SMALL TALK

WINTER 2018

Microbiology students, faculty, research, news and alumni

Oregon State University

SMALL
TALK
Winter 2018

Editor
Debbie Farris

Writer
Katharine de Baun

Designer
Sharon Betterton

Department of Microbiology
Jerri Bartholomew, Head
Mary Fulton, Newsletter Coordinator

Publisher
Department of Microbiology
Nash Hall 226
Oregon State University
Corvallis, OR 97331

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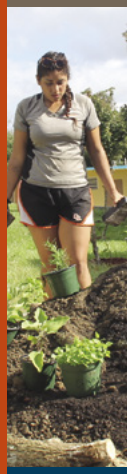
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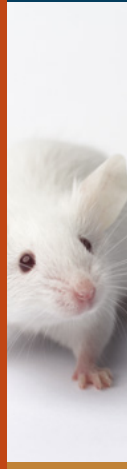
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On the cover — Kim Halsey and postdoc Cleo Davie-Martin initiate incubations on the *R/V Atlantis* to quantify carbon cycling in the North Atlantic. See p. 10.

FROM THE HEAD

Jerri Bartholomew

Welcome to the fourth edition of our alumni newsletter, *Small Talk*! This year we are expanding distribution to include BioHealth Sciences (BHS) graduates along with our microbiology alumni.

Our department is growing! Assistant professor Maude David, who arrived last January, has established her research lab, training students in using bioinformatics to study how microbes can impact our behavior. Her husband Kenton Hokanson is teaching Introductory Microbiology and has a research appointment in the biochemistry and biophysics department. This spring, instructors Allison Evans and Shawn Massoni joined the department to help expand on-campus and online offerings in the department. Finally, microbiologist Valerie Elias was hired to support our teaching labs.

Three faculty were promoted this year and their research is featured in this issue. Martin Schuster, who studies bacterial cooperation and communication, was promoted to full professor. Kim Halsey and Ryan Mueller were promoted to associate professor with tenure. Kim studies phytoplankton ecophysiology and Ryan researches interactions of microorganisms within natural communities. Congratulations!

This also was a busy year academically. We updated our BHS curriculum to ensure students receive an interdisciplinary background, preparing them for a wider variety of health-care professions. We revised our microbiology minor to make it more accessible and available online. And we are thrilled to have the first student enter our Accelerated Masters Program.

To make our academic space more welcoming, we renovated office spaces and labs to accommodate the shift to computational research, designed a dynamic lunchroom with "idea spaces" to encourage creativity, created a resource center for BHS students and added picnic tables and a sculpture of the Willamette River (see photo above and on p. 9) to complete the Nash Hall courtyard.

We could not accomplish any of this without the support of our alumni and friends. Your generosity makes it possible to provide scholarships, travel opportunities, and seminars and activities to enhance student learning. Thanks to your strong philanthropic support, we were also enabled to offer graduate fellowships. With salaries and tuition for graduate students approaching $50,000 per year, your support is vital for maintaining a vibrant research program. Thank you!

If you are in Corvallis this year, please stop by and visit us.

Jerri Bartholomew
Department Head

UPCOMING EVENTS

January 24, 2019

Microbiology Seminar:
Michael Freitag, Ph.D.
Department of Biochemistry & Biophysics, Oregon State

February 2019

Annual OSU Food Drive

February 7, 2019

Microbiology Seminar:
Brooke Napier, Ph.D., Biology Department, Portland State University

April 13, 2019

5th Annual Microbiology Student Association Symposium

April 18, 2019

Microbiology Seminar:
Stephen Giovannoni, Ph.D., Department of Microbiology, Oregon State

May 6, 2019

Annual Microbiology Scholarship Luncheon

May 16, 2019

Microbiology Seminar:
Melissa Marks, Ph.D., Department of Biology, Willamette University

June 14, 2019

Department Graduation Celebration

BRIGHT MINDS, BOLD MOVES

Clockwise from top left: Junior Sydney Phu (photo by Ariella Wolf); Krystal Urrutia in Costa Rica; Krystal getting hands on in Costa Rican veterinary clinics and rescue centers.

UNDERGRADUATES

A summer to remember

Senior **Julianna Donohoe** spent 10 weeks last summer in Madrid, Spain, as a Benjamin Gilman International Scholar, one of thirteen OSU students chosen to study abroad in summer and fall 2018 thanks to this U.S. Department of State scholarship. Julianna worked as a medical research intern assisting with research on Parkinson's disease at the Cajal Institute, a leading research center in neuroscience. Having experienced laboratory research in the United States, Julianna was eager to explore research environments in other countries. She found a "more relaxed and relationship-focused work atmosphere" in her lab in Madrid and highly recommends research abroad for "getting a different worldview." Julianna plans a career in medical research and possibly becoming a physician.

Sydney Phu, an Honors BioHealth Sciences junior, took one step closer to realizing her dream of being an optometrist during a 10-week internship at the Mayo Clinic's prestigious Summer Undergraduate Program in Biomedical Ethics Research in Rochester, Minnesota. Paired with a mentor, Sydney worked on her own regenerative medical research project involving the biobanking of embryonic stem cells. Already a published scholar in the *Journal of Bioethics*, Sydney's love affair with science was inspired by her high school biology teacher, a passionate advocate for science.

Krystal Urrutia traveled to Costa Rica for a summer internship sponsored by OSU's Carlson College of Veterinary Medicine. Along with two veterinary students and two professors, she traveled to a different town each week, working in veterinary clinics and rescue centers. She observed two German Shepherd puppies receive blood transfusions, helped a sloth with rehab and observed surgery on a white-headed capuchin. Along the way, she also collected research samples, including fecal samples from local Jersey and Sahiwal cattle and other domestic animals, to compare their bacteria with those isolated from rodents and mosquitoes from the same area.

Krystal reflects, "Costa Rica was a wonderful experience. I would go again to experience the nature, forest and wild animals and the opportunity to meet such kind people."

Julianna Donohoe in Madrid, Spain

Two seniors win Fulbright Scholarships

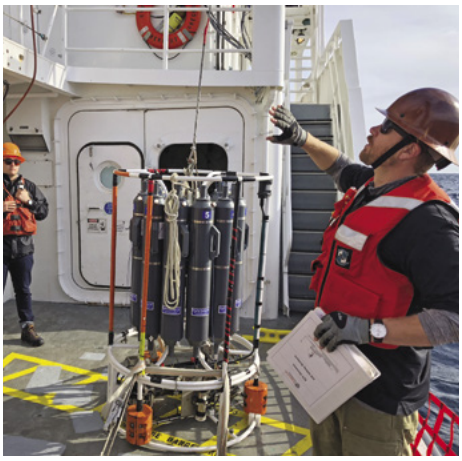
Last year, we were thrilled that two microbiology seniors received prestigious Fulbright Scholarships.

Maria Grazia "Grace" D'Angelo is pursuing a master's degree in marine microbiology at the Max Planck Institute for Marine Microbiology in Germany. An accomplished musician, Grace will also continue her growth as a flautist by studying and performing with German peers.

Dang Duong received a Fulbright Scholar English Teaching Assistantship to Kazakhstan, where he will engage with students in and out of the classroom to share the English language and culture. A world traveler who has already engaged in service work and research in Uganda, Malaysia, and India, Dang believes "it is always good to put yourself in situations for long periods of time where you need to develop a competency and experience a rolling ball effect." Fluent in English and Cantonese and proficient in Spanish, Vietnamese and Mandarin, Dang plans to apply to medical school.

Grace D'Angelo


Dang Duong, center



Clockwise from top left: Jennifer Stanton prepares the Multicorer to collect deep sea sediment; Andrew Woogen leads a safety brief prior to launching a water-sampling probe 600-meters deep; students in aquatic microbiology subsample a watershed sediment core.

All aboard for aquatic microbiology

This year students enjoyed an innovative new course that took them to sea — Aquatic Microbiology. Led by Associate Professor **Andrew Thurber**, students embarked on three day trips: to the Andrews Long Term Ecological Research Forest, the Yaquina Bay estuary and a final trip aboard the R/V *Oceanus*, a 177-foot research vessel owned by the National Science Foundation and operated by OSU as part of the University National Ocean Laboratory fleet. While collecting a diversity of water and sediment/seafloor samples, the students observed the very different aquatic ecosystems that make up Oregon's waterways from a microbial perspective.

Back in the lab, students employed a sample-to-synthesis methodology: analyzing the samples they collected using sequencing, bioinformatics, figure generation and paper presentation. Student-led projects ranged from cataloguing toxic algal species to better understanding how forest burn cycles impact nutrient cycling. The new aquatic microbiology class, unique to Oregon State, allows students to witness the environments that are connected in a water continuum and to apply cutting-edge analytical techniques that microbiologists use to study these critical ecosystems.

Fostering diversity in science

Trisha Chau, **Selena Carrizales** and **Aimee Nguyen** were delighted to attend the Society for Advancement of Chicanos/Hispanics and Native Americans in Science (SACNAS) national conference in Salt Lake City, Utah, in October 2017, thanks in part to the generous support of alumni and friends. SACNAS, the largest multicultural and multidisciplinary STEM diversity organization in the nation, has a mission to help "our country live up to its potential" by making sure that more underrepresented students attain advance degrees, careers and positions of leadership in STEM fields.

New pipeline for osteopathic medicine

Oregon State's new pre-osteopathic student club earned national recognition as Chapter of the Year from the Student Osteopathic Medical Association (SOMA). Just last year, BioHealth Sciences major **Coby Cates** founded the OSU Pre-SOMA Club under the guidance of medical students from Western University of Health Sciences College of Osteopathic Medicine of the Pacific-Northwest (WesternU COMP). An inaugural workshop brought together 15 WesternU and 20 OSU students. Several undergraduates who had never considered the field of osteopathic medicine are now excited about it as a career and plan to apply to WesternU.

Mysteries of mixotrophs

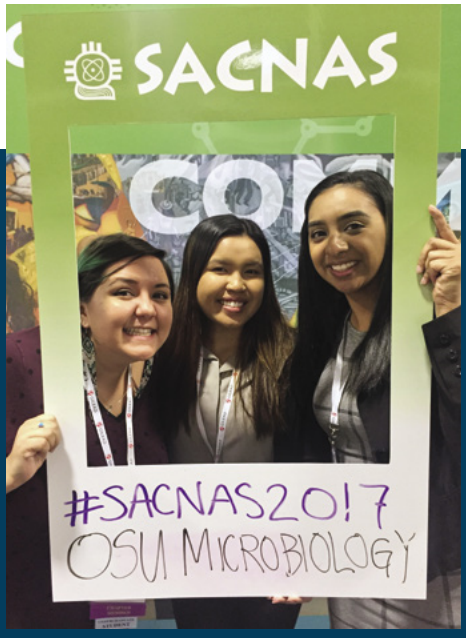
Thanks to the Sheila Van Zandt Student Research Experience Scholarship, which sponsors undergraduate-graduate student research teams, senior **Emma Tornberg** and graduate student **Bryce Penta** have been probing the mysteries of mixotrophs, which are phytoplankton uniquely able to produce carbon by both photosynthesis and the consumption of other organisms. Hoping to identify the unique differences in mixotroph photo-physiology, the duo are measuring chlorophyll and carbon in lab cultures of different mixotrophs across a range of light and carbon. Their research will improve estimates of phytoplankton's global net influence on our atmosphere, a critical step toward understanding climate change.

GRADUATE STUDENTS / POSTDOCS

Making their mark

Grace Klinges won a prestigious National Science Foundation Graduate Research Fellowship Program 2018 award. Only in her second year of graduate school, Klinges' research on corals in the Vega Thurber Lab has taken her to far-flung parts of the world — the island of Mo'orea in French Polynesia, the Solomon Islands, Papua New Guinea, France and Taiwan. Skilled in bioinformatics, Klinges discovered on her travels a new genus of bacteria which she named *Marinoinvertebrata*, and was able to assemble its complete genome. She is carrying out further computational analyses to fully characterize its genes and its role as an agent of coral white band disease. Her research will contribute to global efforts to preserve coral reef ecosystems under attack from climate change.

Courtney Armour, who is mentored by Thomas Sharpton, recently received the inaugural Larry W. Martin & Joyce B. O'Neill Endowed Fellowship. The Martin-O'Neill Fellowship is awarded



From left: SACNAS Attendees Trisha Chau, Aimee Nguyen and Selena Cararizales; BHS major Coby Cates (photo by Ariella Wolf); senior Emma Tornberg with graduate student Bryce Penta; Grace Klinges (photo by Tara Expeditions)

to a graduate student in the College of Science who demonstrates high achievement and whose research involves computational modeling.

Cleo Davie-Martin blogged about just how much sleep she really needs — "half an hour just doesn't cut it!" — and other marine adventures onboard the often rolling decks of the R/V *Atlantis*, which completed the last of four cruises supported by the NASA-funded North Atlantic Aerosols and Marine Ecosystems Study last March. Davie-Martin is an environmental scientist in the Halsey Lab studying the production and consumption of volatile organic carbon compounds by marine plankton, an effort critical to understanding the planet's resiliency under the stress of climate change.

Nicole Hams ('18), a postdoc in the Bartholomew Lab, is "not afraid to be working on a lot of different things." A recent OSU biochemistry and biophysics Ph.D., Hams is currently researching parasitic disease in Klamath River salmon, specifically identifying extracellular proteins involved in the ability of the parasite *Ceratonova shasta* to sense salmonids. In 2017, she published a paper on otoferlin, a protein critical for human hearing, in the *Proceedings of the National Academy of Sciences*.

Gifted with almost preternatural determination and curiosity, Hams was laughed at by a high school counselor when she asked about graduating early. She used her anger to take college classes at night and pursue summer school, graduating from high school at 15. Deep in her research, she still finds time to develop a two-part STEM literacy program for high school students in Linn and Benton Counties and spend time in the woods with her two dogs.

1 Emily Schmeltzer: My research interests lie in marine microbial ecology of tropical coral reefs, specifically how coral-associated microbial communities from different coral host species respond to nutrient enrichment, coral bleaching events, predation pressures and varying anthropogenic impacts.

2 Priyanka Singla: I am interested in probiotics, or how microbes can improve human health. My research will focus upon the impact of the gut microbiome on behavior.

3 Grace Deitzler: I am rotating through three labs this year, beginning with a study on how gut microbiota impact autism spectrum disorder. I am learning and utilizing computational methods to explore large data sets. I'm generally interested in microbial ecology and microbiome research.

4 Ian Humphreys: I am interested in leveraging computational techniques to improve our understanding of microbial evolution. My work currently focuses on assessing the accuracy of 165 phylogenetic trees, an integral tool to infer evolutionary relationships between members of microbial communities.

5 Sarah Wolf: I am interested in microbial diversity, bioinformatics, and the roles that microorganisms play in various aquatic systems. To find the project that best suits my aim, I will be rotating through the Giovannoni, Vega-Thurber and Bartholomew labs.

6 Christine Tataru: I am studying gut bacteria and their relationship to human health, focusing on the gut-brain axis. Evidence suggests that gut flora may play an intimate role in stress, obesity and depression. In addition, they may be related to neurological disorders such as Parkinson's or autism. By understanding the communities that take up residence in our bodies and our own relationship to them, we can develop more sensitive and specific diagnostics, effective treatments, and lifestyles conducive to a healthy body and mind.

7 Jessica Buser: High-latitude aquatic microbiomes are particularly dynamic and responsive to climate change, and yet we do not understand, and cannot predict, how crucial aspects of this system will change. My research will focus on defining functional diversity of northern wetland metagenomes and the role they play in global element cycling, with specific attention to iron.

8 Corbin Schuster: I am interested in utilizing zebrafish as a biomedical model to further investigate immunological mechanisms that occur when fish are exposed to parasites such as the microsporidian *Pseudoloma neurophilia* and other pathogenic organisms.

MAKING WAVES

Microbiologists and other service leaders make an impact in Puerto Rico.

Nicole Hams holds a cane toad.

Puerto Rico Service Learning

Kate Field co-led a team of 31 undergraduates, graduate students, postdoctoral scholars and faculty who embarked on a service learning trip to Puerto Rico during spring break last March. The group was eager to take on projects to help rebuild the educational infrastructure and to restore the natural resources destroyed by Hurricane Maria. The students flew to San Juan and made their way to San Sebastian in the northwest part of the island where they worked to repair the Segunda Unidad Bernaldo Mendez Jimenez School. The project was carried out in conjunction with Puerto Rico's land-grant university, University of Puerto Rico Mayaguez.

Microbiology postdoctoral scholar **Nicole Hams** assisted Kate in repairing cisterns that supply water and in creating a curriculum to teach students about the importance of water quality and how to monitor it. The impact of the trip extends far beyond spring break. As Trinity Shodin, an agricultural sciences major, says, "I didn't realize how tough education was there, and how that impacts families and communities. I learned that you have to utilize your resources and be flexible. You won't always have everything you need." Shodin developed agriculture curriculum kits for seventh and eighth grade students and helped repair a community cistern.

Making noise in science communication

Linda Bruslind and **Walt Ream**'s microbiology writing guide made the greatest hits list of the Writing Intensive Course (WIC) writing guides. The guide received more than 52,000 total hits from all over the world during a period of 18 months, far eclipsing any other offerings on the WIC website. The most popular page, accounting for half of the hits, was "Presenting Data," a topic that is critical at all levels, to all fields of science.

Katherine Field collaborated with OSU graduate students Kim Grzyb (Environmental Science) and Wesley Snyder (School of Writing, Literature and Film) to publish the successful outcomes of the course they designed, "Learning to Write Like a Scientist: A Writing-Intensive Course for Microbiology Students" in the *Journal of Microbiology and Biology Education*.

The course provides upper-division students with science-specific writing skills, which are often not formally taught but provide tremendous benefits to bioscience students. In the course, students write a press release, a case study, a controversy/position paper and a grant prospectus. They then revise drafts after feedback. To assess the course, Field, Grzyb and Snyder administered pre/post surveys and collected writing samples for analysis. The surveys revealed that students gained confidence and skill in both discipline-specific writing and content.

"There are compelling reasons to teach discipline-specific writing to bioscience students," concludes Field. "There is a strong connection between undergraduate experience in 'real-world' research and writing, and perceived self-efficacy and student identity. In addition, writing science improves students' ability to understand primary literature, think critically and communicate science."

Bridging the girls in STEM gap

Last April, the Hanby Girls STEM group, a club hailing from Hanby Middle School in Gold Hill, Oregon, connected with members of the department to learn about life at the microscopic level. As part of their two-day campus tour, the girls experienced hands-on laboratory activities as well as short lessons on principles of microbiology.

Kim Halsey coordinated the tour and **Cindy Fisher**, **Nicole Hams** and **Cleo Davie-Martin** led activities with the help of graduate and undergraduate students in the department. Fisher led a hands-on workshop on bacterial morphology through Gram staining, observing and contrasting Gram positive and negative bacteria under the microscope. The girls also inspected bacteriophage plaque assays and learned about their utility in counting viruses. Hams offered a crash course on fluorescent proteins and their biological functions. The visitors then had the opportunity to isolate their own fluorescent proteins, contrasting Green Fluorescent and mCherry (red) fluorophore qualities. Finally, Davie-Martin led an exercise illustrating the necessity of microscopic particles in the air to facilitate water condensation.

The Hanby Girls STEM group strives to introduce students to research and careers in science, technology, engineering, and mathematics (STEM) and to help bridge the gap for females pursuing STEM professions. Thirty-five Hanby students, almost one-third of the girls at the middle school, attended the event, marking their second visit to Oregon State.

Hanby middle-schoolers examine different morphologies of bacteria grown on petri dishes.

Sparks continue to fly

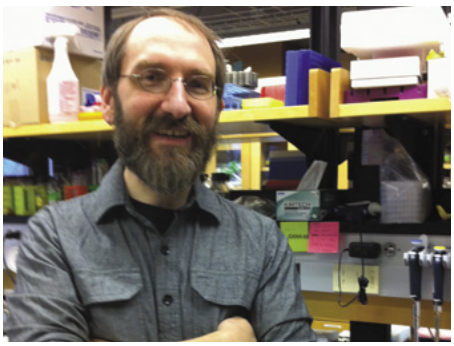
Renowned Seattle painter and sculptor Michael Schultheis presented "Venn pirouettes: Changing the way the world sees math" on October 24, 2018, as part of the ART:SCI Lecture Series. Trained in economics and mathematics and a former software developer at Microsoft, Schultheis is a self-described "analytical expressionist" who employs geometric models and overlapping mathematical notations on canvas to capture human experiences. ART:SCI lectures like this one continue to fan the flames ignited last year by SPARK, a yearlong celebration of the convergence between art and science. The series is co-hosted by the departments of Microbiology, Mathematics and Physics, the College of Science, the College of Liberal Arts' School of Arts and Communication and the OSU Research Office.

Accelerated Masters Program kicks into gear

M.S. candidate **Ian Humphreys** is the first student to enter our Accelerated Master's Program, which enables highly motivated students to earn a master's degree in microbiology while finishing their undergraduate degree. Students apply to the program in their junior year and take graduate level classes in their senior year, enabling a seamless transition to graduate school. Humphreys works in Tom Sharpton's lab, leveraging computational techniques to improve our understanding of microbial evolution.

Discovering Venn in the Ionian **by artist and mathematician Michael Schultheis**

Allison Evans



Shawn Massoni

Hellos and goodbyes

We welcome two new faculty to our instructional team, who will contribute to the delivery of new courses online and on campus. **Allison Evans**, a recent doctoral graduate of the OSU Fisheries and Wildlife program, has a broad background in microbiology and the environmental sciences and will teach core microbiology classes and develop an online immunology course for the BioHealth Sciences (BHS) program. **Shawn Massoni** received his Ph.D. in microbiology from the University of Massachusetts, and was most recently a visiting professor at Mount Holyoke College. He will be developing an online bacteriology course and teach writing intensive courses this year.

Valerie Elias joined the department last fall to run the media kitchen that provides support to our teaching labs.

We bid a fond farewell to long-time advisor **Ariella Wolf**, who recently retired. Through the generosity of Ariella and her husband Aaron, BHS will offer its first scholarship next year.

SPRUCING UP NASH HALL COURTYARD

Over the past three years, the department has been making the courtyard on the west side of Nash Hall more inviting, starting with the landscaping of the memorial garden, a project completed by Eagle Scout Trevor Gazley and Gaia Landscaping. Earlier this year the department added picnic tables that were constructed by the Linn Benton Community College (LBCC) welding program, led by Marc Rose.

This fall the courtyard was completed with the addition of a beautiful sculpture of the Willamette River. Capturing both the dynamics of the river and the complexity of its channels, the sculpture was an artistic collaboration between student **Karl Payne**, the designer, and department head **Jerri Bartholomew**, who cast the glass portions of the sculpture. The sculpture is dedicated to Drs. John Fryer and Carl Bond, professors in the departments of Microbiology and Fisheries and Wildlife, respectively, who were both mentors for Bartholomew. The LBCC welding program again donated their time and efforts on construction of the piece. Mary Fryer generously contributed funding for materials. Thanks to all of our generous friends!

One Year, Three Awards

Michael Kent received well-deserved recognition this year both from the university and in his profession. He was awarded both the OSU Alumni Association Distinguished Professor and the Agricultural Research Foundation Distinguished Faculty Award for 2018**.** The awards recognize superior academic performance, professional renown and service to both the university and the public. Kent's dynamic and topical lectures in General Parasitology and Mechanisms of Disease attract a diverse cohort of undergraduate students and earn him high teaching evaluations. He has mentored many graduate and undergraduate students, and actively promotes diversity by creating training positions for under-represented minorities.

Kent was also honored with the Outstanding Steward of Zebrafish Award by the Zebrafish Husbandry Association at the annual meeting at Aquaculture America 2018 in Las Vegas. In collaboration with colleagues at OSU and across the country, Kent's lab is developing zebrafish as models for infectious diseases in humans. Research in his laboratory is primarily funded by a grant from the Office of Research Infrastructure Program of the National Institutes of Health and is focused on the transmission, characterization, and control of pathogens in zebrafish. As a co-PI at the Zebrafish International Resource Center, Kent assists with health studies and their diagnostic service.

INNOVATION
in our labs

Kim Halsey and postdoc Cleo Davie-Martin collect seawater to analyze the gases produced by phytoplankton.

KIM HALSEY LAB

Planetary influence of phytoplankton

Microscopic but mighty, phytoplankton have global impacts on the environment. These single-celled plants interface between aquatic, sediment, terrestrial and atmospheric environments by exchanging climate-active gases, fueling the aquatic food web and interacting with other microbes. In the Halsey Lab, we pursue a greater understanding of these diverse and complex organisms, whose collective activity is so critical to understanding both climate regulation and life on Earth.

In our continuing study of phytoplankton, four of us spent a month last March aboard the R/V *Atlantis* in the rough seas of the North Atlantic Ocean. One of our goals was to measure the gases that are produced by ocean microbes and answer some of our many questions about them. We found out that the gases are composed of isoprene, methanol, dimethylsulfide, methane thiol, acetone and many other compounds. How fast are they produced and under what conditions? High light and cold temperatures seem to promote production of some gases. Are different gases produced by different species? Yes, microbes have different "gas fingerprints." Can these gases be used as growth substrates by other microbes? Yes! And the interactions are really interesting.

How do we know all this? Postdoc **Cleo Davie-Martin** and graduate student **Eric Moore** use proton-transfer-reaction mass spectrometry to detect these gases in seawater and in lab-grown cultures. Their research is revealing complex roles for these gases, including how and why they are exchanged between microbes. Bacteria that consume these gases help to shunt these compounds into their cells instead of allowing the gases to escape into the atmosphere. When these gases do cross the sea-air boundary, they can help form cloud-condensation nuclei or create greenhouse gases. We also study freshwater plankton. Graduate student **Lindsay Collart** is interested in the algae that produce cyanotoxins in fresh water lakes like Upper Klamath Lake, Oregon. She is studying the gaseous compounds produced in the lakes and their relationships with toxicity, lake eutrophication and the atmosphere.

The other half of our team is studying how phytoplankton respond to environmental shifts, such as changing light and nutrients. Phytoplankton carbon composition is very flexible. Graduate student **Michelle Pombrol** is identifying genetic regulators of carbon allocation using transcriptomics. The balance of subcellular pools of energy-rich carbon (lipids and proteins) and energy-poor carbon (carbohydrates) impacts its ultimate fate: assimilation into microzooplankton, predators export into the deep ocean for long term carbon sequestration, or remineralization back to CO_2. Postdoc **James Fox** spent five weeks late last summer aboard the R/V *Revelle* in the North Pacific Ocean to trace carbon export back to signals retrieved by satellites. Last but not least, graduate student **Bryce Penta** is working to adapt the current one-size-fits-all model of global ocean plankton productivity calculations to allow for their dizzying physiological diversity and improve model predictions.

MAUDE DAVID LAB

The microbiome-mind connection

The thousands of bacteria found in the human gut can have a dramatic influence on mental health. Whipple's disease, for example, caused by the common and usually asymptomatic gut bacterium *Tropheryma whipplei*, can cause manic psychosis and other neurological symptoms that mimic those of many other neurologic diseases. In another example, the gut bacteria *Lactobacillus rhamnosus* is reported to regulate emotional behavior in mice via expression of neurotransmitter receptors. Despite their startling influence, however, very little is known regarding the mechanisms by which gut microbiota can have such powerful effects on the mind. Resolving this gap in understanding is crucial to the advancement of modern medicine and microbial ecology: the precise goal of the David Lab.

In collaboration with neuroscientists **Kenton Hokanson** and Kathy Magnusson, we manipulate the diversity and composition of microbial communities in mice and analyze the effects of such changes on the anxiety phenotype. Two new graduate students in the department, **Grace Deitzler** and **Priyanka Singla**, and Shannon Quinn, a bioengineering undergraduate, are making significant progress towards achieving many objectives of this endeavor.

We are launching a crowd-sourced initiative to study anxiety disorders in undergraduate women at OSU. **Austin Martin**, a microbiology senior, is designing a novel questionnaire model that will enable self-reporting of anxiety episodes while concurrently amassing data from multiple mobile devices to correlate with the self-reporting. This system will address and mitigate the many challenges associated with safe and secure processing and analysis of sensitive data acquired from human participants. In collaboration with Denise Hynes, director at the Center for Excellence in Genomic Research, this project also advances the development of secure infrastructures that will enable other OSU investigators to perform analyses of sensitive health information in an ethical and responsible manner.

Like most microbiome-oriented research, both of these programs will generate an immense amount of raw sequencing and multi-Omics data. Subsequently, our lab also invests in novel methods of processing and analyzing enormous quantities of microbiome data. To this end, **Christine Tataru**, a Ph.D. student and recipient of OSU Provost's Distinguished Graduate Fellowship, has begun optimizing emerging machine learning algorithms along with Sonica Gupta, a computer sciences undergraduate student.

Our new interdisciplinary lab is off to a strong start, thanks in large part to Oregon State and its land-grant mission, which fosters an exceptional, collaborative environment. I wholeheartedly appreciate everything the microbiology department has done to guide me, from developing a teaching curriculum to finalizing research objectives. At its heart, my laboratory is great people seeking answers to game-changing medical and pharmaceutical questions. We work hard, we encourage and promote respect, inclusion, and diversity, and we have terabytes of fun!

Gut microbes have far reaching effects. Maude David studies the effect of gut bacteria on mental health in mice.

From left: Mary K. English, Winni Wang and Ryan Mueller

RYAN MUELLER LAB

Splendid is the seagrass

The Mueller Lab enjoyed a golden year. We received multiple awards for graduate and undergraduate students, promotion and tenure for myself and a new federal grant. The lab also produced some significant published research. Graduate student **Brandon Kieft** published a major research piece, his first, in *Frontiers in Microbiology*. Exploring the ecology of microbial communities found within the Yaquina Bay estuary near Newport, Kieft's research highlighted how the highly dynamic nature of estuaries can dramatically affect the types of microbes found within the water column, which in turn can have significant effects on the potential biogeochemical cycling of these systems. His results provide novel insights into the unique adaptations that specific groups of microbes possess, allowing them to compete and thrive in these globally important ecosystems.

A second article published in *Frontiers in Microbiology* was the fruit of a collaboration between myself and OSU colleagues Byron Crump from the College of Earth, Ocean, and Atmospheric Sciences and Fiona Tomas Nash from the Department of Fisheries and Wildlife. We examined the role of the microbiome of seagrasses on their overall health, and were the first team to detail the types of microbes found in association with the native seagrass, *Zostera marina*, as well as an invasive seagrass, *Zostera japonica*. **Winni Wang**, a Ph.D. student in my lab, was awarded a Markham Fellowship to follow up on this initial study by researching how the seagrass host and its microbiome respond to nutrient pollution stress.

Mary English, an undergraduate in microbiology, spent the past summer performing experiments to characterize the development of the microbiome on seagrass roots after transplantation. We hope that the combined results of these studies will provide insight into the factors affecting the health of seagrasses, which are important foundation species found all along the Oregon Coast.

In outreach news, **Winni Wang** was also awarded a scholarship from the College of Science and the Department of Microbiology to participate in the OMSI Science Communication Fellowship Program. The fellowship enhances and broadens the science communication and outreach skills of participants by helping them introduce their research to diverse audiences. Wang created an interactive display to educate youth (and all ages) about the effects of pollution on eelgrass ecosystems, a part of her Ph.D. research on the role that microbes play in Oregon Coast seagrass.

Winni Wang also recently helped to host the department's booth at da Vinci Days, the annual community arts and science festival in Corvallis. Manned by a dozen or so other microbiology graduate students, the booth engaged festival goers of all ages with conversations and activities surrounding genome assembly, fish disease, DNA extractions and general microbiology facts.

Tanner Robinson and Martin Schuster pour petri dishes to study bacterial behavior.

MARTIN SCHUSTER LAB

Bacterial buzz

The secret social lives of microbes is the revelation of the Schuster Lab. Long thought to be asocial, it turns out that bacteria cooperate and communicate largely by secreting products into a shared environment, such as enzymes that help other bacteria acquire nutrients, or toxins that harm other cells. Rooted in molecular microbiology, our lab has incorporated approaches over many years from ecology and evolution to investigate this still mysterious world of bacterial interactions. How do bacteria do it, and why?

One central question we're trying to answer is how cooperative behavior can be maintained in the face of cheaters – individuals that reap the benefits of cooperation without contributing themselves. Several studies from my lab have helped solve this puzzle. In one project, led by former students **Kyle Asfahl** and **Tanner Robinson**, we found that adaptations to environmental conditions can give cooperators an edge and leave cheaters behind. In another project led by former student Joe Sexton, we found that the costs of cooperation are highly contextual and depend on specific nutrient conditions. Surprisingly, in some cases cooperation doesn't cost anything – and when it's free, cheating doesn't provide an advantage. Graduate student **Parker Smith** is focused on the heterogeneity of bacterial social behaviors at the single-cell level and its ecological implications.

I have been fortunate to work with very talented graduate students and excellent colleagues, and to receive continued federal funding support over the years. Looking to the future, we are aiming to further incorporate mathematical modeling into our work, and to assess the extent and significance of bacterial interactions in natural ecosystems.

Thomas Sharpton (right) and postdoc Christopher Gaulke study how exposure to environmental toxins disrupts the gut microbiome of zebrafish.

THOMAS SHARPTON LAB

The invisible company we keep

Our journey through life is less solitary than we might imagine. Even in our most isolated moments, we carry deep within our bowels a diverse and vibrant community of microbes, known as the gut microbiome. Microbes, or bacteria, are often viewed as pathogenic enemies to nuke from orbit. But an explosive array of discoveries continues to confirm how much our health actually depends upon these tiny organisms: they facilitate digestion, promote nutrition, shield us from infection and even mediate our behavior. The search is on to identify which microbes elicit which effects, a knowledge that could catapult medicine into a new age. But so far, attempts to do so are akin to looking for a needle in a haystack.

The Sharpton Lab reasons that evolution may provide important clues as to which gut microbes matter to health. Humans did not evolve in isolation from the microbiome. Rather, we – and all other mammals – have lived alongside these microbes throughout our evolution. In a recent series of publications, the Sharpton Lab postulated that if humans today depend on gut microbes to maintain health, then the survival of mammals in nature, including our human ancestors, may similarly depend/ have depended on key gut microbes. Consequently, if microbes or groups of microbes descended from a common ancestor have been conserved in the gut microbiome across many species and over millennia, it may indicate that these particular microbes helped mammals, including humans, to survive and propagate their genes.

In hopes of finding and identifying such microbes, the Sharpton Lab developed a new analytical approach, an algorithm-based software program that groups microbes based on their ancestry and common distribution across mammals. The list of key common microbes flagged by the software included both well-known health-promoting gut bacteria and many less well-studied microbes. The study also found that individuals from industrialized societies harbor a paucity of the usual range of gut microbes shared among mammals. This finding elevates concern that industrialization has altered the composition of the gut microbiome that humans inherited from their ancestors, exposing industrialized humans to largely unknown health risks.

The Sharpton Lab is currently following up on these important discoveries by conducting tests of the effects of these prevalent microbes on mammalian health. These future studies will not only determine if our evolutionary theory holds merit, but will also resolve which microbes impact human health and help determine if individuals living western lifestyles require microbiome amendments to prevent microbiome-related diseases. Lastly, this research, alongside other exciting work, may ultimately transform how we think of ourselves as individuals and what it means to be human.

ALUMNI AND FRIENDS

Love of science inspires gifts for next generation

Helen Alford Hays, a long-time microbiology instructor and advisor from 1955-81, established the Helen Alford Hays Women in Microbiology Scholarship with her husband Dale. Hays would have been 100 years old in 2018. The department's annual scholarship luncheon last May was a tribute to her spirit and generosity. Her son, Dr. Charles Hays, a Canadian science journalist, was the guest of honor. "Science was my mother's life," said Hays. "My mom raised me on stories of scientists."

Pursuing a master's degree in bacteriology at OSU in the 1950s, Helen was the only woman in her graduate chemistry course. She was driven to succeed by the professor who said, "no woman would earn an A in this course...women can't do science." At the end of the term, Helen had the highest grade in the class. She created a scholarship in microbiology for women to help ensure that "everyone should have the opportunity to be the best they can be," says Charles.

A recent endowment by alumni **Eugene W. Seitz** (Ph.D. '62) will provide fellowships for graduate students, especially if they happen to be Canadian. As a graduate student, Eugene worked with microbiology professors William Sandine and Paul Elliker on the causes of milk spoilage. He then went on to a successful career as an industrial scientist.

RECENT GRADS

Where are they now?

Jeannie Klein-Gordon ('16) is pursuing a Ph.D. in plant pathology at the University of Florida and was recently awarded an NSF Graduate Student Fellowship. She continues to be grateful for the Helen Hays Scholarship and others at OSU that allowed her to focus on her undergraduate studies.

Nick Meermeier ('10) and **Erin Riscoe** ('10) got married after graduation. Meermeier completed his M.D. at Oregon Heatlh and Sciences University (OHSU) and will be a radiology resident physician in Phoenix, Arizona, next year. Also at OHSU, Riscoe researches T cells as a postdoctorate fellow in pulmonary medicine while job-searching in Phoenix.

Justin Moss ('17) is currently a medical student at Western University of Health Sciences in Lebanon, Oregon, and was recently commissioned as a Second Lieutenant in the Air Force. He reports, "Overall I'm happy and doing well — and once I pass my board exams I'll be even happier."

Melinda Guzman ('16) is a master's student in the Botany and Plant Pathology Department at OSU. She studies aphid-transmitted viruses in *Rubus* and seeks to determine what virus complex(es) cause the destructive raspberry leaf curl disease. In her spare time, Guzman enjoys hiking and attending Blazer games.

Pioneering alumna honored for distinguished research

Joan Countryman Suit ('53) was awarded the 2018 College of Science Distinguished Alumni Award, which recognizes alumni whose exceptional achievements have brought honor, distinction and visibility to the College. A specialist on the genetics of bacteriophages, whose career spanned three decades, Suit succeeded at a time when women scientists were scarce.

After pursuing a doctorate in microbiology at Stanford University, Suit made important contributions to the rapidly growing field of virology and bacterial genetics. As a research scientist at the Massachusetts Institute of Technology, she worked with Dr. Salvador Luria, who won the 1969 Nobel Prize in Medicine and Physiology. There, she was awarded a patent for engineering a mutant strain of E. coli that produces a therapeutic protein more efficiently.

Suit and her husband Herman are deeply committed to giving back. They support SURE Science Scholarships, which enable undergraduates to pursue summer research, and the Joan Countryman Suit Scholarship for microbiology graduate students.

Honor Roll

The Honor Roll recognizes annual supporters who have made outright gifts or pledge payments to the department totaling $1,000 or more between July 1, 2017, and June 30, 2018.

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Thank you!

Every attempt has been made to ensure the accuracy of these lists. However, if you notice an error, please contact:
Pam Powell, Associate Director of Stewardship, OSU Foundation, Pam.Powell@osufoundation.org or 541-737-5820.

HONORING MOMENTS THAT CHANGED A LIFE

James Winton (Ph.D., ’81) remains grateful for how a single microbiology course changed his life. After serving as a U.S. Naval officer during the Vietnam War, Winton arrived on campus in 1971 to take some pre-med courses. His first microbiology class struck a spark, and his second, Pathogenic Microbiology, flamed a passion that lasted a lifetime. The class was taught by Dr. John Fryer, the OSU Distinguished Professor of microbiology and renowned, award-winning educator who helped build the foundation for the science of fish diseases. Fryer was “charismatic and engaging,” reflects Winton, “able to pull disparate materials and stories together and make you want to know more.”

Winton dropped his pre-med plans and pursued a Ph.D. in Fryer’s Lab on fish disease. Recruited in 1986 to lead the fish health research program at what is now the U.S. Geological Survey’s Western Fisheries Research Center (WFRC) in Seattle, Winton published more than 200 scientific papers on fish disease over a long and fruitful career. As both a federal research scientist and an affiliate professor at the University of Washington, he established many academic, industry and government partnerships to bolster fish health around the world, mentored dozens of young scientists and played a leadership role in establishing the WFRC as an internationally-recognized center for fish health research.

Retired since 2017, Winton feels passionately about giving back: “It’s important to honor those individuals and institutions that made a difference in your life.”

The department is grateful for Winton’s generous contributions to the John L. Fryer Scholarship Endowment Fund as well as to his mother for funding the Winton Housing Facility at the Marine Science Center and establishing the Harriet M. Winton Scholarship in appreciation to Dr. J. L. Fryer for introducing her son to the study of fish disease.

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Department of Microbiology
Oregon State University
226 Nash Hall
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microbiology.science.oregonstate.edu

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