Hosting regional meet-ups, teaching local kids about synthetic and microbiology, trying to eradicate a deadly bat disease – these are some of the ways Missouri S&T’s iGem team is giving back to its community.

S&T’s iGem chapter is a student design team that uses synthetic biology to solve real world problems. It participates in the annual International Genetically Engineered Machine (iGEM) competition, where for the past two years it has presented research findings on white-nose syndrome.

S&T’s iGem team also hosted a meet-up of collegiate iGem teams from around the Midwest this past year. Teams had a chance to present projects, share ideas and collaborate.

In July 2016, members of S&T’s iGem team held a free hands-on workshop for Rolla-area kids at the Havener Center. They presented BioBuilder outreach activities and spoke of the benefits of a biology education. The team has continued to do outreach in the community, hosting workshops at venues like the Kaleidoscope Discovery Center in downtown Rolla.
Dear alumni and friends,

Welcome to our spring 2017 newsletter. This is an exciting time for our department as we embark on a new era—searching for a new department chair, exploring the development of a Ph.D. program in Integrative Biosciences and making plans for a new building (casb.mst.edu/schrenkhall/). Our faculty, staff and students look forward to a bright future.

Our students, alumni and faculty continue to do wonderful things and this newsletter is our opportunity to share with you some of the great things that have been going on in the department since our last newsletter. We would love to hear about the new and exciting things going on in your life, so please share your news with us for future newsletters.

First, let’s share some comings and goings in the department. Dr. Adam Martin, who has been an incredible asset to the department, has moved on to a post-doctoral position at the University of Missouri. Dr. Martin has been our most prolific instructor for several years, teaching our largest classes for non-majors, running the molecular genetics lab course, various sections of general biology, and general biology lab this spring semester, and will be adding additional classes in the fall. She will also serve as an advisor to undergraduate students. Stephanie Lewis has also joined us as secretary of the department.

Enrollment in our department continues to grow, while opportunities for undergraduate research remains one of our distinguishing characteristics. This experience is enhanced by the number of students who spend their summers in research experience for undergraduates at other universities. Several of these students are featured in this newsletter. These experiences make our students very attractive to graduate schools, schools of health professions and biotech companies. To continue to offer these types of opportunities, the College of Arts, Sciences, and Business has given the department nearly $40,000 to repair or replace several outdated pieces of equipment such as fridges, ice machines, growth chambers and thermocyclers. We also plan to buy a few new pieces of equipment to enhance our teaching and research capabilities. The department has also submitted a request for funds to replace some of the teaching lab microscopes with microscopes with video and camera capabilities. This should greatly enhance the active learning we are trying to achieve with our curriculum. Of course, we still have many needs and would welcome donations of equipment and supplies to enhance our teaching and research mission.

Speaking of active learning, Dr. Katie Shannon and I contributed to a video submitted by S&T to celebrate active learning day on Oct. 25, 2016. This two-minute video was submitted to STEM Central at rol.la/2n3WUis.

To keep up with our latest news, visit the department web site at biosci.mst.edu or follow us on Facebook at rol.la/2mnn78G.

Warm Regards,

Dr. David Westenberg
INTERIM CHAIR, BIOLOGICAL SCIENCES
BIOLOGY ALUMNA TACKLES WOMEN’S HEALTH ISSUES

Grace Dietzler’s chosen field became clear when she took teacher Julie Ertmann’s advanced placement biology class her senior year at University City High School in the St. Louis suburbs.

That class led Dietzler, BSci’16, to where she is today, a research scientist in the Washington University in St. Louis Lewis Lab of Microbial Glycobiology and Women’s Health. And it is leading Dietzler to where she wants to be – a Ph.D. scientist and physician unlocking the secrets to treating infectious diseases.

She spent the summers in 2014–16 as an intern and research technician in the Lewis Lab tackling problems of urinary tract infections and bacterial vaginosis in pregnant women.

“I’ve always kind of been interested in women’s health,” Dietzler says. “It’s fulfilling to me because we’re working on issues that can apply to women around the world.”

The team at Washington University pushes her to be her best, Dietzler says, but the work is rewarding.

“I think maybe she says we challenge her because we think she is a gifted young scientist, she works hard and we think she can make important contributions to women’s health,” says Amanda Lewis, the lab’s director.

Dietzler was the lead author for two papers published on the American Society for Microbiology’s Genome Announcements website. It is not typical, Lewis says, for undergraduates to be listed first on research papers.

Although Dietzler knows where she wants to go, she hasn’t pursued that goal with a single-minded focus that excludes all other pursuits. She was editor-in-chief of the Missouri Miner and she worked on-air at KMNR. The Helix Life Sciences Club, the Miner League Theater Players/Alpha Psi Omega theater honors fraternity and the Phi Sigma biological sciences honors fraternity were other activities.

Deitzler gives Ertmann perhaps the best recommendation a teacher can receive.

“Her passion about the subject opened my eyes that biology was more than just a class I was taking,” Dietzler says. “I want to be able to solve national and global problems of infectious diseases and other health epidemics.”
MEAD MAKING MINER

One Missouri S&T alumnus reached deep into the past to determine his and his family’s future. Patrick Martin, BSci and Chem’11, practices the ancient art of mead-making at his family’s winery, Martin Brothers Winery, using his extensive education and passionate interest in microbiology as his muse.

Mead is considered the oldest alcoholic drink known to humankind. It is made from honey. The fermentation process is where Martin’s expertise in microbiology and biochemistry really comes into play.

“It all begins with grade ‘A’ premium honey and then we ferment it. We add our yeast and our oak,” he says. “We just have to baby the yeast and make sure it’s as happy as can be. It’s all about making the yeast happy.”

Fermentation happens in the meadery’s fermentation room, which has the makings of a microbiology or biochemistry lab. Beakers and test tubes line tables between fermenters and oak barrels. It is here that Patrick works his mead making magic.

He takes the handpicked honey and adds yeast to it. The yeast consumes the sugar in the honey. For every one mass unit of sugar, half a mass unit or less of alcohol and half a mass unit of carbon dioxide is produced.

But it’s not that simple. Honey is rich with flavor, as well as inert molecules. As a microbiologist, Martin uses yeast to break down different honey molecules, pulling them apart or splitting them in two to see what they taste like.

And Patrick does taste his reactions. “Understanding taste is an amazing thing because all throughout four years of chemistry, we were told to never smell, never taste because it’s too dangerous,” he says. “But yet here we are tasting these reactions as they occur.

“What I learned at S&T is paramount,” he adds. “Anyone can make mead. But will it taste good? That’s where when to do it and how to do it comes in.”

RESEARCHERS SUGGEST ANTS NEED WORK-LIFE BALANCE TO SURVIVE

As humans, we constantly strive for a good work-life balance. New findings by biology researchers at Missouri S&T suggest that ants, long perceived as the workaholics of the insect world, do the same.

In fact, according to these researchers, it is imperative that some ants rest while others work to conserve food, energy and resources for the colony. And the larger the colony, the more important this work-rest balance becomes.

“It has been a long-standing question in the field as to why large colonies of ants use less per-capita energy than small colonies,” says Chen Hou, assistant professor of biological sciences at S&T and research team lead. “In this work, we found that this is because in large colonies, there are relatively more ‘lazy workers,’ who don’t move around, and therefore don’t consume energy.

“We found the portion of inactive members of a group increases in a regular pattern with the group size,” Hou says.

By not consuming energy, these “lazy” ants are actually saving resources for the colony and making the colony more productive.

This realization could provide valuable insight into making our societies more productive and sustainable.

“Humans are like ants in a way that we all live together in groups, collaborating toward our own betterment,” Hou says. “Both humans and ants face similar problems of allocating resources based on tasks and energy. Understanding how ants spend their energy in relation to their group and why they do so will provide insight into conditions for individuals that allow a group to perform collective optimization of behavior, that is, in the context of sustainable use of scarce resources.”

Hou’s research team includes biological sciences undergraduate students Nolan Ferral and Kyara Holloway.
The daughter of a logger and a school teacher, Katie Payne, BSci’14, knew she wanted to make a big impact on the world, but it took an anatomy class at Cuba (Mo.) High School to guide her decision to go into medicine.

“When I started telling people I wanted to be a doctor, because I come from a small town with no family background in healthcare, their first reaction was to tell me how unpractical this was,” Payne says.

Her choice to attend Missouri S&T started out as an economical one, but when she saw how caring the faculty were, and started on her first research project, she knew she was in the right place.

“I have been very fortunate with research opportunities in college,” says Payne, who worked as a research assistant for Rolla dermatologist Dr. William V. Stoecker. “The job allowed me to collect data directly from patients and analyze it.”

Payne graduated with eight research publications on her resume. Her favorite, which was published in the November 2014 Journal of the American Medical Association Dermatology, examined the way pain is transmitted in a patient with a brown recluse spider bite.

Now in her third year of medical school at the University of Missouri-Kansas City, Payne is still conducting research. She works with a neurologist and headache specialist at Children’s Mercy in Kansas City to use trigeminal nerve stimulation to treat chronic migraines in kids.

“Medical school is challenging but very rewarding,” Payne says. “I spend most of my time trying to find a good balance between work and play, which I think is common to most careers.”

Payne plans to graduate in May 2019 and begin her residency that June. This past March, she started clinical rotations at Truman Medical Center, a safety-net hospital in Kansas City. She was thrilled to get out of the classroom.

“Working with patients at Truman Medical Center is a humbling experience,” she says. “It really adds a new perspective to medicine.”
Talking “Trash” with Biology Alumna

A Missouri S&T biological sciences graduate and aspiring artist has illustrated her first book, and it has a decidedly Rolla and mid-Missouri flair to it.

Lara Edwards, BSci’13, did the illustrations for Rolla author and speech therapist Marilyn Frederick’s The Very Happy Trash Truck, which documents the daily exploits of Timmy the Trash Truck. The children’s book was recently published by Steeple Publishing Company and is available on Amazon.

Edwards, herself a Rolla native, painted the mural in the Leola Millar Children’s Library in the Rolla Public Library when she was a student at Missouri S&T. She has also painted several murals in Sunday school classrooms at the First United Methodist Church in Rolla, where she is a member.

Edwards and Frederick, who is also a member of First United Methodist Church, connected through a mutual friend, and spent the greater part of last year writing and illustrating the children’s book.

Edwards used a traditional approach to illustrating the book.

“I did not do this digitally. These are actual, physical water colors,” she says, pointing at an illustrated page. “I’m still illustrating in a very old-fashioned, traditional way.”

Edwards says her main inspiration as an artist has always been Beatrix Potter, author and creator of Peter Rabbit.

“I read Beatrix Potter books a lot as a little kid,” she says. “Her illustrations are very soft, very organic, very lively and variable water color and ink illustrations. I always hoped that if I ever became an illustrator that I could do that too. I’m certainly no Beatrix Potter, but I can see why she used that method.”

Edwards considers this way of illustrating books a dying art form, and one that is hard to replicate via digital illustrations using computer programs.

“I don’t know if that look will ever be perfectly imitated in software,” she says. “It’s getting harder and harder to find folks who illustrate that way. And it is for good reason.”

Edwards says that hand illustrating and painting can be time-consuming, especially when making edits.

To illustrate The Very Happy Trash Truck, Edwards started with card stock, penciling in her illustrations using waterproof India ink pens. Then she would make a copy of the page, and watercolor either the original or the copy.

She says that each page took about four hours to illustrate, although some took much longer. She specifically mentions a page featuring a brick building.

Edwards says that she and Frederick had to do a surprising amount of research to illustrate the children’s book.

One scene in the book takes place in the rain, so Edwards and Frederick had to track down a waste collector and ask them what they wear when it’s raining.

“We were making some copies of some other pages and we saw the truck,” she says. “We ran over and said, ‘Hey, hey, hey, we have a question. What do you do when it’s raining and you’re collecting trash?’”

Edwards says she also had to go to the Phelps County Transfer Station several times to memorize what it looked like for another scene.

“We have a few people we’d like to give a free book to because they don’t realize how much they helped in answering our questions,” Edwards says.
It’s mid-morning in the Mill Creek watershed, located about 20 miles southwest of Rolla. The sun is beginning to break through the low clouds, sending beams of light shooting through a forest canopy of walnut, sycamore and oak trees. Dev Niyogi stands waist-deep in fast, clear-flowing water, talking to a dozen students about the characteristics of Yelton Spring and the greater Mill Creek watershed. Yelton Spring’s discharge rate varies greatly by season, recent rains and the groundwater table level, he explains. Today the spring’s water level is high because of heavy rain the night before.

Niyogi, an associate professor of biological sciences at Missouri S&T, asks for a student volunteer to join him in the frigid spring to help skim the water for marine invertebrates using a fishing net. Seth Mahon, a senior from Louisville, Kentucky, eagerly jumps into the water in board shorts and flip-flops. Two more students enter the spring with a multiparameter meter to record the depth, flow and temperature of the water, which is determined to be 56 degrees Fahrenheit.

Niyogi encourages the rest of his field ecology students to explore the spring and watershed. He asks them to make particular note of the vegetation specific to the spring as compared to the rest of the watershed. They scatter, individually and in small groups, to check water quality, catch tiny water critters like mayflies, and collect spring-specific flora.

Not a bad way to earn two credit hours.

Field ecology is one of four week-long, two credit courses offered every summer through the biological sciences department. These courses give students the chance to take what they learned in the classroom and apply it to the field. The other classes are cave biology, mammal ecology and vegetation of the Ozarks.

Mahon, an environmental engineering major says the courses provide “the actual application of what I learned in class,” including water quality testing. Mahon took field ecology and cave biology in summer 2016.

Three of the four classes – field ecology, mammal ecology and vegetation of the Ozarks – use the Missouri S&T field station and surrounding Mark Twain National Forest as their classroom. But students aren’t always outdoors. The field station includes a room modified for use as a traditional classroom, with a projection screen and internet connection.

Students also benefit from the expertise of professional biologists. Leah Berkman, adjunct professor of biological sciences and biometrician at the Missouri Department of Conservation, teaches mammal ecology and Justin Thomas, adjunct professor of biological sciences and instructor at the Institute of Botanical Training in Springfield, Missouri, teaches vegetation of the Ozarks.

The only class that does not take place at the field station is cave biology. Maria Potter, who teaches the course, is natural resource manager and superintendent at Onondaga Cave State Park, located 35 miles east of Rolla. She gives her students special access to Onondaga and Cathedral caves at Onondaga Cave State Park and Fisher Cave at Meramec State Park. Potter graduated with a master of science in environmental biology from Missouri S&T in 2008. Students in the course learn about the biodiversity, geographic distribution, ecology and evolutionary biology of subterranean organisms, primarily those that live in caves, as well as the structure of subterranean communities and ecosystems.
TAPPING INTO RESEARCH

It was a thirst for knowledge and locally brewed beer that drew a crowd to the first Research on Tap.

“Research on Tap” is a new monthly event at Public House Brewing Company in Rolla that lets Missouri S&T researchers, particularly in the College of Arts, Sciences, and Business (CASB), share their latest research and news and promote events. The social hour is held at 6:30 p.m. the second Wednesday of every month in the upstairs loft at the brewery.

The first Research on Tap welcomed Dave Westenberg, professor and interim chair of biological sciences at S&T.

Before the event began, Westenberg scattered stuffed microbe toys across the upstairs loft tables. As attendees found their seats at various tables, they were greeted by these “giant microbes”: cholera (the stomach bug), chlamydia, salmonella, the “kissing disease,” otherwise known as mononucleosis, and appropriate to the venue, yeast (affectionately called “Beer and Bread”).

Westenberg introduced himself by saying he had brought his own audience in case no one showed up for his presentation. “I have the yeast family – gigantic, giant and mini giant yeast,” he says while holding up three plush microbes.

To give an idea of the wide variety of bacteria on our planet, often from the same genus, Westenberg asked one of the attendees with a streptococcus microbe to hold it up. He then asked if anyone else in attendance had a streptococcus microbe. Two other attendees held their plush toys up.

He explained that these were three different types of streptococcus bacteria – one that could give you a sore throat, one that would give you pneumonia, and one that was flesh-eating. “You can go anywhere from a sore throat, to pneumonia, to flesh-eating, all in the same bacteria,” he says.

Westenberg also invited interested attendees to play a BioBuilder game that looked at the ethics of synthetic biology.

RESEARCH COULD PREVENT NEXT MAJOR HUMAN-RELATED DISASTER

Headline-grabbing disasters like the Chernobyl nuclear incident could have been prevented through better labor practices, like shorter shifts and more structured shift rotations, says a biology researcher in a new book on risk management.

Matthew Thimgan, assistant professor of biological sciences at Missouri S&T, wants to prevent the next major human-related disaster from happening, and says one concern is lack of sleep and rest. In Human Fatigue Risk Management, Thimgan and his co-author, Susan Murray, interim chair of the psychological science department and professor of engineering management and systems engineering, examine the American Petroleum Institute’s recent Recommended Practice (RP) 755 guidelines released to reduce these types of incidents and compare them to their own sleep deprivation research.

“It is impossible to generalize a single solution to every unique situation, but this book provides a reference to communicate our understanding of the causes, contributors and consequences of sleep deprivation in the workplace so that rational and individual practices can be tailored to an organization’s needs,” Thimgan says.

“RP 755 – Fatigue Prevention Guidelines for the Refining and Petrochemical Industries” was written in response to the U.S. Chemical Safety and Hazard Investigation Board’s investigation of the 2005 BP Texas City incident, in which an explosion at what was then the third-largest oil refinery in the United States killed 15 workers. The guidelines “at a minimum, limit hours and days of work and address shift work.”

Thimgan and Murray’s book goes one step further by explaining how stakeholders can implement a “fatigue risk management” system in their organization.

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Westenberg also invited interested attendees to play a BioBuilder game that looked at the ethics of synthetic biology.
Since the last biological sciences newsletter, department students and faculty have been featured in a number of internal and external news stories. Here are a few:

Dr. Melanie Mormile was featured in an episode of “Space’s Deepest Secrets,” a television series broadcast on BBC and the Science Channel: rol.la/2niYwRk

Dr. Chen Hou was featured in the summer 2016 issue of Missouri S&T Magazine: rol.la/2m6tcFq

Dr. Dave Westenberg was featured in an article in the Fulton Sun: rol.la/2fYf1qm

Dr. Westenberg and Grace Deitzler, a 2016 biological sciences graduate, were featured in a Thanksgiving-themed video by S&T’s marketing and communications department: rol.la/2mmX5SF

Dr. Hou’s research was selected as one of the top 16 S&T research stories of 2016: rol.la/2na26hH

Dr. Westenberg and Ms. Lisa Snoderly-Foster were recognized with Outstanding Teaching awards: rol.la/2niCP4e

Dr. Dev Niyogi was selected to receive a Faculty Teaching award and Ms. Terry Wilson was selected to receive a Faculty Achievement award. Dr. Niyogi and Ms. Wilson were recognized at an awards dinner on Feb. 21, 2017

Dr. Yue-Wern Huang was selected to serve as an editor for the journal Austin Environmental Sciences: rol.la/2mpqE7N

The S&T iGEM team was featured in a blog on the American Society for Microbiology’s website highlighting the value of mentoring: rol.la/2k5PPv8
**PRE-MED STUDENT TO SHADOW DOCTORS IN SPAIN**

Claire Brewer, a junior in biological sciences from Troy, Missouri, has been accepted into the Atlantis Project, a premedical studies exchange program that allows college students to witness medical practices in a different country.

Brewer will shadow medical doctors at a general practice hospital in Almansa, Spain for five weeks, spending a week at a time with different specialists. She will shadow professionals throughout the week and have weekends free to study or explore the local community.

“Claire will get to experience the medical practice outside the United States, expanding her perspective about how to help people,” says Julie Semon, assistant professor of biological sciences at Missouri S&T. “I couldn’t think of a better applicant to the program, due to her experience in both the laboratory and in her non-classroom work.”

Brewer already has experience in the medical field. During the 2016 summer, she worked 13-hour shifts as a medical scribe in the emergency room (ER) at Phelps County Regional Medical Center. When not taking notes for ER doctors, Brewer talked to visiting medical students to learn more about medical school and the application process.

“I decided to be a doctor when I was really young,” says Brewer. “You are hearing about a person’s intimate histories and stories, and earn their trust. They let you heal them, which requires a special bond that is built between two people.”

The Atlantis Project offers accepted applicants one- to eight-week fellowships during semester breaks to travel to countries such as Spain, Italy and Argentina to shadow medical professionals. The project aims to expand students’ perspectives while exposing them to on-the-job training.

“It can be pretty intense in the emergency room, but if you can survive and thrive in that environment you are in the right field,” says Brewer. “The trip will hopefully reaffirm my call to join the medical profession.”

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**STUDENT SPENDS SUMMER IN NEBRASKA AS EXPERIENTIAL FELLOW**

Natalie Holste, a senior in biological sciences at Missouri S&T, spent her summer researching winter cover crops as a 2016 University of Nebraska-Lincoln experiential fellow.

Holste’s research, titled “Carbon and Nitrogen Content of Winter Cover Crop Biomass,” was published to the University of Nebraska-Lincoln’s CropWatch website. Excerpts from her article provide an outline of the research:

- “Cover crops grown after primary crops can reduce costly nitrogen losses by taking up soil nitrogen into their biomass. After these cover crops are killed, soil microorganisms decompose their residue, using their carbon as an energy source and their nitrogen to build protein. A carbon to nitrogen (C:N) ratio of 24:1 is best for soil microbes.”

- “In our study, we wanted to investigate whether the species and age of the cover crop affected the C:N ratio, percent N, and total N in the aboveground biomass of cover crops.”

- “For this study cover crops (cereal rye, legumes, and a cocktail mix) were grown at the UNL Agricultural Research and Development Center near Mead. They were planted either early (first part of September) or late (mid-October after crop harvest). Above-ground cover crop biomass was sampled in mid-April when cover crops were terminated. Cover crop biomass was dried, weighed, and analyzed for percentage of carbon and nitrogen.”

- “This study shows that to ensure an N supply, cover crop dry matter must be high. To avoid N immobilization, cover crops should be terminated before their C:N ratio is greater than 24:1, probably in mid to late April for rye cover crops.”

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BIOPHILES NEWSLETTER 9
GRADUATION DOESN’T MEAN GOODBYE.

Tell us how you’re doing. We’d love to hear about new appointments, degrees earned, job promotions, and other family or professional news.

It’s easy to stay in touch with your department. Just say hello when a student representative calls from Phonathon or drop us a note at biosci@mst.edu.

With your support, there’s no limit to what we can achieve.