

Bama Biology

Newsletter of the Department of Biological Sciences

Spring 2018 Volume 3 No. 1

NOTE FROM THE CHAIR

Dr. Janis O'Donnell

Hello everyone!

We had an eventful year with many activities that I will summarize here. Last summer (2017), we launched a brand new venture for our Department, the Bama Biology Bootcamp, to serve incoming students registered for Principles of Biology, the first course for biological sciences majors. Why Bama Biology Bootcamp? Frankly, we felt that too many new students were performing well below their expectations and that they needed a

solid start for a successful college career. on material they'll see again in their course in the Fall. They take exams. They work hard! Interspersed with these lectures and exams are sessions on how to effectively study for comprehension, how to study more efficiently, how to develop successful study groups, and how to manage their time. They work in small groups and have graduate and undergraduate student mentors. They also get to know their professors in an informal setting. And it works!

we thought 500 majors was a huge program! Yes, this means classes are larger, so we continue working to improve upon traditional teaching approaches. You'll hear more about some of the exciting and innovative learning strategies we are adopting in future newsletters.

At the end of September, we combined several events that previously occurred at different times into the Bama BioFest. Meeting in the Ferguson Center Ballroom, our wonderful graduate and undergraduate students presented research posters, representatives from various programs hosted a Biology Career Fair, and New Student Welcome provided opportunities for freshmen and transfer students to meet our faculty and to learn about available volunteer options, including how to be involved in research. In excess of 300 students and members of the campus community attended. We followed that event with a tailgate for students, families, alumni and friends of the department on a beautiful Saturday afternoon before a home football game. We hope these events will become a tradition! So, watch for announcements on our website and in future newsletters. We want to get to know all of our students, and we love to have alumni return!

As we look to the future, our collective goals are to build our ties to the great students, faculty and staff of past years and decades and to continue building programs and activities to enhance student success and the experiences they have here on campus.

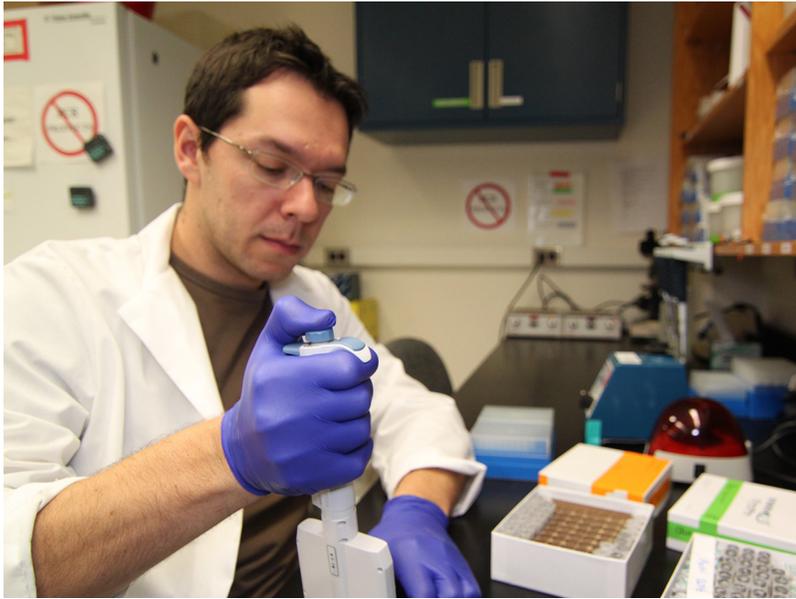


solid start for a successful college career.

College really isn't grade 13, and the transition to college courses is often more challenging than expected. So, we enlisted the advice of two of our alumni, Bill and Sheri Wischusen, who established a highly successful and long-running bootcamp at LSU. Students voluntarily sign up for a week of bootcamp during the summer. They attend some lectures

Participating students tend to retain their study groups, apply those survival skills learned in bootcamp, and on average, are earning higher grades – in biology and in other courses. So, we are committed to continuing and growing the Crimson version of bootcamp for biologists.

This year has brought a record-setting number of undergraduate majors – 1,582 of them, officially! I can remember when



NEW FACULTY SPOTLIGHT

Dr. Gui Becker is a new Assistant Professor in the Department of Biological Sciences. Gui is a disease ecologist with broad interests in spatial epidemiology and wildlife conservation. Here, Gui is running qPCRs to quantify pathogen infection loads from skin swabs.

GUI, what motivated you to pursue a career in science?

I think my love for biodiversity stems from a childhood immersed in Brazil's amazing wilderness.

Describe the path that led you to your current research area.

I started my career as a landscape ecologist studying how different patterns of deforestation impact breeding migrations in amphibians. As a PhD student, I used my background in spatial ecology to understand the spatial distribution of one of the most devastating wildlife diseases in recorded history: amphibian chytridiomycosis. Since completing my PhD work in 2014, my research interests fall at the interface of wildlife epidemiology and spatial ecology, including detailed mechanistic studies of diversity-disease relationships, ecology of host microbiome, host-pathogen responses to abiotic factors, and the genetic connectivity and dispersal of animal populations.

What about your area of research excites you the most?

It is fascinating that biodiversity often leads to ecological stability and reduced disease risk. What is even more exciting is that diversity of symbiotic microorganisms might contribute to host health through fighting disease-causing agents. I am now eager to investigate how biodiversity impacts system stability across multiple scales, from skin microbiomes to host community structure. The whole theory by itself is beautiful; plus, these studies will have clear applied impacts for conservation.

What are the most challenging aspects of your research?

I enjoy doing research in remote tropical areas, and I don't mind the challenging conditions in the field. However, it was difficult working in forest areas where illegal hunting and palmito

extraction happens, because these activities raised some safety concerns. Fortunately, my new sampling sites are much safer. Also, obtaining sampling and export permits from several countries is also challenging, because of the rapidly changing environmental regulations.

What advice would you offer to students?

Devote significant time to learning statistics. A good background in stats will facilitate appropriate experimental design and analyses to robustly test all the great ideas that come out of undergraduate and graduate work. For those interested in evolutionary ecology, I believe that an appreciation for natural history will lead to interesting observations and relevant ideas to be tested. For graduate students, developing a passion for writing scientific papers is also essential to excel in academia.

So far, what do you like most about your job at UA?

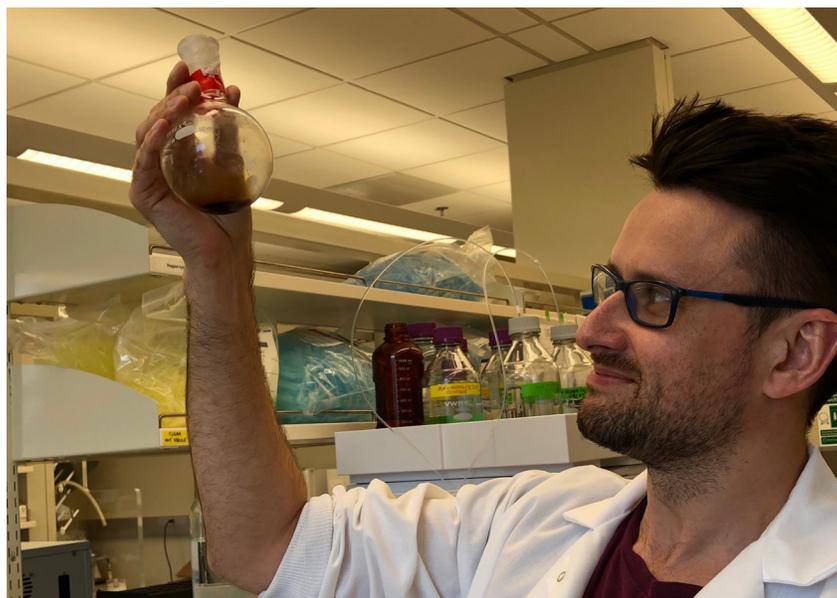
I absolutely enjoy the collegiate environment of our department; it is amazing to see such a diverse group of scientist being so friendly and collaborative. I am sure that many opportunities for internal collaborations will emerge in the next couple of years.

Thank you for the interview, Gui! We're excited you've joined us here at UA.

GUI BECKER earned his PhD in Ecology & Evolutionary Biology at Cornell University and completed his postdoctoral work in tropical disease ecology at State University of Sao Paulo, Brazil. He has been awarded a Fulbright PhD fellowship, an NSF Doctoral Dissertation Improvement Grant, a Brazilian Research Council Early Career Research Grant, and other prestigious awards from the American Philosophical Society, Atkinson Center for a Sustainable Future, and the Andrew Mellon Foundation.

NEW FACULTY SPOTLIGHT

Dr. Lukasz Ciesla is a new Assistant Professor in the Department of Biological Sciences with an interest in natural products and drug discovery.



LUKASZ, what motivated you to pursue a career in science?

I knew I wanted to be a scientist at an early age. Being a scientist allows you the liberty of choosing the problems you want to work on and knowing that your research has the potential to dramatically change the lives of others.

Describe the path that led you to your current research area.

Early on, I was mostly interested in the variety of chemical structures produced by plants as many of these compounds could be potential candidates for drug leads. Therefore, after completing my training in secondary plant metabolite identification techniques, I joined a drug discovery team. One of the problems we encountered was the identification of pharmacologically active metabolites in very complex samples. While searching for solutions, I came across a team at the National Institute on Aging that had developed numerous bioassays used for the identification of biologically active natural compounds in complex matrices. They recruited me to work on their drug discovery program aimed at the identification of drug leads from natural samples for the possible prevention and treatment of age-related diseases. I became particularly interested in Alzheimer's disease, and my current research projects focus on looking for drug candidates that might be used to prevent and/or treat this debilitating disease.

What about your area of research excites you the most?

Revealing the real potential of natural products for the treatment of so many diseases. It is a surprise for many people, even health professionals, that numerous currently approved drugs were originally derived from natural products.

What are the most challenging aspects of your research?

The complexity of the natural samples we work with. To address this, we create our own bioassays to "dig" for pharmacologically active compounds. The other issue is the poor understanding of pathophysiology of some of the diseases; i.e. Alzheimer's disease.

What advice would you offer students?

One of the first things I tell my students is my favorite Latin proverb, "Non scholae sed vitae discimus": *We do not learn for school, but for life.* It is important for the students to realize the reason they are here at the university is to obtain knowledge and skills to change their life and lives of other people for the better.

So far, what do you like most about your job at UA?

I love the campus. It is one of the most beautiful university campuses I have ever seen. I enjoy the diversity of topics studied by my colleagues and the chance it gives us to do truly interdisciplinary research. I also like that the university supports the involvement of undergraduate students in research projects. I think this is one of the best ways of attracting young people to pursue a career in science.

Thank you for the interview, Lukasz! We're excited you've joined us here at UA.

LUKASZ CIESLA received his PhD from the Medical University of Lublin in 2011. He worked as a post-doc at the Department of Plant Biochemistry at the State Research Institute, Pulawy, Poland, and the Medical University of Lublin. In 2014 he became a laureate of the program SKILLS-Mentoring and was mentored by Prof. Christian Zidorn, Universität Innsbruck, Austria. In September 2014, he came to the United States to work at the Laboratory of Clinical Investigation, at the National Institutes of Health in Baltimore, Maryland.



NEW FACULTY SPOTLIGHT

Dr. Michael McKain is a new Assistant Professor in the Department of Biological Sciences. He studies plant systematics with emphasis on grasses and agaves.

MICHAEL, what motivated you to pursue a career in science?

My interest in science began when I was very young. I spent a lot of time reading Seymour Simon astronomy books, Ranger Rick magazines, and pretty much any non-fiction book on animals I could find at my local library. Growing up, I loved exploring nature and had a keen interest in conservation and biodiversity. I had a microscope, chemistry set, telescope, and fossil collection, so I pretty much covered the bases.

Describe the path that led you to your current research area.

My junior year of college I took a course on vascular plants with Amanda Ingram, and after working in Dr. Ingram's lab on a plant hybridization project, I decided that plant evolution was where I wanted to go with my future. My wife became pregnant my second semester of graduate school, so I decided to shift my research—studying the bimodal karyotype exhibited by agaves and genome evolution—to a more computational-based project that didn't involve field work. Luckily, my PhD advisor, Jim Leebens-Mack, was part of a large Tree of Life grant, and I was able to jump into phylogenomics and coding when high throughput short-read technology was just getting started.

What about your area of research excites you the most?

I am fascinated by the genomic origins of diversity and adaptation. How existing genes and gene networks change at various levels is truly amazing. Looking at polyploidy (whole genome duplication) as a driver of plant evolution and a facilitator of adaptation is not a new idea, but with our ability to get whole genomes from many species, expression data from even single cells, methylation patterning of multiple tissues, and chromatin structure mapped to actual sequence, we are

now able to see polyploidy's impact like we have never before.

What advice would you offer students?

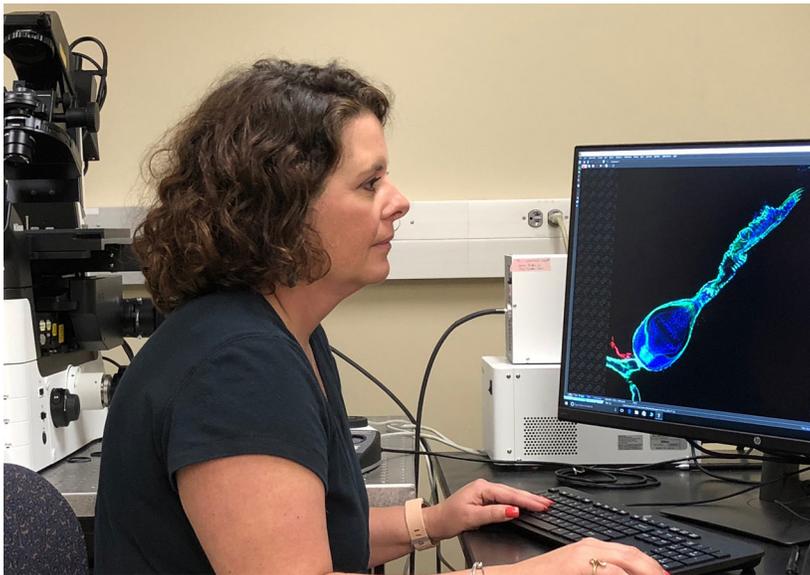
Fail. If you have not failed at something in your life, then you are missing out on valuable experience. Being able to handle failure, and more importantly learn from it, is a basic part of being an adult. If you plan on going into science, then failure is like breakfast: you may not have it every day, but some days that's all you'll have time for.

What are the biggest challenges of your job?

Time. There just isn't enough of it to do everything, so I, like everyone else, have had to learn when to say no. Teaching, having students in the lab, getting the lab up and running, getting plant growth facilities going, working in the herbarium, and working with the UA Arboretum have all needed time and attention. I was a bit surprised on the amount of time spent on emails with students, but I have thoroughly enjoyed my interactions with them. Many of my challenges have been met with the help of the faculty and amazing staff. They have been patient with me and my many questions and requests.

Thank you for the interview, Michael! We're excited you've joined us here at UA.

MICHAEL MCKAIN earned his PhD from the University of Georgia in Plant Biology, where he received an NSF DDIG (Doctoral Dissertation Improvement Grant) and investigated polyploidy in monocots. For a post-doc, he moved to the lab of Dr. Elizabeth Kellogg at the University of Missouri-St. Louis and worked on phylogenomics and genome evolution of polyploid grasses. He then went to the Donald Danforth Plant Science Research Center.



NEW FACULTY SPOTLIGHT

Dr. Kim Lackey is the Coordinator of the Optical Analysis Facility and a new Assistant Professor in the Department of Biological Sciences.

KIM, what motivated you to pursue a career in science? I was always fascinated by the ocean and Jacques Cousteau and came to UA to become a marine biologist. However, an opportunity to do undergraduate research with Dr. Margaret Johnson altered my path from marine to molecular biology.

Describe the path that led you to your current research area.

My PhD research required use of the confocal and electron microscopes housed in the department's EM laboratory. I took a graduate course in electron microscopy to help with my research, thinking I would probably have little use for the course material once I graduated. As I still tell my students, you never know when you will have to use information or techniques learned. After several positions within the department, I was asked about my interest in an open position as the Coordinator of the Optical Analysis Facility (formerly the EM laboratory). On a leap of faith, and receiving a healthy dose of promises for training and assistance with the steep learning curve, I accepted the position. That position led to an offer of an assistant professorship January 2017 doing basically the same job.

What about your area of research excites you the most?

I do not conduct independent research but rather work on numerous different projects with a common theme, use of a microscope. I absolutely love my job, which I call playing because it is so much fun to learn about the many diverse projects and research occurring on our campus. Ultimately my job is to oversee the operation of the microscopes and to train users, but I try to give users guidance and critics.

What are the most challenging aspects of your research?

Working on so many projects that I forget about the little details we discuss between experiments; users are constantly having to remind me. Also, the physical limitations on the microscopes challenge us or prevent users from obtaining the data they want.

What is the most exciting project you have worked on?

I love them all but hands down the first one that comes to mind is one I played a small roll in but which was extremely rewarding. Graduate student Nathan Whelan, working under Phil Harris, collected a species of snail, *Leptoxis compacta*, in the Cahaba River that had been declared extinct in 2000. Nathan used scanning electron microscopy and other techniques to compare his specimen with museum specimens collected in 1881. He was able to show that this snail was still present in the Cahaba. To see radula from a specimen collected in 1881 was exciting enough but to realize the snail was still present was very exciting.

Thanks, Kim, for all your work at UA and congratulations.

KIM LACKEY teaches BSC 656 Microscopical Techniques, a hands-on graduate level lecture and laboratory course that introduces students to the theory of electron microscopy. Students learn sample preparations and imaging on a variety of microscopes as well as discuss the ethics of micrograph and data presentation. While very labor intensive training, students leave with a much better appreciation of images published in scientific articles, of the incredible amount of work and skill behind these images.

The OPTICAL ANALYSIS FACILITY houses a transmission electron microscope, scanning electron microscope, fluorescent light microscope, and a new confocal microscope. Recognizing the value of supporting research facilities such as the OAF so faculty and students can obtain critical data for grants, the College of Arts and Sciences and the university support the facility.

GRADUATE STUDENT RESEARCH SPOTLIGHT

Liz Johnson is pursuing a doctorate in Dr. Ryan Earley's lab studying endocrine disruptors, which are synthetic or natural compounds that mimic hormones and/or interfere with hormone signaling.



GIVING OPPORTUNITY

Biology Dept. Gift Fund:

This fund provides flexibility and is used to support student research, conference travel and equipment repair.

To make a tax-deductible donation:

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Thank you for your contributions!

LIZ, what motivated you to pursue a career in science?

I have always been fascinated with the natural world. I was always outside, on the hunt to find new creatures to observe. However, I was unsure of how to apply this passion toward a career. In my Vertebrate Zoology class, I got a glimpse of what a career in research might be like. I immediately got involved in undergraduate research, and then I knew I wanted to pursue a career in research.

Describe the path that led you to your current research area.

As an undergraduate researcher, I entered Dr. Phil Harris' phylogenetic and systematics lab with no prior knowledge of any scientific techniques. Within a few short weeks, I was extracting DNA, running PCRs, and conducting gel electrophoresis to establish phylogenetic relationships among fish species. I found myself asking more conceptual questions about the behavior and physiology of the different fish species we studied. These questions required different techniques than what I was learning at the time, so Dr. Harris recommended me to Dr. Ryan Earley, who focuses on integrative animal behavior. Once I

entered Dr. Earley's lab, I felt there were no limitations to the questions I could ask or the research I could conduct. I was able to explore tons of integrative ideas centered on a rather unique fish species, the mangrove rivulus. I also discovered the many ways environmental factors can alter development and cause long-lasting changes to important phenotypic traits, like behavior. For my graduate research, I was able to merge my love of conservation with this idea and focus on the impacts that exposure to endocrine disrupting compounds can have on fish.

What is the most challenging aspect of your research?

Working with live animals. Experiments require large sample sizes of various genetic lineages, and generating enough individuals takes considerable time, effort and patience. The fish I study doesn't become sexually mature until about 5 months old, and it takes about a month for a freshly laid egg to hatch. It can take well over 6 months just to generate the animals necessary to run an experiment. Couple that with the time it takes to actually conduct the experiment and a year or more has already gone by. This has taught me the importance of patience and planning well in advance.

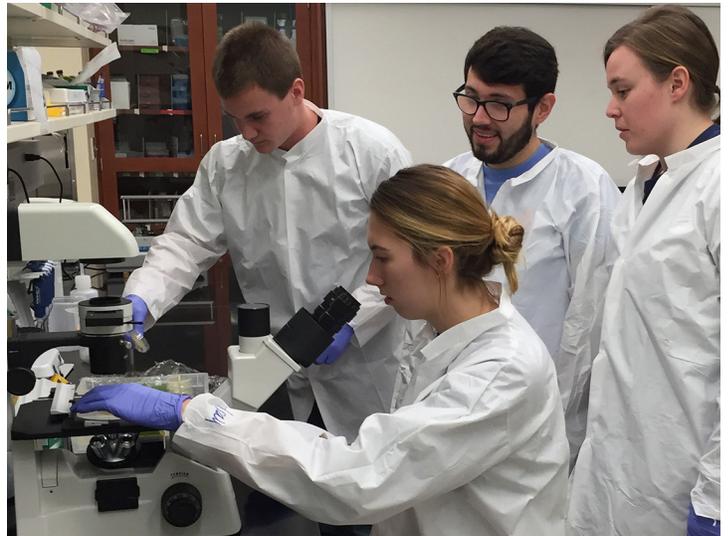
POPULAR AND PRACTICAL NEW LABORATORY CLASSES

With our current curriculum, the Department of Biological Sciences offers a wide array of courses that are effective at providing the necessary didactic coursework in support of our student's future goals with respect to post-graduate educational opportunities (e.g., graduate school, medical school, dental school, etc.). However, not all of our students will seek to continue their educational training at the post-graduate level. Therefore, over the last couple of years we have worked very hard at developing new laboratory-based courses that would greatly benefit our students by affording them a more "hands-on" approach to learning that would not only make them stronger candidates for graduate school, but also provide them with skills necessary for a career in research. In the current age of "omics" research (e.g., genomics, proteomics and metabolomics) students can benefit from a diversity of laboratory coursework that expands their expertise in cell, molecular and biochemistry techniques.

Historically, the department only routinely offered two laboratory courses (BSC 442 Integrated Genomics and BSC 438 Molecular Biology Laboratory) that focused on training students in modern molecular techniques. Although these are highly relevant courses, limitations in space and support equipment only allowed the department to service a small number of students each year. Back in the spring of 2015, the Department of Biological Sciences began developing some new upper-level biology laboratory courses. Some existing equipment and resources from current laboratory courses were available for the new course.

However, purchase of several new items of equipment was possible from funds associated with a 2010 Howard Hughes Medical Institute Precollege and Undergraduate Science Education Program Grant awarded to The University of Alabama and directed by Dr. Martha J. Powell. One of those new courses was the cell biology laboratory course that specifically focuses on training students in modern laboratory techniques not offered by the other laboratory courses. Many of the techniques taught in this course expand on the basic concepts that all of our biology majors are exposed to through the required BSC 300 Cell Biology lecture course.

For example, rather than trying to grasp the intricacies of enzyme kinetics from one or two lectures in BSC 300, in the cell biology lab course students spend three weeks culturing cells



Students analyze the results of an experiment in which they have prevented the normal expression of proteins in microscopic nematode worms during embryonic development through a technique known as RNA interference to look for phenotypes associated with abnormal neuromuscular function.

and purifying active cell lysates to perform enzyme kinetics assays under a variety of different conditions using a high-end SpectraMax i3X multi-mode microplate reader system. Other experiments include a combination of both computer-based approaches and laboratory bench "wet work" for protein analysis. Students also utilize basic cell culture techniques, as well as advanced techniques such as fluorescence microscopy and flow cytometry, to analyze the basic characteristics associated with cell growth and the cell cycle. Finally, students participate in different experiments in which they manipulate the expression of specific proteins in living organisms or cells, by either preventing a protein from being expressed or using procedures to artificially overexpress a protein, to further investigate protein function.

All of these techniques allow students to generate and objectively evaluate experimental data, while also promoting problem-solving skills and deductive reasoning. Furthermore, these techniques represent some of the standard research expertise required for someone to work as a research technician in an academic research lab, and also provide training necessary for careers in applied research in industry or biomedical laboratories. The response to this course by students has been overwhelmingly positive, and we look forward to continuing to expand this course to offer our students new experiential learning opportunities.

Dr. Matthew Jenny designed this course and is an Associate Professor.





PROFESSOR RECOGNIZED BY INTERNATIONAL ORGANIZATION

Dr. Benke has enjoyed the entirety of his career, from the scientific discoveries to publications to the validation of these discoveries by others. And he has found that for him, the real thrill is discovering something new in his field, not the scientific prize, even though he is really grateful for this recognition.

DR. ARTHUR BENKE INDUCTED AS FELLOW OF SOCIETY FOR FRESHWATER STUDIES

Arthur C. Benke, Professor Emeritus of Biological Sciences at The University of Alabama, was inducted as an inaugural Fellow of the Society for Freshwater Science (SFS) on June 8, 2017, in Raleigh, NC. The SFS (previously the North American Benthological Society) is an international scientific organization that promotes understanding of freshwater ecosystems—rivers, streams, wetlands and lakes—and ecosystems at the interface between aquatic and terrestrial habitats. Benke, who received the SFS's Award of Excellence in 2012, was recognized along with 26 other inaugural Fellows. The Fellows program was designed to recognize SFS members who are outstanding freshwater scientists that have made significant contributions to the field and our society, and who are active in promoting freshwater science through their education and outreach.

Benke received his PhD from the University of Georgia in 1972 and served on the faculty of Georgia Tech from 1971 to 1984. He was a Professor at The University of Alabama from 1984 to 2012 and is currently Professor Emeritus. He received The University of Alabama's Blackmon-Moody Outstanding Professor Award in 2006.

Benke has been a leader in the ecology of freshwater benthic

invertebrates and their role in aquatic ecosystems with more than 100 research articles over a 40 year period. Among his major accomplishments have been his pioneering research on secondary production of benthic invertebrate communities and how this approach can be used in quantifying food webs and understanding ecosystem function, research that continues today. Benke presented the Baldi Memorial Lecture on this topic for the International Association of Theoretical and Applied Limnology in 1992.

In addition to his research, Benke played a significant role in the advancement of river conservation in North America, as demonstrated by his 1144-page award-winning book *Rivers of North America* (A. C. Benke and C. E. Cushing 2005) published by Academic Press/Elsevier. This reference volume represented the first comprehensive effort to describe more than 200 of the continent's rivers from southern Mexico to the Arctic in terms of their physiography, geomorphology, hydrology, biodiversity, ecology, and the human impacts of each system.

Benke and Cushing subsequently published a "short version" in 2010, *Field Guide to Rivers of North America*. A longtime member of the SFS/NABS, Benke has served as the Society's President, as chair of its Executive Committee, and as a J-NABS Associate Editor. He has displayed a lifelong love and dedication to the Society and to its goal of promoting the further understanding of freshwater ecosystems.

ALUMNI - DO YOU HAVE NEWS TO SHARE?

What are you up to now? If you have news to share, please send it to us for inclusion in an upcoming issue of Bama Biology Newsletter: bscacademics@ua.edu

