

Department of Biology Updates

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A Message from the Outgoing Chair

Dear colleagues, alumni, and students,

Welcome to our latest issue of the Biology Department newsletter. We have two issues per year, Spring and Fall, in which we hope to keep you up to date on departmental activities and achievements. In turn, I encourage you to please drop us an e-mail and let us know about any news and developments in your life and career (BiologyDept@luc.edu).



Jim Cheverud, Ph.D.
Professor and
Former Department
Chair

After serving as Biology Department Chair for the last nine years, Jim Cheverud is stepping down to continue his research and teaching responsibilities. In an email to the faculty and staff, he acknowledged the teamwork that it takes to keep the department running:

I want to thank you all for all you do for the students and for being such an interested and active faculty. A chair can't really do anything without the active participation of department faculty.

I have depended on the kindness and hard work of our departmental staff. It continues to amaze me that we handle over 2,000 students out of a four-person office plus MAMS. I especially depended on our department office manager, Virginia Lorenzo, for dealing with much of the day-to-day administration, doing our schedules, approving orders, etc. She has also been invaluable in handling grants in the department.

Of course, I will still be around discovering what it is like to be a faculty member at Loyola. I want to say that I have enjoyed working with all our various Deans in the college. I have great respect for them and their incredible work rate.

Best wishes,
Jim Cheverud

A Message from the Incoming Chair

Greetings alumni, students, staff, and faculty of the Department of Biology!



John Kelly, Ph.D.
Professor and
Chairperson
773-508-3681

I'm excited to begin my new role as Department Chair. I have been a faculty member in this department since 2001, and over the years I have benefited tremendously from the support of the university, the college, the department, and all my colleagues. I am grateful that as chair I will have the opportunity to give back to this institution and repay some of the support I received by serving the faculty, staff, students, and alumni of the department. I see challenges ahead, but also opportunities, and I am confident that together we can embrace both while building on our strengths and addressing areas in which we need to improve.

I would like to thank our outgoing Department Chair, Dr. Jim Cheverud, for his years of exemplary service. Jim led the department through the unprecedented challenges of the COVID pandemic with skill and grace, and was still able to enhance our department by adding new programs and new colleagues, and of course more Biology majors! Jim was always a strong advocate for and an outstanding representative of the department. I know that everyone appreciates the work that he did, and we will all miss his leadership.

I hope that I can follow Jim's example and lead the department as effectively as he did. I view the chairmanship as a service role, and I look forward to serving the faculty, staff, students, and alumni of the Department of Biology. Please know that my door and my email inbox are always open, and I look forward to hearing from you and working with you.

A handwritten signature in black ink that reads "JK Kelly". The signature is written in a cursive, flowing style.

John Kelly

Biology Faculty Receive Sujack and Ignatius Loyola Awards for Excellence in Teaching

Each year, Loyola University Chicago and the Sujack Family present awards to faculty who have demonstrated excellence in teaching as well as faculty who have excelled in research and scholarship outside of the classroom. This year, **Dr. Daniel Cavanaugh**, Assistant Professor in Biology, and **Dr. Shauna Price**, Lecturer, received the 2022 Sujack Master Teacher Award. Additionally, the the St. Ignatius Loyola Award for Excellence in Teaching recognizes faculty whose teaching involves a commitment to excellence, raises global awareness, promotes social justice, and educates the whole student. This year, **Dr. Michael Burns**, Assistant Professor in Biology received the runner-up for this award for his teaching. Congratulations to Drs. Cavanaugh, Price, and Burns on their achievements in and out of the classroom!



Biology Faculty Promotions

This year, four Biology faculty (listed below) have been recognized for their work in their field of research and teaching and have been promoted to the next academic rank. Congratulations on an excellent job across the spectrum of research, teaching, and service. The new promotions take effect on July 1, 2022. *Congratulations Drs. Franks, Sanger, Sines, and Yu on your promotions!*

Dawn Franks has been promoted to Senior Lecturer

Thomas Sanger has been promoted to Associate Professor with Tenure

Bree Sines has been promoted to Senior Lecturer

Wei-Ming Yu has been promoted to Associate Professor with Tenure

Biology Faculty and Staff Service Recognized

At the College of Arts and Sciences Faculty and Staff 2020 and 2021 Service Recognition during the December 2021 Holiday Reception, several Biology Faculty and Staff members were honored for their service to the College of Arts and Sciences. Listed below are Faculty and Staff members who had milestone years of service to the College and University. Thank you to all of the Faculty and Staff for your service and commitment to the students and Loyola University Chicago!

5 Years

Michael Burns
Daniel Cavanaugh
Thomas Sanger
Heather Wheeler
Wei-Ming Yu

15 Years

Peter Breslin, SJ
Gerald Buldak
Erin Hayes
Bree Sines

25 Years

F. Bryan Pickett

35 Years

Joseph Schlupe

10 Years

Dawn Franks
Timothy Hoellein
James Lodolce
Pamela Osenkowski

20 Years

Beata Czesny
John Kelly

40 Years

William Kroll

MAMS Program Update

This year, the MA in Medical Science (MAMS) program added a new series of workshops for our students addressing racism and implicit bias in medicine. The series is the brainchild of Meghana Mohan, a Loyola alumnus and contemporary MAMSer currently serving as a graduate intern in the Student Diversity and Multicultural Affairs office. More than anything, Mohan wanted to create a space where future doctors could ask questions and “learn how to learn” about complex structural problems that might occur within the clinic but outside of the classroom. With her SDMA supervisor, Eva Long, Mohan designed a series of three workshops that focused on exploring power and oppression in medicine. The experience has been met with an enthusiastic response from the wider MAMS community. By the last workshop Mohan said she could see her peers “dismantling their biases in front of each other.” MAMS director Dr. Dawn Franks agrees that the series meets a program need and committed to continuing the partnership with SDMA into the next year, even after Mohan graduates this Spring. “We’re a Jesuit school that’s social justice oriented,” Mohan says “we need to understand the entirety of a person to treat them holistically.”

Dr. Yoel Stuart's Lab Receives NSF CAREER Award

Can biologists predict long-term outcomes of evolution by extrapolating what we know about short-term evolutionary processes? Does knowing something about populations and the forces acting on them today help predict where populations will eventually evolve? The answers to these questions relate to pandemic forecasting, design of medicines for infectious disease and cancer, as well as predicting how agriculture and agricultural pests will respond to human activity. And yet they are hard questions to answer because the time scale scientists need to observe are typically inaccessible to experiment and observation. Biologists either observe evolution today for as long as possible to extrapolate forward or observe evolutionary endpoints and infer backwards. Both approaches miss the middle of the evolutionary trajectory. The Stuart lab was recently awarded a National Science Foundation CAREER award to aim for the middle, documenting 20,000 years of evolution of a fossilized lineage of Threespine Stickleback fish (*Gasterosteus doryssus*). Stuart will measure the population at the start of the trajectory and test whether that information predicts evolution observed by the end of the trajectory.

Using a museum collection of fossil *G. doryssus*, the Stuart lab will measure 19 anatomical traits from ~4,500 fish sampled at a continuity, resolution, and length of time rarely available in studies of living or extinct species. Because Stuart is observing evolution directly in a single lineage through time, the ancestral form is known. Thus, Stuart can better ask about rates of evolutionary change, how selection shaped trends, how ancestral genetic correlations among traits constrained evolution, and whether constraint itself evolved. This

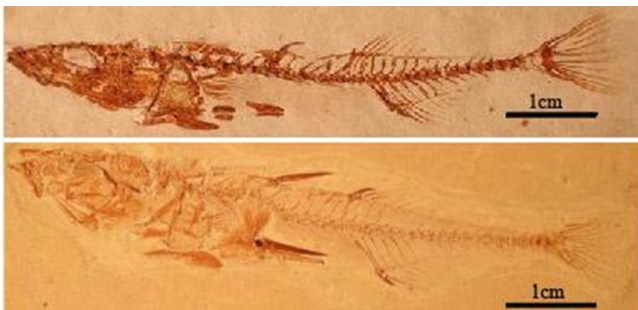


Figure: Low armored (top) and high armored individuals of *G. doryssus*. The low armored form evolved from the high armored form over ~20,000 years (10,000 generations). The low armored form has a reduced pelvic girdle, missing pelvic spines, and only a single dorsal spine.



Diatomite rock is formed from dead diatoms, which inhabited this lakebed 10 million years ago. When they died at the end of each season, diatoms sank to the bottom and fossilized, creating a new layer each year. Fish would fossilize alongside the diatoms. Here, colleague T. Frank is measuring distance between diatomite layers, akin to measuring tree rings, to help date time between fish specimens. There are about three layers (years) per mm of rock. Occasionally, there were volcanic ash falls (the thick layer near Tanner's hands), which allow us to radioisotope date the rock. We can follow stickleback evolution over 20,000 years by cutting out the rock, splitting it open, and finding fish fossils.

study organism has the added strength of being a stickleback and part of a family whose evolution, ecology, genetics, and development have been thoroughly studied in living populations. As such, Stuart can place observed change in *G. doryssus* into a broader biological context to better answer whether macroevolution is microevolution predictably writ large.

You can read more about Stuart Lab research here (www.stuartlabloyola.org) and a bit more about this system, with pictures, here (<https://ecoevocommunity.nature.com/posts/genetics-of-miocene-threespine-stickleback-evolution>).

For scientists. By scientists — Post events update! A seminar series dedicated towards promoting anti-racist STEM pedagogy

Biology faculty members **Drs. Thomas Sanger** and **Michael Burns** along with Anthropology Department faculty member Dr. Kristin Krueger invited national experts on anti-racist pedagogy in STEM onto campus (virtually) to provide their insights into challenges and best practices related to teaching in STEM classrooms. These “How To” sessions included: Integrating Diverse Students Into STEM with Dr. Mica Estrada on January 26th, Making Class More Inclusive with Dr. Tracie Addy on February 17th, and Using STEM to Promote Social Justice with Dr. Ebony McGee on April 12th. These events were sponsored by Badia Ahad and the Office of the Provost, the Faculty Center for Ignatian Pedagogy and an NSF-ADVANCE grant.

More information about these events as well as selected recordings can be found at: <https://www.luc.edu/fcjp/anti-racistpedagogy/anti-raciststemseries/>

The following seminars were held during the spring semester, and were well-attended and received by the Loyola community!



January 26, 2022: Dr. Mica Estrada
Associate Professor, Institute for Health & Aging
UCSF

HOW TO INTEGRATE DIVERSE STUDENTS INTO STEM



February 27, 2022: Dr. Tracie Addy
Associate Dean of Teaching & Learning
Lafayette College, Easton, PA

HOW TO MAKE CLASS MORE INCLUSIVE



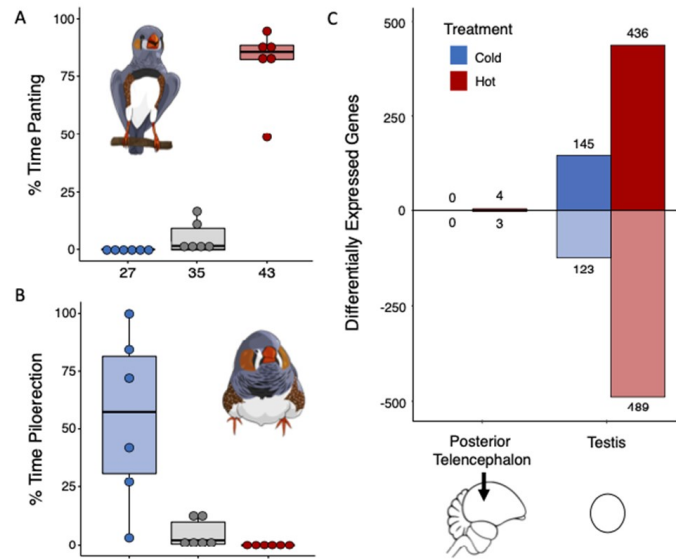
April 2022: Dr. Ebony McGee
Professor of Education, Diversity and STEM Education
Vanderbilt University

HOW TO USE STEM TO PROMOTE SOCIAL JUSTICE

Faculty research updates

New Biology department faculty member, **Dr. Sara Lipshutz**, had a paper accepted in the journal *Molecular Ecology* this past March entitled "How thermal challenges change gene regulation in the songbird brain and gonad: implications for sexual selection in our changing world". Aspects of the research included looking at behaviors related to temperature and thermoregulation within these songbirds, including panting and piloerection, as indicated in Figure 1, from the manuscript shown on the right:

Figure: Temperature treatments affected thermoregulatory behaviours, including (a) panting and (b) piloerection, illustrated here as boxplots. Treatments also affected (c) up- and down-regulation of gene expression in the posterior telencephalon and the testis. Bird illustrations by Mae Berlow.



Dr. Joseph Milanovich's laboratory has received two grant awards over the past year. The first, was a grant (2021-2023, \$78,721) from the Indiana Department of Natural Resources to survey for the endangered Copperbelly Water Snake (*Nerodia e. neglecta*) in Indiana. They are using visual encounter surveys and coverboards (Photo 1) to survey for the snakes at new and historical sites.



Photo 2: Spotted turtle with radio-transmitter attached by researchers in the Milanovich lab.

The second award (2022-2023, \$30,000) is from Northern Indiana Public Service Company (and ORS) to examine the impact of heavy metal accumulation on the behavioral and physiological ecology of state endangered spotted turtle (*Clemmys guttata*). They are using radio-telemetry and conservation physiology to examine the home range, habitat use, thermal ecology, and impact of metals on physiology (Photo 2).



Photo 1: Deer Lake Nature Preserve near South Bend, IN. Loyola undergraduate students Ashriya Patel and Ella Janson and graduate student Jess Lindberg are lugging coverboards to deploy at the site to survey for

Undergraduate researchers present their work in the Miersch lab at scientific conferences!

Christine Severude (below), an undergraduate working on a joint project between the Mierisch and Wheeler labs, has been awarded a Tri-Beta Research Grant and a Barry Goldwater Scholarship, in addition to an ongoing Carbon Fellowship to support their research project studying the genetic regulation of spermatogenesis in *Drosophila melanogaster*. Research in the Mierisch lab has demonstrated that increased Notch signaling in the somatic cells of the testes results in arrest in spermatogenesis. To better understand how increased Notch signaling interferes with spermatogenesis, Christine prepared samples from control and Notch overexpression and mutant samples for RNA-sequencing analysis and is currently performing bioinformatics analysis of this data to identify potential Notch targets. Research funding will allow Christine to characterize these targets over the next year. Christine presented this work at the virtual National Council for Undergraduate Research Conference and the Chicago Area Undergraduate Research Symposium this April, and will present at the Tri-Beta National Convention in Oklahoma City in June.

Characterization of the Role of Notch in Drosophila Testes
C. Severude, A. Soriano, H. Wheeler, J. Janic
Department of Biology and Bioinformatics, Loyola University Chicago

Introduction
The process of gonad development and gametogenesis is crucial for the propagation of our species and the conservation of biodiversity. The gene Notch plays an important role in these processes and associated with spermatogenesis arrest, suggesting that the differentiation and survival of male germ cells is dependent on the Notch signaling pathway. However, how Notch functions in this process is not well understood. Previous studies in *Drosophila* have shown that a loss of Notch signaling in the embryo results in defects in cell establishment, indicating that Notch functions in gonad development. Recent work in our lab demonstrates that increased Notch signaling in somatic cells of the testes also negatively impacts spermatogenesis, resulting in spermatogenesis arrest and infertility. Despite these important roles, no transcriptional targets of Notch in the testes through RNA-sequencing analysis understand the processes and regulation of spermatogenesis in *Drosophila* and across animal phyla. This work will also pave the way for future research endeavors exploring the function of identified target genes. These genes could represent therapeutic targets for individuals dealing with infertility.

Methods

1. Use genetics to alter Notch signaling levels.
 - Control vs decreased Notch signaling
 - Control vs increased Notch signaling
2. Isolate RNA from testes and conduct RNA sequencing
 - Dissect the testes of 50 flies
 - Purify RNA
 - Send to Novogene for RNA sequence analysis
3. Analyze RNA-sequence data through bioinformatics
 - Quantify transcript abundance through kallisto
 - Conduct differential RNA expression analysis through sleuth

Results

Figure 1: Notch activation. At the molecular level, Notch is a cell surface receptor. When activated by the ligand Delta, the intracellular domain is cleaved and will enter the nucleus, interacting with transcriptional factors and modifying gene expression. In the adult testes, Notch functions in the maintenance of germline stem cell lineage and is found in the somatic cyst cells of the testes.

Figure 2: Structures of the adult *Drosophila* testes. There are three main cell types in the testis: germ cells (shown in green), somatic cells (shown in gray), and somatic cyst cells (shown in yellow). The stages of spermatogenesis progress in order of development from the apical tip of the testis, containing germ stem cells, to the basal end of the testis, containing mature sperm bundles.

Figure 3: Differential interference microscopy of Notch overexpression flies vs. control flies. Notch overexpression flies are viable in Panels A and B, but show the control testes. Panels C and D represent the Notch overexpression phenotype, lacking defined sperm bundles. They are also significantly shorter in length, showing an abnormal morphology.

Figure 4: Immunohistochemistry of Notch overexpression flies vs. control flies. Panel A shows Traffic jam expression in control flies, while panel B shows Traffic jam expression in Notch overexpression flies. Notch overexpression causes prolonged expression of Traffic jam, an early overexpression flies. Notch overexpression causes prolonged expression of Traffic jam, an early overexpression flies. Notch overexpression causes prolonged expression of Traffic jam, an early overexpression flies. Notch overexpression causes prolonged expression of Traffic jam, an early overexpression flies.

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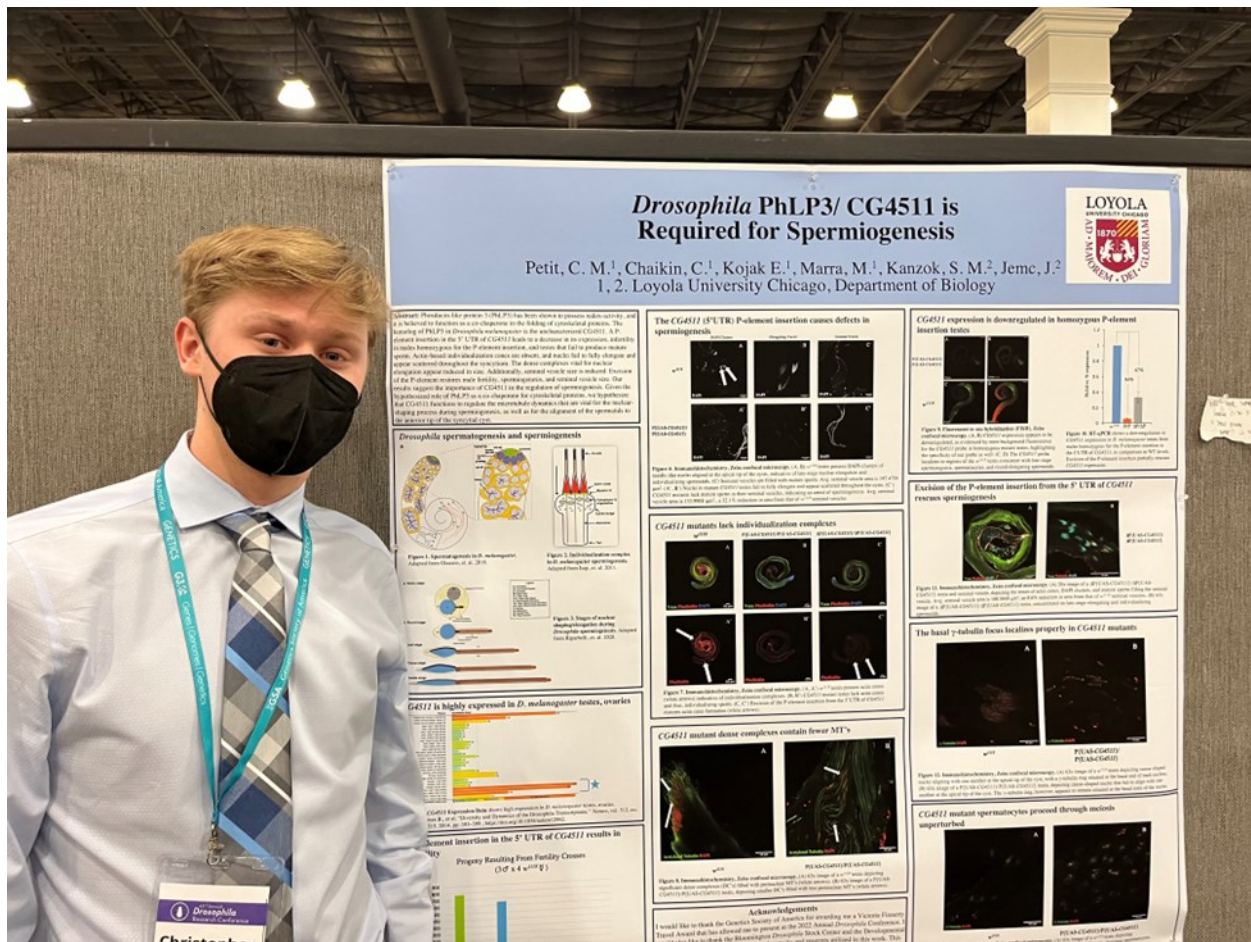
Valcano Plot of Significant Genes: Notch Overexpression

Valcano Plot of Significant Genes: Notch Underexpression

Gene	Description	Regulation
AHSP1	Organizes endoplasmic reticulum tubule network	Down
nmo	Regulates Notch signal transduction	Up
Cyp4p1	Required for sex induction in metabolism of insect hormones	Down
CG32971	Required to regulate transcription of RNA polymerase II and enable transcription elongation activity	Down
CG33271	Expressed in embryonic head sensory tissues	Up

Acknowledgements
Special thanks to Dr. Jennifer Mierisch and Dr. Heather Andrich Soriano for her previous advice. Thanks to the Carbon Fellowship program, Ben Slayton and Barry Goldwater Scholarship and Excellence in Education for funding. Thanks to the internal research grant from Loyola University Chicago. Thanks to the following groups for providing reagents: Bloomington Drosophila Stock Center, Gene Project, University of Chicago, Mark Saito, University of Illinois, and the Department of Biology, Loyola University Chicago.

This April undergraduate Christopher Petit (below) presented his research at the Annual Drosophila Research Conference in San Diego, California. Christopher is working on a collaborative project between the Mierisch and Kanzok labs exploring the role of Drosophila Phosducin-like Protein-3 (PhLP-3), a protein hypothesized to function as a member of a chaperone complex that regulates cytoskeletal protein folding, in the late stages of spermatogenesis. Christopher and others have demonstrated that mutation of this gene results in a failure of sperm to individualize and male infertility. Examination of spermatogenesis at the cellular level reveals that nuclei fail to elongate completely in mutant spermatids, resulting in spermatogenesis arrest and a failure to progress to sperm individualization. As nuclear elongation depends on microtubules, Christopher is currently examining the microtubule cytoskeleton in dPhLP-3 mutants. Support from a Mulcahy Fellowship from the Loyola Undergraduate Research Opportunities Program and a Victoria Finnerty Award from the Genetics Society of America made this research and conference attendance possible.



10th Annual Beauty in Biology Competition

The 10th annual Beauty in Biology art competition ran again year and Loyola student, Zach Pitsenberger was the winner with his piece “Artificial Sting” (shown here). There were many excellent submissions - you can find a presentation that highlights the top 3 finishers [here](#). In addition, every work submitted is listed by author, alongside its description. The judges for the submissions this cycles were Biology Department faculty, Drs. Heather Wheeler, Emma Feeney, and Alfred Diggs. The winning artwork will be displayed on the first floor of the Quinlan Life Science Building alongside prior years’ winners!



Artificial Sting By Zachary Pitsenberger, 1st place, 10th Beauty in Biology Competition

Collecting Insects in Winter?

The Department of Biology's Aquatic Insects class taught by Professor Marty Berg, has been offered every other Spring since 1996 to introduce juniors, seniors, and graduate students to the field of aquatic entomology. Lectures focus on the behavior, physiology, phylogeny, and ecology of aquatic insects. The laboratory component involves learning how to identify aquatic insects and includes a four-day field trip in mid-March to northern Wisconsin and the Upper Peninsula of Michigan to collect insects from nine streams. The class dealt with more than two feet of snow at some sites, which made walking in waders difficult; however, the collecting was excellent and only a couple of students took an involuntary swim. Brrrrr!



Students collecting samples above Agate Falls (top) and Tamarack Creek (bottom)





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ABOUT THIS NEWSLETTER

This newsletter was compiled by Dr. Michael Burns and edited by Drs. Jennifer Zitzner and Caroline Turner for the purpose of keeping our departmental alumni abreast of new developments, programs, and events.

We would love to hear from you!

If you know someone whom you would like to see featured in the Faculty or Alumni Spotlight section, or have ideas about things you would like to see in future newsletters, please send an email to:

biologydept@luc.edu

Also, we here in the Loyola Biology Department just love hearing from our alums. So don't be a stranger! Please email us at biologydept@luc.edu, let us know where you are, what you're doing, and send us pictures if you have them!

Alumni Support

The University and the Department of Biology are extremely grateful for the generosity of all our donors. Donations in any amount from one to thousands of dollars are appreciated and help the department serve our students. Your support of the Biology Department permits us to continue many programs and services including:

- Student research fellowships
- Travel funds for students to attend local and national meetings
- Professional development opportunities for Biology Faculty
- Equipment for teaching and research laboratories

If you would like to make a gift to the Biology Department Gift fund, you may do so in two ways:

Online: [Click here to be directed to the secure donations website](#)

Mail: Please mail checks to:

Loyola University Chicago
Biology Department
c/o Stephanie Tomakowski
820 N. Michigan Avenue, Ste. 1721
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Please include in the memo line: Biology Department Gift Fund