College of Science

2015–2017

ANNUAL REPORT

Transforming the world through science.

Oregon State University

College of Science highlights for the fiscal years beginning July 1, 2015 and ending June 30, 2017.

TAKING SCIENCE **OUT THERE**

Faculty and student travel for research, outreach, and collaboration 2015–2017

Departments of Biochemistry/Biophysics, Integrative Biology, Mathematics, Microbiology, Physics and Statistics

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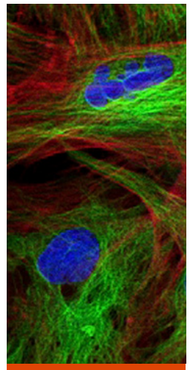

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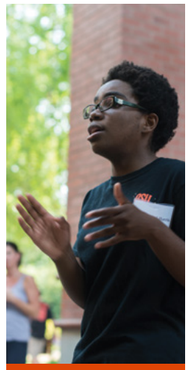

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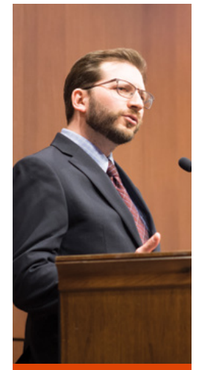

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ONE SCIENCE

Oregon State Science is a strong, diverse community that is committed to working collaboratively to achieve a set of common goals that foster the academic, personal and professional growth of all its members.

In the College of Science, diversity is much more than a concept that we aspire to. It is in our DNA. Diversity makes science better. It helps us achieve excellence and defines who we are. It is the foundation of the world-leading science that happens here.

Great science is not just the facile product of a routinely applied scientific method: it is the creative, determined, and unpredictable pursuit of inquiry across boundaries, whether those boundaries occur among disciplines, nationalities or people. Boundaries are drawn around the known for a purpose, but science ultimately pursues the unknown. It crosses boundaries, even sacrosanct ones, to deliver the dreams of the future.

One of the ways we work across boundaries to discover new knowledge and solutions to society's most pressing problems is to begin with a diverse team of thinkers and doers. As our 2017 Spring Distinguished Lecturer, renowned physicist Sylvester James "Jim" Gates, Jr. remarks, "Diversity makes for excellent science." Diversity and equity "provide our field with the greatest possible opportunity to draw individuals who can bring that vitally important, distinct set of perceptions and abilities to the scientific effort."

Diversity is the catalyst for our inspiration.

People, not colleges, perpetuate change and progress. From the different backgrounds and talents of our 200 faculty, 3,600 students and 28,000-plus alumni to our collaborators around the world and the thought leaders we bring to campus, diversity is key to the teamwork and open-minded inquiry that thrives here across a broad spectrum of disciplines, from biology, biochemistry and biophysics, biohealth sciences, microbiology, zoology and chemistry to physics, mathematics and statistics.

Diversity is the catalyst for our inspiration and our potential.

The College of Science is an inclusive, welcoming and intellectually stimulating environment to a diverse community. Working together, the College is a nucleus of learning, societal engagement, achievement and discovery.

FROM THE DEAN

Science is at the heart of the modern university. For Oregon State University to promote economic, social, health, cultural and environmental progress for the people of Oregon, the nation and the world, it must have a strong College of Science. In the past two years, our faculty, staff, students and alumni have made significant progress delivering on our core mission of advancing science and building global leaders.

A global center of excellence in research and pedagogy, the College of Science is known for its strengths in ecological and quantitative sciences that inform public policies on climate change; materials science to identify cost-effective sources of renewable energy and sustainable technology; biological sciences to advance understanding of disease mechanisms to improve animal and human health; and data science to enhance the quality of our research and spur economic development. Our strategic goals reflect our commitment to the success of our people — our faculty, our students, our alumni and friends and our communities — to build a diverse and inclusive science community focused on excellence, to be a global leader in scientific research and scholarship for a better world and to excel in outreach, engagement, visibility and economic development.

As scientists, we are driven to understand how the world works. Through fundamental and curiosity-inspired research, we create knowledge and enable solutions to major societal problems, making our communities and our world better. This report highlights the incredible accomplishments of our strong science community. We are thinkers and doers who value diversity of thought, strive for excellence and welcome inclusivity and difference. Together, we can make the College of Science at Oregon State University the best ever.

Roy Haggerty
Dean, College of Science

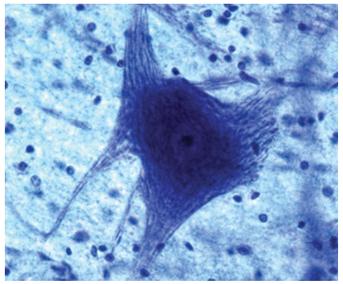
LOOKING BACK, MOVING AHEAD

Sastry G. Pantula

Dean of the College of Science from 2013-17, Dr. Sastry Pantula launched our first strategic plan and established initiatives in the areas of student and faculty success, innovative programs and outreach and engagement. He is credited with significantly enhancing diversity among faculty and leadership, advocating for women in science, creating a Board of Advisors, building a science communication team, launching a Science Success Center and recruiting exceptional faculty and staff. He worked tirelessly to raise the visibility of science across campus, Oregon and beyond.

Dr. Pantula remains grateful to many alumni and supporters for their personal friendships and increased investment in scholarships, teaching and research. He continues to be an enthusiastic cheerleader for our OneScience community of students, faculty, staff and alumni.

OUR RESEARCH



We are driven by our core mission: To advance science.

Biochemist Viviana Perez (top left) uncovered a second anti-aging mechanism of the compound rapamycin, a discovery which opens up new therapeutic approaches to neurologic disease, including dementia and Alzheimer's. Rapamycin acts directly to improve the toxic, inflammatory environment created by aging cells, helping to protect fibroblasts (left) and neurons (top right) from damage. This enables people to live longer, healthier lives.

Research fuels our core mission: **To advance science and build global leaders for a healthy people, living on a healthy planet, in a healthy economy.** That is why we seek out the most promising minds who embrace our values, have the tenacity to tackle the toughest problems, engage in leading research and are dedicated to inspiring and teaching our students.

Collectively, our research plumbs a vast breadth of topics, from supernovae to superbugs. But we bring unique talent and resources to the table in marine, materials, biohealth and data science. We are leaders in microbiome research: in 2017 Oregon State University was named one of eight centers for a $14 million National Science Foundation program to study and develop improved genomics tools.

Our internationally recognized faculty were awarded over $18.7 million in research funding in FY17, an increase of 54% from the previous year. Our three-year moving average of research funding shows a continued upward trajectory over the last three years. State-of-the art facilities, such as the Linus Pauling Science Center, Nuclear Magnetic Resonance Facility and more than 100 research laboratories, serve as the crucibles for new discoveries and the proving grounds for the next generation of scientists.

Our work is collaborative, interdisciplinary and global, reflecting the complex and worldwide problems we wrestle with everyday. Our curiosity-driven research plays a foundational and pivotal role – laying the chemical or biological groundwork for tomorrow's new touchscreen or cancer drug – as well as its immediate applications, such as making better batteries or novel radiation clean-up technologies. Since 2011, our faculty produced 48 new technologies and secured 18 U.S. patents.

WARM OCEANS NEED COOL SCIENCE

Just two years after one of the most severe marine ecosystem epidemics in recorded history nearly wiped out the population of West Coast sea stars, marine biologist Bruce Menge discovered a starfish baby boom: “The number of juveniles was off the charts…300 times normal.” If we can slow or stop global warming, ocean ecosystems can respond with incredible resilience.

The College of Science forms the intellectual core of OSU’s Marine Studies Initiative, a campus-wide effort to address the threats facing our oceans with world-leading research and teaching, global leadership, and pioneering collaboration with government and industry partners. With access to the Pacific and OSU’s world-class research facilities on the Oregon Coast, the College pursues fundamental understanding and practical solutions for today’s challenges, from climate change and ocean acidification to disease, biodiversity loss and pollution. Our research, teaching, advocacy, and collaboration will help lead us towards healthier, more resilient and productive ocean ecosystems and “blue” economies.

Smarter models of climate change

Accurate models of climate change are taking a giant leap forward thanks to Stephen Giovannoni’s research on microscopic plankton. Plankton dynamically alter earth’s chemistry and have an outsize influence on our atmosphere. Giovannoni was the first to discover the smallest and most abundant plankton, SAR11 bacteria. These tiny but ubiquitous organisms are so dominant that their combined weight exceeds that of all of the fish in the world’s oceans, and they produce enough sulfur gases to play a major role in cloud formation and climate models.

Understanding the deep ocean is critical

Plankton research also sheds light on the vast amounts of carbon stored in the ocean in the form of dissolved organic matter (DOM), a food source for micro-organisms. Giovanni applied genome sequencing to the abundant microbial “dark matter” far below the ocean’s surface, discovering the deep-ocean SAR202 plankton and the role it plays in metabolizing harder-to-digest forms of DOM ignored by surface species. Even SAR202 leaves behind refractory forms of DOM, carbon-rich matter that collects in the ocean in staggering amounts, up to 615 Pg of carbon globally. This is roughly equivalent to the amount of the greenhouse gas carbon dioxide (CO_2) in our atmosphere today. If SAR202 ever evolved to tap into this latent food source, it could release disastrous amounts of CO_2 into the atmosphere.

Protecting the ocean floor

The oceans also house vast reservoirs of methane, a greenhouse gas whose warming effect is 25 times stronger than CO_2. In 2016, Andrew Thurber and a coalition of 14 scientists were the first to survey research on the hydrothermal vents and methane seeps on the ocean floor, first discovered by OSU researchers 40 years ago. These habitats have surprised the world with their bizarre ecosystems, including hot oozing gas, sulfide chimneys, bizarre tube worms and giant crabs and mussels that eat methane and toxic sulfide. Thurber discovered that the influence of these habitats extended far beyond their immediate zones to have an ocean-wide and global impact.

“We had no idea at first,” Thurber said. “Through methane consumption, these life forms are literally saving the planet. There is more methane on the ocean floor than there are other forms of fossil fuels left in the oceans, and if it were all released it would be a doomsday climatic event.”

As these methane seeps and hydrothermal vents are currently under threat by deep sea mining and bottom trawling, it is critical that we enact global policies to preserve them before it’s too late.

In 2017, Thurber published research warning that thermal stress and acidification caused by climate change could trigger extinctions in the seafloor by the year 2100, an area that covers over 63% of the globe. This potentially massive biodiversity loss and die-off on the deep ocean floor would result in fewer nutrients and oxygen returning to the surface from the deep sea, depleting sea life and starving the coastal communities so familiar to us.

Towards a more sustainable future

Giovannoni and Thurber’s work is critical to understanding the risks facing our oceans and to creating smarter policy for a healthier future. As former NOAA Administrator and the nation’s first U.S. Science Envoy for the Ocean, Jane Lubchenco has written, “If we harness human ingenuity and recognize that a healthy ocean is essential for long-term prosperity, we can tackle the enormous threats facing the ocean and we can make a transition from vicious cycles to virtuous cycles.”

LEADING CHANGE WITH SUSTAINABLE MATERIALS

Chemist May Nyman's research has led to newer, greener ways to clean up radioactive waste.

The College of Science is a leader in the race to discover sustainable materials, contributing the research behind next-generation electronics and cutting-edge techniques for clean energy generation, storage and conservation. Our work ranges from fundamental science to applied research in new technologies and startup companies to the training of the next generation of environmentally conscious innovators.

Seizing opportunity

Breakthrough innovation in material science often happens at the crossroads of serendipity, experience and sudden insight. When chemists **Doug Keszler**, **Art Sleight**, physicist **Janet Tate** and engineer **John Wager** set out to test a class of materials known as p-type transparent semiconductors in the late 1990s, they discovered a powerful new application for these materials: transparent electronics. Over the next decade, Keszler and Wager's work on new semiconductor materials for transparent transistors and flat-panel displays received national attention and formed the basis for Apple's Retina display monitor.

> "We're pushing the boundaries of science and seeing things no one has ever seen before."
>
> Douglas Keszler, Distinguished Professor of chemistry

In the last two years, Tate and Keszler have harvested more discoveries from this original research. Tate, a Dr. Russ and Dolores Gorman Faculty Scholar, has created semiconductors to solve pressing problems like the efficient conversion of solar energy. She has collaborated with scientists from the National Renewable Energy Laboratory and several universities on a new Energy Frontier Research Center, sponsored by the Department of Energy, to design and make metastable materials with new and interesting properties.

Keszler's work has led to multiple patents for environmentally friendly building materials for new generations of semiconductor and solar-energy devices. He and his team have made significant contributions to the liquid crystal display industry and new aqueous-based, green-chemistry platforms that show promise for new high-performance electronic and energy devices and coating. In the future, windows, mirrors, walls and counters could display messages and harvest solar energy.

"We're trying to turn this industry into a truly zero-waste proposition while improving performance," says Keszler, a principal scientist at Oregon State's Center for Sustainable Materials Chemistry. "We'd like to do electronics the size of a wall. The question is: How do you do that efficiently without producing even more waste?"

Abundant metals for a greener future

On another greening front, chemist **May Nyman** is exploring new cluster chemistries to harness some of the most Earth-abundant and least corrosive metals to build transformative energy and environmental technologies for a healthy planet. Her research has led to new, greener materials to clean up radioactive waste, safely degrade chemical warfare agents like nerve gas and support sustainable methods for nuclear fuel processing. She invented a process to capture highly stable, non-reactive metal oxides in water, something scientists had struggled with for decades. Metal oxides help degrade air and water pollutants, and Nyman's breakthrough research allows industry to produce them with the absolute control needed for high-performance materials in electronic circuits.

Powering up with next-gen batteries

There is a worldwide race to develop the next-generation energy storage devices, and chemist **David Ji** is a frontrunner. Last year, he received the National Science Foundation CAREER Award—NSF's most prestigious honor for outstanding young scientists— to support research that will broaden the field of battery chemistries by introducing potassium-ion batteries as an alternative to expensive lithium-ion batteries.

Since then Ji and his team have accelerated the pace of innovation in new battery technologies. They have revealed materials chemistry for new potassium-ion and hydronium-ion batteries holding promise for more sustainable energy storage, potentially for microgrids, solar-powered devices and more.

BIG DATA, **BOLD INSIGHTS**

"OSU is a perfect research environment for developing better disaster response strategies, which require input from diverse experts and build upon many of our research strengths, like data analytics. It's also locally relevant, given that we live in the Cascadia Zone." —Juan Restrepo

With demand for statisticians projected to grow 34% between 2014-2024, the science and art of mining and distilling useful information from vast datasets has never been in greater demand. The College of Science is doing its share to meet this surging need for computational skills in an era of data explosion. We have hired some of the top minds in mathematics, statistics and bioinformatics, launched a new online masters degree program in data science analytics, and we are training graduate students how to work with large data sets, a skill essential for their future career success.

In addition to these quantitative leaps, Big Data is increasingly driving breakthroughs and shaping new thinking across a wide range of topics at the College. From climate change to the stock market, from personalized medicine to precision agriculture, data science enables scientists to identify the key signals and trends from a noisy torrent of data to make more accurate predictions and to inform smarter policy. Data science provides an immense opportunity for the College to align our expertise with market and national needs, federal priorities and funding opportunities, while positioning the University as a leader in the statistical, mathematical and computational sciences.

> "Data science is the heartbeat of 21st century global economies, and innovations in sciences, engineering, business and education are becoming increasingly computationally and data-enabled"
>
> Sastry G. Pantula, professor of statistics and former dean of the College of Science

Predicting extreme weather

Mathematician **Juan Restrepo**, former chair of the American Physical Society's Focus Group on Climate, former vice chair of the Society for Industrial and Applied Mathematics/Geosciences and winner of the 2017 Geosciences Career Prize, has probed big data and models for better analyses of climate. He has contributed to the understanding of subjects as far ranging as ocean dynamics and sandbar formation, oil-spill and pollution modeling, acoustics and voting theory. He is currently developing more accurate estimates of hurricane landfall.

Restrepo is also leading a team of statisticians, engineers and social scientists to formulate adaptive response strategies to disasters such as flooding, wildfires and hurricanes. They are taking advantage of physics models, disaster response protocols, sensor data, and citizen cellphone reports/locations to coordinate faster and more efficient recovery efforts. This initiative in resilience exploits the talent, research strengths and collaborative working style of Oregon State's scientists and engineers.

Smarter disease prevention

Big data can inform better policies and strategies for global health and disease response and prevention. For example, population biologist and mathematician **Benjamin Dalziel** analyzed medical data from the 2014 Ebola epidemic and discovered that "superspreading" events accounted for almost two-thirds of all infections. With greater understanding of superspreading events, we can help design better control strategies and public awareness campaigns to reduce the spread of epidemic disease.

Bioinformatics hire **David Hendrix** in the biochemistry and biophysics department uses genome-wide sequence analysis and deep sequencing data to explore gene regulation, with a focus on the role of noncoding RNAs. Previously thought of as "junk," noncoding RNAs are gradually being understood as key to gene regulation and expression. Hendrix's research has revealed that important non-coding RNAs can be activated or suppressed in reaction to influences such as aging and oxidative stress, micronutrients such as sulforphane from broccoli, and environmental toxins. Hendrix's lab is also using deep learning to identify gene expression important for cancer detection.

DECONSTRUCTING DISEASE **WITH BIOHEALTH**

Bruce Geller developed a new weapon in the battle against antibiotic-resistant germs—a molecule that neutralizes the bugs' ability to destroy the antibiotic. The 2016 discovery received worldwide attention and media coverage given its potential impact on a looming health crisis.

For more than a century, the College of Science has expanded its world-class leadership in fundamental, quantitative and applied research to fight disease and promote health. The rise of biohealth, an interdisciplinary effort to understand and treat the underlying mechanisms of disease, is an opportunity for the College to accelerate discoveries through the breadth and depth of its research. Across seven departments and many interdisciplinary centers and institutes, faculty and students collaborate to pursue new understandings of our most intractable diseases, drawing upon human biology, molecular biology, biochemistry, mathematical and statistical modeling and environmental science. Biohealth, and the College of Science, promise to blaze a path of innovation throughout the 21st century.

Chemist **Sandra Loesgen** is pursuing the development of "drugs from dirt," based on the anti-viral, antibiotic, and anti-tumor properties of metabolites produced by certain fungi and bacteria.

Biochemist/biophysicist **Ryan Mehl** has won two prestigious NSF and NIH grants to expand his Unnatural Protein Facility, the first of its kind in the world. His lab uses genetic code expansion, the insertion of non-canonical amino acids into cell DNA, potentially allowing for the production of hundreds of new proteins and chemical abilities. The technology has the potential to engineer gene-based cures for diseases like atherosclerosis, cancer, chronic pain, neurodegeneration, stroke and more. Through annual conferences and workshops, Mehl is educating scientists around the world about how genetic code expansion can improve human health.

Colin Johnson recently won a five-year, $1.7 million NIH grant to support his pioneering work exploring the role that the protein otoferlin plays in human hearing and potentially devising a gene therapy cure for deafness.

Persisting towards a cure

Joseph Beckman's 24-year pursuit of a cure for amyotrophic lateral sclerosis (ALS) exemplifies the value of persevering despite setbacks on long-term basic research. The baffling pathology of ALS — the gradual and fatal progressive paralysis with the eventual wasting of every single muscle in the human body — was first related to anatomical evidence of motor neuron death in 1869 by the founder of modern neurology, Jean-Martin Charcot.

But why the motor neurons were dying in ALS remained a mystery for another 100 years, until 1993, when the first gene mutation associated with ALS was discovered, raising hopes that scientists could understand the mechanism behind the disease and how to treat it. It was at this point that Beckman unexpectedly entered the scene.

The genetic mutation associated with ALS encodes the same protein, SOD1, that Beckman, a distinguished professor in biochemistry and biophysics, was studying for a different purpose: how to protect the brain from stroke and oxygen radicals. When the genetic link to ALS was revealed, Beckman's work took on a new urgency and dimension. He began testing his theory of how and why SOD1 could go rogue and cause neurons to die, exploring a possible cure for ALS and other progressive neurologic diseases, like Parkinson's.

Beckman's lab made slow but sure progress. They discovered that in ALS in mice, the SOD1 protein was deficient in copper, a critical micronutrient for healthy brain cell function. The copper deficiency posed a tantalizingly clear experiment: deliver copper to the brain. But in practice this was difficult as loose copper is toxic and the brain works hard to keep concentrations very low. So Beckman's Lab used a small molecule, Copper-ATSM, that helps deliver copper specifically to cells with damaged mitochondria and that reaches the spinal cord where it's needed to treat ALS.

For 25 years, no one had been able to extend the life of the most widely used mouse model of ALS by even a month. The results from using Copper-ATSM, published in 2016, were unprecedented: Copper-ATSM could extend the life of these mice by 18 months, approaching their normal lifespan.

Copper-ATSM is currently in clinical trials to evaluate its safety in humans. Beckman's work has opened many doors on other neurodegenerative mechanisms affecting Alzheimer's, Parkinson's and multiple sclerosis and establishing new therapeutic opportunities.

PRESERVING CORAL REEFS **FOR HEALTHY OCEANS**

Our coral reefs are dying. Not only is just the coral reef itself being lost, but also whole ecosystems, a symbiotic "web of life" whose reach extends far beyond the oceans and touches human health as well. We do not yet understand all the intricacies of this web of life. With a backdrop of climate change where many species and entire ecosystems like the coral reefs are under threat, researchers in the College of Science are urgently seeking to enhance understanding of the reefs to prevent further loss.

For nearly three decades, marine biologist **Virginia Weis** has studied coral reefs to pursue these potentially life-saving "known unknowns." Corals comprise interconnected animal hosts called polyps that house microscopic algae inside their cells. The coral-algal symbiosis, or partnership, is the foundation of the entire coral reef ecosystem; the polyps receive food from the algae, and the polyps in turn provide nutrients and protection to the algae. Weis's research is revealing how the symbiotic creatures that form the backbone of a healthy coral reef communicate and how this communication breaks down during environmental stress.

Virginia Weis, Director of the School of Life Sciences (2014–17) and Chair of the Department of Integrative Biology, has devoted her career to exploring symbiotic relationships, which form the backbone of a healthy coral reef.

Weis's recent National Science Foundation (NSF) award will explore this and more. She is one of eight researchers across the country selected for a new $14 million NSF program to develop enhanced genomic tools for more precise insights into how genetic makeup affects an organism's form and function. Building upon her earlier work in 2016 to identify the molecular and cellular interactions that occur during coral bleaching, Weis is leveraging a lifetime of research to map how the symbiotic partnership in a healthy coral reef functions on a genetic, cellular and molecular level. The new understandings and genetic techniques that her team is developing can be used by scientists across a vast field of health and biological research.

By understanding the basic workings of coral-algal symbiosis, we can understand how and if corals can survive and adapt to a rapidly changing planet. The longterm survival of reefs is vital for healthy fisheries, storm barriers, ecotourism and more. They also hold promise for bioprospecting, or finding compounds that are useful to humans as medicines, as our immune systems share some of the same molecular biology that corals do when it comes to stress. In helping save these "rainforests of the sea," Weis's research could spawn potential cures for some of our most serious ailments as well as preserve a global treasure for future generations.

On another coral front, Microbiologist **Rebecca Vega-Thurber** and her team lead an NSF-funded Global Coral Microbiome Project that seeks to document and analyze the macrobiotic diversity in coral reefs around the world, collaborating with researchers at Australia's Great Barrier Reef and Saudi Arabia's Red Sea coast.

The goal of Vega-Thurber's research is clear: To understand how their unique and underexplored microbial communities can help coral reefs withstand and recover from stress or disease in order to help mitigate their worldwide decline due to overfishing, pollution, acidification and climate change.

REVOLUTIONIZING HEALTH THROUGH MICROBIOMES

A palpable urgency is driving microbiome research globally. With chronic diseases on the rise, ever-increasing ecological disruptions, and a mounting need to improve plant and animal agricultural productivity, more and more scientists are looking to microbiomes for answers. While tiny in size, these communities of microscopic organisms have profound effects and may hold the key for an improved understanding of animal, plant and ecological health.

The term "microbiome" worked its way into the nation's dialogue 10 years ago and settled into the public's consciousness. Since then, support and funding for microbiome research has grown substantially.

An assistant professor with joint appointments in microbiology and statistics, **Thomas Sharpton** brings expertise in these two symbiotic areas that give him an edge and a wholly unique perspective on microbiomes.

In May 2016, Sharpton was invited to the White House for the launch of its Office of Science and Technology Policy's National Microbiome Initiative (NMI), a new $121 million federal program to maximize $500 million in philanthropic support from private foundations in order to study the microbes in humans, crops, soils, oceans and more. The initiative aims to coordinate research to understand microbiomes and restore damaged ones, and Sharpton, a nationally recognized microbiome expert, is playing a key role.

> "There's a growing awareness of the importance of the bacteria in our gut microbiome for human health. There are consequences to constantly trying to kill the bacteria in the world around us, aspects we're just beginning to understand."
>
> Thomas Sharpton, assistant professor of microbiology and statistics

The NMI is channeling its $121 million through various federal agencies, including approximately $16 million to NSF to fund microbiome research that spans the spectrum of ecosystems, species and biological scales. In early 2017, Sharpton received $520,000 from these NSF grants to develop computational methods to identify which specific members of the microbiome are important to ecological and human health. Sharpton's Lab is exploring how changes in the operation of the gut microbiome broadly influence human and animal health and evolution.

This year Sharpton launched the Oregon State University Microbiome Initiative (OMBI), a virtual center for microbiome research and education, that plays a key role in supporting the National Microbiome Initiative's mission to foster the integrated and interdisciplinary study of microbiomes across different ecosystems. As a focal area of research, OMBI will help attract sustained external funding to OSU faculty, who have received $10 million in grants for microbiome studies since 2015.

TO SEE THE UNSEEN. A 2017 exhibit at The Arts Center in Corvallis was the culmination of a year's collaboration between microbiologists and artists, part of SPARK, a year celebrating art and science at OSU. A detail from Oregon fiber artist Linda Reichenbach's quilt, left, titled "Beyond the Naked Eye 1" depicts her love of diatoms.

lindareichenbachartquilts.com

STEPPING UP AND SPEAKING OUT

Scientists have often been reluctant to speak out and to step into politics, believing perhaps that it is better to let research speak for itself. But in an era of accelerating climate change combined with "alternative facts," many feel an urgent need to move beyond their comfort zone and find their voice to speak out about the public value of research as well as the value of science itself.

Our scientists are also stepping out of the lab and into the public sphere. The College of Science held a "Science worth Spreading" public outreach event, a TED-like series of talks by OSU scientists on life-changing research to elevate the importance and value of science.

Our scientists are leaders in an ever-evolving movement. Skilled advocate and MacArthur genius award winner and marine scientist **Jane Lubchenco**, a marine biologist who recently won the National Academy of Science's Public Welfare Award, wrote an influential editorial urging all scientists to stand up and use lay-friendly, non-scientific language to champion the merits of science to the general, voting public. Lubchenco uses her trademark optimism and candid manner rather than an all-too-common "imperious, threatening or doom-and-gloom" tone to broadcast successful solutions and ways to scale them, as well as to train the next generation of scientists to engage positively with the public.

> "We must engage more vigorously with society to address the intertwined environmental and social problems that many have ignored, to find solutions, and to help create a better world."
>
> Jane Lubchenco, Distinguished Professor of integrative biology

When scientists act collectively, there is a much better chance that relevant research will cross the desks of policymakers and industry leaders to inform change. Biologist **Francis Chan** co-chaired a 20-member panel of leading West Coast ocean scientists who developed a comprehensive report outlining recommendations to decrease ocean acidification and hypoxia, or extremely low oxygen levels. The report urges the governments of Oregon, California, Washington and British Columbia to take immediate action to offset and mitigate the effects of global carbon dioxide emissions, which are all too rapidly changing ocean chemistry along the West Coast.

Chan's recommendations were grave but hopeful, offering a variety of highly do-able ways to remedy ocean acidification, from planting kelp and eel grass, which remove carbon dioxide, to exploring better breeding techniques for shellfish and cleaner resource management.

Marine biologists **Jane Lubchenco** and **Kirsten Grorud-Colvert** are important voices in the international ocean conservation community. Lubchenco, the U.S. State Department's science envoy on ocean policy issues and former NOAA Administrator, and Grorud-Colvert published a paper in the journal *Science* that highlighted the need for greater ocean protection to support fish stocks and to be better stewards of our oceans.

Microbiologist **Jerri Bartholomew** is changing policy at the local level. A long-term project in the Klamath River integrates monitoring and research to develop recommendations for fishery management by providing real- time data on parasite densities and their predicted effects on juvenile salmon. When parasite levels and water temperatures exceed set thresholds, this triggers river managers to release a pulse of water from the reservoir to reduce disease risk. Models developed by her team link areas of high disease risk with physical parameters, such as water flows and temperature, and forecast how climate change might alter future infection rates.

Jerri Bartholomew, left, Emile F. Pernot Distinguished Professor and director of the Fryer Aquatic Health Center, collects samples from the Klamath River.

OUR STUDENTS

"Coming from a small town, even going to university seemed extraordinary. Research seemed an impossible dream. But here I am pursuing my dream."

Their passion and dedication continually inspire us.

Microbiology major Christina Moody (above right) worked in Bruce Geller's Lab, contributing to groundbreaking research on the construction of a powerful molecule that can inhibit deadly antibiotic-resistant bacteria.

Left, students get hands-on marine science experience at Hatfield Marine Science Center.

Our faculty are internationally recognized for their life-changing research. But it is our 3,600 students who will become the next-generation of leaders in science, leaders who will be called upon to solve our most pressing problems and expand our fundamental understanding of the universe and our place in it. Their passion and dedication continually inspire us.

Nearly 25% of our students are the first in their family to go to college, bringing rich perspectives and unique life experiences, and often a deep commitment to make a difference. They are drawn to Oregon State's reputation for providing transformative opportunities to "get their hands dirty" early on their education, by working in one of more than 100 research labs, collecting data out in the field, gaining valuable experience through an internship, volunteering in the community, studying abroad or collaborating with peers in the physics Worm Hole, a study and tutoring spot on campus.

Whether they pursue fundamental or applied research in academia, industry or non-profits or embark on a meaningful career in health care, actuarial science or education, our students will become tomorrow's leaders working towards a healthy, sustainable future for our planet, people and economy.

OPENING DOORS FOR STUDENT SUCCESS

Lectures are highly interactive in the Learning Innovation Center, a 600-person, theater-in-the-round smart arena equipped with wrap-around screens.

Across the country, universities and colleges are making sweeping changes in response to multiple challenges. Key drivers of this change are technology, funding challenges, falling numbers of high-school students and the needs of non-traditional students, whose enrollment is predicted to rise more than twice as fast as traditional students through 2022.

Oregon State's unique mission as a land, sea, space and sun grant university has always been to broaden access to our world-class teaching, research and outreach. Today's national effort in higher education to better recruit and support non-traditional, underrepresented and first-generation students has always been our main focus. The College of Science is deeply committed to student success, a major focus of our 2015-2020 strategic plan. Using evidence-based strategies, adaptive learning technologies and innovative pedagogy, we are attracting high-achieving students, expanding access to non-traditional students, and improving both first-year retention and graduation rates.

Our student success initiatives have been building momentum over the last two years. From bold experimental pilots to evidence-based innovations with a clear track record of success, effective programs for our students are being scaled to serve many thousands more, on campus or online. We have also strategically invested in a strong team of advisors. To enhance student success, advisors have helped implement a system of predictive analytics from the University Innovation Alliance, a consortium of 11 large public research universities, including OSU, dedicated to improving educational outcomes and degree attainment for all students regardless of socioeconomic background.

Flexible, adaptive learning: anytime, anywhere

Hybrid classrooms that combine online learning components that can be done "anytime, anywhere" with in-class instruction open up highly effective alternate pathways for students. Our online learning platforms give students instant, personalized feedback and continuously adapt content based on a student's evolving competency, eliminating needless repetition and circling back to areas of difficulty till mastery is achieved. Face-to-face time with peers and instructors keeps students engaged and on track.

Math instructor **Sara Clark** redesigned our developmental math sequence, transforming the courses from a traditional lecture-style to an adaptive learning online platform. The new format saved students time and money, improving DFW (D-grade, F-grade or Withdrawal) rates by 30%. In 2016 she won a Digital Learning Innovation Award from the Bill and Melinda Gates Foundation that provided seed funding to share her success with other universities.

ESTEME@OSU: Supported by a $2 million NSF grant, Enhancing STEM Education (ESTEME@OSU) has continued over the last two years to transform calculus-based freshman and sophomore-level courses in biology, chemistry, engineering, mathematics and physics with evidence-based innovations. Capacity in our studio-based Physics for Scientists and Engineers course sequence has increased by 50%, with nearly 600 students participating in active learning in small groups.

Active Learning: In instructor **Devon Quick's** large introductory biology course, up to 300 students sit in a circular arena classroom equipped with wall-to-wall screens. Ten well-trained undergraduate student learning assistants circulate and work with students on assigned questions, engaging them through questions and dialogue to probe the conceptual thinking behind their answers.

VividScience: Biology instructors **Lesley Blair** and **Mark Lavery** teach their popular general biology courses to 1,000 undergraduates each year through the medium of "VividScience," which teaches science through art and design principles and materials. Students move through "object assemblages" including activity stations, exhibits, interactive manuals and lecture performances.

Project Boxsand: instructor **KC Walsh** is researching how students interact with online physics content. His "flipped" classroom (hence the name 'boxsand' instead of 'sandbox') has students engaging with course content online and using class time for problem solving and critical thinking.

Fortifying the STEM pipeline

Across the nation, too many students entering two- and four-year colleges require remedial courses in math. Oregon ranks 40th among all states for academic achievement, and our National Assessment of Educational Progress scores have stagnated for decades while most other states have recorded significant progress. In response, our outreach programs seek to improve K-12 math and science education for greater student equity and success at the college level and beyond.

The Ambitious Math and Science Teaching Fellows project, funded by a six-year NSF Noyce Teaching Fellows grant and co-led by mathematics faculty and OSU's College of Education, is training and supporting 16 teaching fellows to complete the master's degree program in secondary mathematics or science education.

Mary Beisiegel, professor and national leader in mathematics education, uses the Mathematical Quality of Instruction instrument to give teachers scores on multiple dimensions of their teaching. She won a five-year 2016 NSF grant to support her work on curriculum renewal in lower division mathematics courses, collaborating with a consortium of 11 institutions and the Mathematics Association of America. Collectively, their work will impact more than 52,000 students and 200 faculty.

High-impact, transformative experiences

Students are drawn to the hands-on, transformative experiences in the College of Science, from working in a research lab, winning a SURE (Summer Undergraduate Research Experience) scholarship, studying abroad or serving as a leader in one of our 25 science student clubs. In 2016, our College launched an Integrated Professional Development program to accelerate career preparation as well as training and internship opportunities for students.

The human touch

Advisor bots and e-classes may be on the rise, but face-to-face contact remains a powerful influence on students' success. In 2017, we launched a new Science Success Center to accelerate improvements in student advising and engagement and to boost retention and graduation rates within the College of Science.

Stronger Advising Bench: A new STAR advisor (Students Taking Academic Responsibility) and career development advisor for science students enhance our existing support team. They allow us to increase touchpoints with students; strengthen our freshman orientation START program; integrate smarter, data-centric advising tools; and employ predictive analytics. The College is currently improving advising for the roughly 30 percent of its students who transfer from community colleges.

Peer Advisors: Obtaining immediate help on how to prioritize course work, where to find academic resources, and from-the-trenches advice on who to talk to is invaluable to students. Peer Advisors are available 24/7 by text and on a drop-in basis.

Peer Mentors: Upperclassmen provide guidance, support and encouragement for new students to help them navigate the landscape at OSU.

Science Clubs: From bioethics to investigative diagnosis to women in mathematics, more than 25 student science clubs provide community and an organizational hub for study groups, outreach and career networking and advice.

"I GAINED SO MUCH MORE THAN A DEGREE."

—Yuriyah Reed-Harris ('18), Biology

Peer Advisors like Reed-Harris and Andrew Lam (below left) provide unparalleled support for other science students and a personal point-of-contact for parents.

DIVERSITY MAKES FOR **EXCELLENT SCIENCE**

Great science always has great people behind it. Our science community is committed to our core values of excellence, diversity and harmony. We continue to strengthen outreach and support for minority students, women and first-generation college students through academic advising and mentorship programs. We strive to represent the diverse fabric of our nation in our faculty, guest speakers and special events. The best ideas evolve in a context with multiple perspectives and mutual respect. Every member of our community contributes to that richness. Below are initiatives and organizations we invest in to advance excellence through diversity in our College.

OSU STEM Leaders Program is an NSF-funded initiative designed to increase the success of historically underrepresented undergraduate students in STEM fields at the university. First-year students participate in a year-long orientation course, cohort-based workshops, peer mentoring with upper division STEM students, and a paid, faculty-mentored undergraduate research experience culminating in a public symposium where students present their research to the community.

Mi Familia Weekend has a mission to make Oregon State University accessible to Spanish-speaking families, recognizing that the success of students in school is strongly linked to support from family and role models. The College of Science hosts a special session so families can take pride in their student's achievements.

Louis Stokes Alliance for Minority Participation (LSAMP), funded by the National Science Foundation, LSAMP is dedicated to increasing the number of traditionally underrepresented students who successfully complete a STEM baccalaureate degree program. Connecting students immediately to a warm, welcoming community of support where they often make friends for life, LSAMP brings students to campus for 1-2 weeks before classes begin for a residential academic bridge program. Programming continues with exclusive access to mentors, tutors, workshops, a student center and undergraduate research funding.

SURE Science Thanks to the generosity of our alumni and friends, the College has expanded support for underrepresented minorities in our SURE Science program. Undergraduate students received stipends of $5,500 for a summer research experience that complements their academic experience and education and opens doors to a meaningful career path. Students spend their summer actively engaged in research while working alongside faculty for an engaging, hands-on learning experience. In 2017, 65% of the 31 SURE students were from underrepresented minorities and non-traditional backgrounds, versus 25% in 2015.

OSU ADVANCE This NSF-funded program is aimed at increasing the participation and advancement of women in academic science and engineering careers in order to develop a more diverse STEM workforce. Our College has had high participation from faculty since this program began in 2014.

BioHealth Sciences major Ido Almog found his STEM Leaders Program freshman seminars invaluable, giving him a "reality check on where I was and what I needed to do next." As a sophomore, he is currently working in a research lab on human aging.

GRADUATE STUDENTS WHO GO BEYOND

Claire Couch, an ARCS (Achievement Rewards for College Scientists) scholar, did her doctoral research at South Africa's Kruger National Park introduces novel ecological approaches to study the transmission of respiratory disease in African buffalo.

The College of Science graduate programs are building the next generation of leaders in science, producing top educators, researchers and doers across a wide variety of in-demand STEM fields. Our graduation rates are trending up: in 2017, we graduated a record-breaking 64 master's and 66 doctoral students, a 33% and 66% increase respectively over the previous year.

Attracting the best and the brightest

World-class faculty and facilities across seven departments and 13 interdisciplinary programs offer unparalleled and unique opportunities to pursue research with global impact, from studying the evolution of plant viruses with Vrushali Bokil to evolving cutting-edge computational tools for discovering sustainable materials with Paul Cheung.

Business opportunities abound in Corvallis, recently voted the most innovative city in the United States based on number of patents per capita. Student entrepreneurs are drawn to this hub for start-up industries from high tech to food and forest products, innovative materials and advanced manufacturing, energy/clean technology and more.

Two NSF-funded programs targeting graduate students will have broader, long-lasting influence:

A $3 million, five-year NSF Research Traineeship will build cohorts of leaders trained in marine science, data analytics and policy in order to study, protect and manage ocean systems. This innovative pilot program can be applied to any program where big data competency enhances research.

A 2017 NSF Research Traineeship in Innovations in Graduate Education is helping develop STEM professionals skilled in bringing innovation to market thanks to Lens of the Market ™, a team-based, experiential curriculum that guides students in designing research to address market needs while honing their entrepreneurial skills.

Going wherever their passion leads

Our NSF Graduate Research Program Fellows go wherever their research takes them, persisting despite obstacles and unexpected twists. In the last two years, eight graduate students in the College of Science have received the prestigious award.

Becca Maher will use her NSF award to travel to the Gump Research Station on Mo'orea, French Polynesia to investigate how predation by parrotfish and elevated nutrient levels affect coral microbiome and the rate of coral death. The project is a natural continuation of Maher's long-held passion for travel and regional conservation. She has participated in eco-tourism and biodiversity conservation projects in Latin America; directed a year-long Engineers Without Borders project to modernize a water distribution system in Nicaragua, conducted marine research in Honduras, and studied the impact of endangered capuchin monkeys on a cloud forest reserve in Ecuador.

Claire Couch recently returned from an eight-month visit to Kruger National Park, one of the largest of South Africa's game reserves, where she sedated highly dangerous African buffalos with tranquilizer darts to collect blood and tissue samples. She then did lab tests to determine the sex, age, health, disease pathogens and nutritional status of the animal as well as other demographic and genetic data. Ultimately, she hopes her research will improve the tracking and management of African buffalo respiratory disease outbreaks, which have broad ecological and economical impacts.

Nathan Waugh dropped out of high school at the age of 16 and worked in a number of low-paying, jobs. Six years later, "on a whim," he enrolled in night classes at nearby Weber State University in Ogden, Utah, where, surprised by his aptitude for math, he graduated magna cum laude with a double major in physics and mathematics.

In OSU's biophysics and biochemistry graduate program, Waugh finds his physics background helps him to "tie things together in a mechanistic way." His award-winning NSF proposal, "Binding artificial amino acids to surfaces" addresses the problem of improper adsorption of proteins to non-biological surfaces that results in insufficient experimental results, wastage of surface area and the risk of cross-contamination.

OUR OUTREACH

Research that sits on a shelf helps no one.

Our College hosted the Pacific Northwest chapter of the American Physical Society Conference for Undergraduate Women in Physics conference in January 2016. The three-day conference offered undergraduate women in physics a unique opportunity to explore careers in science through panel discussions and workshops by women physicists, discussions about women and underrepresented minorities in physics, lab tours, poster sessions and opportunities for students to network with peers and professionals.

Advocacy and communication are the essence of science. Excelling in outreach, engagement and visibility is therefore an integral part of the College's mission. From promoting scientific literacy and the value of science, to launching startup companies, influencing smarter policy and increasing public and private support, outreach ensures that the critical work we do achieves maximum impact.

As part of its five-year plan, the College is deepening its engagement with Oregonians and people around the globe via online technologies, stories, events and calls-to-action. We are expanding partnerships to promote lifelong learning, civic engagement and online degree completion near and far. We continue to enhance engagement with alumni and friends to advance and support our mission. Our connections across Oregon continue to deepen — from the coast with an expanded Marine Studies Initiative to new programs at the Cascades campus as well as Portland, home to 26 percent of OSU alumni.

Last but not least, the College of Science is driving economic development in Oregon and beyond by nurturing innovation and helping to build an ecosystem for successful translation of fundamental research into a wide range of societal benefits.

HARNESSING A GLOBAL NETWORK

To advance knowledge and innovation in these critical times, science must reach a global audience quickly. Even before it leaves our campus, much of our research has gone viral, a tribute to its relevance and our collaboration with colleagues around the world to get things done. Our 28,000 alumni and more than 100 students who travel and study abroad every year help us distribute science more broadly. Each year we welcome scientists from across the country and around the world to present ideas and learn in our state-of-the-art laboratories and conferences.

The 2016 International Indian Statistical Association Conference (IISA), a unique, landmark event in the field of statistical sciences in Oregon, attracted 200 participants in academia, industry, government and research institutes from around the world. With a theme of "Statistical and Data Sciences: A Key to Healthy People, Planet and Prosperity," the conference featured more than 50 award-winning speakers and panel discussions on statistical innovation and applications in areas ranging from big data to genomics, climate science, public health and biomedical science.

A 2017 International astrophysics conference on the physics and observations of supernovae, supernova remnants and other cosmic explosive phenomena drew nearly 30 astrophysicists from seven different countries, including Denmark, Japan, Ireland, Britain, Italy and the United States. The speakers discussed topics ranging from neutrino emission to gravitational waves and gamma-ray bursts. In addition, there were 50 contributed talks by physicists from a wide variety of universities and research institutes as well as a poster session.

The first-ever **Genetic Code Expansion (GCE) Conference** was hosted at OSU in August 2016 in what promises to be a biennial event. Nearly 100 scientists from industry, academia and other research institutions converged to discuss the latest GCE techniques and approaches applicable to drug discovery efforts, material science, bioorganic chemistry within cellular and molecular processes, the development of interdisciplinary research tools and probes and more. The conference was chaired by **Ryan Mehl**, director of OSU's Unnatural Protein Facility, the first laboratory of its kind providing researchers around the world with full access to current non-canonical amino acid protein production capability.

Physicist Davide Lazzati organized FOE Fifty-One Erg in 2017, an international workshop featuring nearly 30 astrophysicists presenting their research on supernovae, supernova remnants and other cosmic explosive phenomena.

The conference was preceded by a weeklong GCE workshop for researchers around the world to bring their experiments to the lab to collaborate, problem solve and resolve challenges that may have stumped them back in their home labs.

The inaugural 2017 **Biological Nuclear Magnetic Resonance (NMR) Symposium** drew over 100 participants across the Pacific Northwest to understand how NMR is illuminating biology and how OSU's expanded NMR facility can accelerate their research. The facility includes a new 800 MHz Macromolecular Nuclear Magnetic Resonance instrument, the highest field NMR in Oregon and one of only 50 nationwide. The facilty offers state-of-the-art spectroscopy resources for advancing research on protein folding, gene discovery and biochemical structural informatics used to treat diseases, such as Alzheimer's and cancer.

In 2016 the Department of Mathematics hosted the **Computational Representation Theory in Number Theory Conference**, with 35 invited speakers and participants from universities across the United States as well as from the United Kingdom, Canada and Switzerland.

ENLIGHTENING CONVERSATIONS: **DISTINGUISHED SCIENCE LECTURES**

The College of Science Distinguished Lecture Series brings fresh perspectives, pioneering research and impactful innovations to stimulate conversations on campus that are incredibly important for us to have as we reflect on the value and future of science. The dialogue and learning inspire small-to-large shifts in how we think, educate and advance science to improve our people and planet.

Why diversity makes for excellent science
Our 2017 Spring Distinguished Lecture featured Sylvester James "Jim" Gates, Jr., a National Medal of Science recipient and physics professor at the University of Maryland. Gates, the first African American to hold an endowed chair in physics at a major research institution in the United States, explored the importance of diversity to scientific progress and achievement. Gates employed scientific and historical perspectives to illuminate how fostering racial diversity and closing the equity gap in STEM fields are essential for scientific excellence and social harmony.

Taking a scientific approach to learning and teaching science (and most other subjects)
The 2016 Fall Distinguished Lecture with Nobel Laureate Carl Wieman, a Stanford physicist and Corvallis native, examined why science education has remained largely "medieval" even while science itself has advanced rapidly in the past 500 years. Wieman shared his research and ideas on how "active learning" is dramatically more effective than a more traditional lecture-based approach.

Diversity and Inclusion: Grand Challenges for Science and Engineering The 2016 Spring Distinguished Lecture featured Shirley Malcom, Head of Education and Human Resources Programs for the American Association for the Advancement of Science and an international leader in opening STEM pathways to women. Malcom explored how enlarging and diversifying the STEM talent pool, both across our country and around the globe, are urgent considerations as we prepare the next generation of leaders in science.

Sylvester James "Jim" Gates


Carl Wieman


Shirley Malcom

SPREADING SCIENCE TO COMMUNITIES EVERYWHERE

Deeply enriching and consequential: our local outreach continues to expand. Investing in our local and regional community enables us to cultivate local friends and supporters to help us spread the word about our research and the value of science, seed excitement in elementary-, middle- and high-school students, partner with educators to strengthen the K-12 STEM pipeline and influence smart policy at state and federal levels.

The 72nd **Northwest Regional Meeting of the American Chemical Society** was hosted by the College in June 2017 with featured speakers addressing topics ranging from green chemistry, nanotechnology, biotechnology and biomedicine to environmental, atmospheric, polymer, industrial, and nuclear chemistry. Also on tap was the chemistry of Oregon's famous beers and wine.

Beakers and bunks! Eighteen Latino high school students across Oregon enjoyed the first **overnight chemistry camp** on campus in June 2017 as part of the OSU Juntos Program, which educates and empowers Latino families around education and college-readiness.

More than 50 Oregon math and science teachers, teacher candidates, and education leaders flocked to campus for the inaugural **Ambitious Math and Science Summer Institute** in June 2017, co-sponsored by the College of Science, the College of Education and the Oregon Department of Education. Ambitious teaching aims to support all students—across ethnicity, race, class and gender identity—to not only build knowledge, but to deepen their understanding of content to solve relevant real-life problems.

Professor of Statistics and former Dean Sastry G. Pantula makes friends with an alligator during Discovery Days, a beloved campus outreach tradition for K-12.

The College of Science hosted the statewide **Science Olympiad**, "the nation's most exciting K-12 science competition" in April 2017. Middle-school and high-school students who won regional championships earlier in the year competed in one of 23 categories across STEM disciplines, ranging from "Astronomy" to "Robot Arm," "Hydrogeology," and "Food Science."

More than 1,500 elementary students flock to campus twice a year for one of our most popular and beloved traditions, **Discovery Days.** The outreach program immerses students in a wide variety of hands-on learning exercises such as trying chromatographic tie dying, exploring dry ice experiments, observing a live juvenile alligator, experiencing static electricity and visiting dozens of stations that showcase chemistry, zoology, physics, marine science and engineering. Rich and dynamic exposure to science at the middle- and high-school levels has been shown to influence interest in pursuing a STEM career in college.

Science worth spreading involved a series of powerful, stimulating 7-minute talks from scientists in our own backyard at Oregon State followed by a mind-bending community conversation about science was held on Earth Day 2017. The free public talks, with topics ranging from our changing oceans to discovering drugs from dirt to promising science start-ups across Oregon, were held in OSU's Learning Innovation Center, a 600-person, theater-in-the-round smart arena equipped with wrap-around screens.

Young women explore hands-on science at Discovering the Scientist Within designed to introduce middle school girls to careers in science, technology and engineering.

OUR HONORS

Our scientists pursue knowledge with passion and purpose.

(Left) Distinguished Professor Douglas A. Keszler is presented the American Chemical Society (ACS) Award in the Chemistry of Materials by Allison A. Campbell, ACS President and sponsor representative John Gavenonis. The American Chemical Society is the world's largest scientific society. Photo by Peter Cutts / ACS

(Top) Integrative Biology faculty Brock McLeod, Bob Mason, Lori Kayes, Virginia Weis, Devon Quick and their partners attend University Day, OSU's prestigious awards ceremony.

Our faculty and students receive national and international honors and accolades. We are terrifically proud of them and the diverse individuals, students, support staff and families in our broader College of Science "OneScience" community who make their achievements possible. Our scientists pursue knowledge with passion and purpose.

Our world-class faculty work at the intersection of the biological, mathematical, physical and data sciences to educate new scientists, to make discoveries and to innovate. They often toil tirelessly for years and decades to advance their research encountering points of discovery, setbacks, fits and starts and recalibration before reaching those aha! moments and making a significant impact. Scientific breakthroughs are often the result of immense tenacity and patience over the long-term and perseverance through obstacles, unexpected results, the inevitable curveballs and even a bit of serendipity.

Our faculty across all disciplines strive to create knowledge as a means of advancing science to improve the world, leveraging their talents for the greater good. The well-deserved awards and recognition our faculty have earned affirm the value of their contributions, research and public service in both expanding the boundaries of our knowledge and innovating towards a healthier future for our planet, people, and prosperity.

Faculty Awards 2016–17

BIOCHEMISTRY & BIOPHYSICS

Kevin Ahern won the Phi Beta Kappa Society Best Mentor/ Advisor Award.

CHEMISTRY

Chong Fang received the Oregon Medical Research Foundation's New Investigator Award.

Douglas Keszler won the American Chemical Society's national Chemistry Materials Award.

Daniel Miles won the Phi Beta Kappa Society Best University Instructor Award.

Richard Nafshun received the 2017 Outstanding Educator in Science and Mathematics, Higher Education Award by the Oregon Academy of Science.

INTEGRATIVE BIOLOGY

Jane Lubchenco won the National Academy of Sciences' most prestigious award, the Public Welfare Medal, honoring individuals "who have worked tirelessly to promote science for the benefit of humanity."

Jaga Giebultowicz received a Fulbright research and teaching scholarship for a year at the University of Warsaw in Poland.

MATHEMATICS

Sara Clark won a Digital Learning Innovation Award from the Bill and Melinda Gates Foundation's Online Learning Consortium, recognizing her work in overhauling developmental math at OSU with an online learning platform.

Juan Restrepo won the Society for Industrial and Applied Mathematics' Geosciences Career Prize for his impressive and extensive leadership in mathematical modeling and numerical simulation of oceanography and climate dynamics.

Mary Beisiegel received the Mathematical Association of America's 2017 Henry L. Alder Award for Distinguished Teaching by a beginning university mathematics faculty member.

Tevian Dray received the 2017 Deborah and Franklin Tepper Haimo Award for distinguished university teaching of mathematics from the Mathematical Association of America . The award recognized his exemplary mathematics teaching and his positive influence on college mathematics curriculum development and teacher training on regional and national levels.

Elise Lockwood received a five-year, $800K National Science Foundation (NSF) CAREER Award for her project, "Developing Undergraduate Combinatorial Curriculum in Computational Settings."

MICROBIOLOGY

Jerri Bartholomew, the Emile F. Pernot Distinguished Professor and Head of the Microbiology Department, was awarded the American Fisheries Society (AFS) S.F Snieszko Distinguished Service Award for her outstanding accomplishments in the field of aquatic animal health. This lifetime achievement award is the highest honor presented by the Fish Health Section of the AFS.

PHYSICS

Matthew Graham was awarded a 2017 SPIE Defense and Commercial Sensing Rising Researcher award, one of only 10 scientists across the country to receive the honor.

Student Awards 2016–17

Bethany Matthews won a U.S. Department of Energy Office of Science Graduate Student Research Award to continue her work on how atoms connect and how changing these connections influences how atoms behave, at the National Renewable Energy Laboratory in Golden, Colorado.

Gregory Mirek Brandt, a junior studying physics and mathematics, and **True Gibson**, an Honors College junior majoring in biochemistry and biophysics, both received Goldwater Scholarships. Brandt and Gibson are not only Goldwater Scholars, but are neighbors who have been best friends since first grade. They attended the same elementary, middle and high schools before enrolling at OSU.

Biochemistry and biophysics senior **Arianna Kahler-Quesada** and integrative biology doctoral student **Ian Morelan** were selected for the Fulbright Scholarship as was biochemistry and biophysics alumna **Lynda Bradley** ('15).

Three Ph.D. students received prestigious National Science Foundation Graduate Research Fellowship Program awards in 2017: **Rebecca Lucia Maher** in microbiology and **David Lynn Hubert** and **Claire Couch** in integrative biology.

Biochemistry and molecular biology junior **Tricia Chau** received a 2017 Tunison Scholarship from OSU's chapter of the honor society Phi Kappa Phi for her impressive scholarly achievements.

Four doctoral students were selected as 2016 ARCS (Achievement Rewards for College Scientists) Foundation Scholars from the Portland chapter: **Gisela Abigail Gonzalez-Montiel, Shannon Hennessey, William "Bryce" Penta** and **Dallas Foster.**

Ph.D. student **Heather Kitada** and her team took first place in the ResearchHack 3.0 competition, hosted by the U.S. Census Bureau, at the 2017 annual conference of the American Association of Public Opinion Research. She wrote a Shiny App that provided innovative and useful insight on employing data from several sources to help non-profits in planning future fundraising endeavors.

The OSU chapter of SACNAS (Society for Advancement of Chicanos/Hispanics and Native Americans in Science) won the 2015 Outstanding Development and Outreach Role Model Award, one of 13 chapters recognized for outstanding achievements.

Faculty Awards 2015–16

CHEMISTRY

Chong Fang won the Robin Hochstrasser Young Investigator Award and the Honor Society of Phi Kappa Phi Emerging Scholar Award

Xiulei (David) Ji was awarded a five-year $530,000 National Science Foundation CAREER Award for his project, "Carbon Anodes in Potassium-Ion Batteries."

Walter D. Loveland was elected a 2015 Fellow to the American Association for the Advancement of Science (AAAS), the world's largest general scientific society.

Mas Subramanian won the Outstanding Scientist Award by the Oregon Academy of Science.

INTEGRATIVE BIOLOGY

Jane Lubchenco received the 2016 Linus Pauling Legacy Award

David Maddison and his twin brother Wayne Maddison, a professor in the departments of zoology and botany at the University of British Columbia, were honored with the Society of Systematic Biology's prestigious Presidents' Award for Lifetime Achievement.

MATHEMATICS

Tevian Dray won the Outstanding Educator in Science and Mathematics, Higher Education Award by the Oregon Academy of Science (OAS).

PHYSICS

Janet Tate was elected a Fellow of the American Physical Society, a rare and highly prestigious honor that is conferred upon no more than one half of one half percent of the society's membership, in honor of her outstanding contributions to physics.

Heidi Schellman won the inaugural 2015 Mentoring Award by the American Physical Society's Division of Particles and Fields.

Corinne Manogue won the Outstanding Educator in Science and Mathematics, Higher Education Award by the OAS.

STATISTICS

Sastry G. Pantula was honored for his outstanding and extensive service to the statistics profession with the 2016 Paul Minton Service Award from the Southern Regional Council On Statistics at the 2016 Joint Statistics Meeting.

Debashis Mondal was awarded the 2015 Young Researcher Award by the International Indian Statistical Association (IISA).

Student Awards 2015–16

Microbiology doctoral student **Stephanie Rosales** spent two months in Nepal on an NSF Graduate Research Internship Program (GRIP).

Natalie Hambalek, an integrative biology master's student, was one of four students nationwide to receive the Graduate Student Policy Award by the Ecological Society of America.

Integrative biology doctoral students **Holland Elder** and **Caroline Glidden** received the prestigious National Science Foundation Graduate Research Fellowship Program awards.

OUR COLLEGE

Our mission is at the intellectual heart of Oregon State University.

(Above) Kidder Hall, now home to the College of Science, was formerly Oregon State's library, built in 1919 and named after its first professional librarian, Ida Kidder.

Our Mission: To advance science and build global leaders for a healthy people, living on a healthy planet, in a healthy economy.

For nearly a century, the College of Science has thrived through intellectual exploration, the quest for new knowledge, translation of discoveries into good use, solutions to society's most pressing problems and communication of science across Oregon, nation and the world. Our mission is at the intellectual heart of Oregon State University's larger mission as a comprehensive, research-intensive public land-grant university, one of only two universities in the U.S. to have land, sea, space and sun grant designations. While each of these grants have a separate focus, a common thread is the integration of teaching, research and extension.

Founded in 1932 as the School of Science, the College of Science has been advancing the frontiers of knowledge and delivering discoveries to enable transformative contributions to OSU's signature areas of distinction encompassing sustainability, health and economic well-being for 85 years.

Our distinction lies in the depth of our intellectual engagement and the breadth of our scholarly work in the life, physical, mathematical and computational sciences. Through investments in these areas, we inspire and build leaders in science.

SCIENCE FOR THE 21ST CENTURY

Zoology major Ellie Bohrer was delighted to attend the 8th International Symposium on Canine and Feline Reproduction in Paris, France, thanks to the College's Student Travel Award Fund supported by generous donors.

Undergraduate Majors

Biochemistry and Biophysics
Biochemistry and Molecular Biology
Biology
BioHealth Sciences
Chemistry
Mathematics
Microbiology
Physics
Zoology

Master's Degrees

Biochemistry and Biophysics
Chemistry
Integrative Biology
Mathematics
Microbiology
Physics
Statistics, including Data Analytics (online)

Doctoral Degrees

Biochemistry and Biophysics
Chemistry
Integrative Biology
Mathematics
Microbiology
Physics
Statistics

Departments

Biochemistry & Biophysics
Chemistry
Integrative Biology
Mathematics
Microbiology
Physics
Statistics

Interdisciplinary Programs

Data Analytics Certificate (online)
Ecosystem Informatics (Ph.D.)
Environmental Sciences
Geographic Information Science Certificate
Geographic Information Science Graduate Certificate
Molecular and Cellular Biology Graduate Program
Natural Resources
Pre-Health Professions
Pre-Education
Science and Math Education
Subsurface Biosphere Interdisciplinary Graduate Program
Water Resources Graduate Program

By the numbers

3,000
undergraduates

350
graduate students

124
tenure/tenure-track faculty

300
total faculty

3.66
average GPA of incoming students

33%
of Honors College students are science majors

66%
average medical school admittance rate, one of the highest in the country

12/16
Goldwater Scholars at OSU were science majors

3/6
Fulbright Scholars at OSU, 2017

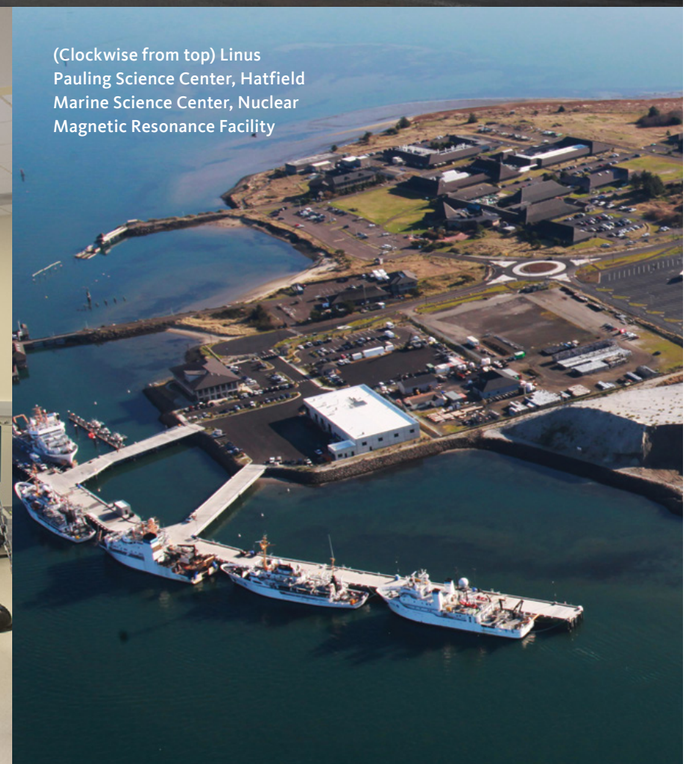
15/44
OSU Fulbright Scholars were science majors since 1965

11/20
Gilman International Scholars at OSU were science majors, 2015-16

19
Distinguished Professors, the highest of any College at Oregon State

2
National Academy of Science members

FACILITIES THAT ACCELERATE DISCOVERY



(Clockwise from top) Linus Pauling Science Center, Hatfield Marine Science Center, Nuclear Magnetic Resonance Facility

The College of Science builds upon 150 years of storied history that defines our campus and begets great science. Unique, state-of-the-art technology, labs and equipment allow researchers and students at OSU — as well as the Pacific Northwest and beyond — to conduct world-class research on campus.

These state-of-the-art structures anchor the prominent position for Oregon State science. Together with the university, we have made significant strides to increase both the academic and research footprint on campus. Facilities represent vital operational and strategic components of the university's research enterprise, especially in science. Taking a transdisciplinary approach to address society's most pressing issues, OSU researchers collaborate in three key areas: advancing the science of earth ecosystems, improving human health and wellness, and promoting innovation and economic prosperity.

Linus Pauling Science Center: The 105,000-square-foot teaching and research facility is named for OSU alumnus and two-time Nobel laureate Linus C. Pauling '22, one of the greatest researchers of the 20th century. Featuring newly-designed, contiguous laboratory space, the facilities foster interdisciplinary collaboration to further understanding how nutrition and micronutrients prevent chronic and debilitating diseases.

John L. Fryer Aquatic Animal Health Laboratory: This regional fish disease facility is dedicated to the study of disease in salmonids and other species of freshwater fish. With 9,000 sq. ft. of wet and dry laboratories, the facility gives researchers the space to work in heat and chilled conditions, a boon for scientists studying the effect of climate change on aquatic organisms. Water drawn from the nearby Willamette River helps model natural conditions.

Electron Microscopy Facility: The facility provides advanced electron microscopy instrumentation services to research communities at OSU and throughout the Pacific Northwest. Instruments include the newly installed Titan 80-200 analytical transmission/scanning transmission electron microscope, used to visualize the structure, chemical composition and arrangement of atoms in thin, extraordinarily small specimens. It is one of only two at a U.S. university.

Nuclear Magnetic Resonance (NMR) Facility: With the highest field NMR spectrometers in Oregon with fields of 800 MHz and 700 MHz, the facility provides unique capabilities for biological, biomedical, chemical and environmental research, a regional NMR resource for businesses/industry, national labs and colleges and universities throughout the Pacific Northwest.

Mass Spectrometry: A central pillar in the interdisciplinary network of research on campus, the Center offers state-of-the-art service in mass spectrometry. Researchers from chemistry, biochemistry/biophysics, environmental toxicology, botany/plant pathology, microbiology, pharmacy, food science, agricultural science and other fields collaborate at the facility.

Center for Genomic Research and Biocomputing (CGRB): Since the 1980s, the CGRB has sought to improve health, to better use natural and agricultural resources, to understand the global environment, and to develop new bio-based products and energy sources. The CBGR facilitates genomic and data-driven research in the life and environmental sciences across Oregon and is the intellectual home to more than 120 OSU faculty.

Center for Sustainable Materials Chemistry (CSMC): A $20 million, NSF Center of Research Excellence in Science and Technology, the CMSC conducts curiosity-inspired research, giving rise to new methods and techniques that will transform new generations of products while preparing students to become the next generation of green chemists.

Hatfield Marine Science Center (HMSC): Located on the Oregon Coast, an unparalleled living-learning laboratory with diverse ecosystems, the Center is a leading marine lab with research and education programs from seven OSU colleges and six state and federal agencies on the 49-acre Newport campus. HSMC is the site of the new OSU Marine Studies Initiative (MSI) with the construction of a 72,000-sq-ft facility planned for 2019. The expanded campus will leverage OSU's deep expertise in marine science to foster creative collaborations and create meaningful impacts. Students will live and learn at the ocean, addressing challenges facing Oregon and the world.

BOARD OF ADVISORS

New board member Prabu Nambiar (left) welcomed by former board member Suzanne P. McGrath (right). Our Board's collective expertise across a broad range of industries helps guide us towards our strategic goals.

Jan Armstrong ('57)
Retired Director of Community Relations
Kansas City Southern Industries

Rich Carone ('72)
CEO
Korvis Automation

Judy Faucett ('70) +
Retired Senior Vice President
Equitable Life Assurance (now AXA US)

Eileen Hartmann ('74, '76) +
Retired
Certified public accountant

Keith E. Krueger ('86)
Private dental practice
Bend, Oregon

Suzanne P. McGrath ('70) *
President
Vision Capital Management, Inc.

Doug Morton ('66)
Executive Director
Woodruff-Sawyer & Co.

Prabu Nambiar ('88) +
Founder and Principal
Syner-G Pharma Consulting

Joel Peterson ('69)
Founder
Ravenswood Winery

Susan H. Poole ('69) *
Retired
OSU Student Health Services

Heather Runes ('01) +
Head of Quality Services
Genentech

Ronald Schoenheit ('65)
President
Cascade Coil Drapery

Gretchen Schuette ('80) *
President Emeritus
Chemeketa Community College

David Vernier ('76)
Co-founder
Vernier Software & Technology

Brad Zenger
Founder and Managing Director
Pivotal Investments

\+ Joined Board of Advisors in 2017
* Served 2014–2017

GAINING MOMENTUM

Biology alumna Claire Skach
photographed by OSU student Nicki Silva

The **College of Science** has experienced strong gains in the past two years, with extraordinary accomplishments in the areas of student success, faculty research, outreach and engagement, visibility and fundraising.

The past two years have been filled with milestones. We attracted the most high-achieving students at the University, graduated the highest number of students in six years — the most in more than a decade, awarded the third most degrees at OSU and welcomed nearly one-third of our students from underrepresented minority populations. We launched a new biochemistry and molecular biology major and, in data analytics, completely online master's and certificate programs. We reached our second highest year for research funding in five years and set a record-breaking year for fundraising with $6.2 million in gifts.

We will continue to invest in attracting the best and brightest minds to science at Oregon State. Four new faculty awards support research and teaching excellence. Providing access to a world-class education to all students is an important part of OSU's land-grant mission and will be critical to sustaining our excellence and momentum.

We reach for our vision as a world-class leader in science education and research, building on our wide-ranging breadth as well as core strengths in marine, materials, biohealth and data sciences. Our path forward is grounded in our commitment to diversity and inclusion and guided by a rich and enduring 150-year old heritage. With every student, we expand our vision and fulfill our mission to transform the world through science.

Metric	Baseline 2013–14	Current 2017	Target 2020
Bachelor's Degrees Awarded	530	**577**	680
Master's Degrees Awarded	51	**56**	65
Doctoral Degrees Awarded	28	**55**	38
First-Year Retention Rate	86%	**81%**	91%
Six-Year Graduation Rate	63%	**67%**	67%
Junior Transfer 4-Year Graduation Rate	53%	**59%**	72%
High-Achieving Oregon High School Graduates	46%	**57%**	52%
U.S. Minority Students* in the College	29%	**32%**	35%
International Students	6%	**7%**	13%
External Funding	$18M	**$19M**	$21M
Invention Disclosures	14	**7**	22
Annual Private Giving and Grants	$4M	**$6M**	$6M

* Includes African-American, Asian, Pacific Islander, Hispanic, Native American, or those reporting "two or more races." Excludes international students.

OUR FACULTY

A diversity of perspective brings unsolvable mysteries to light.

Thomas Sharpton (left), assistant professor with joint appointments in microbiology and statistics, presents the OSU Microbiome Initiative's inaugural lecture by award-winning science writer Ed Yong.

Javier Rojo (above left), an internationally renowned statistician, joined as the inaugural Korvis Professor of Statistics in 2017 from Rice University where he directed the nation's first Research Experiences for Undergraduates in statistics.

Afua Nyarko (above right), assistant professor of biochemistry and biophysics, is one of a few scientists worldwide studying proteins from a structural biology perspective.

Our 200 faculty share a deep commitment to fundamental research and discoveries to improve the quality of life for everything and everyone on the planet and to the building of future leaders in science. They are also deeply engaged in general education, advocacy and outreach efforts to expand scientific literacy for all, maximize the impact of scientific research and inform smarter policy on a local, national and global level.

At a land grant university with a 150-year-old mission to educate all students, apply research to solving problems and create new opportunities for our nation's collective health and prosperity, our faculty never forget that their research and teaching is built on a foundation of public trust. It remains our moral imperative to teach a science class to every student who passes through OSU's doors. Research that collects dust on a shelf does no one any good. If novel scientific evidence brings fresh perspective to tired public discourse and debate, now is the time to air it to seed new thinking.

Above all, we are proud of the world-class research, community and leadership that our faculty, across seven departments and a wide array of fields — from microbiology to marine science, from biohealth to data analytics, mathematics to materials, and from physics to chemistry — bring to the table. The rich conversations and collaborations nourish a constant questioning of our purpose, a constant stream of innovation in the lab and in the classroom, and a constant diversity of perspective that brings even the most unsolvable mysteries to light.

FACULTY HIGHLIGHTS

A DISTINGUISHED LEGACY
The Provost and Executive Vice President awards the title of OSU Distinguished Professor to professors who have achieved truly exceptional records in teaching and advising; in research, scholarly, or creative work; and in outreach and service.

Left: Distinguished Professors P. Andrew Karplus and (inset) Jo-Ann Leong and John Fryer.

Distinguished Professors

2015
P. Andrew Karplus, Biochemistry and Biophysics

2013
Joseph Beckman, Biochemistry and Biophysics

2012
Andrew Blaustein, Integrative Biology
Stephen Giovannoni, Microbiology

2010
Balz Frei, Biochemistry and Biophysics

2006
Douglas A. Keszler, Chemistry

2005
Bruce A. Menge, Integrative Biology

1998
Arthur W. Sleight, Chemistry

1996
Frank L. Moore, Integrative Biology

1994
William Sandine, Microbiology

1993
Jo-Ann Leong, Microbiology
Jane Lubchenco, Integrative Biology

1992
James D. White, Chemistry

1991
Arthur Boucot, Integrative Biology
Christopher Mathews, Biochemistry and Biophysics

1990
John Fryer, Microbiology
Donald J. Reed, Biochemistry and Biophysics

1989
T. Darrah Thomas, Chemistry

1988
Kensal van Holde, Biochemistry and Biophysics

National Academy of Science

Jane Lubchenco, Integrative Biology
K.E. van Holde, Biochemistry & Biophysics

American Association for the Advancement of Science

Christopher Bayne, Integrative Biology
Andrew Blaustein, Integrative Biology
Kenneth Hedberg, Chemistry
P. Andrew Karplus, Biochemistry and Biophysics
Walter Loveland, Chemistry
Jane Lubchenco, Integrative Biology
Christopher Mathews, Biochemistry and Biophysics
Bruce Menge, Integrative Biology
Sastry G. Pantula, Statistics
Vince Remcho, Chemistry
Bob Smythe, Statistics

Strategic Provost Hires

BIOINFORMATICS
Patrick De Leenheer, Joint appointments in Mathematics and Integrative Biology
David Hendrix, Biochemistry and Biophysics
Duo Jiang, Statistics
David Koslicki, Mathematics
Thomas Sharpton, Joint appointments in Statistics and Microbiology

BIG DATA
Sharmodeep Bhattacharyya, Statistics
Debashis Mondal, Statistics
Benjamin Dalziel, Joint appointments in Mathematics and Integrative Biology

MARINE STUDIES
Felipe Barreto, Integrative Biology

TENURED FACULTY DIVERSITY INITIATIVE
Juan Restrepo, Mathematics
Javier Rojo, Statistics

STUDENT SUCCESS
Afua Nyarko, Biochemistry and Biophysics
Elizabeth Gire, Physics

DUAL CAREER HIRES
Andrew Thurber, Microbiology
Molly Burke, Integrative Biology
James Strother, Integrative Biology

OUR ALUMNI

Alumni and friends extend our reach and impact around the globe.

Our 28,000-strong community of alumni form a vast worldwide network of friends, donors and advocates for science. Here is but a small sampling of some of our impressive achievers.

After graduating magna cum laude with degrees in biology and chemistry, Megan Cook (left) plunged into her career as an ocean ambassador working to bridge the areas of science, communication, industry and exploration.

Above: Chung Kwai Li and Jon DeVaan

John Blankenberger ('52) is credited with developing the first commercially available personal computer, pre-dating the Apple 1 by five years.

Peggy Cherng ('72) is co-founder of the restaurant chain Panda Express and currently #11 on Forbes list of self-made women.

Jon DeVaan ('85) is the former senior vice president for Windows Development at Microsoft who led teams that developed Microsoft Office, Excel and other products.

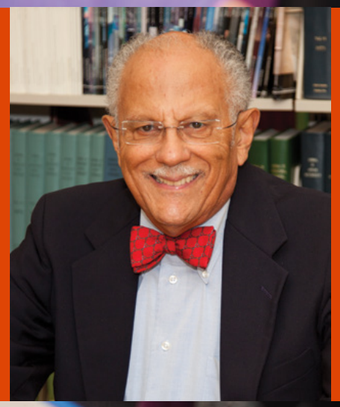
Chung Kwai Lui ('41) is the first woman Ph.D. in physics at OSU and worked on the top-secret Manhattan Project to develop the atomic bomb.

David Wong ('64) was one of three scientists credited with discovering the game-changing anti-depressant Prozac at Eli Lilly.

George Andrews ('64), mathematician, National Academy of Sciences member and the world's leading expert in the theory of integer partitions, is known for discovering Ramanujan's Lost Notebook in 1976.

MC Kang ('84) led the development and commercial launch of Fuzeon, the first of a novel class of drugs to treat HIV infection.

LIVING LEGENDS



A tradition of building leaders in science — Kent Thornburg (above) leads a team of scientists at OHSU in an exciting new field of science called "epigenetics." Karen Wooley (far left) directs the National Heart Lung and Blood Institute-supported Program of Excellence in Nanotechnology. Warren Washington (left), a renowned climate scientist of nearly 50 years, shared in the 2007 Nobel Peace Prize.

Kent Thornburg ('72)

A globally acclaimed scientist in cardiovascular physiology, adult-onset chronic disease and maternal-fetal health at Oregon Health & Sciences University, Kent Thornburg arrived at OSU in 1967 as a budding young zoologist pursuing a Ph.D. His graduate research in amphibian embryology under the direction of Howard Hillemann, who taught courses in comparative vertebrate anatomy and embryology from 1946-75, set him on the path, oddly enough, of becoming a cardiologist.

Fascinated by vertebrate cardiopulmonary development, Thornburg focused his doctoral research on how the heart changes in frogs from the embryonic state onwards. Though he later switched his research to cardiovascular physiology in humans as a postdoctoral researcher at OHSU, his interest in the development of the heart has remained a constant and he credits his graduate work at OSU and the "personal attention from my professors" as having had a huge impact on his scientific career. Over a lifetime, his pioneering research has opened up new understandings of how the environment in the womb can be a determinant of disease, including heart and cardiovascular disease, later in life.

Currently, Thornberg leads a team of scientists at OHSU in an exciting new field of science called epigenetics, which explores how genes can be permanently modified by the environment, primarily through maternal diet and stress, and how changes can be passed along to future generations in a family. Thornburg is the principal investigator on multiple NIH-funded research projects involving maternal-fetal signaling, training in cardiovascular research, thyroid hormone and heart development and placental function.

Karen Wooley ('88)

Chemistry alumna Karen Wooley ('88) is director of the Laboratory for Synthetic-Biologic Interactions at Texas A&M University, where she holds joint appointments in the departments of Chemical Engineering and Materials Science & Engineering. Renowned for her research in polymer chemistry and its many applications in medicine and industry, Wooley is also a multifaceted leader. She directs the National Heart Lung and Blood Institute-supported Program of Excellence in Nanotechnology, is an Associate Editor for the *Journal of the American Chemical Society*, and has served as Chair of the National Institutes of Health NANO study section, among many other advisory roles within the broader scientific community.

She has won a number of awards from the American Chemical Society—most recently the 2014 American Chemical Society Award in Polymer Chemistry—and the prestigious Royal Society of Chemistry Centenary Prize.

Warren Washington ('58, '60)

Warren Washington (B.S. '58 in physics, M.S. '60 in meteorology) is a senior scientist at the National Center for Atmospheric Research, first African-American president of the American Meteorological Society, and one of the first to develop atmospheric computer models that helped scientists understand climate change.

For nearly 50 years, Washington has engaged in research and provided advice, testimony and lectures on global climate change. He has served on the President's National Advisory Committee on Oceans and Atmosphere and had presidential appointments under the Carter, Reagan, Clinton, and Bush administrations. Recently, he served on the National Science Board as a member and as its chair.

Washington and members of his group at NCAR shared in the 2007 Nobel Peace Prize as significant contributors to the Inter-governmental Panel of Climate Change (IPCC) Assessment. In 2010, Washington was awarded the National Medal of Science, the nation's highest science award.

ART + SCIENCE CREATES SPARKS

Adorning the walls of Linus Pauling Science Center, this series of four light paintings composed of filtered, prism-like glass by Boston artist Stephen Knapp draws both literal inspiration from Linus Pauling's work in chemistry and nutrition, and symbolic inspiration from his genius, creativity and passion for peace.

The commissioned art, entitled "Structure, Space and Time," was one of many works purchased through the Oregon Arts Commission's "Percent for Art" program. The four pieces intentionally reflect different complementary colors depending on the direction of the light source. On bright days, the colors are diffuse, ephemeral. When clouds obscure the sun, the light paintings blaze out in vivid patterns across the wall.

To create the light paintings, Knapp relied on materials science and worked with dichroic glass, which consists of sheets of glass coated with multiple layers of metallic oxides in a vacuum chamber. The resulting material transmits one color — wavelength — of light while reflecting the complementary color.

"Structure, Space and Time" is about discovery, possibility and that which is not yet known. Like science.

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