DEPARTMENT OF

# BIOLOGICAL SCIENCES

2014-2015 ACADEMIC YEAR HIGHLIGHTS

## ADVANCING HUMAN AND ENVIRONMENTAL HEALTH

UNIVERSITY OF NOTRE DAME
College of Science

## TABLE OF CONTENTS



### MISSION STATEMENT

The Department of Biological Sciences has the mission of advancing and transforming human and environmental health through excellence in research, education and outreach.

### CONTACT INFORMATION


ADDRESS: 100 Galvin Life Science Center
PHONE: 574-631-6552
EMAIL: biology@nd.edu

Design/layout by Matt Frazier
EMAIL: mfrazie3@nd.edu



# LIFE SCIENCES IN THE 21ST CENTURY

Solutions to the grand challenges facing our society—such as ensuring an adequate food supply, maintaining biodiversity on land and in the ocean, and finding treatments, cures and preventions for human diseases—potentially lie in biological research of the 21st century. Implementing solutions to these societal problems will depend not only on a detailed understanding of how cells and individual organisms function, but on our ability to characterize and predict the function of entire biological systems and ecosystems.

In the last decade, research in the life sciences has undergone two major innovations. First, the life sciences have become highly integrative. The study of life now cuts across all fields and levels of biological organization, from genes and proteins to whole organisms and the biosphere. Second, technological advances have made it possible to collect vast amounts of biological data from a single experiment. Whole genomes are now sequenced routinely and the activity patterns of genes and proteins can now be followed in cells and whole organisms. Together, these innovations provide the raw material for identifying genes and biochemical pathways underlying cancer and disease, understanding the mechanism of totipotency in stem cells, and illuminating how organisms adapt to diverse and changing environments. We can also genetically monitor nature by assessing what organisms are present and what they are doing, to gauge ecosystem and global health.

A major challenge of 21ST century biology is how best to use the wealth of new data being generated to address urgent questions of societal importance. Realizing the potential of highly complex and voluminous data requires a collaborative effort across several disciplines. Successful integration will provide us with both: 1) the microscopes to resolve the critical details of systems amenable to experimental manipulation for societal benefit; and 2) the telescopes to view how whole organisms and ecosystems function and interact to better manage their and our health for survival.

As is evident from the following pages, the Department of Biological Sciences is in excellent position to fulfill the promise of the new integrative approach to biology. Unlike departments at other universities that fractured into isolated subdisciplines over the last several decades, Biological Sciences at Notre Dame has remained a unified entity, engaged in numerous cross-cutting teaching, training and research collaborations across the University and the globe.

*Contributed by Professors Jeff Feder and Nora Besansky*

## FROM THE CHAIR

Dear Colleagues and Friends of Biological Sciences,

As the new department chair, I am pleased to introduce myself and send greetings. Over the past 16 years at Notre Dame, I have relished the opportunity to work with an exceptional group of faculty colleagues, students and staff. Through this departmental newsletter, we are proud to share some of their accomplishments over the 2014-2015 academic year.

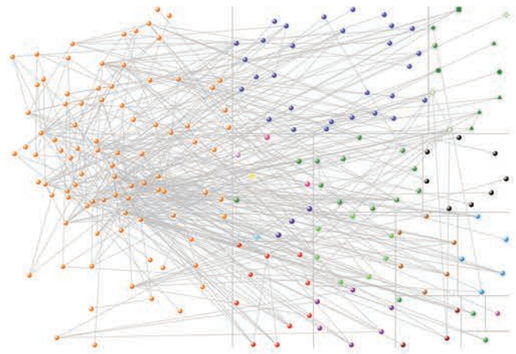
The Department of Biological Sciences is the core of research and education in the Life Sciences at Notre Dame. The department is positioned as a hub to connect the many biology-related endeavors across our campus. Our faculty, whose research interests span the wide realm of the life sciences, have programs as varied as infectious disease pathogenesis and transmission, cancer initiation and progression, global climate change and the effects of land use and water quality on biodiversity. We partner and collaborate with centers, institutes and other departments. This uncommon level of wide-ranging yet integrative biological inquiry provides an extraordinary learning environment for our students.

Recognizing that real-world solutions require putting information to new uses in new ways, we seek to expand our faculty to build bridges across our traditional strengths, within the department and across the University. At a time of fiscal austerity for researchers, it is through collective effort that we will achieve big objectives. Our activities this past year have included planning strategic faculty growth, innovating our student curriculum by enhancing inquiry-based learning, introducing a student-led vertical peer mentoring program, increasing faculty governance and transparency in our tenure and promotions processes and improving our operational efficiencies.

There is new momentum as we approach the next academic year. I hope to be able to report to you on more success as we launch several new initiatives in the coming year.

**CRISLYN D'SOUZA-SCHOREY** // DEPARTMENT CHAIR

## THE REACH OF BIOLOGICAL SCIENCES



Network visualization of collaborations between faculty in the Department of Biological Sciences and the wider University community. *(Connecting lines between nodes represent faculty collaborations on joint grant proposals and co-publications over the past six years.)*

Data provided by ND Research.

- Biological Sciences

COLLABORATIONS:

- Chemistry & Biochemistry
- College of Arts & Letters
- Computer Science & Engineering
- Chemical & Biomolecular Engineering
- Applied and Computational Mathematics and Statistics
- Civil & Environmental Engineering / Earth Sciences
- Aerospace & Mechanical Engineering
- Electrical Engineering
- Physics
- University-level units
- Mendoza College of Business
- Mathematics
- Indiana University School of Medicine
- Centers & Institutes

# INNOVATION FELLOWS WORK TO CREATE A CULTURE OF ENTREPRENEURSHIP AND INNOVATION ON CAMPUS

Innovation and entrepreneurship are terms often associated with the business world, but four Notre Dame students have dedicated themselves to changing that perception on campus. They believe that innovation and entrepreneurship are a vital part of any discipline and the academic experience.

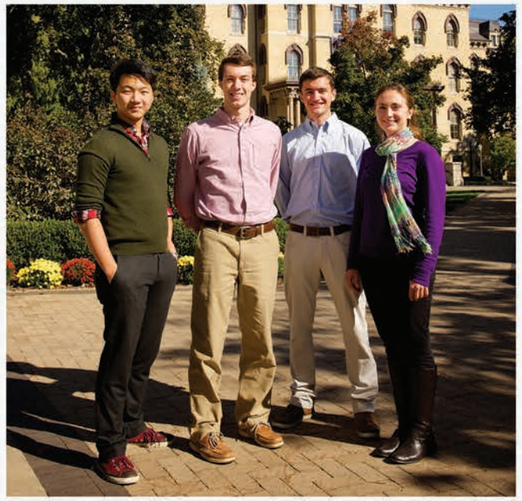
The **four biological sciences majors,** junior Mark Brahier and seniors Elena Brindley, Jeff Hansen, and Jonathan Jou, are members of the national University Innovation Fellows **(UIF) program**. The program aims to empower student leaders to increase campus engagement with entrepreneurship, innovation, creativity, design thinking and venture creation. There are 168 Fellows that represent 85 institutions across the country. These students are the first from Notre Dame to be selected for the program.

Following acceptance into the program, the Fellows completed six weeks of online training, which included connecting with their new network of Fellows, examining Notre Dame's entrepreneurial ecosystems, and creating action plans to implement their ideas.

During the fall semester, the Fellows met with University leadership, faculty, and students across campus to share their ideas and discuss the entrepreneurial climate on campus. "There was a campus-wide consensus that everyone could benefit from more collaboration and coordination of resources," Brahier explained. "Through this process, we learned that the task of uniting various organizations can be very challenging."

To address this issue, the Fellows have proposed the creation of the Council for Academic Leadership and Innovation (CALI). The mission of CALI is to be a collaboration among students and faculty to break down barriers to interdisciplinary education, communicate opportunities and promote a culture of innovation.

Another initiative the Fellows have undertaken is Mobile miNDspace, a moveable whiteboard that would travel throughout campus to encourage responses to innovative questions. Each month,



*(L-R) Jonathan Jou, Mark Brahier, Jeff Hansen, and Elena Brindley*

a new real-world problem would be posted on the board and students could share their creative solutions on the board.

Mobile miNDspace was piloted in the Hesburgh Library during finals week in December and was well received by students. The board was tested in two different locations in the library with the Fellows observing from a distance as students answered questions such as, "What is your most effective study break?" They observed that students were eager to respond, especially when the board was in very visible, high-traffic area. For their efforts and accomplishments, the fellows were recognized by Provost Thomas G. Burish and the Department of Biological Sciences at a pinning ceremony last December.

To kick off the spring semester, the Fellows hosted an Innovation Roundtable with University administrators, faculty and 35 student organizations across campus. The goal of the roundtable was to promote interdisciplinary discussions and begin the formation of CALI. The Fellows are also planning to find other locations on campus to test Mobile miNDspace.

*Adapted from original news article by Stephanie Healey*



# ANNA KOTTKAMP NAMED 2015 VALEDICTORIAN

Anna Kottkamp, an environmental science major from Wenatchee, Washington, was named valedictorian of the 2015 University of Notre Dame graduating class and presented the valedictory address during the University Commencement Ceremony on May 17 at Notre Dame Stadium.

A member of the Glynn Family Honors Program and Phi Beta Kappa Honor Society, Kottkamp achieved Dean's List honors each semester and earned a 4.00 cumulative grade point average.

During her Notre Dame career, Kottkamp was awarded an Undergraduate Research Opportunity Program grant and traveled to the highlands of Bolivia in the summer of 2014 to conduct a case study on an organization that works with small-scale farmers. She also earned an Experiencing the World Fellowship from the Kellogg Institute for International Studies for an internship during the summer of 2013 in Peru where she worked on various projects, including the design of an environmental education curriculum.

As an undergraduate research assistant for **Jennifer Tank**, the Ludmilla F., Stephen J., and Robert T. Galla Professor of Biological Sciences, Kottkamp worked as part of a research team on a watershed scale study about the impact of cover crops on agricultural streams.

The environmental science major, housed in the Department of Biological Sciences, places particular emphasis on understanding interactions between human societies and the environment from social, ethical, economic, anthropological and governmental points of view.

Kottkamp was also a member of the varsity women's rowing team. She was selected for the Rosenthal Leadership Academy within the athletics department and was named an NCAA Elite 89 award winner, Atlantic Coast Conference Scholar-Athlete of the Year, Collegiate Rowing Coaches Association National Scholar-Athlete, and ACC postgraduate scholarship recipient.

*Adapted from original news article by Sue Lister*

# UPLIFT: A STUDENT-LED MENTORING PROGRAM

Uplift is a vertical mentoring program pioneered in the Department of Biological Sciences that fosters security and confidence through the intentional creation of peer-mentoring teams led by a Biology junior or senior. The teams are comprised of 3-5 sophomores and up to 5 freshmen. By the numbers, this allows nearly a 1:1 mentoring relationship between freshmen and non-freshmen, achieving the personal interactions desired. With this support structure in place, Uplift hopes to improve quality of life for Biology intents and mentor students in all aspects of their academic and professional lives. Team activities can include course tutoring or review sessions, research lab shadowing, going as a group to academic events, inviting a graduate student to dinner to talk about their research or service activities.

During the 2014-15 academic year, Uplift organized 12 vertical teams, each with approximately eight members. In the future, Uplift plans to continue crafting a more supportive, collaborative and therefore more successful Biology experience at Notre Dame.

*Contributed by Professor Michelle Whaley*

# GRADUATE STUDENTS EARN NSF RESEARCH FELLOWSHIPS

The National Science Foundation (NSF) recently announced the recipietns of the 2015 Graduate Research Fellowships Program (GRFP). This year, eight College of Science students and two alumni received awards. In addition, several students and alumni received honorable mentions. There were over 16,000 applications for this year's GRFP with 2,000 awardees nationwide.

The fellowship provides three years of support for the graduate education of students who have demonstrated the potential for significant achievements in science and engineering research. Past NSF Fellows include individuals who have made significant breakthroughs in science and engineering research, as well as some who have been honored as Nobel laureates.

**Warren Chatwin** is a first-year biological sciences graduate student in the laboratory of Jeanne Romero-Severson. His research seeks to understand how oak trees can better adapt to environmental stresses, such as drought or flooding, caused by climate change. He hypothesizes that hybridization between oak tree species may create new adaptive gene combinations that increase survival under heightened environmental stress. To test his hypothesis, Chatwin is examining the genetic structure of second- generation hybrid seedlings to determine if they survive more often under increased environmental stress and if new gene combinations are shared among the surviving seedlings. This research will lead to a better understanding of the effects of a changing climate on forests, as well as the importance of hybridization in adapting to these changes.

> **"I have always been interested in forest trees. As an undergraduate, I studied the genetic diversity present in the remnant post oak forests across the lower Midwest," Chatwin said. "When I realized how little is known about oak tree genetics, I decided to pursue graduate studies in this area to continue my research."**

Chatwin graduated in 2014 from Brigham Young University with a bachelor of science in genetics and biotechnology.

First-year biological sciences graduate student **Jon D'Amico** studies cell biology, specifically focusing on intracellular motor proteins. He studies a protein called StARD-9 that appears to be localized in the lysosomal membrane and may be involved in the transport of cholesterol within the cell. The goal of his work is to characterize the structure and function of StARD-9. This research may have many implications for diseases in which cholesterol transport is defective, such as Niemann-Pick Type C. D'Amico is advised by Kevin Vaughan.

D'Amico really enjoys the experimental side of science, versus the theoretical side.

> **"I chose cell biology because it allows the incorporation of molecular and biochemical methods of investigation at a cellular level," he said. "I enjoy being able to look through a microscope and actually see my research in action. It gives my work more of a real feeling."**

D'Amico graduated from Indiana University in 2012 with a bachelor of science in biology and minor in chemistry.

Working in the laboratory of Zachary Schafer, first-year graduate student **Mark Hawk** studies cellular death and its application to cancer. When epithelial cells detach from the extracellular matrix (ECM), which is often required for cell survival, they can induce a form of cellular death. When cancer metastasizes from the primary tumor site, the cells are no longer attached to their ECM. To successfully metastasize and spread, cancer cells must overcome and shut down all forms of cell death induced by ECM detachment to form a secondary tumor. Understanding the regulation of programmed cell death following ECM detachment can improve knowledge on how cancer metastasizes and eventually lead to treatments to alleviate metastasis.

Hawk was inspired early in his life to pursue a field in cancer research.

> **"My sixth-grade science teacher consistently challenged me to ask the question of how particular phenomena, both normal and abnormal, function. She lost her life to metastatic breast cancer, and as a result of her influence on me, I have been motivated to study cancer and better understand how cancer cells to spread throughout the body."**

Hawk graduated summa cum laude from the University of Dayton in 2014 with a bachelor of science in biology.

Second-year graduate student **Amanda Marra** works in the laboratory of Rebecca Wingert where she studies kidney development in zebrafish. Marra's research focuses on identifying the cellular process of nephron development, the functional unit of the kidney that produces urine and removes waste from the blood. Understanding of nephron and kidney development can have implications for better recognizing onset of kidney disease.

> **"I chose this field of study because I have always been interested in how different organs of the body develop," Marra explained. "The kidney is an extremely useful model organ to study organogenesis and other aspects of biology. The knowledge gained from studying the pathways in kidney development can potentially provide insight into the development of other tissues in the body."**

Marra graduated from Lyon College in 2013 with a bachelor of science in biology.

*Original news article by Stephanie Healey*

**Rachel Hesselink Gentile**, a member of Jason McLachlan's laboratory, is currently serving as director of the Safe Climate Caucus chaired by Congressman Alan Lowenthal, CA-47. Rachel accepted placement with the Safe Climate Caucus as the result of a John A Knauss Marine Policy Fellowship through the National Oceanic and Atmospheric Administration (NOAA) Sea Grant that began in February 2015.

**Brandon Gerig**, in Gary Lamberti's laboratory, received an EPA-STAR award for his project entitled, "The Interactive Effects of Watershed Condition and Contaminant Biotransport by Introduced Pacific Salmon on the Contaminant Load of Stream-Resident Fish in Great Lakes Basin Tributaries." The United States Environmental Protection Agency recognizes that scientific, technical, engineering and mathematical (STEM) competence is essential to the Nation's future well being in terms of national security and competitive economic advantage.



# KELSEY KREMERS EARNS NASA EARTH AND SPACE SCIENCES FELLOWSHIP

*Adapted from original news article by Stephanie Healey*

**Kelsey Kremers**, a graduate student in the Department of Biological Sciences, has earned a NASA Earth and Space Sciences Fellowship for her proposal, "Is arctic greening consistent with the temperature sensitivity of coupled carbon and nitrogen cycles?" The fellowship is very selective—only 64 fellowships were funded out of 391 applications this year.

Kremers' proposed research seeks to understand the greening trend by examining the links between temperature, nitrogen, and carbon. She will assimilate 20 years of arctic long-term ecological research measurements into a coupled carbon and nitrogen cycling model. Kremers will work on this research under the guidance of **Adrian Rocha**, assistant professor of biological sciences and member of the Environmental Change Initiative.

"This work is very timely," Kremers said. "Ecosystem changes in the arctic are occurring faster than we can understand them. This project will determine how sustainable the widespread increase in arctic plant productivity is under climate change."

## POSTDOCTORAL CORNER

**James Clancy**, postdoctoral fellow in Crislyn D'Souza-Schorey's laboratory, was selected to present his work on the biology and clinical application of tumor-derived microvesicles at the American Society for Cell Biology annual meeting which took place in Philadelphia, Pa., in December 2014.

**Jana Asselman**, postdoctoral fellow in Mike Pfrender's Lab, was selected to attend the Gordon Research Conference in Ecological and Evolutionary Genomics held July 2014 in Maine to present her work on the effects of age and nutrition on methylation profiles in the aquatic crustacean Daphnia.

**Alassane Mbengue**, postdoctoral scientist in Kasturi Haldar's lab, presented a talk at the international Molecular Parasitology Meeting (MPM) held at the Marine Biological Labs (MBL), Woods Hole, Mass., in September 2014, on his findings of a molecular mechanism of artemisinin resistance.

**Suhail Alam**, postdoctoral fellow in the Haldar lab, presented a talk on development of a new therapy for Niemann Pick Type C disease at the international WORLD Symposium 2015 on Lysosomal Disorders, held in Orlando, Fla.

**Paul Kroeger**, postdoctoral fellow in Rebecca Wingert's lab, gave an oral presentation on his work on kidney development during the 2015 Midwest Zebrafish Conference at Washington University in St. Louis, Mo., for which he received the best talk award.

**Holly Weiss-Bilka**, postdoctoral fellow in Matthew Ravosa's laboratory, was selected to present her work on the effects of external forces on the developing skull at the Association for Clinical and Translational Science's annual meeting. The conference took place in Washington, D.C., in April 2015.

**Frank Collins**, George and Winifred Clark Professor of Biological Sciences, received a $2.3 million contract through the National Institutes of Health to continue the bioinformatics resource, **VectorBase**. Housed at Notre Dame since its inception in 2004, VectorBase serves as a valuable portal for scientific access to the genomes and related information on vectors of disease-carrying arthropods and other invertebrates.

Currently in its second year, a **$23 million research grant** from the Bill & Melinda Gates Foundation, awarded to Notre Dame biologists **Nicole Achee and Neil Lobo**, aims to investigate the effectiveness of and global policy for spatial repellents to prevent and control vector-borne diseases. The award is the second largest research grant for a single proposal in Notre Dame's history.

A team of researchers led by **Kasturi Haldar**, Julius Nieuwland Professor of Biological Sciences, has identified a molecular mechanism responsible for making malaria parasites resistant to artemisinins, the leading class of antimalarial drugs. The study was published in the journal, ***Nature***, in April 2015.

**David Lodge**, Ludmilla F. and Stephen J. Galla Professor of Biological Sciences, was named a 2014-15 ***Jefferson Science Fellow***. The Jefferson Science Fellowship Program is designed to further build capacity for science, technology and engineering expertise with the U.S. Department of State and the U.S. Agency for International Development (USAID).

**Siyuan Zhang**, Nancy Dee Assistant Professor of Cancer Research, was a recipient of the **Breast Cancer Research Program Breakthrough Award** from the Department of Defense. Zhang will receive funding toward his project titled, "Targeting Neuronal-Like Metabolism of Metastatic Tumor Cell as a Novel Therapy for Breast Cancer Brain Metastasis."

**Jack Duman**, Gillen Professor of Biological Sciences, was presented with the University's **Faculty Award** at the President's Dinner. The award honors a faculty member who has contributed outstanding service to the University of Notre Dame through leadership activities, mentoring faculty colleagues, or exemplary dedication to students.

**David Hyde**, professor of biological sciences, received the **Rev. Edmund P. Joyce C.S.C. award** for excellence in undergraduate teaching. This award annually honors up to 20 faculty members who have had a profound influence on the under- graduate learning experience, elevated students' intellectual engagement, and fostered students' ability to express themselves effectively within a disciplinary context.

Two Notre Dame biologists were interviewed by Ira Flatow, host and executive producer of **"Science Friday,"** for the live show in October 2014. **Jeanne Romero-Severson**, a plant geneticist, spoke about her work on plant microbiomes. **David Lodge** *(left)* spoke of his work on biological invasions from ballast water and examining the best options for managing these invasions.



# MEET OUR FACULTY
## ATHANASIA PANOPOULOS

*Athanasia Panopoulos is the Elizabeth and Michael Gallagher Family Professor of Adult Stem Cell Research*

Paragliding in Nepal. *Photo provided.*

**For those who may not know you, what is your area of research?**

My lab studies a more recently discovered area of stem cell science called reprogramming. Embryonic stem cells have the ability to become every cell type in the body. This developmental process was always thought to be unidirectional. However, in 2006 it was discovered that mature adult cells (e.g., blood cells, skin cells) could actually be reprogrammed back into an embryonic-like state by expressing just a few key genes.

Research in this field has now enabled us to essentially take any mature cell and turn it back into an embryonic-like stem cell, which like the stem cells that come from embryos, have the potential to become any cell in the body. The initial discovery has already won the Nobel Prize, and it has enabled us new creative ways to study development and disease.

**What specific questions are you trying to address in your field, and why is your area of scientific discovery relevant for society?**

We are using the field of stem cells / reprogramming to ask a number of questions relevant to regenerative medicine and cancer. For instance, can we figure out how to make blood stem cells in the lab that could be used in a bone marrow transplant? If we could, then in theory when coupled with the advances that have been made in the reprogramming field, no one would ever have to wait to find a bone marrow transplant donor match, and we could treat blood diseases in ways we couldn't before. Furthermore, can we figure out why some cancers, like leukemia, inappropriately acquire stem cell properties to cause uncontrolled growth? Can we then use that information to come up with a way to target these cells in a way that could prevent malignant relapse?

Unfortunately, I would bet that every person reading this has been in one way or another personally affected by cancer. The scientific and medical communities have made significant advances in certain areas over the years, but it never feels that way for the person on the other side of the statistic. The bottom line is we need to do better, and so it is important to me to be spending my time researching fundamental and medically relevant questions.

**How did you become interested in science?**

> **"I was always interested in science as a kid, and it was down to either becoming a scientist or a rock star. I felt I had the hair to pull off either career, but perhaps my lack of any marketable talent compelled me to focus on the books and pursue a research career."**

From there, like many other scientists, it was a combination of interests and personal experiences that led me down this particular research path. I have always been interested in development, how cells make decisions to become what they do, and why things go wrong in disease. But it was through some personal experiences of witnessing kids battle cancer, some while anxiously waiting to find a bone marrow transplant match, which really motivated me to focus on the questions I am pursuing today.

> **"I love being a scientist. I love that every day at work is different, that new discoveries are always around the corner, and feeling like we are doing our best to contribute a small role toward the bigger picture of helping understand and treat disease."**

*Continued on next page*

**What are your other passions besides science?**

Besides, of course, family and friends, my passions are traveling and music. I love that I have a job that not only lets us see the world but also enables us to meet people from all over the globe to learn about and appreciate different cultures. Whether it has been related to work or only for fun, I have been fortunate to have traveled to so many countries, and to do things like paraglide in Nepal *(photo on previous page)*, be in Pamplona for the running of the bulls, and hike on Mount Fuji. My other passion is music, and going to live shows is how I recharge. I have diverse tastes and have been to several hundred live shows, spanning musicians like the late greats Ray Charles and B.B. King, to more recent acts like Kings of Leon and Muse. I get this passion from my dad, who owns every Greek song ever produced, and who in his spare time DJ's for Greek events. Music was always playing in our house growing up, and between my mother's culinary genius, my dad's DJ skills, and the Greek dancing abilities of both of them, let's just say they could host a party, and they certainly taught me how to party. And I believe that is a very important component to having a successful scientific career! Opa!

*Contributed by Matt Frazier*

# INDIANA PROFESSOR OF THE YEAR

# MICHELLE WHALEY

Michelle A. Whaley was named the 2014 Indiana Professor of the Year by the Carnegie Foundation for the Advancement of Teaching and the Council for the Advancement and Support of Education (CASE). This is the first Indiana Professor of the Year Award for a Notre Dame faculty member. Whaley has received multiple teaching awards from Notre Dame, including two Joyce Awards for Teaching Excellence and three separate Kaneb Teaching Awards.

Whaley directs the summer Research Experience for Undergraduates (REU) program in the Department of Biological Sciences and has received 16 years of continuous National Science Foundation support for her summer REU Program in Molecular and Cellular Biology.

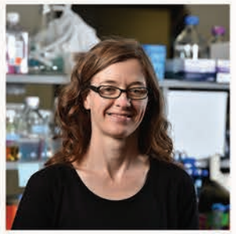
Whaley is the coordinator of the Undergraduate Honors program in the Department of Biological Sciences. She also serves as the department's assistant chair.

Whaley has also been instrumental in developing a series of novel initiatives that engage her department and the College of Science with the local community and school districts. She created and leads the Genetics Mentor Program for middle and high school youth at the Robinson Community Learning Center and was instrumental in bringing to Notre Dame the DNA Learning Center following her visit to the Cold Springs Harbor Laboratory, where the program is centered.

*Adapted from original news article by William G. Gilroy*



# PROMOTIONS: TO ASSOCIATE PROFESSOR WITH TENURE

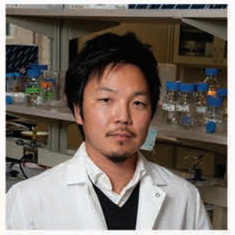


## ELIZABETH ARCHIE

Elizabeth Archie was appointed the Clare Boothe Luce Assistant Professor in August 2009. With support from a CAREER award from the National Science Foundation, the Princeton Global Health Grand Challenges Program and the Clare Boothe Luce Foundation, research in the Archie lab focuses on the evolution of social behavior in animals. The lab is especially interested in two questions: how do social organization and behavior affect the spread of parasites and microbes? And how do social relationships influence individual health, disease risk, immune function and survival? Elizabeth Archie is "thrilled to be tenured in the Biology Department, which is home to many great scientists and colleagues". She's looking forward to a fruitful career teaching and conducting research at Notre Dame.

## PATRICIA CHAMPION

Patricia A. Champion was appointed assistant professor in August 2009. The Champion lab focuses on understanding key mechanisms used by pathogenic Mycobacterium to cause disease. They are particularly interested in how mycobacterial proteins are modified, regulated and transported to distinct cellular locations. Her research has been supported in part by R21 and R01 awards from the National Institutes of Health and a career award from the Great Lakes Regional Center of Excellence. Champion shared her sentiments about her promotion, stating, "Becoming tenured in the Department of Biological Sciences is a tremendous honor. I am excited to continue working and teaching with my colleagues at Notre Dame, and to further grow and develop my research program."



## SHAUN LEE

Shaun Lee joined the faculty as assistant professor in August 2009. The primary research goal of Lee's lab is to gain a better understanding of how bacteria utilize toxins to cause disease. The lab is discovering that many of the toxins that bacteria produce are a potential source of powerful antibiotics. His research is currently supported by the NIH Innovator Award. "Being a tenured professor at Notre Dame is a tremendous honor, and I am grateful for the support of all of the colleagues in the department who have provided a warm and supportive environment throughout my early career." He continues, "It has also been an absolute pleasure to interact with the Notre Dame students over the past several years, both in my classes and in my laboratory. As a tenured professor at Notre Dame, I continue to strive to be an excellent teacher and mentor."

## ZACHARY SCHAFER

Zachary Schafer joined the faculty as the Coleman Assistant Professor of Cancer Biology in August 2009. Schafer's laboratory is interested in understanding the molecular mechanisms utilized by cancer cells to survive during metastasis, the process by which cancer cells travel from the primary tumor to distant sites in the body. His research has been supported in part by grants from the Elsa U. Pardee Foundation, the V Foundation for Cancer Research, the American Cancer Society and the Susan G. Komen foundation. "I feel extremely blessed and honored to have been awarded tenure in the Department of Biological Sciences at Notre Dame," says Schafer. "It is a privilege to be part of such a vibrant, interdisciplinary, and collaborative department, and I am thankful for the opportunity to work with so many tremendous faculty colleagues and outstanding students."

# PUBLICATIONS

**The Department produced over 200 peer-reviewed publications in the 2014-2015 academic year including articles in some of the most prestigious scientific journals. A few examples are listed below.**

Michael C. Fontaine, James B. Pease, Aaron Steele, Robert M. Waterhouse, Daniel E. Neafsey, Igor V. Sharakhov, Xiaofang Jiang, Andrew B. Hall, Flaminia Catteruccia, Evdoxia Kakani, Sara N. Mitchell, Yi-Chieh Wu, Hilary A. Smith, R. Rebecca Love, Mara K. Lawniczak13, Michel A. Slotman, Scott J. Emrich, Matthew W. Hahn & **Nora J. Besansky** (2015). Extensive introgression in a malaria vector species complex revealed by phylogenomics. *Science*, 347(6217), 1258524.

Daniel E. Neafsey, Robert M. Waterhouse, Mohammad R. Abai, Sergey S. Aganezov, Max A. Alekseyev, James E. Allen, ... & **Nora J. Besansky** (2015). Highly evolvable malaria vectors: The genomes of 16 Anopheles mosquitoes. *Science*, 347(6217), 1258522.

**Nora J. Besansky** (2014). Malaria: How vector mosquitoes beat the heat. *Nature*, 516(7531), 334-336.

Cassandra L. Buchheit, Kelsey J. Weigel, & **Zachary T. Schafer** (2014). Cancer cell survival during detachment from the ECM: multiple barriers to tumour progression. *Nature Reviews Cancer*, 14(9), 632-641.

James W. Clancy, Alanna Sedgwick, Carine Rosse, Vandhana Muralidharan-Chari, Graca Raposo, Michael Method, Philippe Chavrier & **Crislyn D'Souza-Schorey** (2015). Regulated delivery of molecular cargo to invasive tumour-derived microvesicles. *Nature Communications*, 6, 6919.

Alassane Mbengue, Souvik Bhattacharjee, Trupti Pandharkar, Haining Liu, Guillermina Estiu, Robert V. Stahelin, Shahir S. Rizk, Dieudonne L. Njimoh, Yana Ryan, Kesinee Chotivanich, Chea Nguon, Mehdi Ghorbal, Jose-Juan Lopez-Rubio, Michael Pfrender, Scott Emrich, Narla Mohandas, Arjen M. Dondorp, Olaf Wiest & **Kasturi Haldar** (2015). A molecular mechanism of artemisinin resistance in Plasmodium falciparum malaria. *Nature*, 520(7549), 683-687.

Víctor Soria-Carrasco, Zachariah Gompert, Aaron A. Comeault, Timothy E. Farkas, Thomas L. Parchman, J. Spencer Johnston, C. Alex Buerkle, **Jeffrey L. Feder**, Jens Bast, Tanja Schwander, Scott P. Egan, Bernard J. Crespi, Patrik Nosil, (2014). Stick insect genomes reveal natural selection's role in parallel speciation. *Science*, 344(6185), 738-742.

Jenny Tung, Luis B Barreiro, Michael B Burns, Jean-Christophe Grenier, Josh Lynch, Laura E Grieneisen, Jeanne Altmann, Susan C Alberts, Ran Blekhman, **Elizabeth A Archie** (2015). Social networks predict gut microbiome composition in wild baboons. *eLife*, 4, e05224.

Ashley M Vaughan, Richard S Pinapati, Ian H Cheeseman, Nelly Camargo, Matthew Fishbaugher, Lisa A Checkley, Shalini Nair, Carolyn A Hutyra, François H Nosten, Timothy J C Anderson, **Michael T. Ferdig** & Stefan H I Kappe (2015). Plasmodium falciparum genetic crosses in a humanized mouse model. *Nature Methods*, 12(7), 631-633.

Erica J. Kistner and **Gary E. Belovsky** (2014). Host dynamics determine responses to disease: additive vs. compensatory mortality in a grasshopper-pathogen system. *Ecology*, 95(9), 2579-2588.



# COVER FEATURES


**Nora Besansky**, O'Hara Professor of Biological Sciences, led an international team of scientists in sequencing the genomes of 16 Anopheles mosquito species from around the world. This work was published as two articles in the journal, ***Science***, in December 2014. *(left)*

*(Cover)* Colored scanning electron micrograph of the mouthparts of a female Anopheles gambiae mosquito. Sheathed in a scaly lower lip ending in two hairy lobes (blue) are a pair of saw-toothed stylets (green) used to cut into the skin. Because only female Anopheles blood feed, only females transmit malaria—a disease that claims the lives of more than half a million children each year.


EMBO Reports
Volume 16, Number 1

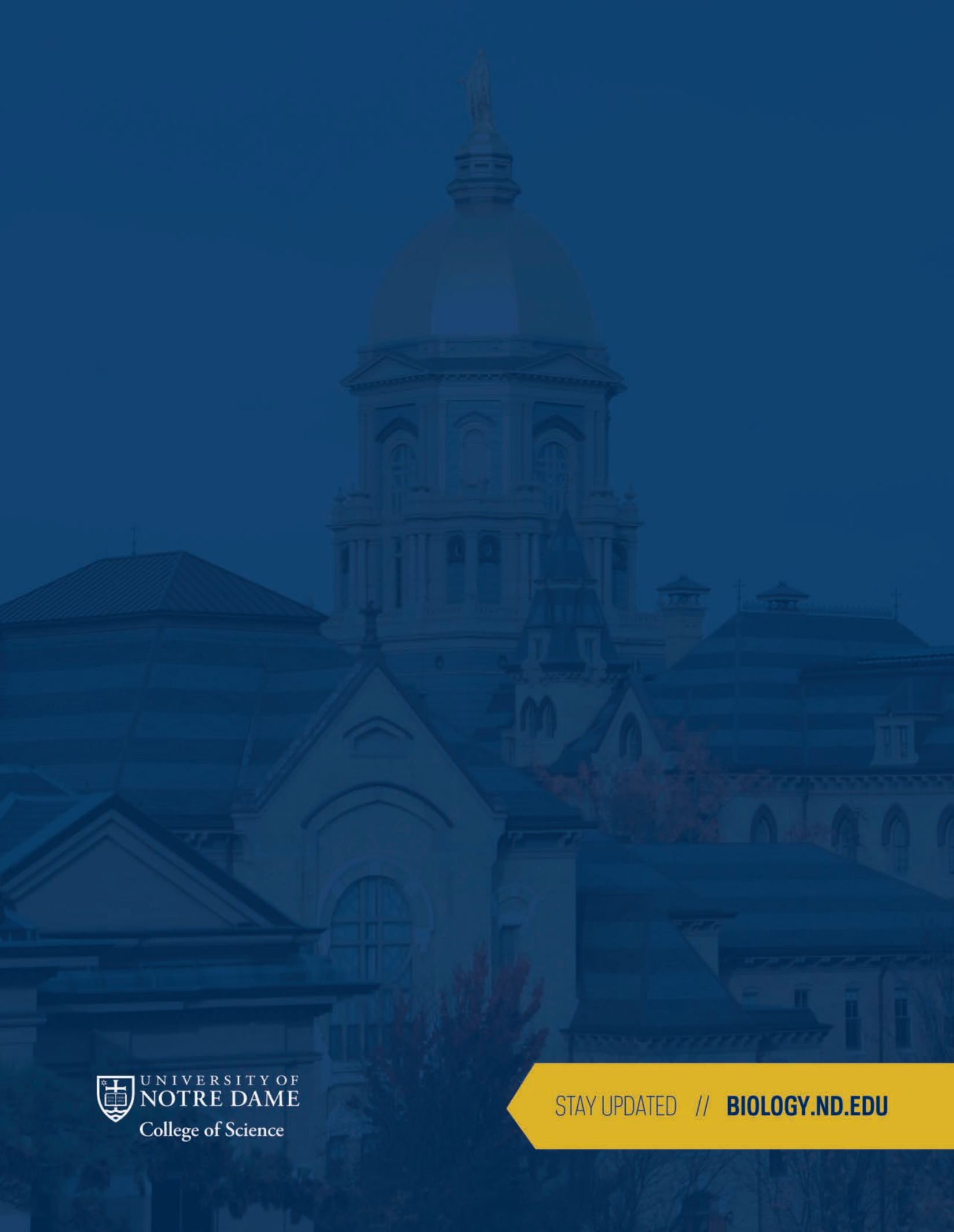
*Featured article by*
***Jeff Schorey and colleagues***


J. Biol. Chem.
Volume 290, Number 14

*Featured article by*
***Zach Schafer and colleagues***


Science
Volume 344, Number 6185

*Featured article by*
***Jeff Feder and colleagues***



UNIVERSITY OF
NOTRE DAME
College of Science

STAY UPDATED // **BIOLOGY.ND.EDU**