



DEPARTMENT OF

# BIOLOGICAL SCIENCES

||||| 2016-2017 ACADEMIC YEAR HIGHLIGHTS

ADVANCING HUMAN AND ENVIRONMENTAL HEALTH



UNIVERSITY OF  
NOTRE DAME  
College of Science



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EVOLUTIONARY BIOLOGY  
**CANCER**  
ANATOMY AND PHYSIOLOGY  
NEUROSCIENCE INFECTION  
AND BEHAVIOR DISEASES  
**ENVIRONMENTAL**  
**SCIENCES** ECOLOGY  
EPIDEMIOLOGY AND POPULATION BIOLOGY  
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**BIOLOGY** DEPARTMENT  
OF BIOLOGICAL SCIENCES

GLOBAL HEALTH  
VECTOR-BORNE DISEASES  
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GENETICS &  
GENOMICS  
DEVELOPMENT  
MICROBIOLOGY  
& IMMUNOLOGY



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The **Department of Biological Sciences** is the core of research and education in the Life Sciences at Notre Dame. Housed predominantly in the Galvin Life Sciences Building at the center of our beautiful campus, the department is home to a diverse community of scholars invested in biological inquiry. Our diverse teaching and research interests span the broad range of the life sciences. Our endeavors can be conceptually organized into three foci: Cellular and Regenerative Biology; Infectious Disease and Global Health; Ecology, Evolution and Environment. However, our culture and practice is highly interdisciplinary; we integrate across these foci and beyond traditional disciplinary, scientific and administrative boundaries. Our overall mission is to conduct research at the forefront of 21st century integrative biology and to cultivate leaders who will make a difference to the future of human health and the environment.



**Crislyn D'Souza-Schorey**  
*Morris Pollard Professor &  
Department Chair*



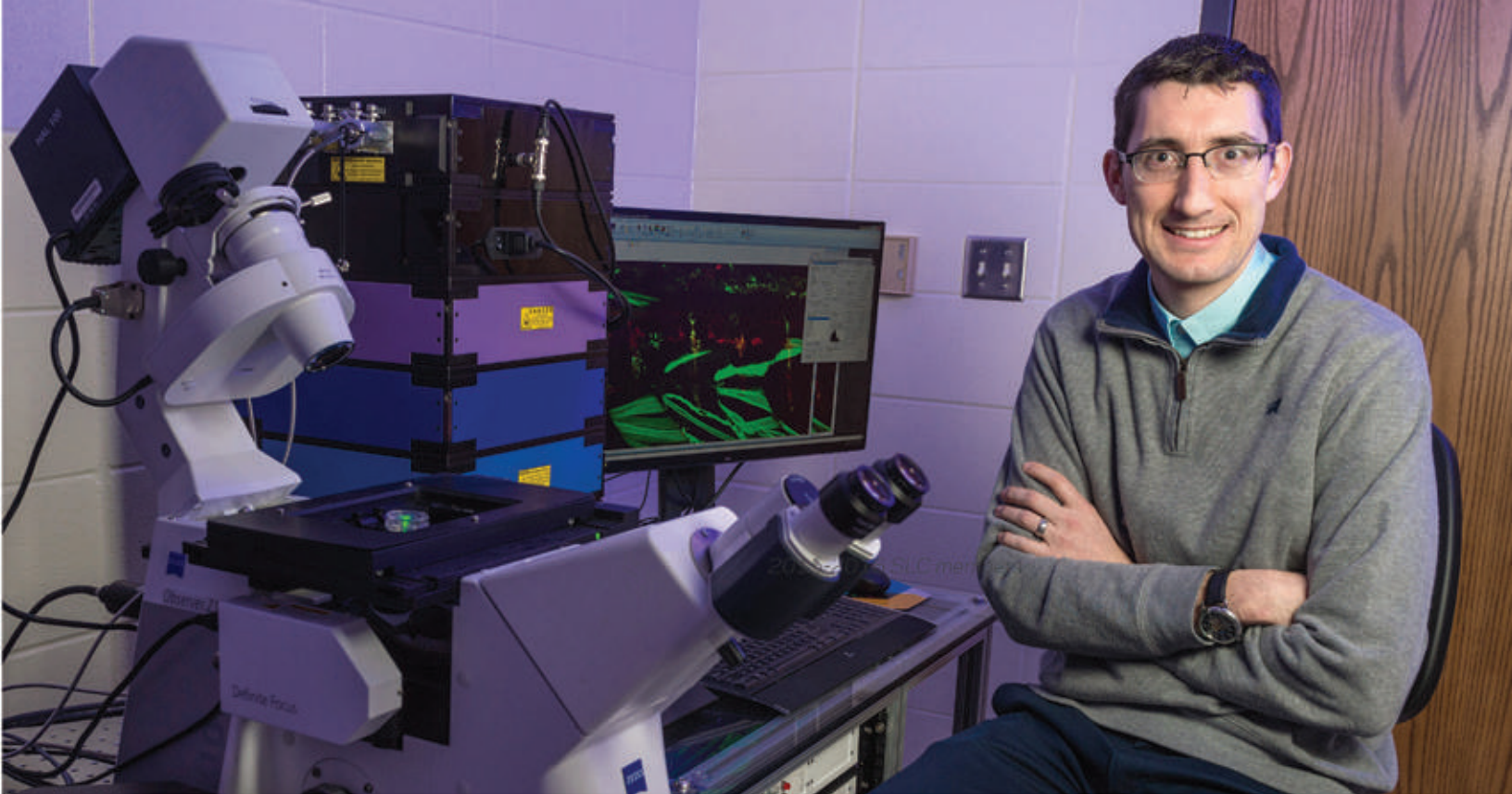
**Nora Besansky**  
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Professor & Associate Chair*



**Michelle Whaley**  
*Teaching Professor &  
Assistant Chair*







## NOTRE DAME BIOLOGIST CODY SMITH WINS PRESTIGIOUS SLOAN RESEARCH FELLOWSHIP

Cody J. Smith, the Elizabeth and Michael Gallagher Assistant Professor in the Department of Biological Sciences, was selected as a 2017 recipient of the prestigious Sloan Research Fellowship.

Every year the Alfred P. Sloan Foundation selects promising early-career scholars from the fields of science, engineering, technology, mathematics, and economics, as recipients of the Sloan Research Fellowship. Recipients are awarded a two-year research grant in recognition of their distinguished performance and unique potential to make substantial contributions to their fields, and society.

Smith explains that his lab studies "how the cells in the nervous system organize in the very early stages of nervous system development." A graduate of Vanderbilt University, Smith earned a Ph.D. in cell and developmental biology, with a specific focus on neuronal cells. Subsequently, he went on to complete a postdoctoral fellowship at the University of Virginia, where he redirected the focus of his work to glial cells. "Neurons have been studied for years, but these other cell populations called glial cells outnumber the neuronal cells and we know very little about them," he explained. Glial cells have been a relatively neglected area of research due in part to the fact that they were once perceived as mere supporting cells for neurons, which functionally drive all behaviors. More recently, however, research has shown that glial cells are involved in early development, learning, and memory.

Having identified a niche, Smith now studies the intersection of neuronal and glial cells. His lab examines how these cells organize to create, maintain and change functional circuits during development, as well as how they impact regeneration. Using time-lapse imaging to observe cells and the proteins within them as they perform various functions in the nervous systems of live zebrafish, Smith and his team are able to gain insight into how these cells and proteins can be targeted to provide therapeutic treatments for spinal injuries and diseases, such as Multiple Sclerosis (MS) and Charcot-Marie-Tooth disease (CMT). The Sloan Fellowship will allow the lab to extend its current research efforts by using the same techniques to answer new questions; utilizing time-lapse imaging they will be able to characterize a phenomenon, then apply molecular techniques to reveal unknown determinants and their potential impact on disease.

Smith lauded Notre Dame for what he identifies as a "unique upward trend in research support." He said, "A university that supports basic research is essential to being able to carry out the kinds of studies we are doing and moving the field forward. The support at Notre Dame is phenomenal and allows researchers the freedom to go after the questions that really interest them." He added, "With this research grant and the support of Notre Dame I'm hopefully going to begin answering some of the questions I've dreamt about asking for the past 10 years."



# KASTURI HALDAR RECEIVES 2017 GANEY AWARD

## IMPACTING HEALTH CARE IN RARE DISEASES

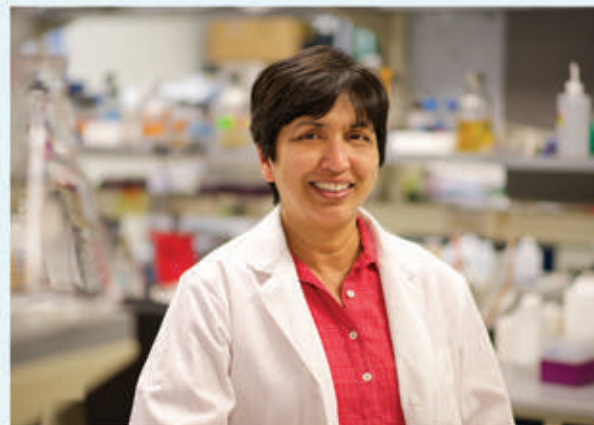
Professor Kasturi Haldar received the 2016 Rodney F. Ganey, Ph.D., Community-Based Research Award for a project that has helped improve rare disease recognition and treatment in northern Indiana. The award is presented annually to a regular faculty member at the University of Notre Dame who has completed at least one research project that addresses a need within South Bend or the surrounding area. Haldar is a molecular cell biologist and the Rev. Julius Nieuwland Professor of Biological Sciences and Parsons-Quinn director of the Boler-Parseghian Center for Rare and Neglected Diseases at the University of Notre Dame.

There are currently about 7,000 recognized rare diseases in the United States, and most medical clinicians will encounter only a small fraction of them even after years of practice in the clinic. So what does a clinician do when a patient with a rare disease appears in her clinic? She might reach out to a rare disease specialist or genetic center for support if she has easy access to either of those. They could provide her with the clinical spectrum of related rare diseases to review and compare with her patient's symptomatology. But clinicians have demanding schedules and often no ready access to this kind of external support.

In northern Indiana, clinicians have long had to seek support for rare disease identification and diagnosis from Riley Children's Health or Indiana University Health in Indianapolis. Because those facilities are distant and often busy, accessing them can be time-consuming, and the key to treatment of any disease is accurate and timely diagnosis and management.

So in 2015, a team led by Dr. Kasturi Haldar applied for and received a Ganey Collaborative Community-Based Research Seed Grant for a project to improve rare disease management and treatment locally. The grant helped her and her team partner with advanced pre-med students, local pediatricians, and families of rare disease patients, as well the National Organization of Rare Diseases, the Michiana Health Information Network, and CRND to create a knowledge base and analytic framework for rare disease recognition right here in northern Indiana.

Using the combined resources of this partnership, Haldar and her team have developed a program that trains upper level pre-med students to evaluate rare disease patient medical records and help produce natural histories of disease. They then provide a local pediatric clinic with tools to strengthen the clinical context to manage and treat children with rare genetic disorders, empowering them with the most current data. This decreases the time to proper diagnostic understanding and the



establishment of a clear course of treatment. The project also empowers patient families by providing clinicians with up to date information on centers of excellence and other resources that they share with patients. At the Annual Notre Dame Rare Disease Day Conference every February, students also partner with patients to present poster and community-based patient talks.

The project has clearly impacted pediatric health care for rare disease cases in northern Indiana, but its impact has also gone beyond the region. In 2015, Haldar's team produced a case report of an unusual occurrence of neurofibromatosis (NF1), a rare genetic neurologic disorder. The report, "Aggressive Tibial Pseudarthrosis as Primary Symptom in Infant with Neurofibromatosis, which suggests need for modification of federal guidelines for NF1 diagnosis," has now been published by Cold Spring Harbor Laboratory's bioRxiv, where it will be available for review by the scientific community.



*Professor Haldar (far left) in her laboratory*

*Originally published by Center for Social Concerns*



# FACULTY SPOTLIGHT: ZACHARY SCHAFER

*Zachary Schafer is the Coleman Foundation Associate Professor. A Notre Dame alumnus, he joined the faculty in 2009.*

## What brought you to Notre Dame?

Being a professor at Notre Dame was (and is) my dream job. I am a proud Notre Dame alumnus (B.S. in Biological Sciences, 2001) and since the day of my graduation, I was thinking about the possibility of returning to Notre Dame as a faculty member. This is a place that means so much to me. My wife (Veronica, also a 2001 alumnus) and I got engaged at the Grotto were married at the Basilica. We brought each of our 4 kids (Noah, Ethan, Claire, and Ava) home from the hospital in a Notre Dame hat. Claire and Ava were both baptized at the Log Chapel.

I think what makes Notre Dame such a unique place is its sense of community and purpose. I was drawn to this as an undergraduate student and am now sustained by it as a faculty member. In addition, Notre Dame has seen significant growth over past 10-15 years in the sciences.

**"That upward trajectory, coupled with the superb faculty colleagues in the Biological Sciences department, allowed me to validate my conclusion that there was no better place to begin my academic career than at my alma mater."**

## What are your research interests and why you are passionate about this topic?

Understanding the intricate and complex mechanisms by which cells either live or die is an enduring question that I find tremendously fascinating. My laboratory is built on studying cell death and survival and more specifically, focuses on how cancer cells survive during metastasis (the process by which cancer cells spread from the primary tumor to distant sites in the body). If we can better understand the basic biological mechanisms by which cancer cells survive during metastasis, then we can potentially utilize this information for the development of novel therapeutic approaches designed to specifically kill metastatic cells.

Unfortunately, cancer cells are insidious in their resourcefulness to employ numerous, diverse strategies that allow for their survival when disseminating to other sites in the body. Thus, my laboratory has taken a multi-pronged, interdisciplinary approach to study this problem. Currently, there are multiple, distinct initiatives underway in my laboratory; all with a focus on better understanding the mechanisms that cancer cells utilize to survive during metastasis. Each project is led by a Notre Dame graduate student (there are currently 5 in my lab) and supported by Notre Dame undergraduate students. About half of the lab is focused on projects related to cell metabolism and how changes in nutrient utilization can impact cancer cell survival. The other half of the lab works on studying programmed cell death (known as anoikis), and how cancer cells block this process.



## What have been some of the strongest influences in your career?

I had the opportunity to train with two of the best cell biologists in the world: Sally Kornbluth at Duke (in graduate school) and Joan Brugge at Harvard (as a post-doc). They instilled in me a love for basic science and have influenced me (and my laboratory) in an indelible fashion. On a couple of occasions, I have had colleagues listen to me (or a student from my lab) give a talk and then tell me they can see Sally or Joan's mentorship in my laboratory's science. No question that I have never received higher compliments than these.

Outside of these scientific mentors, the strongest influences in my life have all come from my family. My wife (Veronica) has, through example, taught me about compassion, selflessness, hard work, and integrity. My kids help me keep perspective on what is most important and consistently motivate me to be a better scientist and father. My parents (Tom and Kathy Schafer) gave me the foundation to build my academic career here at Notre Dame. Without their unending support, love, inspiration, and encouragement, I would not have survived college or graduate school.





Many faculty in the department of Biological Sciences lead in their disciplines through scholarship. Here is a sampling of faculty accomplishments and honors in the past academic year.



### **Ken Filchak promoted To Teaching Professor**

**Ken Filchak** joined the department of biological sciences as a graduate student in 1998, earning his Ph.D. 2001. He continued his research as a postdoctoral fellow until 2003, when he was then appointed to Assistant Teaching Professor. In his time as special professional faculty, he has taught over 7,000 students through variety of courses. Since 2013, Ken has also served as director of undergraduate studies (DUS) for the environmental sciences major in the department of biological sciences. Filchak received the Rev. Edmund P. Joyce, C.S.C. Award for Excellence in Undergraduate Teaching in 2012.

### **Xin Lu receives 2017 Indiana CTSI Young Investigator Award**

**Dr. Xin Lu**, the John M. and Mary Jo Boler Assistant Professor of Biological Sciences, in the Boler-Parseghian Center for Rare and Neglected Diseases, has been awarded a Young Investigator Award from the Indiana Clinical and Translational Sciences Institute (CTSI). His research focus is tumor microenvironment, in particularly rare cancers. Lu is working on methods of drug delivery to selectively find and kill cancerous cells, leaving healthy tissue intact. Lu has proposed a strategy of coupling drugs to antibodies that can recognize targets on prostate cancer cells.



### **Alex Perkins named Early Career Fellow by the Ecological Society of America**

**Dr. Alex Perkins**, Eck Family Assistant Professor, and member of the department of biological sciences, the department of applied and computational mathematics and statistics, the Eck Institute for Global Health, and the Environmental Change Initiative, was named a 2017 Early Career Fellow by the Ecological Society of America (ESA). Early Career Fellows are ESA members who are within eight years of completing their doctoral training, and have distinguished themselves by advancing ecological knowledge and applications and by showing promise of continuing to make outstanding contributions to a wide range of fields served by the ESA. Perkins was one of only seven individuals nationwide honored as an Early Career Fellow in 2017.



### **Patricia Champion receives Joyce Award for Excellence in Teaching**

**Patricia Champion**, Associate Professor in the Department of Biological Sciences, has received Rev. Edmund P. Joyce, C.S.C., Awards for Excellence in Undergraduate Teaching. Patty was one of five faculty members within the College of Science to receive this distinction. Patty joined the department of Biological Sciences in 2007, and routinely teaches the Medical Molecular Genetics course to undergraduates.





### Hyde awarded \$1.9 million as part of the effort to reverse blindness

**Dr. David Hyde**, Professor of Biological Sciences, and his team have been awarded over \$1.9 million from the National Institute of Health (NIH) to identify biological factors that influence neural regeneration in the retina. Hyde will lead one of six projects that are part of the National Eye Institute (NEI) Audacious Goals Initiative (AGI), a targeted effort to restore sight to blind individuals by regenerating neurons and their connections in the eye and visual system.



### Notre Dame researchers to lead NSF Dimensions of Biodiversity study

**Dr. Jeffrey Feder**, Professor of Biological Sciences was awarded a \$2 million grant from the Dimensions of Biodiversity program within the National Science Foundation (NSF) in late 2016. The grant will allow Feder and his team of researchers to examine how shifts in insect behavior in one species affects other species of associated insects to adjust their behavior, generating new biodiversity. The project also includes workshops with high school teachers and students to build curricula supporting “learning by doing” and meeting national standards in science education.

### Stuart Jones recognized as 2016 ASLO Fellow

**Dr. Stuart Jones**, Associate Professor of Biological Sciences, Assistant Director of the University of Notre Dame Environmental Research Center (UNDERC), and member of the Environmental Change Initiative, was honored as an Association for the Sciences of Limnology and Oceanography (ASLO) Fellows at the 2017 meeting in Honolulu, HI. A member of ASLO since 2005, Jones was recognized by the Association “for having achieved excellence in his contributions to ASLO and the aquatic sciences”.



### Gary Belovsky receives Friend of the Lake Award

**Gary Belovsky**, Professor of Biological Sciences and Professor and Gillen Director of the University of Notre Dame Ecological Research Center, and a team of researchers have discovered alarming trends for the brine shrimp (*Artemia franciscana*) population in the Great Salt Lake (GSL) in Utah. His team found a clear relationship between cyst buoyancy of parent shrimp and their offspring. The impact in the reduction of the brine shrimp population could be financially and environmentally substantial, with potential reductions in the \$57 million industry of Utah’s economy, and for the five million birds who feed on the GSL’s brine shrimp population every year.

### David Veselik receives Dockweiler Award for Outstanding Advising

**David J. Veselik**, director of undergraduate studies and associate teaching professor in the department of biological sciences, was one of three recipients of the Dockweiler Awards for the 2016-2017 academic year. David is currently coordinator of the cell biology laboratory, and the biology club advisor. With his guidance, students have participated in several department initiatives, including alumni mentoring, lab shadowing, vertical peer mentoring and networking with the career center.







# Learning



## GOING DIGITAL IN THE CLASSROOM

For many of us, the term “educational media” once meant VHS tapes or CD-ROMs. But the rapid growth of digital technology has opened up new ways to communicate concepts, both in the classroom and in an online environment. Through funds provided by the Provost’s Digital Initiatives in Notre Dame’s Office of Digital Learning, a multi-disciplinary group of Biological Sciences faculty partnered with the ODL to develop media-rich Learning Modules in Biology. The faculty team, led by Kristin Lewis, saw the opportunity to work with ODL digital learning specialists to develop custom materials that connect students, especially those in introductory level courses, with important ideas in biology.

For some faculty, like Dr. Mark Olsen, the motivation came from many years of working with first year students, “I have a good appreciation for the needs of incoming biology major intents. My primary motivation was to discover and leverage new online pedagogy and assessment tools for my students.” Dr. Shaun Lee was “fascinated with the idea of incorporating digital learning into my own pedagogy and wanted to learn how to best use the resources offered by ODL to enhance my class offerings.” Others, like Dr. Gary Belovsky, wanted to help students better appreciate a specific concept such as the evolution of biodiversity, “Students are changing how they want to learn and we need to respond to this to be successful.”

Faculty teams were assembled around core concepts in biology including evolution, ecology, genetics, and energy transformations, and each team took a different approach to presenting the major ideas in their area. Olsen and Lee were joined by Dr. Dominic Chaloner and Dr. Stuart Jones, and focused on “bringing the literature alive” by embedding video and other media to enrich seminal papers in ecology. Drs. Joseph O’Tousa and David Hyde presented concepts of mutation and gene regulation in the context of their own research in retinal disease. Dr. Hope Hollocher developed a detailed online tutorial to help students model the process of evolution through population genetics, and Belovsky made use of the specimens from the Museum of Biodiversity to help students experience biological history.

Dr. Jeanne Romero-Severson worked with the ODL film team and animation artists to go back to the beginning of life in the oceans to better understand how photosynthesis powers the planet today. The various modules have one thing in common; they harness the expertise and passion of faculty so as to motivate students to discover their own passion for biology.

The development process was a rich learning experience for faculty. First, the team learned that developing high quality digital materials takes more effort than it might appear, and that the process requires careful consideration of which concepts are most important. “It’s critical to have a team that is philosophically in sync about both the broader idea and specifics of how that might be implemented” noted Chaloner. Some of the most interesting conversations happened when team members were from different disciplines of biology, for example Lee, a microbiologist, was teamed with Chaloner, Jones, and Olsen, all ecologists by training. Lee said, “Being a microbiologist and thinking about ecological principles with respect to topics such as infection-host dynamics, and microbiomes, in light of fundamental ecological concepts was something truly novel and innovative that our group strived to pursue.”

The Digital Learning Modules provide an important proof of concept of how faculty can better connect with the present generation of biology students.

**“Biological Sciences has been a pioneer in developing a robust online suite of materials for the benefit of the students; the creativity, vision, and quality of these digital materials is exemplary of the faculty’s deep commitment to student learning”,**

said Elliott Visconsi, Chief Academic Digital Officer in the Provost’s Office. These new materials will be piloted with Introductory Biology students this academic year, to be fully integrated into a new and innovative active-learning introductory biology sequence, which will launch in Fall 2018.

*Contributed by Kristin Lewis*



# FACULTY SPOTLIGHT: MICHAEL PFRENDER

Michael Pfrender, Associate Professor in the Department of Biological Sciences, is also the Director of the Genomics & Bioinformatics Core Facility. He joined the faculty in 2009.

## What brought you to Notre Dame?

I grew up not far from South Bend in southern Michigan and so I was always aware of Notre Dame as a powerhouse for undergraduate education and athletics. What I did not know, was that Notre Dame is also a powerhouse in Science and Engineering. Particularly in the area of my research in Evolutionary and Ecological Genomics. In 2009 when a position opened up in Biology I immediately saw an opportunity to work in an environment that would be an ideal place for me to train students in the growing complexity of modern biology. Around this same time, the university was investing in the Eck Institute for Global Health and the Notre Dame Environmental Change Initiative and the growth potential for genomic research in the areas of human and environmental health was clear. I couldn't have been happier when I was offered a position that brought me into this community and at the same time brought my young family closer to their extended family in Michigan.

## What are your research interests and why you are passionate about this topic?

Research in my lab is focused on understanding how populations evolve through time. Evolutionary change is the engine for all the amazing biodiversity the surrounds us. Studying the mechanisms that contribute to evolutionary change, and the rules that govern this process are among the most fascinating and complex problems in biology. Asking questions about how evolution occurs and what limits evolutionary change have been central to biology for more than 150 years. One thing that has always fascinated me is the way that evolutionary biology draws on, and unifies, all areas of biology from genetics and development to physiology and ecology. In my group we are particularly interested in aquatic systems and the organisms that live in them. Maintaining the health of these systems and the water resources they provide are critical to human societies. We study the genes and patterns of gene regulation that allow natural populations to fit into and thrive in their environments. Some major thrusts of our work include studying how aquatic organisms adapt to challenges in their environment like exposure to toxic compounds, elevated levels of ultraviolet radiation, and increasing salinity.



## What do you want the public to know about your research? Why is your topic important?

One clear feature of the environment on earth is that it is continually changing. If organisms are unable to adapt and diversify to track this dynamic environment they cannot persist. One important part of our work is to try to understand how quickly populations can respond to environmental change. What are the limits? How fast can the environment change before populations are unable to keep up and go extinct? It is clear that humans are having a large, and often negative, impact on natural environments. These impacts stress the organisms in natural systems and since human populations rely on the diversity of the organisms around us we are naturally concerned with preserving biodiversity for the long term. As much as evolution can help organisms in changing environments it also can create serious problems for us. Agriculture is constantly threatened by pests, and as soon as we develop a strategy to control these pests they evolve resistance forcing us to engage in a continual arms race. The same dynamic is true for many human pathogens. We develop a drug to combat a pathogen and it rapidly evolves resistance. This problem is amplified by the extremely short generation time for many of these organisms that have a major human health impact.

**"Understanding the process of evolution can help us preserve biodiversity and develop more effective strategies to combat these pests and pathogens."**

## What have been some of the strongest influences in your career?

I have been very fortunate to have worked with great mentors and colleagues at every stop in my career. Early on I worked in a natural history museum, which gave me a great appreciation for biodiversity. Later I worked with two great theoreticians who introduced me to the mathematical side of evolutionary biology. These mentors introduced me to the rich history of our field and prepared me for the incredibly rapid development of the field and genomics techniques over the past two decades. We can generate data and ask questions now that we could not even imagine when I was a graduate student. Can't wait to see what comes next.





## Exploring the GALÁPAGOS ISLANDS

### A UNIQUE STUDENT LEARNING EXPERIENCE

In the Fall semester of 2016, the Department of Biological Sciences offered a new course entitled "Galápagos Islands Field Practicum" to provide a field experience for learning the basic principles of evolution and ecology in the islands that inspired Charles Darwin over 175 years ago. These volcanic islands are located on the equator in the Pacific Ocean, 1000 km west of continental Ecuador, and are part of the Republic of Ecuador. Along with being an Ecuadorian National Park, the Galápagos Islands and the associated Galápagos Marine Reserve are a UNESCO World Heritage site. This volcanic archipelago is a unique and secluded habitat, positioned at the confluence of three major ocean currents, which has resulted in the isolation and evolution of many species of plants and animals over the millennia.

While the Galápagos Islands have been impacted by human habitation over the past 482 years since their discovery, they have largely remained the same as when Charles Darwin made his visit on the second voyage of the H.M.S. Beagle in 1835. The course provides an in-depth consideration of the unique climatological and geological conditions of the archipelago, the endemic flora and fauna of the islands, and the international efforts to study and restore the islands to their original conditions. The **14 students and 2 instructors** visited several islands by boat and explored Santa Cruz Island, our base location, in detail. The group was constantly accompanied by a certified Park Naturalist (as required by law) who provided in-depth information about the biology, ecology, and geology of the archipelago.

In this practicum, the course was designed around research projects developed by the students, in conjunction with advice from the instructors (Drs. Malcolm Fraser and Gary Lamberti, assisted by TA Katherine O'Reilly), that are designed to be easily conducted during the fall break visit to the islands. The students found creative and instructive ways to design their research projects to be completely

non-intrusive to the plants and animals of the islands. This was facilitated by the comparative lack of fear of humans on the part of nearly all the animals in the islands such that animal behavior could be viewed at close but safe quarters. The projects ranged from Galápagos sea lion behavior on remote islands versus at local fish markets to cataloging the invasive plant diversity on the different islands. Students submitted project reports, and gave PowerPoint presentations on their research.

The 8-day field trip over fall break was surrounded by creative learning experiences during the remainder of the semester. For example, the students engaged in a unique community service project before and after the field practicum, supported by ND-GAIN via the Center for Social Concerns. The students designed "Virtual Explorer" lessons for K-12 students at the Robinson Community Learning Center in South Bend, giving interactive presentations to the students prior to and following the actual excursion. While in the Galápagos, the students sent daily blogs to the K-12 students to help them stay involved in the experience. The excitement of the children for biology was tangible.



Marine Iguana, found only on the Galapagos Islands





Galapagos tortoise, with 'saddleback' shell

The course attracted students from a variety of majors including Biology, Environmental Science, Physics, Science-Business, Anthropology, and History. This diversity of interests and perspectives among the students greatly enriched the experience for everyone. Both students and faculty definitely felt the connection with and excitement of this unique environment where Darwin walked and studied and which helped spark the development of the Theory of Evolution by Natural Selection, and where ongoing studies have continued to add experimental evidence in support of this theory. The uniqueness of the ecosystems on these islands makes it easy to see the basis of this concept even in a single visit. For example, each major island has a unique race of Galapagos tortoise evolved to match the local plant food supply.

Biology and English major Sarah Cate Baker states

***"The Galápagos Islands felt like a living biology textbook."***

The concepts and theories I had been learning about for years in the classroom were suddenly right in front of me, and it really brought home the importance of my coursework. At the same time, there were so many new things to learn - it was a good reminder of why science can never stop asking questions. Going to the Galápagos was an incredible learning experience, and with each new discovery my love of biology was reaffirmed." Anthropology major Matt Williams adds "In the Galápagos Archipelago I found my inner scientist - the curious, childlike version of myself that loves nature and is endlessly perplexed by our existence. Coming to intimately know and openly embrace this science-loving alter-ego was pivotal in discovering my passion for science and finding my purpose as a science educator." And Physics and Philosophy major Liz Wildenheim notes "The most memorable feature of the trip for me was how different the Galápagos ecosystem was from any I had previously experienced. The islands had an unusually prehistoric feel with their huge reptiles, landscapes of lava rock, and frigate birds reminiscent of pterodactyls. I am grateful that I had the chance to experience this unusual setting in person."

This Fall semester 2017 will be the second offering of the course, allowing additional students the opportunity for this unique experience. Thus far, all students with financial need have received scholarship support from the Department and NDI Study Abroad, but we look forward to securing additional support for the course from other sources such as ND alumni through an endowment. This type of course embodies exactly what a ND course should entail -- namely a close collaboration among students and instructors, and a 'real' learning experience with active engagement of the study topic. While the course currently has one excursion per year allowing 14 students this unique opportunity, if the demand warrants it, the Department may consider as many as two excursions per year.

From a teaching standpoint, Professor Fraser states "This has been the most rewarding experience of my academic career. I was blown away by the excitement and intellectual curiosity of the students during the course and especially while in the Galápagos. It was especially gratifying to see the students as they experienced all this for the first time, the wonder and thrill of it all for them." Professor Lamberti adds "For me, the close interaction with students, getting to know each other on an intellectual and also personal basis, was marvelous. It was also a fantastic learning experience for us as instructors, where the natural environment substitutes for a textbook and the students lead the way with creative research projects." Both instructors deeply appreciate the support of the Department, College, and NDI in making this dream a reality for our students.



Protected Galapagos sea lion (on town bench)



Sally Lightfoot crab, intertidal inhabitant of the Galapagos

Contributed by Gary Lamberti and Mac Fraser. Photos provided



# ALEXIS DOYLE // RHODES SCHOLAR & BIOLOGICAL SCIENCES VALEDICTORIAN



*Biological Sciences major, Alexis Doyle, was selected to the United States Rhodes Scholar Class of 2017. Doyle, of Los Altos, California, is one of 32 Rhodes Scholars selected from a pool of 882 candidates who had been endorsed by their colleges and universities. She is Notre Dame's 18th Rhodes Scholar and will commence her studies at Oxford University in October.*

*Alexis gave the valedictorian address at the Department of Biological Sciences commencement ceremony on May 21, 2017. The following are excerpts of her remarks.*

Hello and good afternoon, to all of you here today. I am honored to be speaking in front of the single most impressive group of people that I have had the opportunity to know in my life. Sitting here today is a group of students who have accomplished truly remarkable things in just a span of four years. They are researchers, volunteers, leaders, and friends, and most are all of the above.

**In addition to collectively working thousands of hours in research labs studying topics ranging from climate change to tuberculosis, my peers have led clubs to mentor younger biology students here at Notre Dame, volunteered in the local community in literacy programs, at science fairs, in homeless shelters, and in medical clinics for the underserved—right here in South Bend and in countries all over the world.**

We would all be here for a pretty long time if I were to continue sharing all of the incredible things that this class has already done in several short years here at Notre Dame. I have learned immensely impactful lessons from many of these individuals, whose wisdom I will soon share with all of you.

Although we came from different parts of the country and the world, have different reasons for studying biology or environmental science, and will leave this campus soon to do different things, we share something that unites us all.

**We know the power that science has to advance human and environmental health—to preserve the beautiful world that we are lucky to cohabitate with many other living creatures.**

The difficulty that we will face entering the world as scientists will be quite different than the difficulty we

may have faced as science students at Notre Dame. It does not take much time with any newspaper these days to realize that we live in a country and a world that does not always embrace scientific findings with open arms. Claims have been made in recent years against methodically studied and evidence-based vaccines. Proposed federal budgets have been released this year that make some of the largest cuts to the National Institutes of Health in history. And perhaps most concerning: the fact that currently, in the United States, only 50 percent of people are concerned believers in climate change. In light of the intimate connection between the environmental and biological sciences, it is not surprising that studies show that climate change has already contributed to respiratory disease, heat-related conditions, vector-borne disease and food and water insecurity—both in the United States and abroad. Furthermore, these detrimental effects of climate change most significantly impact the vulnerable—such as those around the world who rely completely on small-scale agricultural production to make a living or low-income populations of the Southern United States who are disproportionately affected by parasitic disease due to vector-friendly warmer climates. On top of resistance to embrace scientific realities, we live in a country bitterly plagued by partisan divide, where matters of science can become political footballs thrown without regard to input of the scientific community that has most rigorously studied the issues at hand.

Although this reality can be daunting, I want to share with you just a few things I have learned from some of my classmates sitting here today that remind me of the path forward. I will share with you three stories—about biodiversity, a dinner, and a post-it note.



First, I will share what a graduating environmental sciences student taught me about biodiversity. Put simply, “biodiversity” means what it sounds like—the variety of life forms in a given ecosystem. The body of scholarship surrounding biodiversity is extensive, but its main principles are simple and powerful. When disaster strikes a given ecosystem, its level of biodiversity will be that which can allow the life in the ecosystem as a whole to prevail. How does this work? Well, if biodiversity is high in the form of wide genetic variability, there is a higher chance that certain species can survive due to unique characteristics that allow them to withstand a catastrophic environmental event.

As I reflected on my friend’s explanation of this profound biological concept, I realized that its implications are not just relevant on a biological level. On a societal level, the power of biodiversity reminds us of the importance of appreciating the diversity of our scholarly pursuits, our passions, our talents, our cultures, and even our political views.

**It is only in working with people that have different approaches than our own that we will create authentically resilient solutions to the complex scientific dilemmas that face our world.**

When we face the potential difficulty of working with people who may not have the scientific training that we do, the principle of biodiversity reminds us that our efforts to create new spaces of collaboration will be rewarded with more powerful and robust solutions.

Second, I will tell you a story about a very special dinner that was put on by a graduating biology major. As President of the Notre Dame Right to Life Club, she works on many issues, including abortion. Although abortion is one of the most significant bioethical issues of our day, it is common to avoid the topic in conversation, as it is one that has become increasingly religiously, morally, and politically charged. For her culminating senior capstone project, she organized a dinner in partnership with a pro-choice Notre Dame student. In attendance were 40 students identifying as “pro-life” and 40 students identifying as “pro-choice.” The dinner was filled with conversation between students who identified with different sides of the debate, as they aimed to arrive at more nuanced understandings of opposing opinions, and, in many cases, common ground.

This event was unprecedented at Notre Dame, and is in the process of becoming a model for other college campuses. Even with all she had on her plate this year managing the Right to Life Club (not to mention, being a full-time Biology major), my peer changed the status quo at Notre Dame

regarding an often divisive, but incredibly important bioethical issue. She created a space for dialogue and a platform for people with whom she fundamentally disagrees. As scientists entering a politically-charged world in which we will encounter fellow scientists, politicians, or other professionals with whom we disagree, her efforts remind us of the importance of working to create dialogue that begets understanding.

Finally, the post-it note. A fellow biology major that I met at Notre Dame during my sophomore year has a post-it note that he keeps above his desk. It says only two words: “Embrace Complexity.” I believe that the simple message of his post-it note speaks to the nature of the work of all the graduates sitting here today. As scientists, we ask questions about the complex world that surrounds us. We of course seek answers to these questions, but we never tire of asking questions. The beauty of the scientific method that guides our work is that we are just as satisfied if we disprove our hypothesis as when we prove it entirely. What matters is not necessarily if we were right or wrong in our original position. Rather, the rigor that we commit to our experimentation and investigation of our question is that which marks a worthy scientific endeavor. As scientists, we welcome experimental complication. We cherish the nuances of new discoveries. We embrace complexity.

Our world is one that is not only plagued by climate change and disease, but one that also is plagued by prejudice, indifference, and a refusal to compromise. It is easy to reduce complex problems to sound bites and to refrain from communicating with people from other disciplines or people with whom we disagree. But as scientists, committed to biodiversity, to dialogue, and to the integrity of the scientific method, we see these difficulties as opportunities. Opportunities to deepen our research, expand our understanding of issues, and increase our impact on human and environmental health.

I consider myself honored to sit among you, and I look forward to seeing the ways that each of you continue to change lives for the better. My deepest congratulations, to all of you, for the work that you have done and that you will continue to do. There is not a doubt in my mind that these four years have marked only the beginning of lifetimes of impactful work.

Here’s to all those sitting in the audience who have supported us in ways for which we are eternally grateful. Many of you were our first teachers—the ones that got us excited about learning, about science, and about the complexity of this world. I know that I hope to pay forward the support that has been given to me during my time at Notre Dame by my family, professors, and peers throughout the rest of my life.

Cheers to Notre Dame, to science, and to all of you.”





## 11 STUDENTS RECOGNIZED IN NSF GRADUATE RESEARCH FELLOWSHIP PROGRAM

The National Science Foundation (NSF) announced the 2017 awardees for the NSF GRFP, which included 11 students in the Department of Biological Sciences.

### The BIOS NSF GRF awardees are:

- **Bradley Bowles**, Brownsburg, Indiana; biology, class of 2017.
- **Salvatore Curasi**, North Bellmore, New York; biology, Ph.D. expected 2020.
- **James "Jayme" Hentig**, Rockford, Michigan; biology, Ph.D. expected 2021.
- **Jordan Lewis**, Rock Hill, South Carolina; biology and environmental science, SROP 2016.
- **Zoe Volenec**, Ormond Beach, Florida; environmental science and economics, class of 2016.

### The BIOS honorable mentions are:

- **Clayton Becker**, Evansville, Indiana; biology, class of 2017.
- **Brooke Chambers (Weaver)**, Fort Wayne, Indiana; biology, Ph.D. expected 2020.
- **Joe Chambers**, Fort Wayne, Indiana; biology, Ph.D. expected 2020.
- **Sophia Chau**, Tigard, Oregon; environmental sciences, class of 2017.
- **Mauna Dasari**, Fairfield, California; biology, Ph.D. expected 2020.
- **Samantha Piekos**, Naperville, Illinois; biology, class of 2015.

The NSF GRFP fellowships provide three years of financial support to outstanding graduate and graduating undergraduate students pursuing research in the fields of science, technology, engineering and mathematics, and social science.

## DEPARTMENT HOME TO FOUR FULBRIGHT FELLOWSHIP RECIPIENTS



Two recent graduates and two graduate students in Biological Sciences were awarded Fulbright fellowships this year:

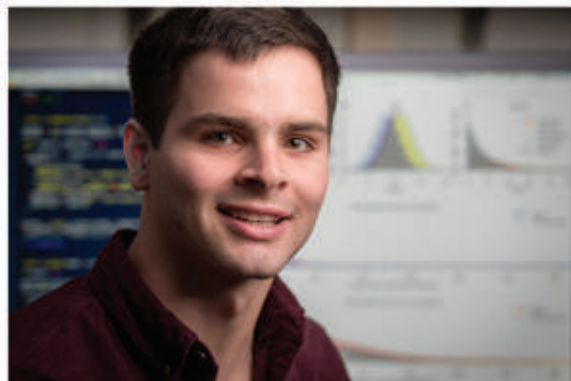
- **Kiley Adams**, class of 2017 — study and research grant to India;
- **Haley Adams**, class of 2017 — English teaching assistantship to Poland;
- **Salvatore Curasi**, graduate student in Professor Adrian Rocha's Laboratory — study and research grant to Russia
- **Jenna Davidson**, graduate student — study and research grant to Indonesia.

The Fulbright U.S. Student Program provides grants for individually designed study/ research projects or for students to participate in English Teaching Assistant programs. Since 1946, the Fulbright program has offered an international exchange of cultures and ideas, promoting a deeper understanding of another culture through research, learning, and daily activities.

*Adapted from original article by Brittany Kaufman*



## JOHN HUBER RECIPIENT OF GATES CAMBRIDGE SCHOLARSHIP



**John Huber**, class of 2017, will be pursuing his master's degree at the University of Cambridge as one of 36 recipients of the prestigious Gates Cambridge Scholarship. Huber conducted his undergraduate research in the lab of Alex Perkins, Eck Family Assistant Professor of Biological Sciences, and Erin Mordecai, an assistant professor of biology at Stanford University.

The focus of his research has been infectious disease, constructing mathematical models for the transmission of mosquito-borne pathogens, principally malaria and dengue.

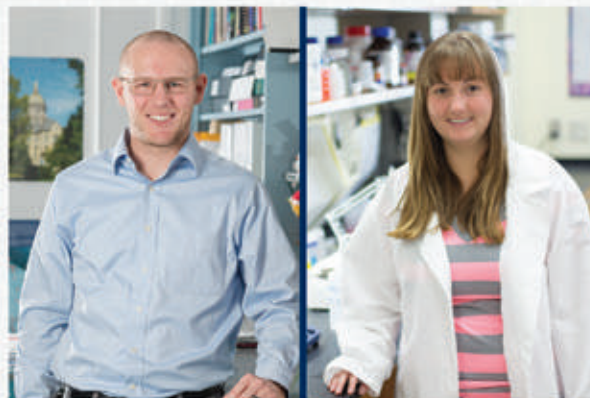
At Cambridge, Huber plans to expand his research interests, applying mathematical and statistical models to determine heterogeneity in bacterial division rates.

This project can increase our current understanding of antimicrobial resistance to bacteria.



*Originally published by William G. Gilroy*

## GRADUATE STUDENTS PRESENT FINDINGS AT ST. JUDE CHILDREN'S RESEARCH HOSPITAL



St. Jude Children's Research Hospital offers two annual invitation-only events for select Ph.D. students: the National Graduate Student Symposium (NGSS), and the Future Fellow Research Conference (FFRC). This spring, biological sciences graduate student **Joshua Mason** attended the 2017 NGSS. Mason's research focuses on a unique protein, SGK-1, found in multiple types of cancer, which plays a key role in cancer cell survival. This protein may serve as a target for drug therapies, designed to specifically eliminate metastatic cancer cells. Mason's work was conducted in the laboratory of Dr. Zachary Schafer, Associate Professor of Biological Sciences and Coleman Foundation Collegiate Chair of Cancer Biology.

Additionally, **Alyssa Lesko**, fourth-year Biology graduate student, was selected to present her work this summer at the 2017 FFRC. Lesko will present her research on the tumor suppressor Adenomatous Polyposis Coli (APC), and how it mediates Epithelial Membrane Protein 2 (a protein upregulated in several cancers), and its effect on cell polarity. Lesko is a researcher in the laboratory of Professor Jeni Prosperi, Assistant Professor of Biochemistry and Molecular Biology at Indiana University School of Medicine-South Bend and Adjunct Assistant Professor of Biological Sciences at Notre Dame.

*Originally published by College of Science*



# INAUGURAL LIFE SCIENCES SYMPOSIUM

This fall on October 11th, the Department of Biological Sciences will host the Inaugural Life Science Symposium on the Notre Dame campus. This exciting event convenes a selected group of preeminent, internationally recognized scientists who will speak about their innovative research.

The symposium has been conceived and organized by graduate students in the Department of Biological Sciences. Intended as an annual event to provide new opportunities for graduate students to interact with prominent scientists, the symposium will rotate through the following areas of biological inquiry encompassed in the Interdisciplinary Life Sciences Graduate Program--Biomedical Sciences; Global Health; and Ecology, Evolution & the Environment.

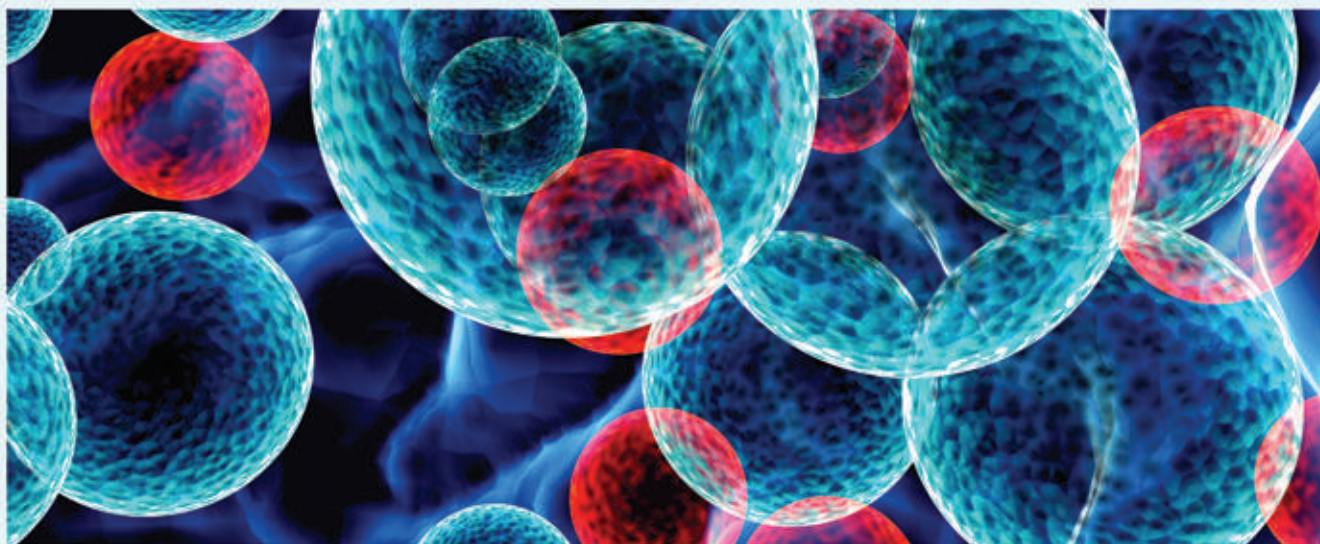
The theme of the inaugural symposium, **"Biomedical Sciences: Bridging the Gap from Bench to Bedside"** will provide a unique forum for our undergraduates, graduate students and faculty to learn and discuss emerging findings and ongoing challenges in these biomedical research. Invited speakers are leaders in their respective fields ranging from cancer to stem cells and neurobiology.

Further, the symposium is a premier way to highlight the cutting-edge research being done on campus, and a venue to foster future collaborations. Led by Mark Hawk, Ph.D. Candidate, the student committee consists of Ph.D. Candidates Ian Guldner, Amanda Marra, Joshua Mason, and Amanda Yamasaki, who have worked in consultation with faculty advisors to the event, Drs. Zachary Schafer, Cody Smith, and Rebecca Wingert. The symposium has been generously supported by the Ar-Hale Family Foundation to promote biological inquiry and professional development of trainees.

The symposium speakers are: Dr. Joan Brugge, Harvard Professor of Cell Biology; Dr. Marc Freeman, Professor of Neurobiology at the Oregon Health and Science University; Dr. John Dick, Professor of Stem Cell Biology at the University of Toronto; Dr. Linda van Aelst, Professor at Cold Spring Harbor Laboratory; Dr. Deborah Yelon, Professor of Biology at the University of California, San Diego; and Dr. Jing Yang, Associate Professor of Pharmacology and Pediatrics at the University of California, San Diego. In addition to presentations from the external speakers, the Symposium will include talks from current Notre Dame graduate students as well as a poster session.

The event is open to the Notre Dame Community.

*Contributed by Rebecca Wingert*





# BIOMEDICAL SCIENCES // BRIDGING THE GAP FROM BENCH TO BEDSIDE

OCTOBER 11, 2017 // THE MORRIS INN



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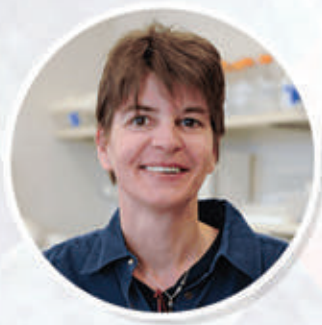
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