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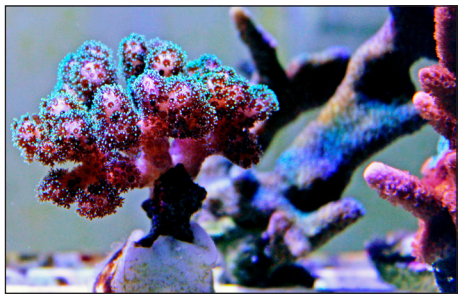
A decoration of pine branches adorns a limestone gate outside the Indiana Memorial Union. *Photo by James Brosher*

INDIANA UNIVERSITY College of Arts + Sciences

BioNews

Keeping you updated on what's happening in the **Department of Biology**

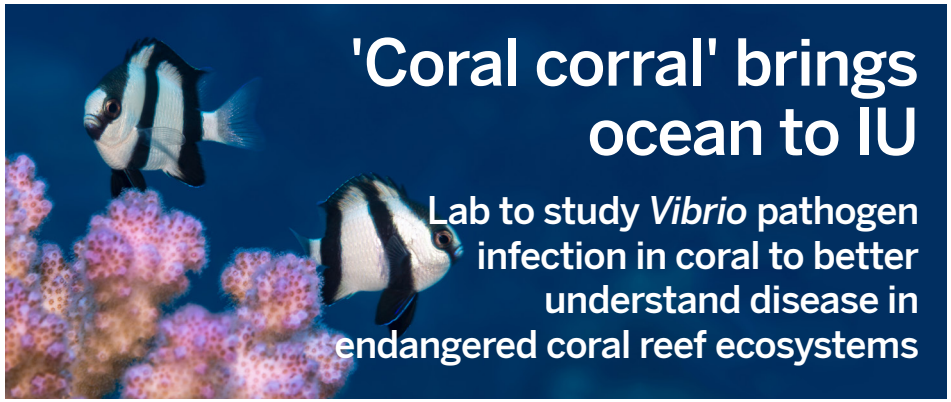
Fall 2022



Julia van Kessel and colleagues seek better understanding of disease in endangered coral reef ecosystems. *Adobe Stock photo* 2

IU Biology shows off its *Drosophila* facilities to IU President Whitten during her visit this fall. *Photo by Chris Meyer* 12

There's a new critter on the IU Bloomington campus. *Adobe Stock photo* 7



'Coral corral' brings ocean to IU

Lab to study *Vibrio* pathogen infection in coral to better understand disease in endangered coral reef ecosystems

Adobe Stock photo

Excitement was in her voice as Victoria Lydick, who oversees the new coral facility in the Department of Biology, explained the purpose of the tanks and other equipment in the lab. Lydick is a research associate in the laboratory of Associate Professor Julia van Kessel.

The National Science Foundation and its internationally funded Binational Science Foundation have awarded a grant to van Kessel and colleagues to study the coral reef ecosystem. Specifically, the researchers hope to gain a better understanding of how to help maintain coral reefs by learning how the coral pathogen *Vibrio coralliilyticus* interacts with its environment in a coral host.

About half of the world's total coral reef cover has been lost since the 1950s due to many causes—including anthropogenic climate change, disease outbreaks, destructive fishing practices, and pollution. Increases in ocean temperature due to climate change correlate with increased disease incidence and outbreaks in coral.

The bacterium *V. coralliilyticus* is a primary and opportunistic pathogen that infects numerous species of coral and causes bleaching and tissue loss, as well as potentially exacerbating the effects of other diseases.

Julia van Kessel.
Photo by Sandee Milhouse

Victoria Lydick.
Photo by Terri Greene

The van Kessel lab—which specializes in quorum sensing, a cell-cell communication signaling process used by some bacteria—and colleagues hypothesize that quorum sensing signaling and temperature variations control virulence genes of *V. coralliilyticus* that are critical to the bacteria's ability to infect coral. They will investigate how temperature, other bacteria, and communications between *V. coralliilyticus* populations alter the ability of the pathogens to cause coral diseases. The researchers will identify and examine virulence factors controlled by primary systems that respond to the

("Coral corral" cont'd on page 4)

BioNews is published by the IU Department of Biology—with support from the IU College of Arts and Sciences—for alumni and friends to encourage their interest in and support for Indiana University, the College of Arts and Sciences, and our department.

Editor: Terri Greene

Editorial correspondence
Email: bionews@indiana.edu
Letters: 1001 East Third Street,
Bloomington, IN 47405-7005 USA

Department of Biology
https://biology.indiana.edu
Chair: Scott Michaels
Associate Chair for Research and Facilities:
Leonie Moyle
Associate Chair for Teaching:
Pranav Danthi

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https://college.indiana.edu
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Frank J. Zeller (Dec. 6, 1927–Oct. 17, 2020)

"Just as Chicago has been called the 'city with big shoulders,' Frank, the Chicago native, has been the 'professor with big shoulders,'" wrote Professor Jim Holland in his 1992 retirement tribute to Frank Zeller. Holland made the statement in reference to Zeller's commitment to convey his enthusiasm for science to his students—affirmed by Zeller's receipt of two prestigious campuswide teaching awards.

A year after he and his wife Carol, a former biology classmate, accepted their first academic positions, they moved to IU, where Zeller served as a teaching assistant and research associate in the zoology department while earning his Ph.D. Zeller completed his Ph.D. and joined the zoology faculty in 1957.

Zeller's research interest was reproductive endocrinology. For many years he collaborated with William R. Breneman. Their research and Zeller's other projects had important implications for the development of endocrine-based contraceptive procedures and for improving understanding of interactions of the anterior pituitary and gonads.

Zeller was acting chair of the zoology department during academic year 1976-77. He contributed to numerous committees in the department and across IU.

He and Carol (who predeceased him in 2017) were a team in the lab and classroom. For several years, he taught the developmental biology lecture while she coordinated the labs. IU and a host of students have greatly benefited from the years of dedicated service given by Frank and Carol Zeller.

Frank Zeller (left) in his lab in May 1958. *Photo courtesy of IU Photo Archives P0020961*

Building the coral facility, aka "coral corral"

Victoria Lydick, a research associate in the van Kessel lab, is responsible for assembling and then maintaining the facilty. Lydick explains that the facility is divided into four areas:

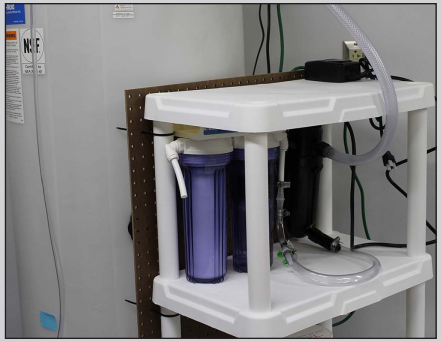
"Instant Ocean" sea salt will be mixed with water to create artificial seawater for the coral tanks. *Photo by Terri Greene*

Water reservoir: 100-gallon tank to store artificial seawater (ASW). The ASW is made in the facility and the reservoir has a closed-circuit system for filtering and sterilizing our seawater.

Quarantine tank: The coral shipped from a distributor will initially be housed in a quarantine tank for an isolation period. It needs to acclimate to such conditions as light intensity, temperature, and water flow used in our facility to mimic the natural environment. Additionally, we must ensure the coral is not carrying parasites or diseases that could infect the coral already in our facility.

Mother tank: This tank stores the healthy coral fragments and is not exposed to experimental conditions. This setup has its own seawater sterilizing system to keep the coral healthy.

Experimental tanks: Two identical tank setups will be used for running experiments. Inside the large tubs, smaller tanks will be organized to hold coral that will be exposed to the bacterial strains created from the project. These experiments are called Infection Assays.



The 100-gallon ASW reservoir has a closed-circuit system for filtering and sterilizing the artificial seawater. *Photo by Terri Greene*

Victoria Lydick trims a plywood shelf with a handsaw during the construction of the facility. *Photo courtesy of Julia van Kessel*

("Coral corral" cont'd from page 2)

environment as well as examine how each of these systems influences coral colonization and disease progression in a live coral infection model and its microbiome.

With guidance from Blake Ushijima, an assistant professor at University of North Carolina Wilmington, and his graduate students, Lydick continues to prepare the IU facility for the coral.

"We'll be using the coral species *Pocillopora damicornis* for our research," said Lydick. "This species is a branching coral which makes it important for reef structure in coastal reefs. It is an incredibly hardy coral species which makes it suitable for aquaculture experiments."

Pocillopora damicornis—also known as cauliflower coral—can be pink, green, or brown in color. It is native to tropical and subtropical parts of the Indian and Pacific Oceans. *Adobe Stock photo*

The researchers are eager to share with the public how global warming specifically affects coral, their natural microbiomes, coral pathogens, and the animals that inhabit coral reefs. As their research evolves, they plan to showcase connections between bacterial pathogens and coral disease by using a live coral exhibit and live bacterial cultures in public outreach exhibits.

"In addition to corals, the *Vibrio* bacteria are pathogenic to fish, shellfish, and urchins; thus, discoveries from our work will contribute to a fundamental understanding of *Vibrio* pathogenesis and extend to other research programs," said van Kessel. "Bacteria have intimate and influential interactions with the environment in many ways that are relevant to society. It is critical that we enable people in our communities to connect with science and observe basic research to understand how it impacts their daily lives."

Collaborating with the van Kessel lab on the project are the Ushijima lab, University of North Carolina Wilmington, and the laboratory of Dor Salomon, Tel Aviv University.

About Victoria Lydick

Lydick grew up in northwest Indiana near Chicago. As a first-generation college student, she completed her bachelor's degree in Marine Science with a concentration in Marine Biology at University of Maine.

Lydick spent spring 2017 studying abroad at James Cook University–Townsville in Queensland, Australia. She focused on courses in coral physiology, coral reef morphology, and coastal animal conservation. While interning at the Australian Institute of Marine Science, she was mentored by two graduate students on projects researching the effects of climate change conditions on hard coral and sea sponges. Lydick maintained coral/sponge tanks and assisted in lab work.

In pursuit of a career in academia, Lydick began working in the van Kessel lab at IU Biology in 2019. She was promoted in August 2022 to research associate and now oversees the new coral facility.

Taylor was a member of the American Academy of Microbiology and obtained a long list of fellowships and awards—including two Fogarty International fellowships, visiting fellowships at Rome University, the Myerhoff Fellowship from the Weizmann Institute of Science, and The "Sword of Hope Award" from the American Cancer Society.

Lucy Cherbas

(passed away Oct. 10, 2022)

Lucy Cherbas (left) with her husband Peter during their vacation in Hawaii, ca 2014. *Photo courtesy of their daughter Katherine Cherbas*

Upon Lucy Cherbas's 2016 retirement, fellow faculty member Thom Kaufman wrote, "Lucy's contributions to science and our knowledge base are numerous and significant. We are enormously indebted to her for all that she has contributed."

Cherbas, a senior research scientist, joined the department in 1985. She, along with her husband who also served on the IU Biology faculty, worked on cell lines and hormonal regulation of gene expression. Cherbas authored or co-authored many key articles on cell methods. She participated in the founding of the IU Drosophila Genomic Resource Center and built up a unique and extremely valuable collection of 135 diverse cell lines. She was instrumental in publicizing these materials and maintaining this widely used resource for the research community. When people needed expert scientific advice on tissue culture, they invariably came to the DGRC and Cherbas for help.

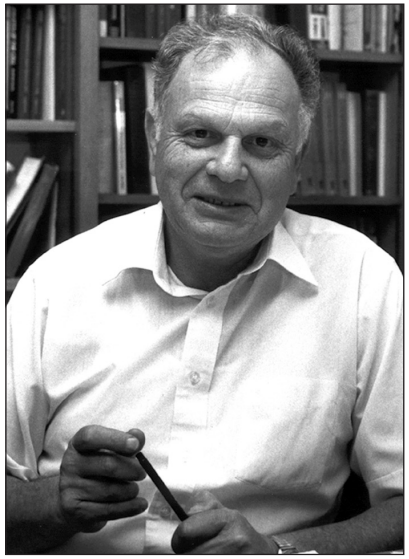
Cherbas was intimately involved in the modENCODE project, which provided the research community with details about the genetic expression pattern of the model organism *Drosophila*. The project—based on analysis of tissue culture cells in which Cherbas' expertise was essential—completely defined all of the transcribed (expressed) genes in the *Drosophila* genome.

In his retirement tribute to Cherbas, Kaufman provided the following quote from Cherbas to offer insight both into her and into the changing science profession, "When I entered graduate school, women were a small minority of my class at Harvard, and there were no women on the biology faculty. Female graduate students were expected to perform special duties like making cookies for the lab and taking on research projects suitable for our gender, and were the subject of frequent verbal slights. I am delighted that as I retire, things have changed: . . ., and since graduate school I cannot recall ever being singled out to make cookies for my colleagues. I was never active as a feminist, but I very much appreciate the change in climate."

A stone wall at Beck Chapel on the IU Bloomington campus, fall 2016. *Photo by Eric Rudd*

In memoriam

Milton Taylor (Dec. 10, 1931–Jul. 1, 2022) had an enormous influence both as a teacher and world-renowned research scientist during his tenure at IU. He began as assistant professor of microbiology in 1967, became full professor in 1976, and retired as professor emeritus in 2008. His dedication to teaching and research fostered lifelong friendships and collaborations with several of his students.

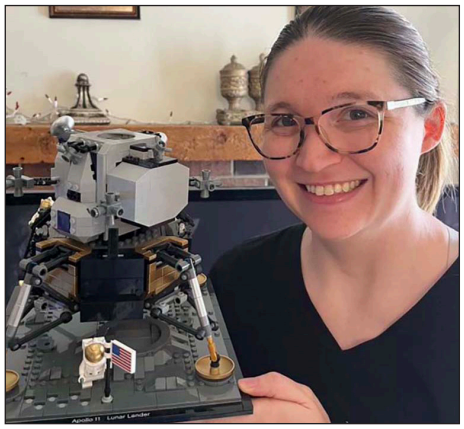


Milton Taylor, ca. 2002. *IU Biology photo*

Taylor initiated a virology lecture and lab for seniors and graduate students, and he reached out to non-biology undergraduate students by designing a course on the relationship between human history and viruses.

Taylor's research was multi-faceted and involved both basic research and clinical studies based upon results in his lab. He began his career studying nucleic acid chemistry as well as viruses. He and his students discovered that certain viruses could wipe out cancers in mice. Taylor also pursued research studying mammalian cell genetics and gene therapy. Another area of Taylor's influential research was the study of a biological chemical called interferon as an anti-viral and an anti-cancer agent. He was also involved in clinical studies on hepatitis C following treatment with interferon.

INSGC funds graduate student's research to develop an energy source for electricity on Mars



Brittany Herrin holds a replica of the iconic NASA Apollo 11 Eagle Lunar Lander (LEGO Creator Expert 10266 Building Kit). *Photo by Jeffrey Mazny*

The Indiana Space Grant Consortium has granted a $12,000 fellowship for the 2022/23 academic year to Brittany Herrin, a fifth-year Ph.D. student in the Microbiology Graduate Program at IU Bloomington.

"Even before attending graduate school," Herrin said, "I had hoped to apply my studies to astrobiology. This fellowship gives me my first opportunity to do this. I am extremely grateful and excited to do this work to further NASA's mission in space."

The fellowship will fund Herrin and her undergraduate assistant Ceilidh Christie, a biology major in the department, as they investigate maximizing hydrogen (H_2) production by a microbial community as a means of producing biofuel on Mars. The transport of fuel to Mars from Earth would be costly, so it is critical to find a way to produce fuel on the red planet.

Photobiological production of H_2 is a promising option for electricity generation on Mars. A group of bacteria, the purple non-sulfur bacteria (PNSB), can produce H_2 under anoxygenic conditions, which is ideal for the Martian atmosphere, but the H_2 yield from these organisms is low. Herrin is working to modify an existing synthetic bacterial mutualism of a fermentative bacterium and a PNSB to maximize the amount of H_2 produced when grown under conditions that resemble those on Mars. This synthetic mutualism produces H_2 from both organisms, but the work she proposes will modify the fermentative bacterium to produce more H_2 from waste carbon than normally accumulates in the mutualism.

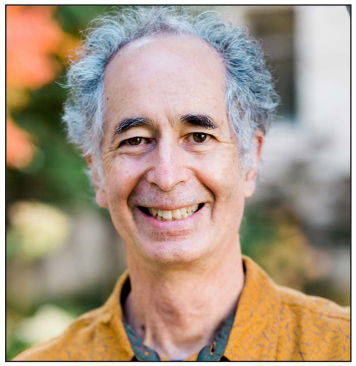
Maximizing the H_2 production of this culture is the critical first step to optimize sustainable H_2 generation on Mars. Herrin's project could ultimately convert waste to generate enough contained H_2 on Mars to use as an energy source of electricity which, in turn, would power living and working spaces.

Herrin is in Associate Professor Jake McKinlay's lab. She is interested in bacterial metabolism, both in a single organism as well as a community of microorganisms. She is also interested in how we can leverage or engineer metabolic interactions and bacteria to generate useful products, like biofuels.

Upon her anticipated graduation in spring 2024, Herrin plans to apply to traditional postdoctoral fellowships, but she will also pursue postdoctoral fellowships funded by NASA as she continues her reach for the stars.

Innes leads research team to develop disease-resistant wheat

Roger Innes strives to understand the genetic and biochemical basis of disease resistance in plants, studying how plants can recognize pathogens and actively respond.



Roger Innes.
Photo by Venus Leah Photography

Innes is a Distinguished Professor of Biology. The USDA National Institute of Food and Agriculture has awarded Innes, his lab members, and colleagues with over $1.2 million to generate wheat and barley lines with enhanced resistance to Fusarium Head Blight caused by the fungus *Fusarium graminearum*.

FHB disease reduces yield and grain quality as well as contaminates grain with mycotoxins. It threatens wheat production worldwide and is predicted to become even more problematic in the future due to climate change. FHB is currently controlled mainly using heavy applications of fungicides, which is detrimental to the environment.

Wheat infected with Fusarium Head Blight cannot be used for food or feed. *Adobe Stock photo*

To develop FHB-resistant wheat and barley, the Innes lab will collaborate with two other laboratories—one led by Matthew Helm, a USDA-ARS crop production and pest control research molecular biologist located at Purdue University and a 2019 Indiana University graduate (Ph.D. in Genome, Cell, and Developmental Biology), and the other based in the United Kingdom and led by Kim Hammond-Kosack, a molecular plant biologist at Rothamsted Research.

Innes and colleagues will take advantage of an endogenous surveillance system in plants that activates immune responses upon cleavage of specific

Nikolov. *Courtesy photo*

Luke Nikolov—an assistant professor in molecular, cell, and developmental biology at UCLA—begins his assistant professorship with IU Biology in January 2023. He graduated cum laude from Harvard University with a B.A. in biochemical sciences. He earned his Ph.D. in biology from Harvard as well. He was an Alexander von Humboldt–Bayer Postdoctoral Fellow (genetic underpinnings of leaf diversity) at Max Planck Institute for Plant Breeding Research in Cologne, Germany.

Nikolov is a plant developmental geneticist interested in flowers. His lab uses a combination of genetic and genomic approaches, particularly single-cell genomics, to address how flowers are built and how they change during evolution.

Nikolov loves to travel and has collected plants on six continents. His favorite pastimes are plant photography and botanical illustration.

While growing up at the foothills of the Balkan Mountains in Bulgaria, Nikolov hiked in the alpine meadows above his hometown, which inspired his interest in plants. He built his first lab in middle school, which he decorated with lichens and bird nests. His most treasured possession at the time was a tiny monocular microscope magnifying up to 100 times—enough to see all kinds of plant cells. He considers himself fortunate to still be looking at plant cells.

Srivastava. *Courtesy photo*

Mansi Srivastava joined our faculty on August 1 as a lecturer for our Biotechnology program. Prior to coming here, Srivastava did a postdoctoral fellowship in the Department of Biohealth Informatics at Indiana University–Purdue University Indianapolis. She obtained her Ph.D. in immunology from Indian Institute of Technology, Indore, India, and a B.Tech. degree in biotechnology from Amity University, Lucknow, India.

Srivastava loves to train students in biotechnology laboratory, specifically in the areas of mammalian cell culture and molecular biology core skills. She has worked extensively in genomics and molecular biology of regulatory protein-RNA interactions using next generation sequencing technology. Her primary research interest is to explore post-transcriptional regulation of gene expression focusing on RNA and its dynamics in a cell that paves the way for RNA therapeutics.

Srivastava is proud of her roots. She grew up in Lucknow, India—a diverse community full of ethnic cultures and traditional values and, consequentially, a hub of a variety of regional and traditional cuisines. She is indebted to her country for providing her education.

Srivastava loves to travel and explore places. She notes that her one-year-old boy always makes life even more adventurous. Outside of work, she enjoys spending time with her family and little one.

Hundley. *Courtesy photo*

Having been affiliated with IU Biology for many years while she served on the IU School of Medicine faculty in Bloomington, **Heather A. Hundley** is no newcomer to our department. She is pleased to now be an official member, beginning her role as associate professor of biology on July 1.

Hundley, who grew up in Springfield, Illinois, received her B.S. in chemistry from Eastern Illinois University. She earned her Ph.D. in biomolecular chemistry from University of Wisconsin-Madison and completed postdoctoral training with HHMI/University of Utah.

Hundley's lab is interested in understanding how regulation of gene expression in different tissues and during development is important for organismal behavior and survival. She and lab members study a process where genes are modified at specific places in their expressed form (a molecule called RNA). As this process changes the molecular information, it is referred to as "RNA editing." They use both human cell lines and the model organism, *Caenorhabditis elegans* (a microscopic nematode) to understand how the machinery that performs editing functions is regulated.

Hundley looks forward to working with undergraduates in the classroom as she revamps the molecular biology laboratory course. She hopes to expose students to modern techniques and how they can be applied to understand personalized medicine and the flow of genetic information. She has trained over 30 undergraduates in her laboratory over the years, but this will be her first time teaching them in the classroom.

Hundley loves hiking and being in nature. She notes how wonderful living in Bloomington is with its many options to escape to the woods on weekends. Her local favorites include Sycamore Land Trust's Canyon Forest Nature Preserve and Rock Shelter/Low Gap Trail in Morgan-Monroe State Forest.

Ledón-Rettig. *Courtesy photo*

Cris Ledón-Rettig, whose research interests focus on the role of developmental and behavioral plasticity in adaptive evolution, has been an assistant professor with IU Biology since August 1, 2021. Before that, she was an assistant research scientist with the department from July 1, 2017, through July 31, 2021.

Ledón-Rettig earned her Ph.D. from the University of North Carolina, Chapel Hill. She was an NSF postdoctoral fellow with University of South Florida, Tampa, Department of Integrative Biology; an NSF postdoctoral fellow at North Carolina State University Department of Molecular Biomedical Science; and a postdoctoral fellow in Armin Moczek's lab at IU Biology.

signaling proteins by proteases secreted by pathogens. Using cutting-edge genome editing techniques, Innes' team will create decoy substrates for these pathogen proteases which, upon cleavage, will activate the plant immune system, thus conferring resistance to infection.

They ultimately hope to develop genetic methods for the detection of pathogen proteases, both inside and outside plant cells, with a focus on wheat. If their proposed combination of intracellular and extracellular protease detection systems succeeds, it could potentially be deployed against many other cereal pathogens such as rust fungi and nematodes. Collectively, this genetic-based approach could dramatically reduce our dependence on environmentally damaging pesticides while increasing crop yields and reducing costs for farmers.

New campus celebrity: a beaver

Move over squirrels! There's a new critter on the IU Bloomington campus attracting attention. The *Indiana Daily Student* reported on Nov. 15, 2022, that a beaver has been busily building a dam along the Campus River near East 7th Street.

According to the Indiana Department of Natural Resources, beavers (*Castor canadensis*) were once rare in the state due to overharvesting—but, after reintroduction in 1935, the mammal has thrived and is now found throughout most of Indiana.

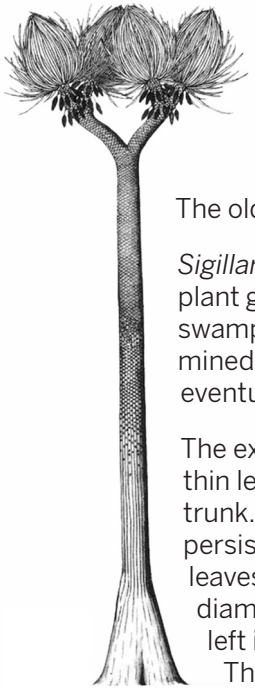
Contrary to popular belief, beavers don't live in dams; as ecosystem engineers, they construct dams to shape the habitat to meet their needs. They are well equipped for the task with front feet adept at digging and carrying and webbed hind feet for swimming. Their characteristic flat tails serve as rudders as well as support them when cutting trees with their front teeth.

Beavers are vegetarians. Although the beaver is North America's largest rodent, weighing between 30 and 70 pounds, it poses little threat to humans.

The campus beaver's dam is in a wooded area far from footpaths. The *IDS* article quoted IU Professor P. David Polly as saying that the beaver presents no risk to students. "The main conceivable risk is that one could fell a tree," Polly said, "The chances of [the tree] hitting a student are almost zero."

Beaver. *Adobe Stock photo*

Oldest tree on IU Bloomington campus?



You won't find it listed in "The Woodland Campus" walking tour guide. Quite possibly the oldest tree on campus—it went mostly unnoticed in the south lawn of the Biology Building for many years. It was moved to a more prominent location in November 2020.

The old "tree" is actually a fossil of a large *Sigillaria* stump.

Sigillaria lived around 320 million years ago. The ancient treelike plant grew rapidly to nearly 100 feet tall in the dense Indiana swamp coal forests. It became a major contributor to the coal mined in Indiana as it died and decayed—becoming peat and eventually coal millions of years later.

The extinct genus looked somewhat like today's palm trees. Long, thin leaves grew in a spiral along its single or occasionally forked trunk. The leaves—which were attached directly to the trunk—persisted only at the trunk's top near its growing tip. Where the leaves had fallen off of the lower part of the trunk, characteristic diamond-shaped scars (that can be seen in some fossils) were left in vertical rows by the old leaf bases as the trunk expanded. The plant produced spores (not seeds) in cone-like structures attached to the stem.

The stump fossil was formed when the plant died; sediment filled the hollow space where the center rotted out within a ring of strong and thick bark. The hardening of the sediment produced the cast of the trunk.

The *Sigillaria* cast displayed on the IU Bloomington campus was collected in 1972 in southwestern Greene County, Indiana, by IU Vice Chancellor and Dean of the Faculties Henry Remak and IU Professor of Paleobotany David Dilcher.

ABOVE
An artist's rendering of the treelike *Sigillaria*. *Courtesy of David Dilcher*

RIGHT
The *Sigillaria* stump cast (shown in this June 2019 photo) sat on the south lawn of the Biology Building for many years. It was relocated and perched atop a large circular planter at the northeast corner of Myers Hall in November 2020. *Photo by Terri Greene*

IU Biology welcomes six new faculty members

We introduce you to our newest faculty members: David Bollivar, Ryan Bracewell, Heather Hundley, Cris Ledón-Rettig, Luke Nikolov, and Mansi Srivastava.

Bollivar. *Photo by Terri Greene*

Upon his arrival in August, **David Bollivar** hit the ground running as a senior lecturer and the director of the Biotechnology Master's Degree Program. Bollivar is an IU alum, having earned his Ph.D. in plant sciences from IU. He joins our department after retiring as the Miner Linnaeus Sherff Professor of Botany at Illinois Wesleyan University.

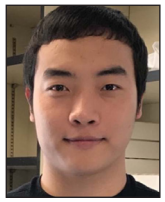
Bollivar grew up in the country outside a small town in central Illinois. He received a B.A. in biology from Illinois Wesleyan. While on faculty at Illinois Wesleyan, Bollivar was active in the community—serving as a faculty advisor to the student Habitat for Humanity chapter. As a project director, he worked on houses every Saturday for over ten years. He and his students built 13 houses in collaboration with students from an adjacent university and the local affiliate.

Bollivar's research interests are tetrapyrrole biosynthesis and the isolation of bacteriophages from natural samples. He has engaged first-year undergraduate students in the isolation of bacteriophages as a course-based research experience as part of the HHMI Science Education Alliance PHAGES program.

Bracewell. *Courtesy photo*

Ryan Bracewell comes to IU Biology from the University of California, Berkeley, where he was a postdoc. He has also served as an entomologist with the USDA Forest Service. Bracewell, who started his position as assistant professor with our department in January 2022, holds a Ph.D. from University of Montana, an M.S. from Utah State University, and a B.S. from Colorado State University. He grew up in Colorado and has "bounced around" the western United States—living in Colorado, Utah, Montana, California, and Idaho before arriving in Indiana. He loves fly fishing and ties his own flies. His first job was as a cave tour guide.

Bracewell studies speciation and evolutionary genetics and genomics. His background is in entomology, so he typically works in insects to try to understand their remarkable diversity. He is also interested in teaching evolutionary genetics and genomics and helping people use genomic data and bioinformatics in their research.


Ren


Bolin


Erdmann

In a paper published in *PNAS*, lead author graduate student **Zhongqing Ren** and colleagues identify how the plant pathogen *Agrobacterium tumefaciens* organizes and segregates its genome.

Ph.D. candidate **Lana Bolin** is part of a team studying how farmers' decisions affect the microbes in their soils and what that means for plant resilience to drought. The researchers received a five-year, $1.4 million NSF award. Watch the YouTube video about Bolin's research at https://www.youtube.com/watch?v=jyoSLyDEcUQ.

NIH presented graduate student **Emily Erdmann** with its Ruth L. Kirschstein National Research Service Award Individual Predoctoral Fellowship to further her research on ADAR function in the germline to understand how RNA regulation and modification contribute to successful reproduction.


Jillian Lewis examines a frame from one of the Newton lab's bee hives. *Photo by Indiana University*

All the buzz! To protect and grow honey bee populations, undergraduate **Jillian Lewis**, a member of Irene Newton's lab, is studying how the bacteria commonly found on and around bees can benefit them. Watch the YouTube video about her research at https://www.youtube.com/watch?v=5uBJC-LEuYo.

IU Biology graduates by the numbers

Sep. 2021–Aug. 2022

273 undergraduate degrees

43 graduate degrees

Undergrad degrees/majors included:

- 9 double majors
- 16 dual degrees (two B.S. degrees or a B.S. degree and a B.A. degree)
- 1 triple degree
- 5 degrees with Dept. of Biology honors

Graduate degrees:

- 12 Ph.D.s in Evolution, Ecology, and Behavior
- 13 Ph.D.s in Genome, Cell, and Developmental Biology
- 7 Ph.D.s in Microbiology
- 6 M.S. degrees in Biotechnology
- 2 M.S. degrees in EEB
- 1 M.S. degree in GCDB
- 2 M.S. degrees in Microbiology

Student profile: Logan Geyman

A natural-born scientist

Logan Geyman stands out among his classmates—literally. He's 6 feet 4 inches tall. But, it's his determination, dedication, and discipline to research that have especially earned him notice.


Logan Geyman (far right) poses in front of the Biology Building atrium with fellow incoming Microbiology graduate students and recent program director Irene Newton (far left) in August 2022 during student orientation. *Photo by Terri Greene*

Geyman is a first-year Ph.D. student in the IU Microbiology Graduate Program. He is a member of Associate Professor Julia van Kessel's lab in the Department of Biology. He also worked in van Kessel's lab as an undergraduate.

"Because Logan has worked in my lab since he was a sophomore at IU, he's a core lab member, mentor, and leader in our group," said van Kessel. "He's one of the brightest and most dedicated students I have encountered, devoted to his education and science career. Logan is passionate about science in many forms: basic biology, human health, science communication, and education. He will shine as a star in grad school here at IU and in his future career."

Geyman is interested in molecular tool design and understanding how communication among bacteria can be leveraged as a target for new therapeutics to fight infections.

"I really enjoy thinking about how pathogens might evolve around new drugs," said Geyman. "Our lab studies quorum sensing (a cell-cell communication signaling process used by some bacteria). We want to know how and why bacteria communicate. Being able to talk to their neighbors allows these bugs to coordinate their behavior, making them really good at forming robust communities. This behavioral coordination also means they're exceedingly good at making us and our livestock sick. While we lean on antibiotics to both treat and—as in the case of livestock—prevent infections, resistance to these keystone compounds means bacterial infections are becoming more severe, more deadly, and more costly. To help curb this effect, we're looking at bacteria's communication system as a way to suppress the behaviors that lead to infection. While developing these drugs is imperative, so is understanding how bacteria might circumvent them."

Specifically, Geyman is investigating how inhibiting bacterial communication impacts how well an organism survives, proliferates, and infects hosts. Understanding this allows us to make predictions on how resistance to treatments might emerge and spread in bacterial populations. And, understanding the nuances of bacterial communication will aid in determining dosages, delivery methods, and guidance on use to minimize resistance and maximize the lifetime of treatments. To facilitate this for future drug development, Geyman hopes to use his research data to build computer models that report on how sensitive drug targets are to the emergence of resistance.

The making of a research scientist

Geyman has loved science for as long as he can remember; however, after watching the "How bacteria 'talk'" TED Talk by Princeton University molecular biologist Bonnie Bassler during his sophomore year in high school, he focused his research interests on quorum sensing. This in turn influenced his college selection.

Hailing from Zionsville, Indiana—Geyman admits that the affordability of attending an in-state university for his undergraduate degree attracted him to Indiana University, but that IU Bloomington's classification as an R01 or "very high research activity" institution played a major role in his decision to attend IU. The final aspects, however, that swayed him were the opportunity to join the IU ASURE program as part of its pilot class and the presence of van Kessel's quorum sensing lab on campus. Geyman credits van Kessel and his ASURE mentor, Mike Manzella, in influencing his choice to pursue a Ph.D. and, by extension, a career in research.

"Their mentorship, support, and guidance gave me the confidence and skill set I needed to step into the field in a meaningful way. They provided me with research experiences that helped me discover my passion," noted Geyman.

As an undergraduate, Geyman received the IU Provost's Award

American Society for Microbiology awarded **Irene Newton** with its 2023 Honorary Diversity Lecturer Award for significant contributions in advancing microbial sciences.


Newton


Patton


van Kessel

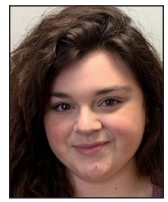
John Patton and his lab will further develop a new technology for a combination oral vaccine to protect infants from deadly viral diarrhea. Venture capital firm GIVAX Inc. granted Patton $1.2 million to develop the first-of-its-kind rotavirus-norovirus vaccine. ◆ And, the Bill and Melinda Gates Foundation has funded Patton to identify features of the rotavirus vaccine strains for modification to induce higher levels of immunization.

National Institutes of Health has renewed funding for **Julia van Kessel**'s quest to develop resistance-proof drugs to fight infection by targeting the quorum sensing pathway of bacteria, awarding van Kessel over $2 million as a five-year extension of the Maximizing Investigators' Research Award for Early Stage Investigators she received in 2017. ◆ She has also received funding to study how a pathogen interacts with its environment in a coral host in order to better understand how to help maintain endangered coral reef ecosystems (*see "Coral corral" on page 2*). ◆ And, van Kessel's team was chosen as first-place winner of the inaugural IU Idea to Startup Pitch Competition for its startup that aims to prevent disease caused by pathogenic *Vibrio* bacteria.

Student achievements

The USDA National Institute of Food and Agriculture awarded Agriculture and Food Research Initiative Predoctoral Fellowships to graduate students **Matt Gibson**, **Allie Margets**, and **Delaney Miller** to fund their projects to solve emerging agricultural challenges. The NIFA initiative seeks to develop new scientists and professionals to enter research, education, and/or extension fields within the food and agricultural sciences in the private sector, government, or academia.


Gibson


Margets


Miller

Margets is investigating the molecular mechanisms of soybean cyst nematode effector proteins. Miller seeks to identify symbiont distribution and natural variance in antifungal production as she explores genomics of a honey bee defensive symbiont. Gibson (who completed his Ph.D. earlier this year) used his award to continue his study of the coastal-inland adaptation genetics of wild tomatoes to establish groundwork to build a better tomato.

Faculty achievements

Find details about the achievements below and more faculty and student accomplishments at https://biology.indiana.edu/news-events/news/.

Steve Bell was named Distinguished Professor, IU's highest academic title for its most outstanding and renowned scholars and researchers.

American Society for Microbiology recognized **Ankur Dalia** with its Award for Early Career Basic Research for his outstanding contributions to microbial sciences.

American Academy of Arts and Sciences, one of the oldest and most prestigious honorary societies in the U.S., elected **Lynda Delph** to its ranks in its latest class of honorees.

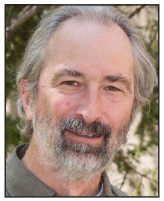

Bell


Dalia


Delph


Ketterson


Lennon


Lynch

The inaugural Sagalowsky Family Endowed Professorship in Biology was awarded to **Heather Hundley**, whose research is paving the way to improve targeted treatments for human disease. The professorship was made possible by a generous gift from IU alumnus Howard Sagalowsky (1943-2020) in memory of his parents and in honor of his brother, Joel, also an IU alum.


Hundley

Joel (left) and Howard Sagalowsky during their campus visit on May 16, 2011. *Photo by Jocelyn Bowie*

Internationally acclaimed evolutionary biologist **Ellen Ketterson** was named as American Society of Naturalists' elite Honorary Lifetime Member.

Jay Lennon was elected member-at-large for the Ecological Society of America governing board. ◆ He was also awarded a Humboldt Research Award from the Alexander von Humboldt Foundation—given to "internationally renowned scientists and scholars in recognition of their lifetime's research achievements."

Genetics Society of America honored Distinguished Professor Emeritus **Michael Lynch** with its Thomas Hunt Morgan Medal for lifetime contributions to the field of genetics.

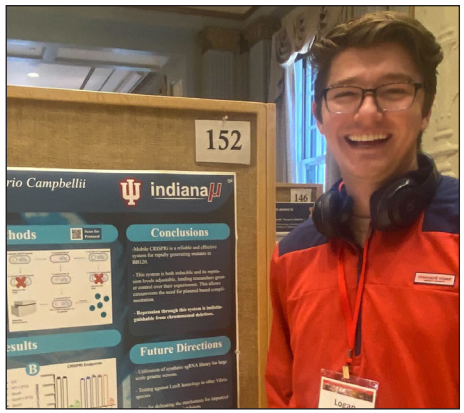
for Undergraduate Research and Creative Activity—granted annually to five exceptional IU students for remarkable work in their fields. Additionally, he received the IU College of Arts & Sciences Award for Undergraduate Research and Creative Activity, the Drs. Sidney and Becca Fleischer Research Scholarship (given to outstanding undergraduate students demonstrating strong potential for success in scientific research careers), and the Jim Griffin Research Scholarship (awarded to ASURE students to fund summer research experiences). The Griffin scholarship funded his first experience in the van Kessel lab.

Geyman completed his Molecular Life Sciences B.S. degree with a concentration in Developmental & Cellular Biology in May 2022. He graduated with departmental honors.

When van Kessel offered Geyman direct admission into her lab through the IU Microbiology Graduate Program, she didn't have to make the offer twice.

"This meant I could continue developing my molecular tools and use them to explore quorum sensing therapeutics and resistance emergence," said Geyman.

"Additionally, picking a mentor is arguably the most critical decision a graduate student can make," he continued. "Dr. van Kessel has demonstrated time and time again her unfaltering support of my curiosity, education, and overall well-being. The other faculty in the department are also incredibly supportive and helpful. Therefore, I knew that staying meant I would be supported through both my successes and failures by my mentor and the rest of the department—something that isn't guaranteed at every school."



Logan Geyman presents his research poster this fall during the 2022 Midwest Microbial Pathogenesis Conference at University of Wisconsin–Madison. *Courtesy photo*

Logan Geyman (right) poses for a photo with his research mentor Julia van Kessel after the IU Biology Student Awards Ceremony on April 29, 2022. *Photo by Terri Greene*

After completing his Ph.D., Geyman looks forward to pursing an academic postdoc position with the eventual goal of obtaining a tenure-track faculty position at a university.

IU President Whitten tours fly facilities

IU Bloomington is a world leader in *Drosophila* (fruit fly) research. The Department of Biology maintains three federally funded centers essential to the research. We were excited to show off the facilities and labs to IU President Pamela Whitten during her visit on September 6.

Senior Scientist Kevin Cook, BDSC Codirector, shows IU President Pamela Whitten (right) one of the center's many *Drosophila* cultures while explaining fly biology and caretaking. *Photo by Chris Meyer*

- The **Bloomington Drosophila Stock Center** (BDSC) propagates and distributes over 80,000 genetically unique fly strains and typically ships 220,000 samples to 50 countries every year.
- The **Drosophila Genomic Resource Center** (DGRC) is a repository for materials used in biotechnology research with flies. It maintains 1.3 million DNA clones and 245 fly cell lines. It shipped 2,500 samples to labs in 30 countries in FY22.
- **FlyBase** is a multi-university consortium that curates information about *Drosophila* research and presents it online. During 2021, there were 10.4 million page views by users around the world. The IU Bloomington team focuses on computer development for the public website.

The genes and physiology of flies are remarkably similar to those in humans, making it possible for *Drosophila* research to uncover the cellular basis for many human diseases—leading to better medical treatments. Nearly 4,000 biomedical labs worldwide use *Drosophila.* U.S. federal funding agencies alone spend a half billion dollars each year to support *Drosophila* research.

Elena Sullivan (left), biology major and undergraduate researcher in the Calvi lab, talks about her project using *Drosophila* as a cancer model with IU President Pamela Whitten and Professor Brian Calvi, principal investigator on FlyBase. *Photo by Chris Meyer*

IU President Pamela Whitten toured rooms where the Bloomington Drosophila Stock Center stores living cultures of over 80,000 genetically unique fly strains. *Photo by Chris Meyer*

Professor Andy Zelhof (right), DGRC Director, discusses the use of *Drosophila* as a research model organism with IU President Pamela Whitten and BDSC Codirector Kevin Cook. *Photo by Chris Meyer*