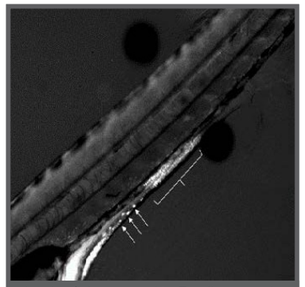
RESEARCH UPDATE: BIOFILMS
(Continued from previous page)

Dr. Henson has been studying biofilms in zebrafish by feeding them fluorescently labeled biofilm-forming bacteria, such as *P. fluorescens* and *Escherichia coli*. The goal of the project is to track the fluorescent bacteria once it enters the zebrafish and observe whether biofilms form within their digestive system. Once the bacteria colonize the zebrafish digestive tract, the fish are collected to look for changes in gene expression that may be altered due to biofilm formation. One example is the gene claudin 15, which codes for a tight junction protein that is essential for maintaining the integrity of the intestinal barrier. Disruption of claudin 15 expression may result in a "leaky gut" which is commonly seen in individuals with Crohn's disease or other intestinal diseases.

Dr. Choi enjoys looking at microorganisms under the microscope that express different fluorescent-tagged proteins. She says, "I love to search and come to a better understanding of God's design for living organisms… The molecular mechanism of microorganisms and the specific immune response related to it is the main interest of my study. I believe such knowledge would lead to more effective therapy and prevention to help people in need."



A zebrafish exposed to E.coli expressing the green fluorescent protein (GFP) for 48 hours. Arrows and bracket indicate localization of E.coli within the zebrafish intestine. Photo taken by Meagan Clark (General Biology Major)

HAMMONS CENTER UPDATE:
By Hayden Rash

Undergraduate student Hayden Rash (HR) had a chance to interview Dr. Bill Thierfelder (BT) regarding recent developments at the Hammons Center.

HR: So to begin, what exactly is the Hammon's Center? A lot of students, myself included, are unfamiliar with this resource.
BT: The Hammons Center was founded around 15 years ago, by Dr. Edward Hammons, who was an MD in the Jackson area. Dr. Hammons loved Union, and he donated some money to Union for faith/science studies. The main goal for the Hammons Center is to encourage scientific thinking for Union's students, but also to interweave faith into all scientific teachings.

HR: What has been done in the past at the Hammons Center?
BT: There are a number of people who have been instrumental during their time as the Director of the Hammons Center. Dr. Wofford was the initial Director and helped get things started. Dr. Huggins helped establish the wildlife rehabilitation center at Union, and made ongoing connections with the Cypress Grove Nature Park. He also established the Scientific Voice, allowing faculty to have insights into different topics, and a Book Reviews Section. Dr. Madison continued to develop undergraduate research programs, while Dr. Jennifer Gruenke used the Center for faith and science issues including book discussions, lectures, and topical discussions by faculty.

HR: As the current Director of the Hammons Center, what are you doing now?
BT: I'm continuing what has been done in the past. Not a lot of new ideas, but new emphasis, including faculty book discussions, for which I plan on doing a different book every semester. The overarching question that we try to discuss is "How can we as Christians contribute to new developments in science and talk about controversial issues?" Our current book is called A Crack in Creation, about CRISPR techniques. The plan is to write a review of the books after our discussions throughout the semester, and include these on the Book Review page, as well as asking others to review other books. I would like to facilitate interdepartmental communication about faith and science. A number of people in different departments at Union are thinking and writing about faith and science, but they aren't communicating across departments very often.

I want more people at Union to know that we are thinking and talking about these things. I also want to be a resource for students regarding faith and science issues. If students can't join a book discussion, maybe they can come to a lecture. This is why I feel that guest speakers would be very beneficial.

The Hammons Center is located in White Hall 320 and houses a number of book on faith and science. While I want these books about faith and science to be available to students, we will treat this resource as a reference library, not a lending library. The collection would ideally be cataloged in the Logos, but found in White Hall. These books would be available for all students who are interested in reading them. I would also like to re-initiate "The Scientific Voice" on faith-science topics. Once a Facebook page is set up, I will do more publicizing and advertising. Students have a lot of questions about faith-science issues, and I want them to know that we, as a faculty, are thinking about and discussing these questions as well.

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BioNews
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CHAIR'S CORNER

Dr. Mark Bolyard

Greetings, and welcome to an update of what is going on in your Department of Biology at Union! We have a number of exciting things to share with you, and some things that are more challenging. First, I want to welcome Dr. Micah Fern ('11) back to the department, this time as a new Assistant Professor. Dr. Fern received his M.S. and Ph.D. from Auburn University (which made Dr. Wamble happy), and taught Ecology and Conservation of the Vertebrates in the Fall, is teaching Wildlife Biology this Spring, and is learning lots of anatomy! We have an article about Dr. Fern in this issue to help you get to know him better. On a sadder note, we said goodbye to our program coordinator/ secretary, Mrs. Frances Lancaster. We really appreciate the work that she did, particularly to get our graduate program off the ground! We are excited to welcome her replacement, Ms. Anna Laura Livingston. We also miss seeing the smiling faces of Drs. James Huggins and Jim Mahan on campus as much as we used to. Each of these brothers has gone to half-time, with Dr. Mahan now working exclusively in Germantown. Things just aren't quite the same around here! There continues to be a lot of great research projects happening in our department. Drs. Schiebout and Kerfoot have a project with our first Conservation Masters graduate student, Olivia Olson, that is underway in Puerto Rico as well as other projects that are heading toward publication. We will let you know about those in the future! The Union Arboretum is continuing to grow, in many ways! During our Campus and Community Day at the beginning of November, we planted 13 additional trees on campus, bringing our total to 66. 20 additional species will be planted in April. We plan to apply for Level 2 Certification by the Tennessee Urban Forestry Council in the near future. Please let us know if you would like to be involved with the development of the Arboretum.

Finally, and with much humility, I want to let you know that I was named Union's Faculty of the Year for the '17-'18 Academic Year. That is a testimony to the great team that we have in place within our department!

Dr. Mike Schiebout and Conservation Masters student Olivia Olson take water measurements of a turtlegrass population using our new YSI Environmental Multimeter

Dr. Marc Lockett and undergraduate student Maddie Dotson work on protein purification using our new AKTA Start Chromatography System

INSIDE THIS ISSUE

UNION UNIVERSITY
Department of Biology

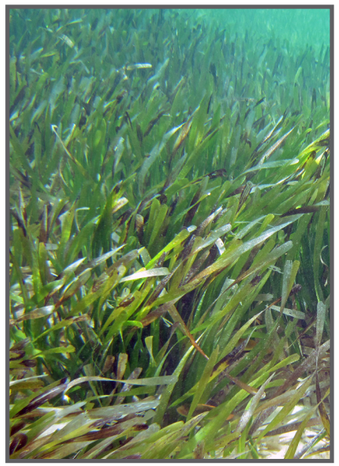
GRADUATE PROGRAM UPDATE
By Jacob Lemon

Union University's Master of Science in Biology is off to another great start this year. Following the start of this new Master's program in 2017, another eight students, who come from all over the United States, have enrolled, and Union is happy to welcome them into the program.

The Master of Science in Biology is a one-year, non-thesis program, and all eight students take several graduate courses and write a research report. Some of the current projects these students are working on include studying biofilms, the effects of anesthesia in fish, and the effects of plant lectins on cancer. These students also take a course in Career Development in the Fall semester, which allows them to practice reading scientific literature, sharpen writing skills, learn interview skills, explore bioethical issues, etc. Most of these students are continuing in their education after this program, so it provides vital skills and information for them as they go out into other graduate programs or careers.

Union University's Department of Biology is also excited to welcome the first Master of Science in Conservation Biology student this Fall, 2018. This Master's program is a traditional, two-year thesis program and allows its students to have their tuition covered by a Research Assistantship. Olivia Olson, the current Master of Science in Conservation Biology student, is doing research with Drs. Kerfoot and Schiebout on turtlegrass (pictured), and they have begun doing research in Puerto Rico.

Dr. Marc Lockett, Professor of Biology at Union University, is the Director of these new Master's programs, and he is happy to see another eight students enroll in the Masters of Science in Biology and one student in the new Masters of Science in Conservation Biology. He enjoys having students wanting to learn more about biology and take their education further, which he notes, "It shows the public we are serious about our sciences." He really



enjoys these students and says, "They are a good group, and I'm excited to see what the future holds for them." Students are already beginning the application process for Fall, 2019!

STAFF PROFILE: DR. MICAH FERN
By Shelby Britt

Dr. Micah Fern

Dr. Micah Fern is one of the newest members of the biology department; however, he is no stranger to Union. Dr. Fern first came to Union as a freshman from the Philippines, majoring in conservation biology and minoring in broadcast journalism.

"I knew I wanted to do something with animals whenever I was riding my motorcycle home one night in the Philippines. I came up on what looked like a speed bump, but instead it was a 12-foot Python. I wanted to take it home with me, so I started wrapping it around my waist. I wrapped it all the way up my waist, but there was still around four feet of snake left so I said a little prayer and wrapped it around my head and rode home."

Since then, Dr. Fern has studied and worked with animals. Most recently, he worked at a ranch in Alabama before coming to teach at Union. Dr. Fern chose to teach at Union because he felt God calling him to do so. During his time as a student, Dr. Huggins left a lasting impact on him and was one of the reasons Dr. Fern considered coming back to Union to teach.

Dr. Fern looks forward to helping students with their research projects, mentioning that he forgot how intelligent the students at Union are. As a student, his research was on alligators, which he calls "The puppies of the water."

When asked what he wants to do in the future, Dr. Fern mentioned teaching people about animals on TV.

"There isn't a presence of Christians on channels like 'Animal Planet' and 'The Discovery Channel,'" said Dr. Fern. This prompted him to minor in broadcast journalism, so he could be equipped to become a voice of truth on these channels if the opportunity presented itself.

He mentioned that teaching at Union is like teaching on a show. He educates people on animals and he has an audience, the students.

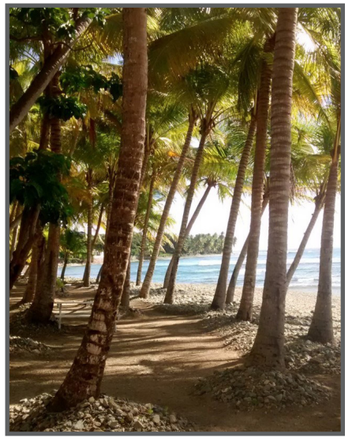
Dr. Fern received his PhD at Auburn University and noted the difference between a private Christian school versus a public state school. He believes that Union has a good community where the professors respect each other and are treated with kindness, which he did not experience during his time at Auburn.

Dr. Fern is an excellent addition to the biology department because of his passion for animals, for teaching, for integrating his faith into his classes, and for sharing a Christian-centered scientific worldview to a larger audience.

RESEARCH IN PUERTO RICO
By Amber Greenburg

Puerto Rico is an important location for the biology department, being the location of both the Tropical Ecology course, as well as the location of our Conservation Masters student's research. An interview with Dr. Michael Schiebout and Dr. JR Kerfoot offered some details on these exciting excursions.

The research in Puerto Rico is being conducted by Union's first ever Masters of Conservation student, Olivia Olson. Dr. Schiebout explains: "We are developing a project [...] here on campus, a lab-type project, looking at turtlegrass growth. In addition, we wanted to do some field research, looking at some of the parameters that allow turtlegrass to flourish." Olson has begun conducting research in



Jobo's Bay (on the Caribbean side of Puerto Rico), which will continue over the course of her two year program. One of the goals will be to discuss possible future environmental changes that may impact the turtlegrass growth. Dr. Kerfoot mentioned the importance of building "a model based on what could happen in the future, to try to predict what areas to conserve, what not to conserve, and what not to worry about." These differing conditions can have an enormous impact on knowledge of the coastal environments. Puerto Rico can act like a model for many other tropical locations: "What's happening in Puerto Rico is happening all over the coast […] this project may seem smaller in size, but the scope is pretty relevant worldwide, and so we are excited about that" (Dr. Kerfoot). To gather the information and make needed measurements, Olson will be travelling back and forth from Puerto Rico approximately 8 times. The idea is to capture two seasons worth of data throughout the year, the winter and the summer, over the course of the two years. Union will be partnering with some research locations that Drs. Kerfoot and Schiebout had established relationships with from the 2017 Tropical Ecology course. This research project is going to be setting the bar high for future individuals: "[This project is] not for the faint of heart, it's pretty ambitious for a first Conservation Masters program here at Union… We are excited about it", said Dr. Kerfoot.

Also, the Biology department plans to offer Tropical Ecology again in Late Spring, 2020. Dr. Schiebout and Dr. Kerfoot offered this class once before in 2017. The course involves a week of lectures and preparation for the trip and then a two-week journey to Puerto Rico. "It's a really cool opportunity for students that doesn't come around very often… we are really looking forward to going next summer", said Dr. Kerfoot. Several of Dr. Schiebout's favorite highlights include staying at a research facility within a tropical rainforest, swimming in bioluminescent water near a research island, and observing coral reefs, and tropical wildlife. The previous trip also incorporated a cultural and historical aspect, as the students were able to visit several surrounding cities, a lighthouse, and a cathedral. Additionally, the students were able to see waterfalls, participate in a lion fish dissection, interact with lizards, and hear from researchers based in Puerto Rico.

RESEARCH UPDATE: BIOFILMS
By Christopher Johnson

The Union University Biology Department is currently conducting a variety of faculty led research projects. Dr. Esther Choi, Dr. Hannah Henson, and several research students, are involved in the study of biofilms. Biofilms are created from a conglomerate of bacteria which work together to form a community. Microorganisms, such as bacteria, work to produce adhesive extracellular substances such as polysaccharides, proteins, nucleic acids, and lipids. These products then cause the bacteria to become fastened to each other. The bacteria proliferate until there is no more surface area to occupy and are detached from there to disperse. On the surfaces of medical devices and human tissue, the bacteria in biofilms work together as a cohesive unit in order to survive external stress from the environment. Dr. Choi is currently using a bacterium, *Pseudomonas fluorescence*, and a yeast, *Candida albicans*, in her biofilm research. Research students working with Dr. Choi are testing different sugar concentrations in media and incubation temperatures in forming biofilms. The purpose of the research is to explore the chemical and physical factors which contribute to differing amounts of biofilm growth. Preliminary results indicate that the number of seeding cells directly affects the extent of biofilm formation. Also, nutrient deficient media induced a larger biofilm population than nutrient rich media. Results with the yeast, *C. albicans*, indicate that microorganisms form biofilms in stressful conditions in order to survive. To study host-pathogen interactions, Dr. Choi is currently setting up a system to study biofilm formation of *C. albicans* in association with human cells.

In addition to testing biofilm formation in human cells, in vivo models are also being used to study biofilms.

Continuing on page 4.