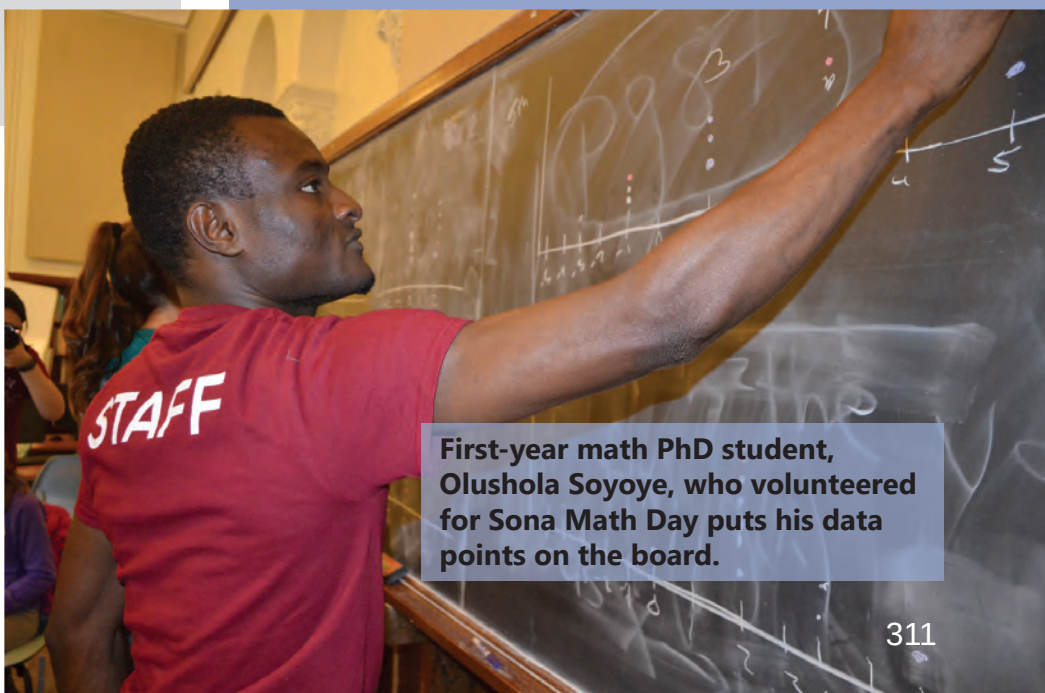
She reports that not only was she lucky enough in middle and high school to have female teachers who were really supportive, but that she actually went to a women's college for her undergrad degree.

> **“I could see that women can do science and math things," she relates, regarding her own experience, and I don't know that everyone has that in their school. So I wanted to make sure that they [the Sonia Math Day participants] had an extracurricular activity where they can see that,” she explains.**

When Ji shows up at Altgeld on a Saturday to help out with an AWM event like the Sonia Math Day, she claims to “find it very encouraging and inspiring…it's mostly female grad students who are helping out, doing the activities, doing the planning. They're in charge. It's both satisfying for me personally,” then adds that she also finds it very rewarding to “get to spread love of math in the community.”

While she hasn’t started her research yet, Ji is considering combinatorics, which she says is “fancy counting, counting the number of ways you can do something.”

For several Sonia Math Day participants, it wasn’t their first time participating in the event. For instance, one girl reports that last year, her math teacher mentioned it to her whole class and she



First-year math PhD student, Olushola Soyoye, who volunteered for Sona Math Day puts his data points on the board.

During Sonia Math Day, several participants write down data as they participate in the "random walk" activity.

just decided to come because her teacher thought it was cool and believed her students would like it. Although she was the only one in her class who came last year, she really liked it, so she came again this year.

She explains:

> **"I didn't really know anyone but everyone was really nice and it was a good learning experience. It wasn't a boring long lecture, you got to do interactive stuff, and that's fun."**

For another participant, Ellen, a freshman at Central High, it was her third time to participate. She had found a flyer in her school mailbox about the Sonia Math Day and thought, "'Oh, this looks interesting! I think I'll go!' So I went," she admits, "and I ended up having lots of fun. It's interactive; it's not boring; they do fun activities."

Might a career in mathematics be in Ellen's future? "I've considered it," she asserts.

Another participant, Kaitlyn, says she might not go into math, but acknowledges, "I'm thinking STEM in general. It's extending to STEAM, which is art in it too. I like art a lot, so something in STEAM in general I like."

More on Sonia Kovalevsky. A pioneer in mathematics, Kovalevsky, who was born to a Russian family in 1850, was exposed to mathematics at an early age—her room was supposedly papered in lecture notes from her father's calculus courses. She was self-taught, and at the age of fourteen, taught herself trigonometry in order to understand a physics book.

Although she struggled to obtain a formal education, facing negative attitudes about women attending universities and lacking a support system throughout her life, she became the first woman to receive a doctoral degree from a modern university. Plus, she gained tenure at Sweden's Stockholm University, where she was also named editor of a math journal. During her career, Sonya published 10 papers in mathematics and mathematical physics.

Following is one anecdote about how she changed perceptions about women belonging at a university. At the age of 20, she went to see Karl Weierstrass, hoping to study with him at the University of Berlin. He sent her away with a set of problems so challenging that he never expected to see her again. However, when she returned with the solutions a week later, he was so impressed that he began privately tutoring her because Germany didn't allow women in universities. She worked under him for four years, finally earning a doctorate from Gottingen in 1874.

AWM's Sonia Kovalevsky Days have been organized and sponsored by AWM and held at colleges and universities throughout the country for more than twenty years now. The events consist of workshops, talks, and problem-solving competitions for female high school and middle school students. The goal, according to the AWM website, is:

> **"to encourage young women to continue their study of mathematics, to assist them with the sometimes difficult transitions between middle school and high school mathematics and between high school and college mathematics, to assist the teachers of women mathematics students, and to encourage colleges and universities to develop more extensive cooperation with middle schools and high schools in their area."**

Second-year math PhD student Chi Huynh writes down some data points during one of the activities.

CHICTECH INTRODUCES HIGH SCHOOL GIRLS TO COMPUTER SCIENCE—OTHER GIRLS WHO ARE PASSIONATE ABOUT IT TOO

December 6, 2018

Excited to interact with other girls (and women) interested in computer science, high school girls from all over the state showed up at ChicTech, a two-day event designed to expose girls to computer science (CS), some possible careers in CS, and to show them that they would have a ready-made community, the WCS (Women in Computer Science) group, should they matriculate to Illinois. And more importantly, during the workshops, they learned that, yes, indeed, they can do computer science.

An Illinois CS student (right) works with a high school girl learning to code during ChicTech.

One of the main goals of Chic Tech was to give participants a chance to learn that they can do computer science. The event featured three different workshops designed for girls with different levels of expertise. For example, girls with little or no coding experience could attend the HTML/CSS: Build Your Own Website workshop and do just that. The other two workshops were intended to expose girls with intermediate or advanced-level coding skills to different aspects of CS. For instance, in the Java Chatbot workshop, the girls created chatbots, which are applications designed to simulate conversation with human users over the Internet. In the final workshop, Java/C++: Image Manipulations, participants learned how to do Photoshop-esque photo editing without using Photoshop, but instead using Javascript and/or C++.

Another purpose of ChicTech was to expose the girls to female role models. For instance volunteering at the event were a number of WCS members, women who are currently studying CS at Illinois. These women (along with a few male CS students) were on hand to not only help the younger students when they had issues during the workshops, but also to be available to answer the girls' questions such as, "How did you end up in Computer Science?" "What's it like being a woman studying CS at Illinois?" and "What are some of the different careers available to CS majors?"

CS Assistant Professor Ranjitha Kumar interacts with the ChicTech participants.

In addition to women who are currently studying CS, the idea was to expose the high schoolers to women who currently have careers in CS. For instance, exposing the young participants to the idea that they could have a CS career in academia, or in her research area, data-driven design, was the first guest speaker, CS Assistant Professor Ranjitha Kumar. Other speakers included Kate Key, along with Illinois alum Corly Leung, who was heavily involved in WCS when

she was here, and actually served as the WCS outreach coordinator back in 2015.

ChicTech planners sought to convey to the participants that Illinois CS students don't just code 24/7, but that they also know how to have fun. So after a day spent hunkered down over computers and wrestling with coding challenges, the girls got into some comfy clothes and settled in for Girls' Night—a relaxing evening playing games, making relationships, and just plain having fun doing...girl-type things. So, with the Disney movie Mulan in the background on the big screen, the girls, both young and old, bonded while doing their nails or playing games, such as a rousing game of Uno while many of the participants were ensconced in their "blankies" or sleeping bags.

One important ChicTech activity of the two-day event was the period just before lunch on Sunday morning. During the Demo session, girls proudly showed their equally proud parents what they had created during their workshops. While viewing her daughter's work, Sandy Jones, the mother of one participant from the Chicago suburbs, explains why she encouraged her daughter to participate in ChicTech.

"Because she's interested in computer science for college, and the University of Illinois is one of her colleges she's looking into. So we thought it would be a great opportunity."

She believes her daughter, a sophomore, benefitted from her first time at ChicTech. "I know I've talked with her and she said that she really enjoyed it," Jones explains, "definitely learned some things, and just enjoyed the entire experience."

WCS Outreach Co-Chair Grace Cao, and President, Shivali Patel.

For Morgan Taylor, a junior at uiuNormal Community West High School, this was her third time at ChicTech. She shares why she keeps coming back.

"It's always fun, she explains, and I always learn something different. Even if we're using the same program, we do something different every time."

Her favorite thing about ChicTech is meeting people who are also interested in computer science.

"I just meet a lot of new people that have the same interests as me," she admits, "and I think it's a lot of fun knowing there's more than just the four girls in my computer science class."

Ensconced in their sleeping bags and "blankies," ChicTech participants enjoy a game of Uno.

The ratio of guys to girls in her high school computer science class is about 8 to 1. So she was happy to discover that the ratio of guys to girls in CS at Illinois (one of her top two choices right now) is currently about 4:1, while the ratio of guys to girls in the last couple of freshman CS classes at Illinois has almost reached 1:1.

Taylor says she's taken several CS courses in high school, including this year's AP CS Principles course, during which they're learning 7 CS languages Since she'll be taking Java script next year, she got a head start by taking the Java/C++ session at ChicTech, where they learned how to edit photos using code instead of Photoshop.

Morgan Taylor enjoys Girls' Night during the Fall 2018 ChicTech.

Her dream job? To work for a company like Amazon, helping to code the algorithms the website uses to recommend products to people. "Because I think it's so cool how accurate they are and how they can predict what you're going to buy," she explains.

Another participant who has also been at ChicTech three times was Rose Riordan, a junior in Matea Valley High in Naperville, Illinois

Riordan, says she plans on going into computer science. "I am, yeah," she acknowledges. "I think that I'm not totally set in stone on what I want to do for sure, but I think that maybe some computer science/law. I think I want to be a lawyer with some kind of computer science background."

Riordan shares why she likes computer science so much:

"There's a lot you can do. It opens a lot of doors…and I feel like coming here kind of gives you a little taste of the experience."

Riordan indicates that her favorite thing about ChicTech, and why she has kept coming back, is the presence of so many girls who have the same passion about CS that she does.

"When I was younger, I'd go to all of the coding and robotics camps. A lot of the time I would be, if not the only girl, one of very few girls. There's just something really nice about seeing so many—having there be so many girls in something like this. There's just something comforting about it, I think."

Rose Riordan (left) interacts with a volunteer during one of the more advanced coding workshops.

Plus, she really likes Illinois. "And U of I is cool, and I like the campus. It's a really fun experience, and I like it a lot."

Another reason she keeps coming back year after year? "Computer science is cool!" Riordan then adds another very important reason for attending: "The bagels that they serve here are really good!"

STEM STUDENT SPOTLIGHT

MCB'S JEREMIAH HEREDIA: PASSIONATE ABOUT HIV-1 RESEARCH, STEM OUTREACH TO UNDERSERVED

February 8, 2018

MCB graduate student, Jeremiah Heredia, interacts with a local elementary student at STEAMcation.

Jeremiah Heredia hasn't always been as passionate about science as he is now. In fact, as a kid, he didn't like it one bit. "Not at all," he admits. "I wasn't into science at all." Actually, he wanted to be a baseball player…a second baseman, to be precise. Nowadays, however, instead of pulling on a baseball glove, the fourth year Biochemistry PhD student is pulling on vinyl lab gloves. But he's still competitive. However, instead of trying to beat an opposing little league team, he's moved on up to the big leagues and is going after an even bigger W. He hopes to beat some of the major diseases plaguing our society, like HIV-1, for instance. And when he's not in the lab, he's out doing something else he's passionate about…getting underserved students excited about science.

Of the work he and his teammates in Erick Procko's development lab do every day, he modestly claims to be "playing a small role" in coming up with a vaccine for HIV-1. He says they're "trying to come up with a method to get several thousands of mutations from one experiment in human cells." According to Heredia, their work could be useful for finding cures for a number of diseases; eventually, he and his colleagues hope to say to the scientific and pharmaceutical world: "Now, here's an example of what you can do in this method."

Learning all about diseases fascinates Heredia, and he particularly relishes the challenge of finding a cure:

> **"I like science, and I like diseases; that's what got me into science," he says. "You find out that someone has a disease and, with science, you get to learn about the disease and then you try to find out how we can cure it. If it's any sort of disease, it becomes tangible for me, I can see it, and it's easier to study."**

In fact, Heredia intends to spend the rest of his life studying them, and he probably won't have to worry about job security.

> **"I'm going to be in science for life because, unfortunately, diseases are still gonna' be with us, and I want to make a difference."**

"I really did not know much about HIV-1 until I got into this lab, and it wasn't until a year and a half ago that I really got into this project. And I like it. Ideally, I would love to stick with the HIV-1 field."

So how did Heredia go from not liking science at all to eating, sleeping, and breathing it? He met a scientist who looked and sounded like him. And for him, a Hispanic who grew up in a low income area in San Jose, California (and other students like him), seeing someone who looks like him doing science was key.

“Growing up, the people who were doing science weren’t like me. They were just different from me. So I never gave it a second thought."

So Heredia had no idea what to study when he went to college—no idea what he wanted to choose as a career. He loved math, and always though he’d do something with that. So did his high school counselor. On noticing that he was doing well in it, she asked Jeremiah, “So you like math? When Jeremiah answered, ‘Yea,’ the counselor advised, “So be an engineer.” Jeremiah wasn’t sure that appealed to him (“That part of my brain wasn’t there,” he acknowledges), but he knew that there were different kinds of engineers, so he asked, “Could give me examples of what type of engineer I should be?" The counselor replied, “Just go for any engineering; you’ll make a lot of money, and you’ll be happy."

So Heredia dutifully followed her advice and was admitted to San Jose State in general engineering. As fate would have it, one of the requirements was chemistry, and Heredia immediately fell in love.

“I did,” he acknowledges. “I did. It was weird. For the first time, there was a course I could really see myself doing.”

So he marched into Professor Seamaster’s office and told her that he loved her class and wanted to switch majors, to which she replied: “You are crazy! So you took one semester in this course, and you want to change your whole life?” She advised, “Don’t do that. If you’re really serious about it, take the second course…If you still like it, come back and talk to me.”

So he did. He took the second course, did well in it, still loved it, and went back to chat with her again.

Realizing that he was serious, "She told me all the possibilities I could have,” he recalls. This conversation was pivotal in terms of his career deliberations. But what had an even bigger impact on him, even more important than the words she spoke, was the fact that she was also an underserved minority—someone with whom he could identify.

“I remember that was the first time I could talk to anyone who was similar to me and into science,” he recalls. “That was the first time I saw a career goal. That moment really stuck with me. That's a big reason I like helping with these events because I never really had anyone help me out. I really felt fortunate I ran into her. If not, I would not be doing this."

Fast forward a few years, and for his Master’s, Heredia attended Cal State, LA. By then, he knew what he wanted to do—biochemistry—and was focused.

“I had no direction before; now I do have a direction, so it’s easier now,” he admits.

So how did Heredia, a California boy born and raised, end up at *Illinois*, with its capricious Midwestern winters? He felt the need to get away and concentrate solely on science and his career.

“I wanted to come and challenge myself,” he acknowledges. He confesses that as an undergrad, he didn’t do as well as he wanted to in school, which was partly because he stuck around home, when he needed to get away. “As much as I loved everybody

Heredia at work.

there, I just had to put science as my number one priority. The best way to do it was to get out of town. As much as I love my friend and family, for this period of my life, I just had to take it seriously."

So he enrolled at *Illinois*, where he's doing cutting-edge research on diseases. Has he ever regretted it? For the most part no. He claims it's been great "experiencing a whole new life." He's gotten the chance to interact with people who are not only from all over the U.S., but from all over the world. And as a member of the MCBees, the MCB Graduate Student Organization, he's with people who "want to connect with each other but also want to be involved in something."

"It's nice that I have found a bunch of people who are similar to me but they're different enough that I'm learning from them," he says.

He joined the MCBees for two reasons. One, it's a place to belong.

"Being with the MCBees is easy. It's easy talking to fellow students outside of the lab. It's such a different dynamic I have with them."

His second reason is for the outreach. Though he acknowledges that he and his fellow MCBees have "gotten much closer because of it," he doesn't volunteer for the social benefits. He hopes to get undeserved kids into STEM—to have an impact on young minority students similar to the impact Professor Seamaster had on him. So he's helped out in numerous MCBees outreach events. "It's always in the back of my mind," he says.

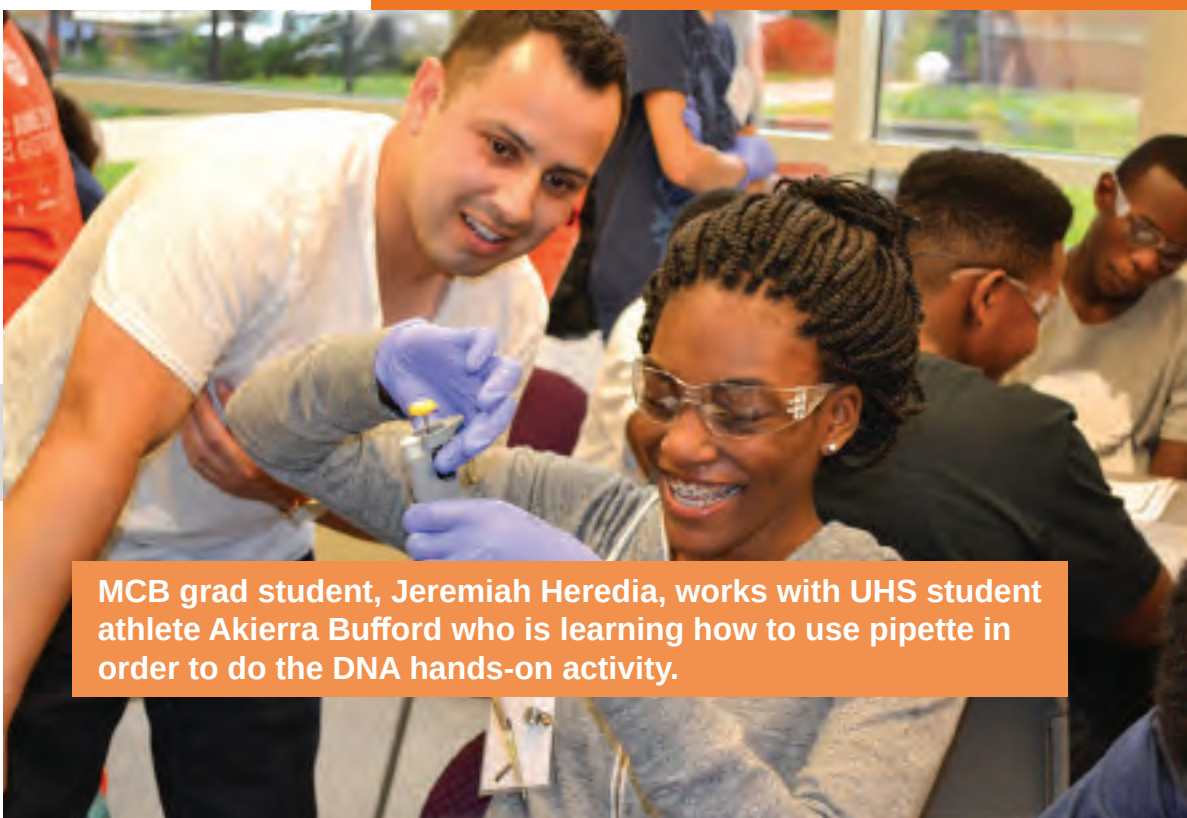
"If I can help out, I help out."

Having encountered Heredia at numerous outreaches, I (the writer) was tempted to say, "He's never met an outreach he didn't like," but that's not actually true. When it comes to outreach, Heredia is somewhat persnickety, and shares this caveat: "If there are kids who are really set on it [science], I'll help them out, but they're set on it and they're gonna' do it. Whereas I want to show science to the ones who may have never seen it before."

He shares this anecdote: He had volunteered one time at the MCBees' monthly outreach at the Orpheum Children's Science Museum, and decided it wasn't for him. He recalls that a lot of the participants were kids of faculty members. "So the kids already knew so much, and they were telling me stuff I didn't know. I felt like, in that case, my time wasn't being effective. These kids were already well on their way to science, and there was not much for me to do."

Heredia has particularly enjoyed I-STEM's outreach events with the Urbana High student-athletes.

"I loved it," he concedes, "because I could talk to them as a fellow athlete. I know that they're competitive and that they like to do well. I would try to be competitive with them, but also encourage them. I would tell them 'Oh, you can pipette and learn these experiments!' The students I was talking to were pretty engaged, and it felt good. I felt like they did appreciate me being there."



MCB grad student, Jeremiah Heredia, works with UHS student athlete Akierra Bufford who is learning how to use pipette in order to do the DNA hands-on activity.

Heredia believes they could not only identify with his being an athlete, but the fact that he's a member of a minority population. He says it's important for undeserved kids to see someone who looks like them doing science.Herida admits:

> **"For me it was huge. It wasn't until I saw that professor that I thought I could do this. She talks like me, and the connection I had, I could see myself doing this. Before, I always had this image of, 'If you're in science, it's because you are automatically smart and you know you want to do science.' Everyone I saw wasn't who I was. I thought, 'Why should I try it?' And there are probably other students who are like that too. If they see someone like me, they might think that they can do this too."**

What is about research that he finds so intriguing? He says that at first, it's about learning the technique, then after that, it's the challenge. "After that, it's fun," he admits.

And for Heredia, the challenge is part of the fun. The current challenge he's working on is the mutating HIV-1 which changes from an open to a closed form. "The fun part is trying all the different ways to solve this problem," he acknowledges.

He also says that while there's nothing like the emotional high of a major breakthrough, those don't come often. He admits this about research: "It does get frustrating after many failed attempts. That part is tough," but adds that researchers must help to buoy each others' spirits. "If you surround yourself with good people, you can't help but be happy. I'm lucky in my lab that we're all good to each other. We all have those down moments, but then we pick up each other."

He also adds that it helps to be an inherently optimistic person:

> **"You have to be optimistic, because you're gonna' fail a lot more than you succeed. But when you get that success…"**

He admits that another strategy is to take a short break from the big project and work on a small one that you know will be successful.

Heredia at his desk in Erik Procko's development lab.

What are Heredia's goals for the future, once he gets his PhD? For one, he doesn't want to be a faculty member; he just wants to be in the trenches doing research. And while he's really into HIV, and feels that in some ways, doing some other kind of research would be a waste, because he's learned so much, he's also realistic and knows that he needs a job. He would be happy with any biomedical research facility…maybe Genan Tech, in his home area.

While Heredia appears to be firmly entrenched in his life's dream of researching diseases, is there any chance he might return to his first dream, playing baseball? Probably not.

"Once they started throwing curve balls, I was done," he admits, "'cause the ball was coming at me!"

ENGINEERING AMBASSADORS' SPEAKING COMPETITION HELPS STUDENTS POLISH THEIR COMMUNICATION SKILLS

April 11, 2018

Illinois' Engineering Ambassadors (EA) are serious about being able to speak well in order to communicate to others about engineering. But they also want to help others, including those in other STEM fields, to express themselves well when they communicate. So on Saturday, April 7th, during the Engineering Ambassadors' Fourth Annual Speaking Competition—SpeakUp!—four finalists, armed with PowerPoints and well prepared by their EA mentors, stood before five judges and spoke for around seven minutes about the "Advancement of Technology in an Engineering Discipline and its Impact and Future Implications in Society." Their goal? To compete and win a prize, of course, but, even more importantly, to improve their public speaking.

Emphasizing one of the tenets of their organization—communicating skillfully about engineering—the EA students ran the competition completely, from making the application, to advertising, to recruiting the students.Those who wished to participate uploaded a video of themselves speaking about an aspect of technology in relation to their discipline. Then, during weekly EA meetings, the Ambassadors, along with EA co-founders and co-faculty advisors, Marie-Christine Brunet, Engineering's Assistant Dean for Undergraduate Programs, and Bioengineering Associate Professor Jenny Amos, watched the videos of the 10–12 applicants, then voted to determine which students would make the cut and compete as finalists.

Although the competition was open to both undergraduate and graduate students in any STEM major, the four finalists were Engineering students—three undergrads and, for the first time ever, one PhD student. Winners received cash prizes ($150 for first place, $100 for second place, $50 for third).

A panel of five prestigious judges, Illinois alumni, engineers in industry, and current faculty, evaluated the finalists using a rubric, which the contestants had in advance. The panel was comprised of: Roberta Branco, a manufacturing engineer who works at Caterpillar in Decatur, Illinois; MechSE Professor Bruce Flaschpart, who is also the Director of the Engineering Student Projects Lab; Jack Ingram, an ECE alumnus who is a technical manager working on hybrid automobiles at Delphi; Eddie Sun, a recent Illinois grad who is a technical assistant at Lincoln Laboratory in Massachusetts; and David Tewksbury, a Communication Professor and Associate Dean of LAS.

Also on hand to support and encourage presenters were friends, Engineering Ambassadors, and the finalists' EA mentors.

While the cash prizes were a nice perk and all four finalists loved the "thrill" of competition, they would most likely admit that it wasn't just about the money or competing. Like the 40 or so Engineering Ambassadors, they too were serious about being able to bujtter

Christina Ernst, winner of 1st place in the EA Speaking Competition, speaks about the use of technology during STEM education.

communicate their craft. And while the actual competition was exciting and probably nerve-wracking, it was also educational. It was the process they went through to get to this point that helped them hone their speaking skills.

For example, first, applicants created and uploaded a video of themselves speaking about a technology in their discipline. "So that they can shine," explains Brunet, finalists were then required to attend a workshop on how to communicate effectively, based on the technical communication class all Ambassadors are required to take. Brunet says the workshop component was added after the first year of the competition, when the quality of the talks was "good…but could have been better." So they decided, "Maybe we need to use our expertise and train them the same way that we train the Engineering Ambassadors."

For the workshop, finalists prepared material ahead of time on their topic for the competition, then, during the day-long training, learned different techniques and communication skills. They were also assigned an EA student who mentored them both during the workshop and afterwards, as they prepared for the competition.

"So it's a win-win," Brunet says of the whole process. "They grow and they learn different skills that are going to be useful not just for their little

EA Competition judge Bruce Flaschpart (right) asks one of the finalists a question during the Q&A portion of their presentation.

speech, but also in life. So, how do you communicate clearly, and use jargon, and organize your thoughts?"

Because one of the finalists was a PhD student, did that give him an edge over the undergrads? The two report that Engineering's curriculum emphasizes writing a lot, but speaking, not as much, so training on how to speak effectively is generally lacking for both undergrad and grad engineering students. "So that's kind of where we come in," says Brunet.

"Most students, even PhD students, don't get formal instruction how to present; you've just gotten by in life," Amos admits.

Marie-Christine Brunet (left) and Jenny Amos with their gavels.

Regarding the PhD student, Brunet says "He came to the communication workshop, and it was very interesting to see, even for a PhD student, how much they enjoy what they learn."

According to Amos, the feedback participants receive in EA training is key: "Our whole workshop is about trying, taking risks, and getting feedback," she acknowledges. "You're finally getting feedback on your speaking skills and tips on how to make them better. And

During her talk, Christina Ernst exhibits an E-Textile kit, which promotes learning about electronics as the user inserts LEDs and builds circuits into fabric.

it’s an iterative cycle, and that’s why it’s effective, even in that short amount of time. They practice; they practice; they get feedback. They practice; they practice; they get feedback.”

“They may have been presenting for years,” she adds, “but maybe no one told them…” for instance, about bad or annoying habits they’d acquired. So the training emphasized helping speakers root those out.

To accomplish this, Amos and Brunet have implemented some not-so-subtle, Pavolovian-esque conditioning techniques. Similar to the Gong Show's gong or American Idol's buzzer, one is designed to help participants overcome unfortunate tendencies, such as those ubiquitous, unconsciously-used crutch words—“You Know,” and “Um,” and “Like.” However, rather than a gong or buzzer, Brunet and Amos wielded brightly colored gavels!

Evidently another oft-used technique is “The photo.” This image of Amos and Brunet exhibitting frowns of disapproval is evidently often displayed as a deterrent. Both amelioration techniques were employed not just during the contest, but also crop up during EA events, such as the two-minute practice talks which start off their weekly meetings.

So did Amos and Brunet wielding their gavels impact any of the finalists for the better?

Christina Ernst, a junior in Computer Engineering, when asked about this just prior to the competition, was hopeful.

"I'd like to think so," she asserts. "We'll find out in a few minutes. The words always change, so as soon as you bash out the 'ums,' it changes to something else!"

Ernst also believes that she gained confidence via the workshop and mentoring. "I think being able to retain some of that poise is something that the workshop taught me." She adds that she also gleaned some helpful tips: "Things like putting blank slides in your PowerPoints so the audience just focuses on you—that's really helpful. And I think that was a new way of thinking about presentation that I hadn't thought about before."

Had all of the extra practice helped to lessen her fear of being in front of people? "Absolutely," she reports. "And I always think preparation is the best way to keep the nerves away, so that was really helpful to have the EA workshops and some help from the ambassadors too."

Ernst says she signed up to be in the competion because she thinks public speaking is really exciting.

"Of course, it's really scary," she acknowledges, "and I do still have that nervousness. It's just very exhilarating to be able to share your ideas with people."

And despite her assertion that public speaking is scary and that she still gets nervous, she evidently did a good job of sharing her ideas with those present—Ernst won first place in the competition.

Darren Liu, a junior in Civil Engineering, who won second place in the competition, reports that he signed up to participate because he loves competing.

“I'm a competitive person,” he reports. “I'm here in U of I engineering, so I figured, ‘Why not?’ It looked like a lot of fun!”

Liu also thought the topic, technology in one's industry, looked intriguing. “That's something I've always been really interested in,” he admits.

“I'm in construction management, which doesn't have the reputation of being very technological. But now, it can be. Robotics. In fact, that's what I'm going to be talking about today—using drones for progress monitoring on a job site, and combining those with different computer models.”

Like Ernst, Liu agress that the workshop had improved his speaking.

“That workshop totally changed the way that I look at making a presentation,” he admits.

“I used to have that very standard idea of what it should look like. The default PowerPoint theme, the bullet points. Using the assertion evidence method and finding good graphics for each individual image really helped me develop my presentation as a whole. Besides that, organizationally, it really helped me think about the flow of presentations from road map to road map. It's been great.”

The third finalist, **Chandler Bott**, a junior in Material Science and Engineering, reports that he signed up for the competition Because he’d had a bit of experience with public speaking in the past, and had never really gotten a chance to continue that in college.

According to Bott, the workshop emphasis that had really helped him was the part about how to make effective slides.

“A lot of my experience previously wasn't with presentations that have visuals,” he admits. “It was just pretty much just giving speeches. So having slides behind me was not something that I have a ton of experience with, so they kind of taught me how to effectively make good slides. I think

Darren Liu, a junior in Civil Engineering and winner of second place in the competition.

that was the most important part for me.”

The fourth finalist, **Kartik Hegde**, a PhD student in Computer Science, says he signed up for the competition because as a PhD student:

“It's important to be able to present the research effectively,” he acknowledges. “So I think by competing, I get those skills and reduce my stage fear and be able to present better.”

Like the other finalists, Hegde believes the workshop and training helped him learn, “how to make effective presentations,” and says he also gained “some intricate skills that I didn't know before. I think it helped a lot.”

So while one can see the obvious benefits for the finalists themselves, how does holding a speaking

competition every year help the Engineering Ambassadors. Amos and Brunet indicate that it's beneficial for EA students in a number of ways.

"One of the things that we like to do in Engineering Ambassadors," says Amos, "is not just impact the community and the university, which is our main mission, but also to develop our own engineering ambassadors and give them the chance to have an impact on others here on campus. I think this is a great way for them to engage with their peers, encourage them to come get trained, and present and showcase some of the skills they gained through the program."

Amos claims the Ambassadors gain a sense of pride through the competition. "They are able to show their friends what they do and the training that they've been through because they talk about it all the time." Plus they're able to give back—especially to the campus—by "paying it forward and having an impact here on campus that they could see," she adds, indicating that EA members usually impact mostly K–12 students, so "This is their opportunity to do something for the campus."

Learning how to mentor and reinforcing their own skills by teaching someone else are other positive impacts for the Ambassadors.

"You learn a topic better if you're able to teach it," Brunet acknowledges. "So I think the fact that they're trying to teach and to mentor a skill that they recently acquired is a reminder for themselves and a way of reinforcing the skills as you are practicing them and mentoring somebody."

Another plus? The competition helps the Ambassadors enhance their leadership skills. "This is something that they get a lot of pride out of doing," Amos continues, "and we're happy to take our Saturday to help teach this workshop. They organize the whole thing; they pick the participants; they mentor them; they set up the judges. So this is really their thing. It's nice for us to be able to watch them take the lead and organize something."

They're really improving their leadership skills," Brunet adds. "Some of them are better than others at delegating, but they're learning on the way. It's very interesting to see."

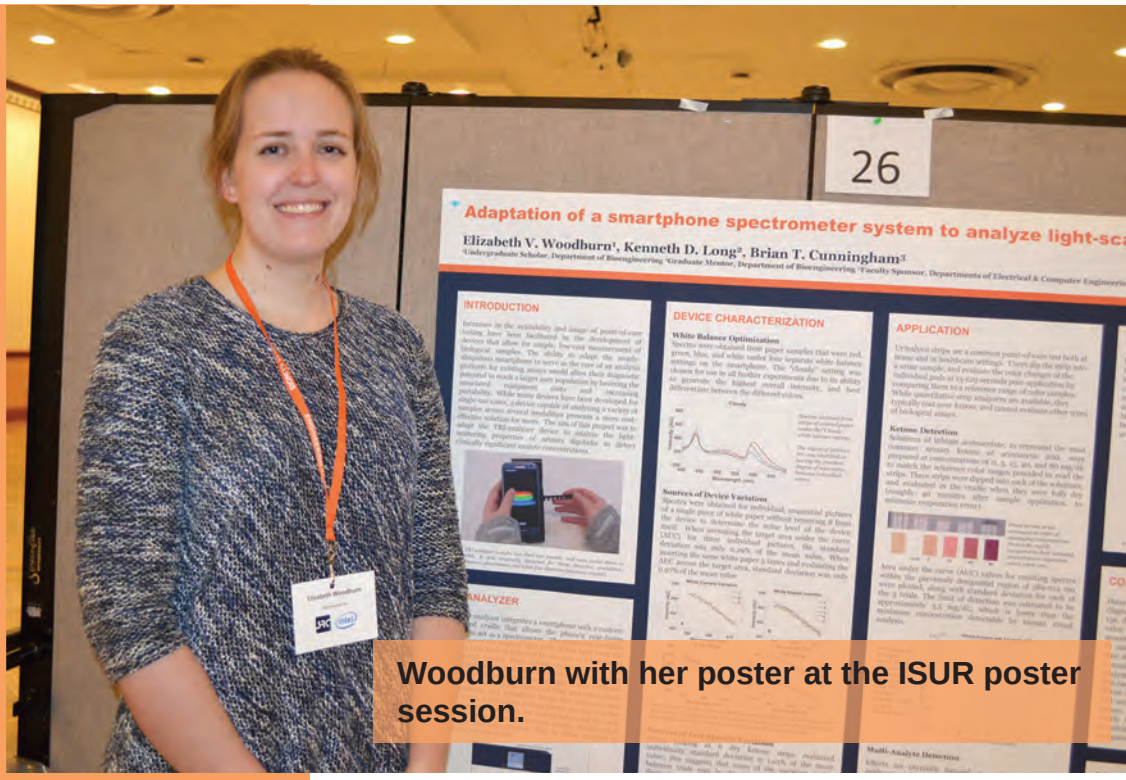
Chandler Bott, a junior in Material Science and Engineering.

The five judges and four finalists of the competition.

Kartik Hegde shakes hands with EA advisers Amos and Brunet when receiving his certificate.

THE (FUTURE) DOCTOR IS IN THE HOUSE: MEET AN ILLINOISAN IN THE INAUGURAL CARLE ILLINOIS MEDICAL PROGRAM

May 30, 2018



Woodburn with her poster at the ISUR poster session.

What do being a librarian and a doctor have in common? Elizabeth Woodburn has considered both as potential careers. But it is the latter that she will be pursuing as a member of the first ever Carle Illinois College of Medicine class. She is the one of two of her 32 peers to hail from the state of Illinois. Coming from Winnetka, IL, Woodburn graduated from the University of Illinois with a degree in Bioengineering this May. Although her parents encouraged her to look outside the state, she followed in their footsteps and became an Illini. At first, joining a large institution like Illinois seemed daunting, but Woodburn found what she calls "wonderful, small pockets of people within the big school".

As a type 1 diabetic herself, Woodburn had grown up around a healthcare environment and had first-hand insight into the medical perspective. Biology had always been her favorite science, and she knew she wanted her college major to be bio-focused. Her choice lay in deciding between engineering versus traditional hard sciences. The diverse nature of Illinois' BioE program attracted her because it allowed her to explore everything from medical devices to cell and tissue engineering.

She was first exposed to medical research as a high schooler, when she participated in a summer research program from 5 weeks at UIC where she worked with pancreatic islet cells. She continued to explore her interests in research as part of the Illinois Scholars Undergraduate Research program or I-SUR. Her research focused on creating a smartphone biosensor system that they have since named the tri-analyzer. It takes three expensive, benchtop instruments for disease detection and consolidates them into one portable, low-cost smartphone cradle. Her diligence led to her being featured on a publication as second author last summer. She is currently working on drafting her own first author publication. Woodburn hopes to have it published in the IEEE Sensors Journal, which is a biweekly peer-reviewed scientific journal, covering research on sensors. She counts herself as lucky to have found a project that tied into her interests in accessible and affordable healthcare, but more so in regards to seeing the same project develop through many different phases of development and gain a longitudinal perspective. This allowed her to be involved in several aspects of manufacturing and data analysis, to the point that she was able to lead her own experiments and only have to check in with her supervisor once a week.

Woodburn was also involved in clinical experiences during her time on campus. She was a part of Illini Emergency Medical Services, a student-led EMS group which she joined as a freshman. Over time, she rose to positions of leadership in the organization, in which capacity she taught EMT courses and helped run CPR outreach programs. Woodburn calls it an intensive course that leads to participants becoming state licensed healthcare professionals. She is quick to stress that they are not paramedics and do not start IV lines or incubate, but that they can assess patients, deal with trauma, and deliver

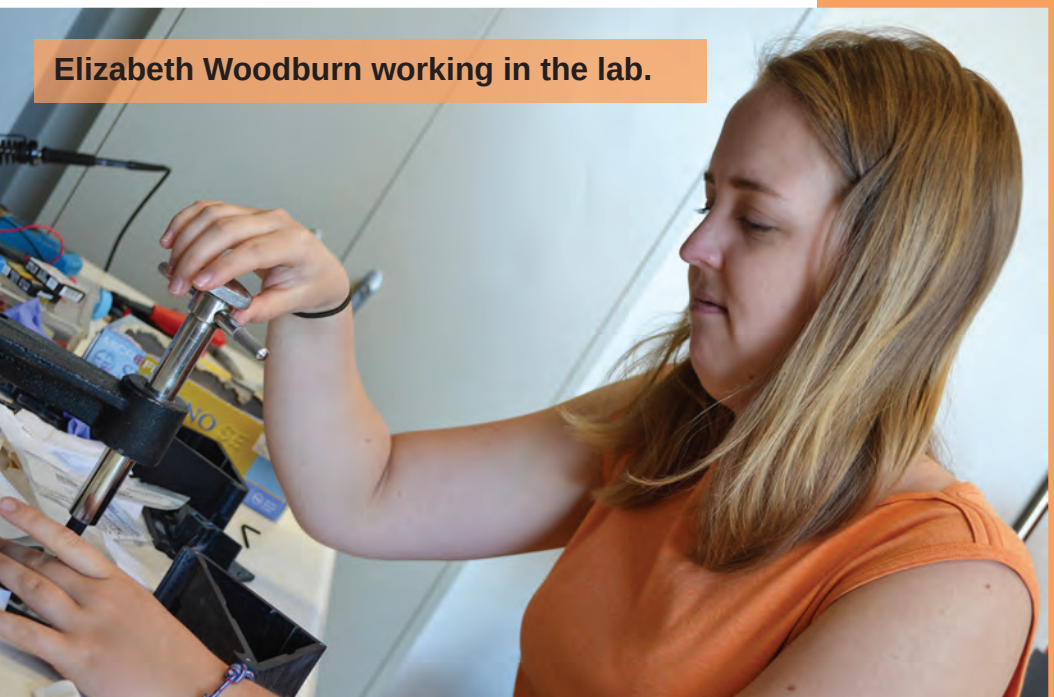
drugs. It also allowed her to explore her interests in healthcare versus technology. She has received the national award for excellent and fire service based EMS through Illini EMS, though it is no surprise that someone named Woodburn would win such an award.

Her summers were spent in an unconventional way, with Woodburn working at a YMCA camp in Michigan in a health clinic and as a wilderness EMT for the past 6 years. In her time there, the injuries she saw ran the gamut, ranging from broken bones to concussions to poison ivy. She also mentions children who came in with chronic conditions that needed regular maintenance medications and routine support while at camp. It is no wonder that she is exploring different pediatric subspecialties given her love of working with children.

Woodburn decided on medical school because spending so much time in a research environment made her realize that she did not just want to be limited to working in a lab, but rather interact with people and help them solve their health conditions. However, she did not want to simply practice medicine in a static environment. Being on the forefront of innovation and cutting edge technology was essential to her. The engineering-based curricula at the Carle Illinois College of medicine allows her to remain engaged with research, without having to do a full PhD. She had the opportunity to apply her knowledge and think critically about class content instead of simply memorizing it. In later years of their clinical rotations, students have to come up with a mini-design project idea to turn into a capstone project, which Woodburn is particularly excited about.

Since it is the first year of the program, Woodburn believes that the class will have a lot of say in giving feedback on the program to revise it for the next year. She is pleased at the prospect, as she is also interested in curriculum development. The hands-on learning based environment was another decisive factor, with the program claiming that students get patient experience starting from the first week there. Although it may start out as shadowing, students of the Carle Illinois program start patient-care a year sooner than most programs. They begin supervised, family medicine care in their second year. Woodburn's passion for conducting research and working with people is undeniable, and her track record indicates a future that (wood)burns bright!

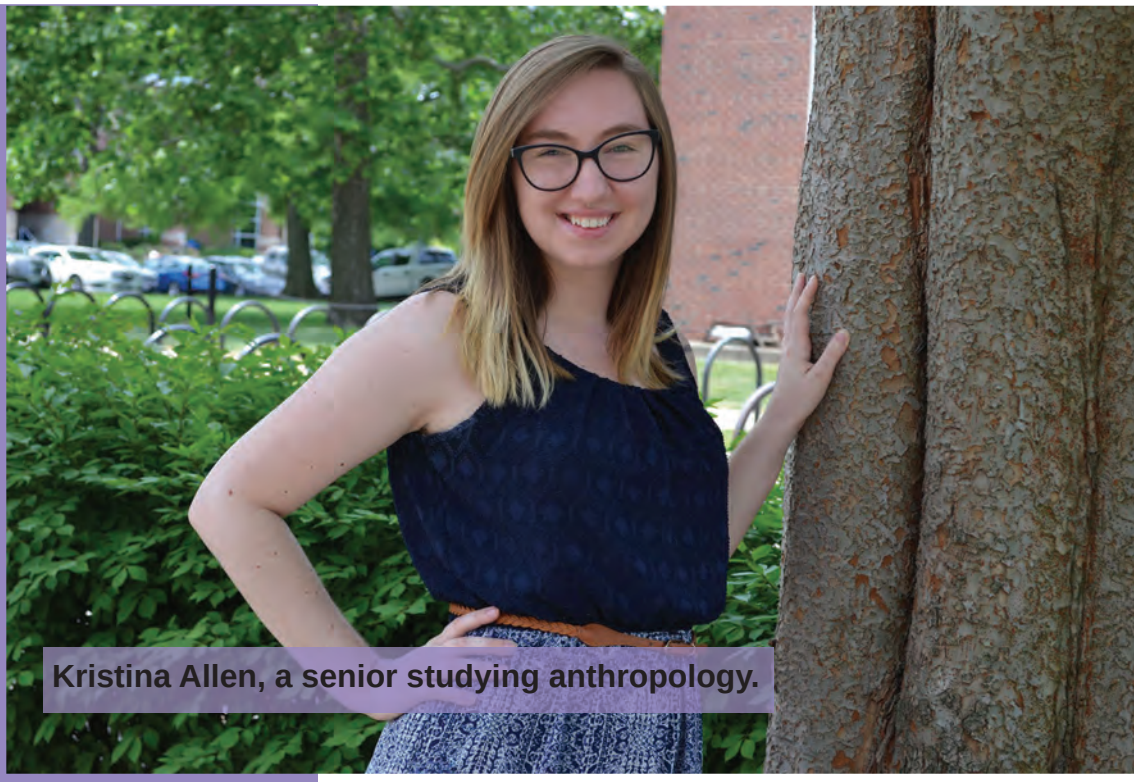
Elizabeth Woodburn with her smartphone biosensor system.



Elizabeth Woodburn working in the lab.

BY WOMEN, FOR WOMEN: KRISTINA ALLEN DISCUSSES HER RESEARCH IN WOMEN'S HEALTH

June 7, 2018



Kristina Allen, a senior studying anthropology.

When most people think of anthropology majors, they may not picture them in a research lab. But rising senior Kristina Allen doesn't let stereotypes cramp her style. She studies biological anthropology, which explores concepts ranging from human evolution to human biosocial variation from a scientific perspective. Her research focuses on reproductive ecology, and she jokes that she may be the first woman to ever say, "I love menstruation." Allen held a love for science throughout her school years, and originally wanted to be a doctor, but switched out of premed after taking a few anthropology courses and realizing that her passion lay elsewhere. She seems to have found her niche, saying "I love what I do now."

Allen stumbled upon her current research laboratory when she was seated at the same table as Dr. Kathryn Clancy, an Associate Professor in the Anthropology department at the University of Illinois, at a meet and greet organized by the department. Allen had just transferred into anthropology at the start of her sophomore year and knew she wanted to get involved in research. She had been looking at the ongoing research in the department, and when she shared her interests with Dr. Clancy, the latter invited her to come work in her lab and from there began a rewarding working relationship.

Dr. Clancy's lab studies how environmental factors such as lifestyle, diet, different exposures affect the menstrual cycles of healthy women. The data are collected from two different populations of women, women from rural Poland and Polish-American women from the Champaign or Chicago area. The study begins with an extensive survey about factors the women were exposed to while growing up, such as having childhood pets or working on a farm while growing up, as well as health factors such as their family history of cancer. A lot of the questions are focused on energetic activities, because women from rural Poland engage in a lot more manual labor than American-Polish women. They then move onto collecting urine samples across the whole menstrual cycle from the first day of menstruation to the first day of the woman's next cycle. These are used to measure all kinds of hormones and the precise timing of ovulation. The researchers also collect saliva samples to genotype the individuals. This is mainly the area of expertise of one of the graduate students in the lab who studies epigenetics, which refers to differences in people resulting from variance in gene expression rather than changes in the DNA sequence itself.

The lab collects data for the Polish population by physically going to Poland. Graduate students are usually sent on these trips, while the American-Polish subjects are usually recruited from the campus population. They do have specific criteria for the participants in their study, such as the subjects not being on any type of contraceptive, being either first or second generation Polish-American, being non-smokers, and obviously not being pregnant or breastfeeding, as the lab is studying menstruation.

Thus far, the lab has found that women from Poland tend to start their menstrual cycles at an earlier age than Polish-American women. They hypothesize that this variance is caused by the difference in activity levels between the two study populations.

Although being involved in research is often a necessity for those who plan to go to graduate school, Allen's reasons for doing so are more noble. Besides making her feel like a part of something bigger, she says:

Kristina Allen pipetting samples in the Clancy Lab.

"By being able to do research, I am contributing to the scientific community in the only way that I really can, because as an undergraduate student, I can't go out and do some crazy research and write this huge paper."

She is wary of going to graduate school and becoming a professor because she feels that they are often caught up simply writing grant proposals and helping other people do their own research rather than being in the lab themselves. Her own faculty supervisor, Dr. Clancy, conducts independent research on women's issues like sexual assault and harassment in the sciences, but does not work in the lab with Allen and the rest of the graduate students anymore. Allen vehemently opposed to the idea of being a "proposal pusher." This has led her to consider industry positions, so she is not pigeonholed based on her research pursuits.

Her time conducting research has shown Allen new ways of thinking about knowledge. She remembers going to her research team once and telling them about feeling overwhelmed by all she did not know. Dr. Clancy turned it into a learning experience, saying:

"That's the first step in knowing more. You know what you don't know, so you can go do research and figure out more."

Kristina Allen working on the computer.

Kristina Allen pipetting samples in the Clancy Lab.

That exchange broadened Allen's perspective, and she now believes that even findings that may seem like small contributions to the body of knowledge on women's health at first can make a large impact on the lives of many women in the future. She also credits her lab experience with teaching her how to conduct herself in a professional environment, while introducing her to the scientific community at large. Allen mentions following one of the graduate students in her lab on Twitter, indicating that the posts are mainly science-based or related to social issues, which showed her how science and women intersect today's social sphere.

During her last year, Allen will continue taking coursework, and plans to write her honors thesis which will make her eligible for departmental distinction. She will be studying various scientific methods in determining time of ovulation. The most accurate way to do so involves undergoing an ultrasound to measure the follicles of the ovaries. However, this means doing the ultrasound exam every day, which can get time-consuming and cumbersome. Allen is comparing other methods such as measuring luteinizing hormone which is usually used in home ovulation test kits, or looking at the ratio of estrogen to progesterone present. This comparison is made by taking urine samples and using these methods to predict when the women ovulated, and then seeing how variable they are. The implications of this paper could be far reaching because there is currently no set standard in research. If researchers are getting different ovulation times based on the method they use, it could be significantly impacting the results they find in their respective studies. Allen is excited about writing the paper, because the graduate students in the lab and the PI, Dr. Clancy, will be reading it over and editing it with the aim of publishing, which will allow her to be first-author on a published paper by the end of her senior year.

Allen plans to take a gap year before going to graduate school. During that time, she wants to continue working in a lab setting to further hone her skills, either as a lab technician or a phlebotomist in a hospital. She knows that she will continue working in the field of women's health given her interest in reproductive ecology. Allen leaves us on a high note, encouraging undergraduates to take advantage of the many research opportunities available to them at the university saying:

"I think everyone should try to do it. It seems very daunting at first, but it will really help you in the long run and it's a great experience to have, especially to make connections."

AEROSPACE ENGINEERING JUNIOR SUZANNE PETERSON RETURNS TO G.A.M.E.S. CAMP

June 13, 2018

Most undergraduates rarely get an opportunity to participate in an immersive experience relating to their future career paths as early as high school. But rising senior Suzanne Peterson is a 5-time veteran of the University of Illinois G.A.M.E.S. camp, having first attended when it was still open to middle school students. Girls' Adventures in Mathematics, Engineering, and Science (G.A.M.E.S.) is an annual, week-long event which allows high school girls to explore scientific ideas through demonstrations and activities. This year, Peterson will be on the other side of the event as a lab assistant who teaches several classes and sessions. Her own experiences at these camps as a young girl opened up the possibility of studying engineering, and she wants to pay it forward, saying, "I'm really passionate about outreach, and I would like to be [an inspiration] for somebody else."

Peterson has participated in two computer science camps, a robotics camp, GLEE (the electrical engineering camp), and of course, the aerospace camp. During the summer between her freshman and sophomore year of high school, This last camp was responsible for igniting her love of aerospace engineering. When she attended the robotics camp the next year, she realized that although she enjoyed robotics, aerospace made her heart soar. Her favorite part of the aerospace camp was going to the airports, getting into the smaller planes, and touring their facilities.

Although the rocket she built at that camp did not go the highest, it did go the farthest, though she attributes this to the wind. She calls her rocket "the coolest thing ever" and laughs about her greatest innovation on the piece being that she spray painted it gold.

Peterson has always loved airplanes:

"I thought [airplanes] were very interesting in how they managed to stay up in the sky when they're so heavy and all the people are on them. I always wanted to try to figure out how that all worked."

Suzanne Peterson in front of Talbot Lab, which houses the Aerospace Department.

She credits her interest in the field to an Earth Science course she took as a freshman in high school which piqued her interest in astronomy, and by extension, the possibilities in space and air travel.

Peterson matriculated to the University of Illinois through the Parkland Pathways program, which allows students to take classes at Illinois while enrolled at Parkland College (at the tuition rates of the latter). She took one course at Illinois every semester while at Parkland for a total of four classes. While her Parkland classes were mostly general engineering courses, taking the aerospace classes at Illinois before she enrolled made the transition

Suzanne Peterson sits next to campus icon Grainger Bob, who watches over Bardeen Quad in a bench just south of Grainger Library.

easier, both academically and socially. Since coming to Illinois, she has taken further coursework in structures and composites. Peterson hails from Monticello, Illinois, a mere 20 miles away from the Illinois campus.

She enjoys going to school so close to home because it allows her to see her family, but more importantly for every college student, lets her do her laundry for free.

Peterson's current research is in composite materials, which she hopes to continue working with in the future. She works with Dr. Philippe H Geubelle in the Computational Mechanics Group, where she is working on a computer code that analyzes the instabilities of one of their projects.

It is a new way to manufacture composites instead of just vacuum sealing it and putting it in an autoclave for 12 hours, wherein it shoots a high temperature front at the parts which cures them faster. Peterson believes that while the composites are as sturdy as they would be if made in the traditional way, there is a lot more research to be done on that front.

Peterson plans to start working on the industry side after she receives her degree, although she is considering the option of graduate school in the future.

She worked as an au pair in Spain last summer, and her host family had a cousin who worked at the aeronautics company Airbus in Madrid. Seeing that the company has opportunities all over the world, and her experience living in Spain itself has Peterson considering a career abroad. Whichever path she chooses, the solid foundation her experiences at Illinois have given her will serve her well.

REACH PROGRAM'S EMPHASIS OF RESEARCH PLUS CLINICAL CONFIRMS ALEXIS CHAMORRO-ORTIZ'S CAREER GOALS: TO BOTH TREAT AND RESEARCH CANCER

Chamorro-Ortiz examines a sample while conducting his research.

July 18, 2018

"I'm not going to be one of those people who say, 'I'm going to cure cancer,' but I want to help to develop treatments for those people." – Alexis Chamorro-Ortiz

Alexis Chamorro-Ortiz didn't just wake up one morning and decide he wanted to spend the summer after his sophomore year at the University of Puerto Rico doing cancer research at Illinois as part of the REACH (Research and Education for the Advancement of Compassionate Health Care), a new USDA-funded RCEU (Research Experience for Undergraduates with an added clinical component). For most of his childhood, he had watched his grandfather first overcome a brain tumor, then lose his battle with brain cancer when Chamorro-Ortiz was a freshman in high school. "He passed away so quickly, and it made me want to help other people who are like my grandpa," Chamorro-Ortiz explains.

Chamorro-Ortiz has loved both science and the arts since he was little. In middle school, he focused more on the arts side, but when high school rolled around, science won out. He participated in scientific competitions and research. Then, his senior year of high school, he got to do a pre-college research program, "and that's what really made me fall in love," he acknowledges. "They polished me up for life as a researcher, and it was an amazing boot camp. It's what ultimately led me to want to do research on top of medical care. I just feel like it's fulfilling."

So when the REACH offered him a chance to participate in its inaugural cohort in a program designed to give underrepresented minority students both a clinical experience and a research opportunity, and when he discovered that his research would help to prepare him for his dream job—researching cancer treatments—Chamorro-Ortiz started some research of his own: looking into flights to Illinois.

"When I was notified that I was accepted into this special program, I felt somehow special," he admits.

Upon receiving the information about the program, he looked the program up online and saw that Carle-Illinois is a new College of Medicine and that he and his cohorts are the first class of the REACH program.

He says:

"With all these things, to just be chosen and be these special five, and not only have the opportunity to do research but to also work at Carle Hospital and do all these different things, I think is very important. It is a great opportunity for undergraduates.

Chamorro-Ortiz' research in Professor Michael Spinella's lab was trying to find a correlation between ATP-binding cassette transporter gene and resistance to a drug, Cisplatin, a chemotherapy medication used to treat cancer and testicular germ cell tumors. Around 15–20% of patients develop this unknown resistance to the drug. He explains

that they were working with different cell lines which would then be translated to human research.

How did his lab assignment so perfectly match his research interests? Chamorro-Ortiz explains that during the application process, they had to write a statement of research interests: “I'm guessing the people at REACH program just tried to match us as well as they possibly could and they obviously did a perfect job with putting me in Spinella’s lab working with cancer!”

Chamorro-Ortiz and his fellow REACH cohorts have been kept quite busy. They were in the lab eight hours a day, four days a week doing research. For the clinical component, on their “day off” from the lab, they spent the morning shadowing Dr. Kevin Teal, a neurosurgeon in the Carle Clinic Spine Institute. When Dr. Teal gave the students the opportunity to watch him perform a spine surgery, Chamorro-Ortiz was the first one to experience it.

“It was just great,” Chamorro-Ortiz reports. “I thought I would be way far in the back, because obviously surgery is very delicate and all these things, but Dr. Teal is just great, and he pulled me closer, and I was right next to him, and he just said to be careful. I was right there in the OR next to the patient. It was a great opportunity.”

Chamorro-Ortiz working in the Spinella Lab.

“You read about all these things in textbooks,” he adds, “but seeing them in person is just so different.”

Chamorro-Ortiz and his cohorts also had additional workshops, such as SROP training (a research writing course on Monday evenings and professional development on Wednesday evenings), as well as weekly research team meetings. The program wasn’t all work, though. Chamorro-Ortiz reports that some of the social events included luncheons and days in the park.

Plus, since the Carle-Illinois College of Medicine not only focuses on engineering, but also social sciences and the humanities, REACH participants were also to incorporate the humanities/social sciences into their end-of-program presentations. Chamorro-Ortiz had chosen to look at the psycho-social afflictions trans-women develop when they acquire testicular cancer. After talking about his research idea with Professor Toby Beauchamp in Illinois’ Women and Gender Studies Department, Beauchamp recommended that Chamorro-Ortiz postpone the study until the fall, since his question was so broad that it would be difficult to include it this summer. Beauchamp even offered to serve as Chamorro-Ortiz’ advisor for the project this fall. So starting in August, Chamorro-Ortiz will be working on that, even though he will no longer be at Illinois.

What did Chamorro-Ortiz like most about the experience? Other than “obviously, the research opportunity and the clinical side of things,” Chamorro-Ortiz says his favorite part of the summer was the people. He called being around “so many different but incredibly smart people amazing.” He explains that they all became close friends, but not in the way one normally chooses friends, “Here, we're kind of pushed into a group because we all have an interest in research and different things that somehow intertwine with each other. Just the fact that you get to meet with those people and become friends...This program has brought a lot of people closer together, and I think that's one of the best parts of this program.”

Some other people he grew to appreciate were the

Chamorro-Ortiz explaining his poster to Ruby Mendenhall (left) and Lisa Goodpaster (middle)

REACH program leaders, especially Ruby Mendenhall and Lisa Goodpaster. “Working with all these people has been amazing, because they not only have given support over all, but I feel like since we’re only five people, they've actually taken care of us, and it's like a home away from home. Even through all the harshness, such as homesickness, we know we have people to rely on and who are always there to help us.”

Along with all of the things he learned over the summer, Chamorro-Ortiz says he also learned some things about himself.

“This program really opened my eyes to all the things that I'm capable of doing,” he says. “It's not meant to be a stressful situation, but all the work induces stress on you. But just the fact that I could get a hold on things and actually do things and get positive feedback towards them was great.”

Despite the stress (he admits that the program “has been a lot of work”), Chamorro-Ortiz believes it not only helped him to learn and grow, but also reaffirmed his career goals. “I feel like my research includes higher level biology courses, and I have only finished my general biology course. Getting here and learning about all these different things that usually seniors or graduate students learn about, it's great. It really confirmed what I wanted to do.”

What’s up for Chamorro-Ortiz down the road? A lot of changes. Having completed his sophomore year at the University of Puerto Rico, he’s transferring to University of Central Florida where he’ll be a junior this fall. Also, although he’s been majoring in chemistry, after he transfers, he’s going into biomedical sciences. Regarding research, while he’ll be focusing on his research with Beauchamp in the fall, starting in January, he plans to work with the biomedical scientists at UCF.

So for him, personally, since he will be moving from home and transferring to Florida this fall, another benefit of REACH was that it has served as a “halfway milestone to start living independently. This was a chance to grow and get ready for what's coming,” he admits.

What are Chamorro-Ortiz’s long-term education/career goals? Actually very similar to the research + clinical emphasis of REACH: he wants to get an MD/PhD, and also impact students the way he himself has been impacted.

“That's actually why I love the REACH program, because I get to do both sides. I see myself working in a hospital as an oncologist. I feel like I have this renaissance point of view, because I want to do so many things. I wanna have my own research lab and have students work under me, and give undergrads the opportunity to experience things like [I did this summer]. I want to help them push themselves and give them that platform, especially students of color.”

Alexis Chamorro-Ortiz, a 2018 REACH participant.

UNDERGRAD BRIONE GRIFFIN GETS ONE STEP CLOSER TO HER DREAM OF BECOMING A DOCTOR VIA REACH RCEU

July 25, 2018

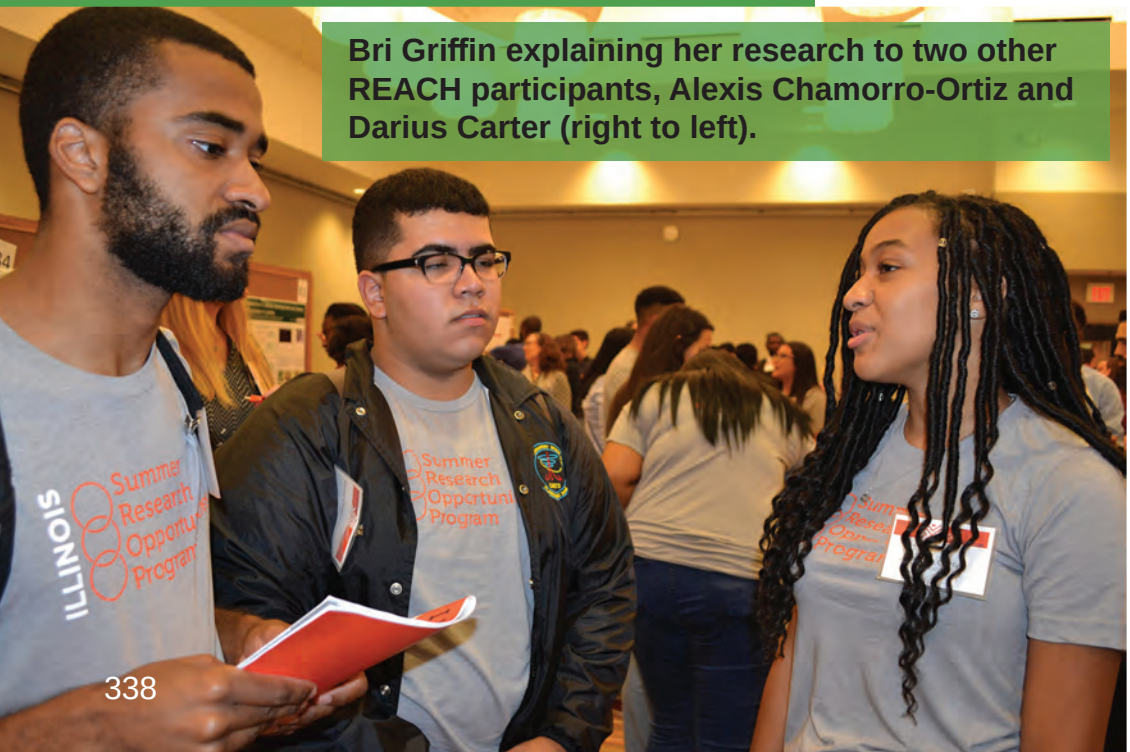
Brione Griffin's career goals have always been "to be a doctor—to be a doctor and help people out." So when she learned about REACH (Research and Education for the Advancement of Compassionate Health Care) RCEU (a Research Experience for Undergraduates with an added clinical component), which is sponsored and funded by the new Carle Illinois College of Medicine, she was intrigued.

REACH participant, Bri Griffin.

"I think it's something I've loved all my life," Griffin says regarding her passion for science, biology, and medicine. She shares an anecdote about how she got interested in those.

"When I was younger, my cousin was in a car accident, and I remember being at the hospital and people being concerned about whether she'd make it or not, and just watching the doctors and how hard and how diligent they were working with her. And it just made me feel like this is something that I would want to do. And I've always just had a passion for helping people, so I feel like the medical route [would help me do that]. I never knew what kind of doctor I wanted to be, but I just knew I wanted to be a doctor—be a doctor and help people out."

It was her dream of becoming a doctor that brought Griffin to REACH. A rising junior majoring in human biology at Michigan State, she was interested in doing research and was looking into a lot of programs. Because she's not sure if she wants to go to graduate school or medical school after graduation, she thought the REACH program was a good fit because it allows clinical exposure, plus exposure to the graduate college as well.



Bri Griffin explaining her research to two other REACH participants, Alexis Chamorro-Ortiz and Darius Carter (right to left).

The clinical component turned out to be one of the highlights of the summer for Griffin. She remarks, "I love the clinical part; it's my

Bri Griffin explianing her research to Lisa Goodpaster and Ruby Mendenhall (right to left)

favorite part. I love everything. I'm glad I made my decision to come here."

Of course, she loved shadowing Dr. Kevin Teal, a neurosurgeon in the Carle Clinic Spine Institute. "It's been amazing," she reports. "I actually got to go watch him perform surgery last week, and it was super, super cool. I got to stand right there while he performed the surgery. He was removing bones from the spine to relieve pressure on the back."

Did seeing the blood get to her? "No, not at all," Griffin asserts, which is key since Griffin wants to be an OB-GYN.

In fact, when she shadowed Teal, she told him of her interest in the area, so he checked around to see if he could find an OB-GYN colleague she could watch. While she didn't get to see a baby delivered, she did get to watch his colleague remove a patient's fallopian tubes. "So that was pretty cool!" she remarks.

She indicates that the research component, while a really good learning experience, was a bit overwhelming. She says it was "definitely a new experience, because I've never done anything like this before. In the beginning, I felt a little intimidated as someone new going in, not doing any of this before. But the people in my lab were so helpful and so welcoming."

Her research in the lab of Dr. Rashid Bashir focused on improving the multitextation of protein analysis to develop a point-of-care device to detect biomarker sepsis. What did she think about working in the lab of such a world-renowned researcher as Dr. Bashir? She reports, "After the first time I met him, and I went back and did my research on him, I'm like, 'Yeah, I probably won't be seeing him a lot.'"

One of the challenges Griffin encountered this summer was being away from her family. She grew up in Canton Michigan (about 30 minutes from Detroit), and went to Michigan State, about an hour from home. So she admits to being homesick this summer.

"I've never been this far away from my family for this amount of time, so that's been kind of tough, not being able to see my mom or dad or my sister." Another thing she missed was the home cooked meals. While she's used to living in a dorm and dorm food, because she goes to school so near home, she goes home once a month or every couple of weeks.

Another challenge was making the poster. While she's taken lab courses where she's had to make a poster, it's usually been a team effort. "But I've never done one all by myself, so it's been kind of tough, trying to put it all together." But she says the people in her lab have been very helpful, very hands-on.

Her favorite part was definitely the people. "Being able to meet so many different people from all over the country that I never thought that I would have the opportunity to meet. That's definitely the biggest part. And just being around people similar to myself, who have similar goals and want to do similar things; it's been a really good learning experience."

Griffin's future plans include medical school, obviously, since she wants to become a doctor. However, she is thinking of taking a "gap year" and going to graduate school.

Might Griffin show up at Illinois in a couple of years to be a part of the Carle Illinois College of Medicine? Maybe. While she thinks she'd like to stay close to home, she says, "I will definitely apply here. The hospitality and how great it's been here, I will definitely apply here."

SPIN INTRODUCES SHELANA MARTIN TO CYBERSECURITY AND THE OPEN SOURCE PLATFORM, MOODLE

September 4, 2018

How did Shelana Martin, who's not a computer science major, end up in an NCSA internship? The rising senior in education technology under the College of Education's Learning and Education Studies program was part of NCSA's SPIN (Students Pushing Innovation) internship program. SPIN fosters interdisciplinary collaboration, encouraging Illinois undergraduate students, and not just computer science students, to do challenging research related to cutting-edge new technology. The new technology Martin learned was Moodle, an open-source learning management system. Plus she also learned quite a bit about cybersecurity too.

Shelana Martin outside the Education Buiilding.

For Martin, who has a background in astronomy, a minor in informatics, and is majoring in education technology, the SPIN project retrofitting cybersecurity facts into an engaging educational technology format was a perfect fit. "The project kind of encompasses all three," she says regarding its alignment to her various studies.

Begun in 2012, SPIN was designed to not only encourage undergraduates to tackle cutting-edge research mentored by world-class researchers on campus, but in doing so to provide access to new technologies such as high-performance computing, data analysis and visualization, or cybersecurity, and possibly NCSA's Blue Waters supercomputer.

Regarding SPIN's interdisciplinary emphasis, according to its director, Olena Kindratenko, NCSA's Education and Outreach Coordinator, most of the projects are interdisciplinary in nature, using computation to solve problems in non-technical areas.

However, Martin's research this past summer was using technology to teach about technology; she was tasked with converting not-so-interesting content on cybersecurity into immersive and interactive content on a platform called Moodle.

Martin explains why the content needs to be more exciting:

> **"Well, because it's important."**

The idea is that users wouldn't just glance at the content.

She explains what the idea is:

> **"[To] actually read the content, and engage with the content, and honestly become aware of any different type of habits they might have."**

She says certain information could be useful when they're creating a password or trying to figure out if their browser is safe or not for them to use. "The content itself is really amazing!" she claims.

Thus, her goal this summer was to make the content more interactive using the Moodle learning management system, often used on campus by various courses. She describes several strategies she employed in an effort to encourage users to actually engage with the content. For one, they could click on a video and answer questions that are in the video. Or, instead of reading a paragraph, a user could drag and drop words to get immediate feedback "to see if where you put those words was correct or if the information was something you could take and apply to your daily life." Her Moodle website also provided links to different sites for information about cybersecurity and how to secure one's PC or laptop.

Might someone who is concerned about cybersecurity (like me, the author of this article and a non-student) access this site in order to learn more about cybersecurity? As of right now, no. However, once the information is fully converted to the Moodle website, Martin hopes to have self-enrollment which would allow the general public to access the information to their own benefit.

Martin reports that one of the challenges she faced this summer was using Moodle itself. Even though she had used it previously for different classes at the university, she says there were a lot of functions she had never used before that she had to become familiar with.

“I had to kind of dive into all of the different tools and learn what each tool can do and possibly make that content more interactive, so it was a bit of a learning curve. But the good thing about Moodle is, it's very content and tutorial based.” She says the platform’s tutorials walk a beginner through each tool, giving examples about how each tool can be used.

Plus, she says that even though she’s from a technology background, she doesn’t have a lot of background knowledge on cybersecurity.

Martin admits:

> **“Maybe [it] could've helped if I’d known a little bit more,” in terms of converting the content to “make it more immersive and get the content through to the learner. But honestly, because I have a little bit of information because my minor is informatics, I'm able to kind of gauge if that content is being used properly and if it is more effective for me to use a certain tool or not to make it more interactive.”**

So did she learn a whole lot more about cybersecurity this summer? “Yes, I did. I need to change some of my own passwords,” she confesses.

Martin indicates that the biggest thing she learned this summer was how to create content and how to make it more immersive on an open source learning management system. She says that a lot of times during her academic career, she’s been able to create lessons on other different platforms.

“But it was my first time working with Moodle and so learning how Moodle works, learning different tools, learning what type of things I can do moving forward to make content, even if not on Moodle, that was very interesting. And being able to kind of throw myself into something that is new to me, but isn't a new topic.” She also appreciated “being able to learn about cybersecurity myself, and also how to use that information to make it more interactive and immersive for a learner.”

Regarding what impact her experience this past summer has had on her skill set, she reports that it definitely gave her a little bit more expertise in these types of management systems, and being able to convert any type of tutorial content, and not just cybersecurity.

“I think it will give me a leg up on how to make certain content more interactive versus being a read-and-go type of content. So I think it's definitely a skill I've developed doing this project—being able to use this website and being able to take content and change it around.”

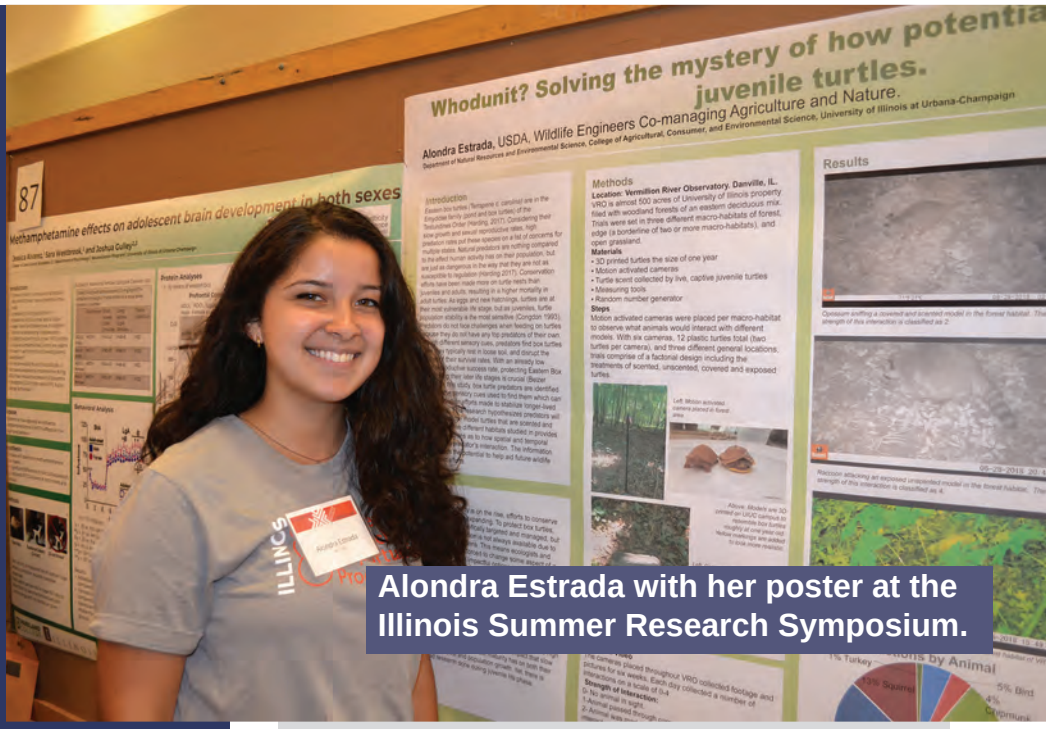
Martin’s career plans include grad school in education and design, still working in technology and education. “I kind of want to focus on educational policy,” she explains.

Shelana Martin with her poster at the end-of-the summer Poster Session at NCSA.

NRES JUNIOR ALONDRA ESTRADA PASSIONATE ABOUT ENVIRONMENTAL SCIENCE, RESEARCH, AND…TURTLES!

September 11, 2018

Growing up in Adison, Illinois, Alondra Estrada, a first-generation Hispanic college student, wasn't even sure she'd be going to college. Then she came to an Illinois summer camp and, as a result, changed her mind about becoming a veterinarian and decided to study environmental science instead. Then, for the last two summers, she participated in the WE CAN REU, which further muddied the waters regarding her next step careerwise. Should she become an animal photographer, go to grad school in environmental science, or go for her dream job, an environmental lawyer? While she isn't sure what the future holds, she does know this: her many experiences have given her a lot of great career options.



Alondra Estrada with her poster at the Illinois Summer Research Symposium.

While she hasn't always been interested in environmental science, she says she's always enjoyed being outside in the major parks near where she grew up. She started getting interested in science in middle school as a result of taking more science classes. Plus, though her high school only required a certain number of science courses, she decided to take an extra year, an AP environmental science class, which was her first real educational connection with the discipline.

Then, the summer before her junior year in high school, she came to the Ag Discovery program here at the University. It was because of that program that she switched from planning to study Veterinary Medicine to NRES (Natural Resources and Environmental Science).

The thing that intrigued her about environmental science was the material.

> **"I liked the way everything was on the micro and macro scale, and it all interconnects in some way. It's not something that's technically made up like math or economics. It's not something that people created; it's something that we're learning from and still learning from. I just really like that idea of it."**

While she visited other campuses, she also credits the Ag Discovery program with her decision to matriculate to Illinois. "That program just made me feel very comfortable here," she admits, "so because I already had a feel for the campus, and some of the staff, it just kind of made it an easier, more comfortable choice to make." Plus, she also likes that it's not far from home.

"It provides a lot that I never even thought possible, so I have no regrets with my decision," she says.

For instance, one really great opportunity she's had while here at Illinois was participating in the NSF-funded WE CAN REU (Research Experience for Undergraduates) for the last two summers. The first summer she was on campus for six weeks prior to a 4-week trip to South Africa. The second summer was conducting research.

While on campus during the first summer in WE CAN, participants were to explore the different kinds of research they might be interested in doing the following summer. They were tasked with meeting researchers who might be willing to serve

as mentors and allow them to help with research in their labs.

Estrada says that once she met with Jinelle Sperry, however, she cancelled the other meetings she had set up, telling herself, “This is it; this is what I've been looking for.”

Sperry works with amphibians and reptiles, particularly snakes and turtles, as well as birds, studying community-level ecological interactions with a focus on predator/prey dynamics.

Estrada’s project was a side project to help with the analysis of her mentor's main research project about different turtles in different habitats. “My job was to figure out how predators are finding them,” she explains.

While Estrada didn’t ever run across a turtle as a kid, she’s pretty passionate about them now. In fact, she did some work on her own time this spring, before her fellowship had even started, just swabbing the turtles: “That was fun, because I got to see all the turtles that were going to be put out in the field in Michigan,” she explains.

Although her WE CAN fellowship ended this summer when she presented her poster at the Illinois Summer Research Symposium, since getting back on campus, she’s been “getting back into thue rhythm” doing some computing in order to finish her data analysis from this summer's research.

While participating in WE CAN didn’t necessarily help her decide on her career goals, Estrada says it definitely impacted her future plans. She says she had been wrestling with several different ideas regarding what she'd do after college—whether to go to grad school, or get a job, or follow her dream and go to law school. But she acknowledges that “This program really helped me plug in to a realistic perspective and really face reality that time is running out, I need to start doing all these things…I mean the next step. I've always been, 'Oh, it'll work out. I'll figure it out later.' But this program was, 'No, there's a time schedule you should work through.'”

Alondra Estrada near the ACES library on campus.

In addition to a sense of urgency, the WE CAN program taught her what a career in research is like, indicating that it:

> **“definitely helped me realize how intense the science research field is.”**

It also opened up a world of opportunities that are available to her, making her career decision even more difficult.

She explains:

> **“But honestly, I don't know if that helped me think about if I want to go to grad school, if I want to go to law school, just because it opened up so many more opportunities for me, that I'm so torn.”**

Did Estrada ever think when she was a kid that she'd be doing some of this stuff? “No. Growing up, I was never sure if I would go to college, just because of being a first-generation student...so I'm very lucky to be here. I never thought I'd be doing things like this. I never thought I would go to South Africa. I never imagined meeting the people I've met so far, building some friendships with professors like from the WE CAN program.” (Regarding many of these relationships she’s made with professors, she intends to keep in touch. In addition to enjoying the relationships she's built, she figures that within the next couple of years, once she makes that career decision, she'll be needing some good letters of reference!)

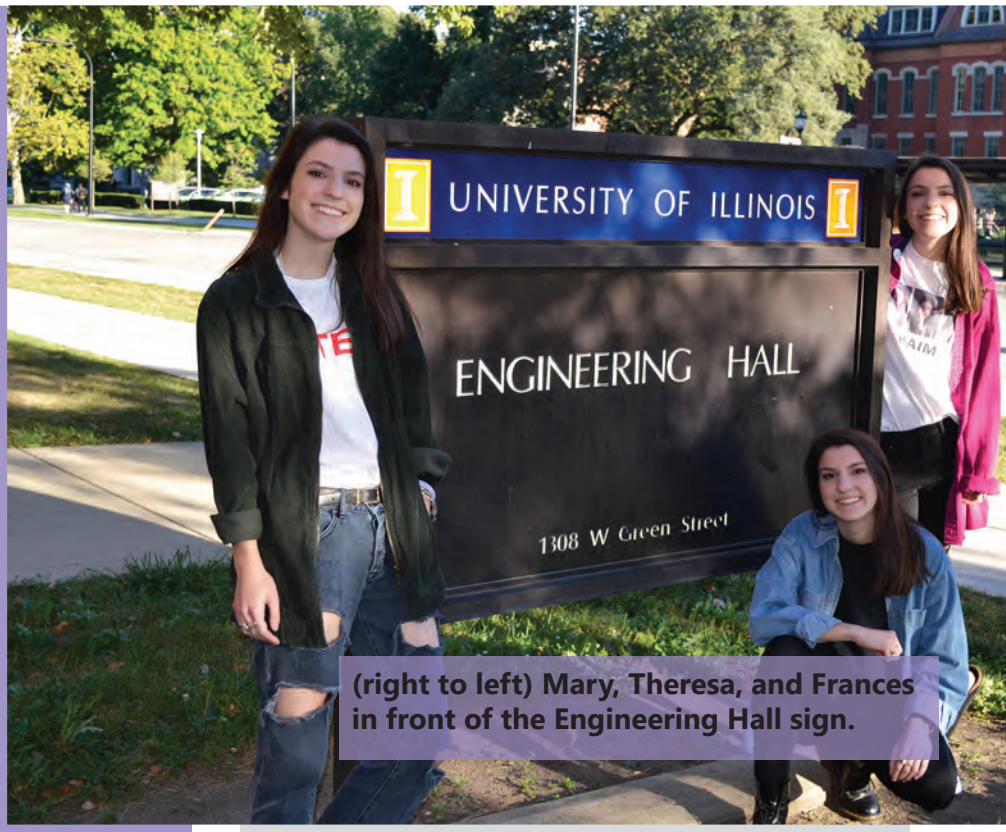
Estrada expresses gratitude for those who helped her on her journey:

> **"I really owe a lot to the people in the guidance department of my high school, Addison Trail (Addison, IL). My counselor and the secretaries were my biggest support system, encouraging, guiding, and helping me become the person I am today. I wouldn't be at this university loving what I study if it weren't for them."**

BECOMING ENGINEERS AT ILLINOIS TRIPLE THE FUN FOR THE PONICKI SISTERS

September 26, 2018

When identical triplets Frances, Mary, and Theresa Ponicki were growing up, there wasn't a huge push to get girls interested in STEM. But the three, currently seniors in the Systems Engineering and Design (SED) program in Industrial and Enterprise Systems Engineering (ISE) loved playing with Legos. Mind you, these weren't the dumbed-down pink ones the toy manufacturer currently makes for girls, assuming they can't handle the same kind of stuff boys can. This Lego kit was a hand-me-down from their older sister who had been interested in industrial design before switching to education— complete with gears that encouraged them to design and build machines. Frances claims that playing with Legos "kind of got us into STEM without us really even realizing it." "We're really focused on design," adds Theresa, "so it kind of runs in the family."



(right to left) Mary, Theresa, and Frances in front of the Engineering Hall sign.

In fact, growing up, they weren't even exposed to STEM outreach events. (They were chess club nerds.) Not only was STEM not being encouraged, but they say that a lot of their high school teachers weren't pro women in STEM at the time. "There weren't outreaches," Frances admits, "it was more like us reaching out and pushing through."

So, despite a less-than-supportive school climate, they recognized what they liked in the math and science field and "kind of took that and ran with it," Mary adds. Despite the fact that their teachers "weren't always super encouraging of it, we were really excited about it, and that's what made the difference."

Plus, they had something other girls in similar discouraging situations might not have had—each other. Sort of like the Three Musketeers (actually four, including their best friend Jess), they had each other's backs; they took all the same math and science courses and, ironically, never really noticed that they were the only girls.

Mary explains:

"When we were in those classes, I never really noticed the gender gap. Now, thinking back on it, there was a serious gap between the number of females and the number of males in the classes, but it never really came to my attention until recently."

Because her siblings were there with her, and because of their support, she's never had to say, "I'm the only female in here," she continues. "Who am I going to do my homework with?" They had a ready-made study group that has lasted even to this day.

How did they all end up at Illinois, studying engineering together? Probably because Mom and Dad were Illinois alums, right? Nope. "That's a good question, because we definitely did not think we were going to go here at all," Frances acknowledges.

The Ponicki triplets grew up just a few miles north of Champaign-Urbana on I57, in Arlington Heights, a suburb northwest of Chicago, so the proximity of a world-class university was always in the back of their parents' minds. "Both of our parents went

here," says Frances, "so I would definitely say it was pushed from the get-go."

However, for the girls, not only was Illinois not in the running initially, but Engineering wasn't even an option at that point. "We were all over the board with what we wanted to do when we were looking at different university programs in high school," admits Mary. Some of their options were physical therapy, pre-vet, even horticulture; plus, they had taken and enjoyed a woodshop class and a CAD class. Mary admits:

> **"We had no idea, but the thing that we all kept coming back to, and the thing that our parents kept reminding us of, was that we were excelling, and that we really enjoyed our math and science classes."**

The thing that clinched it for them regarding Illinois was the SED degree program's option where in the third and fourth year of their program, students can declare a secondary field and focus on whatever specialization they want.

Frances Ponicki.

According to Mary, when they visited SED, the advisor told them, "You can do anything," then described a former student who had been interested in prosthetics and how the body worked, so he specialized in dance and took dance classes to understand that.

The girls were told:

> **"If you're interested in something, and you can make a case for it, then you can pave your own way through the major.' We were really into that, because we really wanted to combine a more creative side of engineering with the degree, and that's why we all ended up here in that specific major."**

Ironically, although they had looked at a number of majors at different schools, and toured numerous universities, all on the east coast, they never once toured Illinois. "I think we applied to U of I a week before the application was due," Frances admits. "It was super last minute. We wanted to make this decision by ourselves!"

Now that they're here, is there always a reaction when the three of them walk into a class together? Not usually. They're known throughout ISE, which is a smaller department. Plus, now that they're seniors, their classes are specialized, so they're with the same people every semester. However, when they walked in to Mechanical Engineering's ME270, Design for Manufacturability lecture for the first time in fall 2018, it caused a bit of a stir. "Professor Liebenberg was super nice about it, super great about it," says Frances. "We haven't gotten that reaction in a while because we're in our senior year."

Regarding having the triplets in his lecture, Liebenberg admits that he's struggled a bit in terms of knowing who's who. "They always sit next to each other; they always answer questions in class; and I never know who they are. It's quite hilarious."

Vis-à-vis not being able to tell the girls apart, we've all heard stories about twins or triplets pulling a switcheroo and posing as each other. Did the Ponicki sisters ever say, "Ok, you bone up on the history and take the test for all of us; you cover chemistry, and I'll cover the math"?

They recall trying to switch once in their freshman year of high school, when they all had the same classes but at different times. However, the first time they tried it, the one teacher in high school who could tell them apart noticed and had a

Mary Ponicki.

heart-to-heart with them. “He wasn't mad,” Frances admits. “He thought it was great. But we talked about how we shouldn't do it for exams, which we knew. Going forward, we wouldn't want to do it for exams anyway, because we were all trying to get into a good university, and so if you only know one subject, then you got to university saying you knew it, it'd be harder.”

What about for a date? Have the three of them ever substituted for one of their siblings? They didn’t even try; their friends are too smart. “If you're friends with my sisters and I, you can tell us apart,” admits Frances.

In fact, their friends might even be better at noticing their differences, personality-wise, than the girls themselves. Frances shares an anecdote: “We were over at my friend's house on campus the other night, and she was doing imitations of the three of us in the same scenario—our friends are very good about picking out our personalities, but I never know how to.”

“We do have different personalities, but it's hard for us to pinpoint what exactly it is unless it's situational,” agrees Mary. “Like I could say, ‘Teresa would do this; Fran would do this, and I'd do this,’ but for personality traits, we have a little bit of everything.”

Do the sisters ever finish each other’s sentences? Mary believes they “think along very similar wavelengths.” For instance, they’ll be driving and see a sign that reminds them of something. One will say, "Remember when…?" and another will say, "I was just going to say that," and that's all they have to say to understand what they’re talking about. Also, when they’re telling stories, they just naturally jump in to tell “their” part of the story without even communicating.

rances continues:

“My sisters and I take a lot of the courses together, so it's never really in the forefront of my mind that there aren't any women in here, because I have my sisters, and that's really all I need.”

Theresa shares an anecdote about when the three of them studied abroad in Australia. “It was so weird,” she exclaims, then shares how she and Mary had gone two weeks early and were sharing a story with a guy they’d just met: “I was telling it,” Theresa says, “and then Mary transitions in really smoothly. And then it gets silent, so Mary and I kind of look at each other and immediately, it was like, ‘This is where Fran would fill in.’ We looked at each other, and we were like, ‘Whoah!’" They had just then realized how much they take turns telling a story until one of them was missing.

In addition to study abroad, the Ponickis’ careers at Illinois have been well rounded. They’ve taken advantage of several RSOs (Registered Student Organizations) and other opportunities on campus. For example, the summer before their freshman year, they took classes on campus through Engineering’s Summer Scholars program. They also did WIE Orientation, and report that some of the girls they met there, especially those in ISE, are still some of their closest friends. “We do all of our homework together, and we talk all the time,” Frances says. “It's been one big journey from start to finish together. We wouldn't have ever met them if we hadn't gone to that.” The RSO they’ve mostly been involved in is Catholic Illini through Newman Hall, where they serve as ambassadors and help plan events. In addition to doing events with Engineering Without Borders and Women in Engineering (WIE), they’ve also been heavily involved in ISE, working to help recruit future students.

Also, because STEM outreach was noticeably absent when they were younger, they’ve been involved with outreach hoping to get younger students, especially women, interested in STEM. Towards the end of their internship this past summer, they joined the board of STEAM Ahead, an organization promoting women-in-STEAM efforts in the Naperville area, helping plan an upcoming event called STEAM Fest. It will offer activities designed to pique college and high-school-aged women’s interest in the different STEAM fields, as well as foster networking and mentorship.


Theresa Ponicki.

Having been involved in mostly the same opportunities, the same major, and mostly the same courses, are the girls thinking about the same career? Pretty much.

The sisters all have the same concentration in Systems Engineering and Design: digital prototyping. Huge fans of Autodesk software, they specifically want to work with computer-aided design (CAD). Theresa's dream job is:

"to be pushing the envelope, developing new technology, developing new designs, being on the forefront of technology."

In preparation for their CAD careers, they haven't really taken a lot of coding classes; their curriculum involved one computer science course their freshman year. "It's more you learn as you go," Theresa explains. "You learn MatLab, different software, but there weren't any specific courses on that. It was more of computer-aided design incorporated into the curriculum."

For example, they're particularly enjoying Professor Leon Liebenberg's ME270 course, which is required as part of their Digital Prototyping concentration. Theresa explains:

"Design with intent, that's a huge thing. When you go to manufacture something, you want to design it so that it's easy to manufacture, it's easy to produce. This is a huge class that focuses on that and the ways that you can produce a product."

Of course, what particularly intrigues them about the course is that in the lab section, they're using CAD software to design things. "We're really excited to see where that all goes," Mary says. She elaborates:

"CAD is a big part of the manufacturing world right now. It's really coming together head on. That's really exciting for us, because that's what we're really passionate about. (We could talk about it probably for hours!)"

On a more personal level, what they also love about ME 270 is that they actually get to be together. Although they live together, according to Frances, "It's like the only 2 hours out of the week where we get to see each other consistently!"

"The interesting thing about this semester," complains Frances, "because we're in senior design and so many other project-based courses, we rarely see each other. This is the first semester that, even though we're in the same courses, we don't see each other very often. Because we're all in different project groups and it's a minimum of 15–20 hours a week for senior design."

For their senior design course, SE494, Professor Wildblood arranged projects with different companies, which give them optimization and design projects and a budget. Projects are assigned based on students' background, concentration, and preference. For instance, Frances is working with Harger Lightning and Grounding Corporation. "We're all on a different design project," Frances says. "I love mine. We're all really happy with them."

Also, because it's their senior year, the three have been frequently discussing their immediate future. Grad school is on the table, as is getting jobs once they graduate. Also, they're not opposed to working for the same company. For example, they all did internships at Nokia in Naperville this past summer. "It was really fun to be working together," Mary acknowledges.

"The project was fun. It was a field we all wanted to be in. Because we're all interested in the same thing, none of us are against working at the same company. That doesn't mean we're seeking it out. We're just taking it as it comes."

Despite having chosen Illinois at the last minute, the girls all say attending Illinois has been quite meaningful for them. For instance, Frances calls it “one giant open door of opportunities.”She continues:

“Every year, every semester has a very defining class that made it easy, hard, or memorable. The friends that I made and the job opportunities that I had would not have been possible without U of I, and definitely not without ISE, our department. I feel very well-developed. I'm really happy with where I am.”

“I was looking at my resume the other day,” Mary chimes in, “and I was like, ‘This is great!’ I really feel like I've gotten to do the things I wanted to do at U of I. It's been really phenomenal! I know I speak for my sisters on this when I say it as well—we're all super grateful that we came to this school. From the professors we've had, to the friendships we've made, the opportunities that we were provided. We haven't really had a professor that we didn't like.”

She also appreciates the multi-disciplinary emphasis of their program, explaining:

“I feel like we've been able to connect with a lot of the professors on campus, and I feel like I have roots in different departments on campus. It just provided so many different opportunities for us professionally, and it's been a really great way to grow and develop over the last four years. We're all really happy here. We're really happy with what it has provided us and the future it set us up for.”

Theresa reiterates that another thing that’s been really special for her and her sisters is that they were able to do it together. She elaborates:

“We were all able to carve our own paths at Illinois, but we were able to have each other in each other’s corners the entire time. A lot of my favorite memories at Illinois have been with my sisters. A lot of the things that we have done together have been special and really defining in my career, and the choices I've made, and the friendships I've developed. It's been really awesome to have my sisters here, because we did consider going to different universities, and we applied to different universities, but we ended up here together and that was the right decision in the end.”

Frances recalls being a freshman and doubting that she could be successful. Now, looking back at all they’ve accomplished, she says, “That's such a testimony to being an overwhelmed freshman talking to our engineering learning assistant. He was very successful and doing a lot of cool things, so it was like ‘Wow, how am I ever going to get there?’"

Now, as a senior on the cusp, she would love to go back and encourage her “freshman year self and be like, ‘Hey, you can do this! You're going to do amazing things! There's going to come a time..’ I'm where I want to be,” she acknowledges, “and I had two amazing partners to do it with. I'm really happy with just going to U of I. It's been amazing!”

(left to right) Mary, Theresa, and Frances Ponicki.

Frances, Theresa, and Mary Ponicki.

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