Newsletter - Department of Biological Sciences Volume 11 - Spring, 2015

LEHIGH UNIVERSITY

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Greetings from Biological Sciences!

Murray Itzkowitz, Ph.D.
Professor and Chair

It's interesting that many students find the seemingly endless biological facts that they are required to memorize as odious, while faculty find these same facts endlessly fascinating. A too easy explanation is that the faculty aren't "forced" to memorize these facts!

There is a better explanation, one that is based on evidence: the faculty doesn't treat facts as facts, but rather as transitory explanations that invite fabulously interesting experiments. Interest leads to more creative understanding and less rote memory. We want students to appreciate biology as we do.

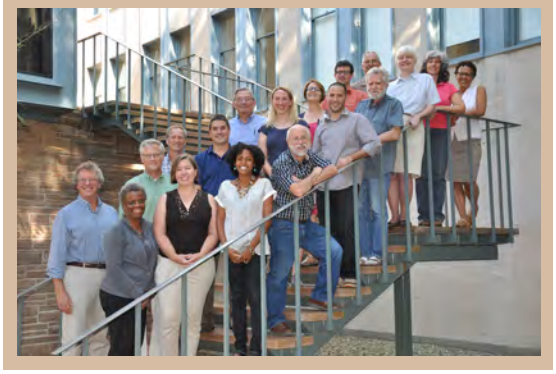
Under the leadership of Dr. Meg Kenna, we are trying to eliminate "canned" labs in courses and replace them with research projects. We also want our students to take creative ownership of biological ideas in lecture as well. As you can imagine, this is a challenge, especially in introductory courses where the class sizes are large.

To help accomplish this goal, we now have a new faculty member, Dr. Krystle McLaughlin, who was specially trained in "new science teaching." One of her techniques is to have students read their textbooks before lecture and come prepared to examine and discuss critical concepts with both her and other students.

It is both our hope and expectation that our students discover that learning about biology is fun and rewarding.

2014 - the department at a glance .....

- **21 faculty members**
- **3 post-doctoral and research scientists**
- **8 technical and 3 administrative staff**
- **39 Ph.D.-level graduate students; 28 Master's-level graduate students**
- **295 Undergraduate majors:**
  - **119 Biology**
  - **31 Biochemistry**
  - **28 Molecular Biology**
  - **117 Behavioral Neuroscience**



Department Faculty

• Murray Itzkowitz, Chair • Michael Behe • R. Michael Burger • Lynne Cassimeris • David Cundall • Matthias Falk • • Julie Haas • M. Kathryn Iovine • Michael Kuchka • Gregory Lang • Michael Layden • Linda Lowe-Krentz • Krystle McLaughlin • • Julie Miwa • Amber Rice • Jeffrey Sands • Jill Schneider • Neal Simon • Robert Skibbens • Jennifer Swann • Vassie Ware •

Welcome to our newest faculty members

Krystle McLaughlin, Ph.D.
Professor of Practice

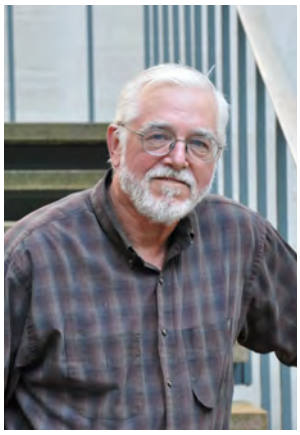
Dr. McLaughlin was hired to help revolutionize the way we teach biology. McLaughlin completed a postdoctoral fellowship in the SPIRE program (Seeding Postdoctoral Innovators in Research and Education) at the University of North Carolina at Chapel Hill. As part of the SPIRE program, Krystle received pedagogy training and was a visiting lecturer at the University of North Carolina at Pembroke. There she taught introductory biology to undergraduates and organized several workshops to prepare undergraduates for research experiences. In her research at UNC, Dr. McLaughlin used x-ray crystallography as her primary tool, with several biochemical and biophysical methods including fluorescence anisotropy, electrophoretic mobility shift assays, and isothermal titration calorimetry to investigate protein-nucleic acid interactions. Dr. McLaughlin received her bachelor's degree from Colgate University and her Ph.D. in Biophysics at the University of Rochester.

Michael Layden, Ph.D.
Assistant Professor

Dr. Layden earned his bachelor's degree in cell and developmental biology from the University of Rochester and his doctoral degree in biology from the University of Oregon. Prior to his arrival at Lehigh, Dr. Layden served as an assistant researcher at the Whitney Laboratory for Marine Bioscience at the University of Florida, Gainesville and a postdoctoral researcher at the University of Hawaii at Manoa.

Layden's primary research interests include 1) identifying and understanding the mechanisms that regulate neural development and regeneration; and, 2) understanding the evolution of nervous systems by comparing the developmental mechanisms that regulate nervous system formation in extant taxa. Mike's work encompasses the fields of developmental biology, genetics, neuroscience and evolution.

Nyby earns status of Professor Emeritus



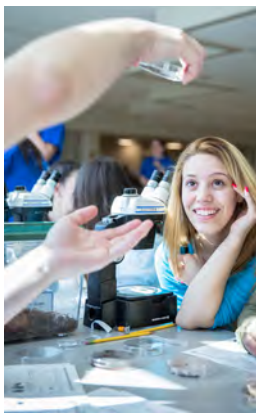
After 37 years of serving Lehigh University, Professor John Nyby retired in the summer of 2014. Many students will remember Dr. Nyby from his having taught a variety of neuroscience classes. Dr. Nyby was also responsible for developing and directing the Behavioral Neuroscience program at Lehigh.

Nyby received his bachelor's degree (honors in Psychology) in 1968 and his Ph.D. (Psychology: Behavior Genetics and Psychobiology) in 1974, both from the University of Texas, Austin. His postdoctoral work was done at Florida State University. At Lehigh, John was initially hired as an assistant professor (1977) but was quickly promoted to associate professor in 1980. He earned the ranking of Professor in 1989. Nyby was chair of the psychology department from 1990-1994 and transferred to the department of biological sciences in 1994. He was also director of the department's undergraduate program from 2008-2012.

Nyby's research focus was on the hormonal and neural regulation of pheromonal and ultrasonic communication in house mice (*Mus musculus*). Dr. Nyby mentored five Ph.D. students over the years, as well as countless undergraduate students.

Grad students host Bio Fair for Bethlehem middle school students

The graduate students of the department of biological sciences organized their first annual bio fair in 2014. Funding for the Bio Fair was provided by a core competency grant from Lehigh's Office of Student Affairs awarded to the Biological Sciences Organization of Graduate Students (BOGS). The Bio Fair was an interactive program designed to expose Broughal Middle School students to science through interactive hands-on activities designed to make difficult science concepts easier to understand. The event featured learning stations where students worked with Lehigh graduate and undergraduate students on learning biological processes. For example, some of the stations explained how brain cells transmit signals, how traits are passed on from parents to children, and how proteins are trafficked in a cell.



Bio Fair organizer, graduate student Joe Brague, noted, "Creating work stations that explain biology at a middle school level was challenging and fun. These activities encouraged graduate and undergraduate students alike to consider the 'bigger picture' in their work. The fair makes science accessible by promoting positive attitudes towards science and encouraging students to enter scientific careers. It is our hope that the event will encourage middle school students to pursue an education in science." Planning is underway for this year's Bio Fair.

An international career in product safety

In 1998, Thomas Koch began working in Procter & Gamble's technical center in Germany, working as a toxicologist for their Pamper's products. He then moved to Brussels, Belgium, assuming responsibility for managing the regulatory compliance of P&G's global cleaning products. In 2010, Thomas was transferred to Sao Paulo, Brazil, where he assumed the regulatory compliance responsibility for the company products in Brazil, Argentina and Chile. After spending four years in Sao Paulo, he relocated back to his home country of Germany, where he is responsible for global product safety for the company's hair products. Thomas' list of language fluencies includes German, English, Portuguese, Spanish and French.

Thomas Koch, Ph.D.
B.A. Biology, '89

How did this international traveler get his start?

Searching for an academic institution in the United States in the early 1980s, Thomas Koch discovered that Lehigh University's program had an excellent academic reputation and standing. Born in Germany, raised in Brazil and South Africa, he found that Lehigh recognized the value of international diversity, but was not too international as compared to similarly ranked and sized universities. He decided to call Lehigh and the United States "home" over the next three years.

What was your experience as an international student at Lehigh?

In the late '80s, the university's interest in diversity was growing and beginning to be valued by both faculty and peers alike. The most notable example had been the establishment of the "German House" and the "International House" in Warren Square with the objective to bring faculty, students and administration together who shared a common interest in language and culture. As a freshman and sophomore I was surprised about the school-like atmosphere. Several subjects I had already covered in my home high school. The insights I brought along allowed me to accelerate and complete my degree in three years.

During his final year at Lehigh, Thomas connected with Professor Murray Itzkowitz through an undergraduate research project in his lab.

The research was the highlight of my degree work at Lehigh. During this time I began to learn to work scientifically, articulating a working hypothesis, testing options, summarizing and discussing the results. The work was in the dungeons of Williams Hall, observing the convict cichlids' mating and pairing behavior. The lab work was the trigger for my interest in animal behavior, be that of fish or human. I took classes in social psychology and was thrilled to do some more experimental work in the area. Since I wasn't clear if I actually wanted to pursue animal behavior as a graduate student, I welcomed the opportunity of doing some exotic research in the Caribbean. The work focused on the pairing and mating behavior of Damselfish, a long standing project Murray had going at the Discovery Bay Marine Lab from the University of the West Indies. This project included observing the fish in-locus for several hours per day for three months in a secluded area on the Jamaican North Coast.As a tangent from the main project, Murray agreed that I pursue an observation project related to the impact of the brittlestar, intruders to the Damselfish habitats. Murray was able to publish this work, which ranks among my favorite pieces of research I did in my science life.

Thomas was awarded his degree in biology at Lehigh in 1989. He then decided to return to his native Germany where he enrolled in graduate school at the University of Heidelberg. He was awarded a Ph.D. in neurobiology in 1998. His research focused on the question of why multiple sclerosis progression is not reversible. This deteriorating progression of the health condition is a consequence of the loss of neuronal insulation by the myelinating cells. Thomas' contribution was the identification of surface molecules of newly born myelinating cells which may contribute to the loss of cellular adhesion and intracellular signaling.

What impact did doing undergraduate and field research have on your education while at Lehigh and how did it prepare you for your graduate studies?

The field work was an element I wanted to complete to round off my education, together with classroom, seminar and lab work, result presentations as well as proposal writing. Still today I consider all these elements integral parts of a well rounded science education. The field work did not have a direct impact on my graduate work, but it did provide a distinct indirect benefit. The field research taught me how to frame and address a scientific question, a key skill which is independent of whether you focus on the mating behavior of coral reef fish or the characterization of membrane surface molecules of oligodendrocytes involved in demyelinating diseases. The work also raised my curiosity to penetrate how discoveries were done, what the underlying work had been, and how the authors came to a specific conclusion.

During his graduate studies, Thomas completed multiple company internships to explore his interest in non-academic research work.

I intentionally screened my many interests to answer, "What do you want to do when you grow up?". I liked academia from the insights I obtained from my experiences in the US and Germany and completed several multiple lab and field work projects to answer the question of whether this was actually an option for me. I then completed several internships in chemical and manufacturing companies to experience the working world. One of these was an internship in 1992 with Procter & Gamble's product safety department. Several years later, and at the end of my PhD, my supervisor at P&G called me up to see if I had an interest in interviewing for a permanent position. Having liked the work, I joined P&G upon completion of my PhD and have been with the company since.

How did a degree in biology from Lehigh University prepare you for working for an international company?

The degree from Lehigh was a key enabler to initially be accepted and later succeed in the company. Together with the field research, the English language capability and the completed degree demonstrated to the employer the diversity I was bringing to the company. This diversity demonstrated additional contributions beyond the PhD, the de minimis expectation for the role. Most importantly, the time at Lehigh prepared me to appreciate the culture and ways of thinking I encounter on a daily basis in a US-based company. The science I learned, I don't use in my daily work. What I need and use is the scientific thinking which Murray and the rest of the faculty took the time to focus on and teach.

Taking aim at drug-resistant bacteria

by Jaime DellaPelle '14

In the fight against diseases caused by bacteria that have become resistant to antibiotics, medical researchers are turning to viruses called bacteriophages. Bacteriophages infect bacteria and replicate within them after injecting their genome into their host's cytoplasm. Bacteriophages have been used in European countries as an alternative to antibiotics.

Michelle Juarez '16 embarked on a study of mycobacteriophages during her freshman year as a student in Lehigh's SEA-PHAGES Program, which is directed by Vassie Ware, professor of molecular biology. In the program, students isolate and characterize bacteriophages that infect a host related to the mycobacteria that cause tuberculosis.

Under Ware's supervision, Juarez has continued her phage research in an independent study project in an effort to shed light on gene functions that are unknown in certain classes of mycobacteriophages. She is attempting to discover the function of gene gp57, which is found in only one group of related bacteriophages.

"There are thousands of bacteriophages yet to be discovered," says Juarez, who majors in behavioral neuroscience. "This creates great uncertainty in the field but also opens up many possibilities for research."

"Thousands of different genes and gene functions remain to be discovered as well, which could give scientists insight into their potential uses in the fight against antibiotic-resistant bacteria."

Vassie Ware (right), professor of biological sciences, helped Juarez secure a summer internship at Harvard Medical School through HHMI's EXROP program.

A summer at Harvard

This past summer, Juarez honed her research skills in a paid internship at Harvard Medical School. She worked with Constance L. Cepko, professor of genetics, who studies the retina, with a focus on the degeneration and regeneration of photoreceptors in the eye and on gene therapy techniques that may help prevent blindness. The 10-week stay at Harvard was made possible when Juarez was accepted into the Exceptional Research Opportunities Program (EXROP) of the Howard Hughes Medical Institute (HHMI).

Michelle Juarez '16 has been studying mycobacteriophages since she was a freshman, first in Lehigh's SEA-PHAGES Program and more recently in an independent study project. (photos by Ryan Hulvat)

Juarez was nominated for EXROP by Ware, who with Neal Simon, professor of behavioral neuroscience in the department, directs the HHMI grants that Lehigh received in 2006, 2010 and 2014. The grants promote interdisciplinary research and research opportunities for students and seek to retain students who are enrolled in STEM (science, technology, engineering and mathematics) fields.

The goal of HHMI's EXROP program is to provide summer research experiences to undergraduate students who are from disadvantaged backgrounds and from groups traditionally underrepresented in the sciences. Since the program began in 2003, EXROP has matched 654 undergraduates with 202 HHMI investigators, professors, group leaders and scientists.

"Lehigh really helped me prepare for an experience like this," says Juarez. "For a program like EXROP, an applicant needs to have research experience, so there weren't many my age who were accepted."

Outside class, Juarez is a member of the Association of Student Alumni (ASA), the Phi Sigma Pi honor society, Multicultural Affairs and the Latino Student Alliance. She is also an ambassador and a tour guide for the office of admission.

"I love science, but it's not the only thing I'm focused on," she says. "I'm a part of so much on campus and there's still so much more that I want to join. This school gives you so many resources to do anything you want. If you have a passion, there is someone here who can help you pursue your dreams."

You are invited to our annual

Undergraduate Research Symposium

Tuesday, April 21, 2015
4:00 to 6:00 p.m.

Poster presentations by our undergraduate researchers

Refreshments provided
Iacocca Hall, 111 Research Drive
Mountaintop Campus, Siegel Gallery

Graduate Student Spotlight

Tia Kowal is a Ph.D. Candidate in the Cell and Molecular Biology program

Tia Kowal, Ph.D. Candidate

Tia came to us from Millersville University where she earned her B.S. in biology and a minor in chemistry. While at Millersville, she took a histology class where she fell in love with cellular staining and microscopy. After working for several years at an optometrists' office, she decided that she wasn't done learning and began pursuing her graduate degree. In the fall of 2010 she joined Professor Matthias Falk's lab to investigate how cells respond to a material that could be used for tissue regeneration. The idea is to implant the material into a patient to promote the regeneration of new tissue, as opposed to replacing the tissue with a traditional implant material that just fills in the defect. The project is unique in that it spans several disciplines since there are multiple potential uses for this tissue regenerative material from bone development to in vitro fertilization to wound healing.

The material that she has been working with is a bioactive glass made of calcium and silica that was designed in Lehigh's Materials Science and Engineering department by Professor Himanshu Jain's lab. Termed TAMP, "Tailored Amorphus Multi-Porous," these scaffolds are glass ("Amorphous") structures that have at least 2 pore types ("Multi-Porous") and uniquely, the Jain lab has discovered ways for several parameters of the scaffold to be changed to fit the needs of the tissue to be regenerated ("Tailored").

So far, Tia has primarily focused on how cells respond to the TAMPs though looking at cellular morphology (shape), attachment, and growth. She feels especially lucky that she had the opportunity to use the Scanning Electron Microscope (SEM), since this is a great way to visualize cells on the scaffolds (see pseudo-colored image of cells on TAMP) and a unique skill to learn. Since the TAMP scaffolds are made from calcium and silica, which are both known to induce bone production in osteoblasts (bone cells), she has also looked carefully into whether the TAMP scaffolds cause osteoblasts to produce bone in vitro (cell culture), which would indicate that it will be useful for regenerating bone tissue in patients.

A scanning electron micrograph of a bone cell (psuedo-colored in purple) attached to the surface of a TAMP scaffold that is useful for regenerating new tissue.

A second project, possible through collaboration with Abington Reproductive group, looks at whether the TAMP scaffolds allow cells to grow more naturally in culture. During the process of in vitro fertilization, a sample of the cells lining the uterus is collected from the mother-to-be and the cells are then grown in culture to act like a nest for the developing embryo. In the body these uterine cells are tall and polarized, meaning that the top of the cells look different than the bottom; however, in culture the cells lose their polarity and grow flat against the dish. This project will look at whether the naturally polarized cells remain polarized in culture if grown on the porous TAMP scaffolds instead of the typical culture vessel, a flat plastic dish. This would be especially useful because when these cells are polarized, they produce and secrete hormones which are important for the development of the embryo. Tia has the unique opportunity with this project to isolate human cells from tissue biopsies provided by the Abington reproductive group.

Outside of the lab, Tia enjoys spending time with her youngest sister who is an undergrad at Lehigh and catching the show when Disney on Ice is in town since her other sister is a skater for the company. She herself also enjoys ice skating, snowboarding, running, swimming and pretty much any outdoor activity, including playing softball for the biology department's summer league team, The Biohazards.

Falk presents research in Cairo

In December 2014 Matthias Falk travelled to Alexandria, Egypt to participate in a workshop titled "Clinical Translation of Tissue Engineering & Regenerative Medicine" at Alexandria University. Falk was invited to present his research on the biological performance of bioactive glass scaffolds. He presented two talks, "In vitro tests using cells in culture" and "Scaffold characteristics determine cell response."

Eight years ago, Dr. Falk began a collaboration with Prof. Himanshu Jain in the department of materials science and engineering, and head of Lehigh University's "International Materials Institute for New Functionality in Glasses (IMI-NFG)" which financed his travel. This research tests the biological performance of novel dual-porous glass scaffolds (TAMP—Tailored Amorphous Multi-Porous) that were invented in Dr. Jain's laboratory. TAMP scaffolds have a unique set of characteristics, including interconnected macro-porosity that allows cells to colonize the scaffolds on the surface and deep within, interconnected nano-porosity that provides optimized nutrient and waste-product exchange, adjustable dissolution rate, as well as osteoconductive (bone-forming) properties.

As a cell biologist, Falk was very attracted to these scaffolds. "I find it remarkable that an engineer can make a synthetic material that, when implanted into the human body, dissolves over time and simultaneously regenerates the natural tissue. The project nicely complements my main research interest in direct cell-to-cell communication via gap junctions, as bone and other cell types of our body are known to communicate with each other when regenerating tissue." A research group in Egypt has tested the TAMP scaffolds in several different animal models (rabbits, goat, dogs), and NIH-approved human trials for dental applications are currently being conducted. Currently considered applications include hard tissue (bone), as well as soft-tissue (skin, tendon, etc.).

2014 Research Publications

Bold = Faculty
Bold+Italics = Graduate Student
Italics = Undergraduate Student
Underlined = Former Student

Oline, S.N. and **Burger, R.M.** (2014) Short-term synaptic depression is topographically distributed in the cochlear nucleus of the chicken. The Journal of Neuroscience. 34(4):1314-24doi: 10.1523/JNEUROSCI.3073-13.2014

Black, A., Draud, M., Richter, M. and **Itzkowitz, M.** 2014. Are conspecific and heterospecific opponents assessed similarly? A test in two species of territorial damselfish. Pomacentridae. Behavioural Processes. 106:107-110.

Close, M., S. Perni, C. Franzini-Armstrong, **D. Cundall**. 2014. Highly extensible skeletal muscle in snakes. J. Exp. Biol. 217, 2445-2448.

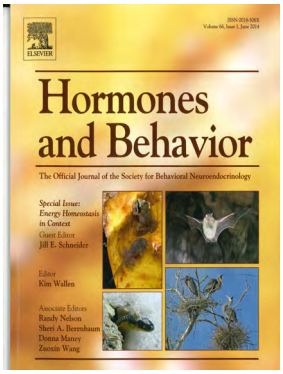
Falk, M.M., ***Kells, R.M.***, and Berthoud, V.M. 2014. Degradation of connexins and gap junctions. FEBS Lett. 588:1221-1229 (Invited peer-reviewed review article, special issue on connexins, pannexins, and innexins).

Sevetson, J. and **Haas, J**. Asymmetry and modulation of spike timing in electrically coupled neurons. Journal of Neurophysiology. DOI: 10.1152/jn.00843.2014.

Govindan, J. and **Iovine, M.K**. Hapln1a is required for Connexin43-dependent growth and patterning in the regenerating fin skeleton. PLoS One. doi:10.1371/journal.pone.0088574. 2014.

Lang, G.I., Desai, M.M. The spectrum of adaptive mutations in experimental evolution. Genomics. 2014 Dec;104(6 Pt A):412-6. doi: 10.1016/j.ygeno.2014.09.011. Epub 2014 Sep 28. PMID: 25269377

Gilotti, A.C., Nimlamool, W., Pugh, R., Slee J.B., ***Barthol T.C.***, Miller E.A., and **Lowe-Krentz, L.J**. 2014. Heparin responses in vascular smooth muscle cells involve cGMP dependent protein kinase. J Cell. Physiol. 229: 2142-2152.



Professor Jill Schneider was guest editor of an entire issue of Hormones and Behavior and designed the cover.

Schneider, J.E., ***Broczek, J.***, Keen-Rhinehart, E. Our stolen figures: The interface of sexual differentiation, endocrine disruptors, maternal programming, and energy balance. Hormones and Behavior. 66:104-119, 2014. PLoS One. 2014 Jun 25;9(6):e100470. doi: 10.1371/journal.pone.0100470. eCollection 2014. PMID: 24963665 [PubMed - indexed for MEDLINE]

Student publications

Cundall, D., Tuttman, C., Close, M. 2014. A model of the anterior esophagus in snakes, with functional and developmental implications. Anat. Rec. 297, 586-598.

Abdulhay, A., ***Benton, N.A.***, Klingerman, C.M., Krishnamoorthy, K., ***Brozek, J.***, and **Schneider, J.E**. Estrous cycle fluctuations in sex and ingestive behavior are accentuated by exercise or cold ambient temperatures. Hormones and Behavior. 66:135-147, 2014.

Lehigh awarded HHMI grant to improve science education

By Jordan Reese, LU Communications

Lehigh University is the recipient of a five-year, $1.9 million grant from the Howard Hughes Medical Institute (HHMI) to enhance undergraduate science education. The program will be directed by Biological Sciences faculty Neal Simon and Vassie Ware, who also led Lehigh's 2006 and 2010 HHMI awards. From a pool of 170 applications from major research universities nationwide, Lehigh was one of only 37 to be awarded a grant to chart new ways to retain students who enter STEM (science, technology, engineering, or mathematics) education. The Lehigh team will use the funds to improve retention in bioscience-related fields among at-risk and underrepresented students, as well as the full population of students studying a STEM field.

Lehigh's programmatic focus is to integrate extensive research engagement early in the learning process with innovative advising and mentoring support services from around the university.

With the new award, Lehigh will expand research experiences and bring intensive mentorship and advising to the first and second years of STEM education. Simon said that "the primary focus will be on improving persistence and retention in STEM among members of disadvantaged and underrepresented groups, which will meet a national need and broaden Lehigh's efforts in diversity."

The Lehigh team's two-pronged approach echoes what many in higher education are calling an important partnership for the future of higher education: research universities and community colleges. One prong will be BioConnect: Community College Collaborations to Improve STEM Retention. The Lehigh team will leverage existing partnerships with community colleges to increase the number of students who successfully transfer from a community college to the universities where most of the nation's scientists are produced. Ware noted that "by providing Lehigh-sponsored, bioscience-related interdisciplinary research experiences, strong mentoring, and interactions as part of an established community of STEM students at Lehigh, community college transfer students will find themselves better prepared for graduation and more in tune with an interdisciplinary research culture that is a defining feature of Lehigh's approach to life science education."

Coupled with BioConnect is RARE, The Rapidly Accelerated Research Experience. This pre-admission-to-graduation science immersion program incorporates four dimensions that are essential for success among students that are underrepresented in STEM fields: an innovative curriculum, a strong sense of identity as part of a community of scholars, the addressing of cultural issues that contribute to low success rates, and an understanding of the commitment required to excel in STEM. RARE will test whether a comprehensive 4-year approach can improve retention in STEM among at-risk and underrepresented students.

"To keep these science-minded students, we must deliver engaging and effective science experiences and a strong supportive environment, particularly in the first two years of college," said Simon.

For more information about the BioConnect and Rare programs, visit www.lehigh.edu/~inhhmi

2014-2015 Langer-Simon Scholars

2014-2015 Langer-Simon Scholars: (l-r) Bijal Desai, Michelle Juarez, Emily Heckman

The department of biological sciences announced the following students were this year's recipients of the Langer-Simon Endowed Fund for Bioscience Research:

Michelle Juarez ('16) is exploring the function of a specific gene in a bacteriophage. Michelle hopes to determine the function of the gene in order to create the smallest viable bacteriophage for clinical use in gene therapy against antibiotic resistant diseases. Michelle will receive $3,000 to support her research. She is working with Professor Vassie Ware.

Emily Heckman ('16), a molecular biology major, studies electrical synapses in Dr. Julie Haas's lab. Emily hopes to show that these synapses survive in hippocampal brain slice cultures, where they can be monitored long-term, and that the strength of those synapses is regulated by overall amounts of neuronal activity within the culture. Emily will receive $1,000 to support travel to a conference to present her work.

Bijal Desai ('15) is a biology major working with Dr. Julie Haas to explore electrical synapses in the suprachiasmatic nucleus, a brain area that regulates circadian rhythms. She hopes to demonstrate that the peptide neurotransmitters native to that brain area modulate the strength of electrical synapses between neurons. Bijal will receive $1,000 to support her research.

Robert & Laura Langer established the Langer-Simon Endowed Fund for Bioscience Research through a generous gift in 2012. The purpose is to support research experiences for undergraduate students in the biological sciences. The fund supports student research projects with an emphasis on lab activities that integrate multiple disciplines and perspectives.

Alumni Updates

Robert Varnum, MD (BA Bio., 1965) just semi-retired from his pulmonary-critical care practice. "Lehigh provided me a great education, and I spent a summer with grad student Stu Swihart in Trinidad studying butterfly eyes. Education, the tennis team, fraternity involvement and travel made for a wonderful experience."

Jennifer (Conigliaro) Montone (BS, Bio., 1999) is a surgical physician assistant at Mount Sinai Hospital in New York.

Daniell Rowles (BS, Mol. Bio., 2008) received her Ph.D. in molecular biology from Princeton University. "I now work as a research scientist in the Translational Medicine Department at QPS, LLC in Newark, Delaware."

Jennifer Olenik, MD (BA, BNS, 2009) graduated from the University of Pennsylvania School of Medicine in May 2014. During medical school she took a year out to do clinical work abroad in El Salvador. "I will be starting my residency in internal medicine at UCSF where I will join fellow Lehigh graduate, **Jake Natalini**, who is currently an intern in internal medicine. I absolutely loved medical school, felt very well prepared by my education at Lehigh, and couldn't be more excited about the new experiences that await me in San Francisco.

Allison Porman (BS, Mol. Bio., 2009) received her Ph.D. in molecular biology, cell biology and biochemistry from Brown University in 2014. In September, Allison started a five month program called Eco-Israel in Modi'in, Israel to learn about organic farming and permaculture.

Ashley Ruby (BS, BNS, 2010) received her MD degree from Drexel University and is currently working at Chestnut Hill Hospital.

Rachel Leskosky (BS, BNS, 2012) is attending Sherman College of Chiropractic in South Carolina.

James Bowen (BS, Biochem., 2014) is a first year medical student at the University of Pittsburgh and plans on a career in oncology.

Let us know what you're doing!

Submit your information online:

Click here to submit your information - it's fast and easy!

Call us:

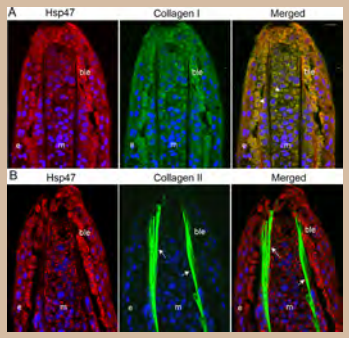
Call the department office (610-758-3680) and give your information to Vicki Ruggiero.

Send us a note:

Biological Sciences
Lehigh University
attn: Alumni Updates
111 Research Dr., B217
Bethlehem, PA 18015

Send us an e-mail:

Send your information to inbios@lehigh.edu. Please include your name, year of graduation, degree, and the information you would like to share.



Confocal image of a longitudinal section of a WT-5dpa regenerating fin. Immunostaining for Hsp47 (red) and collagen type I (green) or II (green) and counterstained with To-Pro (blue). Arrows indicate actinotrichia in Col II panels. 'ble' is basal layer of epithelium, 'e' epidermis and 'm' mesenchyme. Scale bar is 10 µm. Bhadra and Iovine.

A lesson in cell biology

Cohesins as seen through the eyes of the Skibbens Lab

Can a protein perform different functions within a cell? Alternatively, can a protein function be co-opted to impact entirely different cell biological processes? If either scenario is true, then different mutations within a gene might produce significantly different outcomes. In fact, all of these scenarios play out in a cell.

The Skibbens lab studies the regulation of cohesin complexes - mutations which result in completely different outcomes that are of immense clinical interest: cancer and severe birth defects.

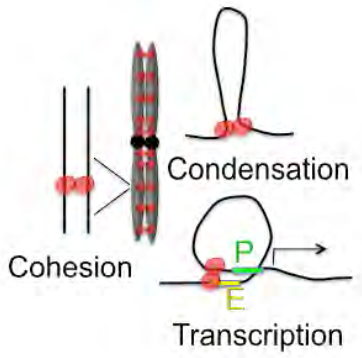
Cohesins were first identified based on their role in chromosome segregation. Prior to cell division, each DNA molecule or chromosome must be faithfully duplicated. To identify the resulting duplicated chromosomes as 'sisters', the cell tethers together each pair. The tethers are termed cohesins. Cohesin degradation during cell division allows the sister chromosomes to separate and move into the newly forming daughter cells. Mutations in cohesins result in daughter cells that contain abnormal numbers of chromosomes. This aberrant DNA content is termed aneuploidy and is a hallmark of cancer cells.

One goal of the Skibbens lab is to discover mechanisms through which aneuploidy arises in hopes of providing a better understanding of cancer biology. The Skibbens lab primarily uses the budding yeast *Sacchormyces cerevisaie* in which all of these gene products are highly conserved and perform identical functions in humans, mice and flies.

Intriguingly, cohesin function is not limited to tethering together the products of chromosome replication. Along the length of a single chromosome reside hundreds of genes that the cell must read out or transcribe (through an mRNA intermediate) to produce proteins. The decision of which gene to transcribe is tightly regulated. One facet of this regulation involves short DNA sequences that must be brought into close proximity even though they reside very far apart along the chromosome. Here again, cohesins come to the rescue. The long linear DNA strand bends or loops to bring these DNA regulatory elements together. Cohesins tether together these regulatory DNA elements at the base of the loop - providing a stable platform from which transcription can proceed. The fascinating aspect is that cohesin mutations that impact transcription regulation need not impact chromosome segregation. This situation is evident in individuals afflicted with Cornelia de Lange Syndrome. Cornelia de Lange patients harbor mutations in cohesion genes that impact transcription but not chromosome segregation. These individuals exhibit severe birth defects that can include profound limb reduction, craniofacial abnormalities (such as microcephaly and cleft palate), and mental retardation.

To better understand the mechanism through which cohesin-related birth defects arise, the Skibbens lab has teamed up with the Iovine lab - which brings expertise in both development and a powerful zebrafish model through which the impact on bone growth can be quantified in response to reduced cohesion gene function.

The Skibbens Lab: (l-r) Krupa Patel, Raj Banerji, Rachel Sternberg, Robert Skibbens, Ph.D., Donglai Shen, Kevin Tong



Cohesin functions in chromosome biology include sister chromatid cohesion (left), chromosome condensation (top right), and transcription regulation (bottom right), (P=promoter, E=enhancer). Modified from Skibbens, 2015.

Dissecting the roles that cohesins play at the cellular level requires commitment from a team of budding scientists. In the Skibbens lab, senior graduate student Kevin Tong is both defining the structure through which cohesins tether together DNA molecules and is identifying genetic modifications through which cohesin functions can be studied in isolation. Donglai Shen is analyzing the impact that cohesion factors play in altering chromatin structure - which is central to understanding the most fundamental aspects of DNA metabolism such as replication and transcription. Caitlin Zuilkoski recently rotated in the Skibbens lab with the goal of identifying new combinations of gene mutations that may rescue cellular defects otherwise present in cohesion mutant cells. Raj Banerji's primary appointment is in the Iovine lab and she is the central conduit through which the Skibbens and Iovine collaboration explores the developmental aspects of cohesion pathways in zebrafish.

The Skibbens lab also is home to talented undergraduate researchers. Rachel Sternberg is pursuing the regulation of cohesion factors that respond to DNA damage - damage that left unrepaired would result in new mutations. Krupa Patel is tracking down candidate genes that the lab hopes will significantly impact cohesin regulatory activities and reveal cell biological pathways currently thought to be unrelated to cohesion pathways. In combination with many other labs involved in cohesion research, one may hope that solving the mysteries of cohesion-related mechanisms and diseases may not be far in the future.

Click here for more information about the research in the Skibbens Lab.