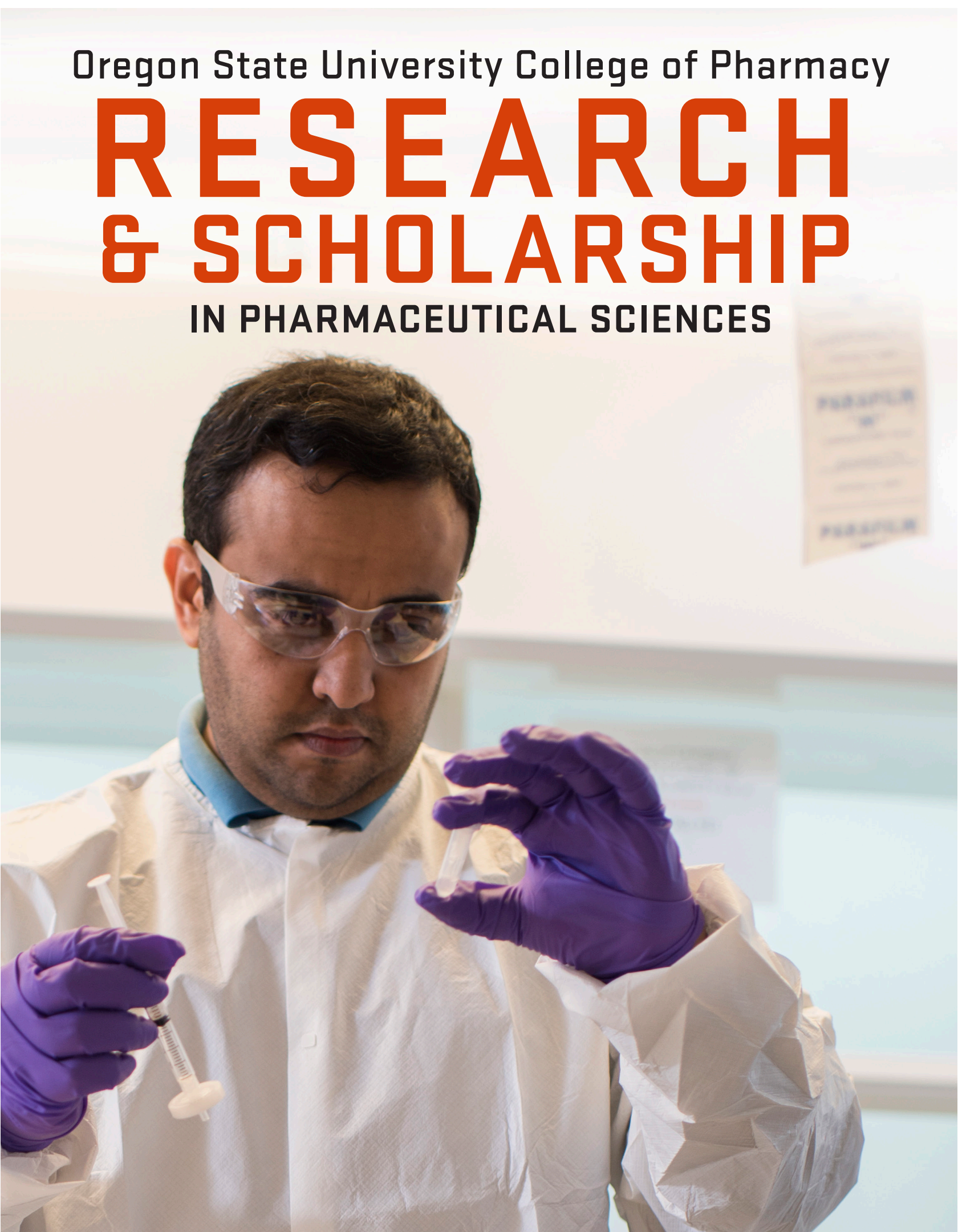
Oregon State University College of Pharmacy

RESEARCH & SCHOLARSHIP

IN PHARMACEUTICAL SCIENCES



WELCOME

The Department of Pharmaceutical Sciences at Oregon State University is located on two campuses, in the Robertson Life Sciences Building on the Waterfront in Portland at Oregon Health & Sciences University and in buildings across the Oregon State University campus in Corvallis from Weniger Hall, to the Linus Pauling Science Center, to our historical home in the Pharmacy building. This geographic diversity allows us to collaborate broadly with scientists and clinicians at both OSU, Oregon's land grant university, and OHSU, the state's major medical research center, to promote translation of research to improve health for all.

We are currently composed of 21 faculty, 34 PhD students, and a crew of postdoctoral scholars, research assistants, undergraduate researchers, and visiting scientists from across the country and the globe. In this brochure, you will find descriptions of the expertise and areas of research explored in our department. Our research mission is to educate and train the next generation of leaders and innovators in pharmaceutical sciences research to discover and develop tools and strategies for prevention, detection, and cure of human disease. An exciting new opportunity for us is the recent funding of an NIH graduate student training grant to support education and research into medicinal natural products. We are proud of our accomplishments and look forward to a bright future.

Theresa Filtz, Department Chair

OREGON STATE UNIVERSITY
COLLEGE OF PHARMACY

CREATING CURES

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DRUG DISCOVERY

Our medicinal chemists are focused on developing medicines from natural sources. By isolating novel chemicals from plants or marine bacteria, they hunt for anti-cancer compounds, new antibiotics, novel anti-malarials, natural sunscreens and agents that might treat diabetes or even slow the aging process. Using bacteria, they are researching ways to biosynthesize novel compounds in greater abundance.

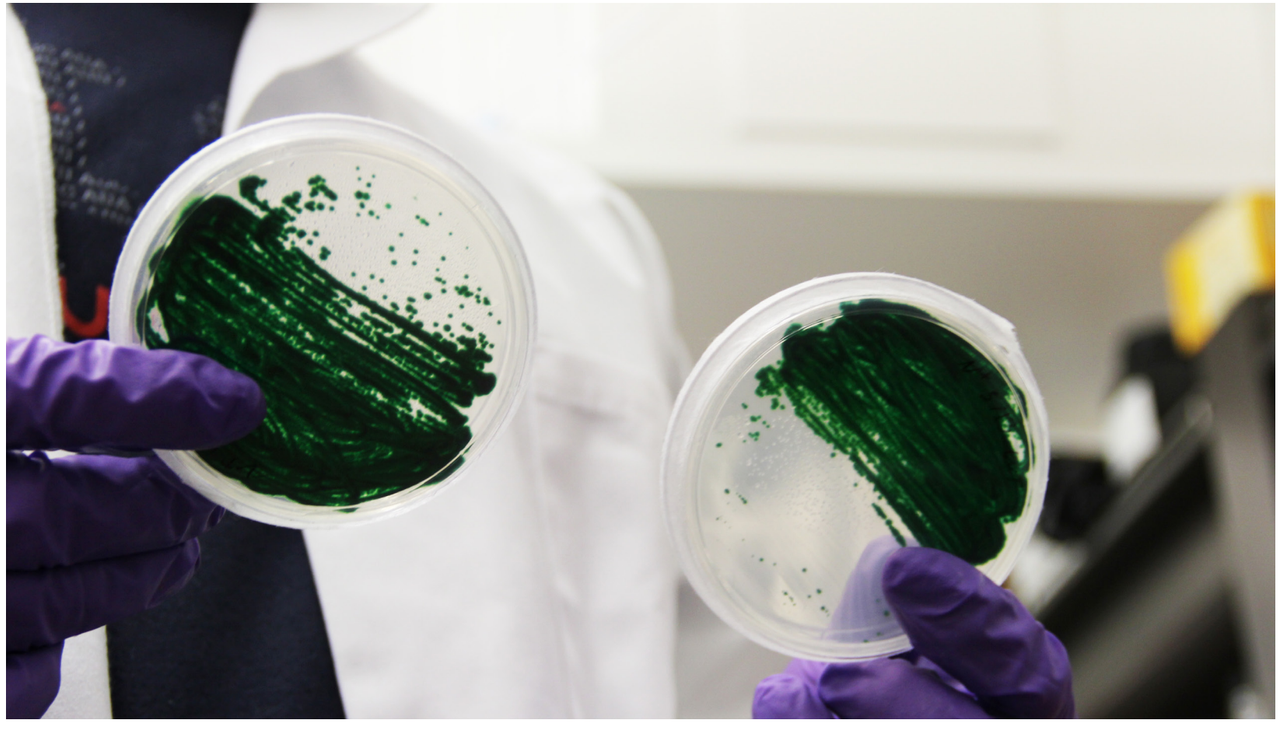
JANE ISHMAEL, PH.D.

Research in the Ishmael laboratory is focused on solving the mechanism of action of experimental compounds that have potential utility against treatment-resistant human cancers. These studies are part of an ongoing collaboration with OSU colleagues working in the area of natural product drug discovery. We take advantage of the College of Pharmacy High Throughput Screening Facility to identify and advance new bioactive molecules to early stage preclinical evaluation. This pipeline has resulted in the discovery and pharmacological evaluation of a number of new chemical entities that disrupt cell signaling pathways and induce survival responses such as autophagy or "self-eating". Our long-term research goal is to identify and validate new biological targets to inspire new cancer treatments.

TAIFO MAHMUD, PH.D.

Dr. Mahmud's research interests focus on natural product-based drug discovery and development. His group employs a multidisciplinary approach that utilizes cutting-edge technologies in molecular genetics, enzymology, and chemistry to produce novel pharmaceuticals. Currently, a number of research projects are being pursued in his laboratory. Those include (1) engineered production of antibiotics, antimalarial, and anticancer drugs, (2) investigation of novel enzymes and their products through genome mining, (3) discovery and development of natural sunscreen compounds, and (4) investigation of new bioactive compounds from Indonesian medicinal plants and rare microbes. Some recent accomplishments of his group include discovering two new families of enzymes with unique catalytic mechanisms and developing natural product-based antimalarial, anticancer, and sunscreen compounds through genetic engineering or synthetic biology.

LAST YEAR
FACULTY PUBLISHED
93 ARTICLES
IN PEER REVIEWED
JOURNALS



J. FRED STEVENS, PH.D.

Research in the Stevens laboratory is aimed at determining the role and function of vitamins and dietary phytochemicals in human health and disease. Dr. Stevens' research is closely aligned with the research mission of the Linus Pauling Institute at OSU (http://lpi.oregonstate.edu/). Mass spectrometry-based metabolomics and metabolic labeling are new directions in the Stevens laboratory for discovery of biological effects and mechanisms of actions of natural compounds in cell culture and animal models of disease as well as in humans.

Current projects include: Xanthohumol for mitigation of metabolic syndrome and inflammatory bowel disease; Vitamin C in mitigation of cardiovascular disease; Brain stimulants from the medicinal herb, Centella asiatica, in the fight against Alzheimer's disease ; and Bioactives from the oilseed crop, meadowfoam (Limnanthes alba).

KERRY MCPHAIL, PH.D.

Microbial natural products continue to be a source of novel, evolutionarily-optimized molecular structures with important biological activities, particularly relevant to cancer and infectious diseases, that may lead to the development of new pharmaceutical drugs. Dr. McPhail's group investigates the natural products chemistry of uniquely specialized bacteria and fungi found in unusual environments or at habitat interfaces, such as within the sapwood of trees, in tunicates and sponges on marine reefs, or in stromatolites ('living rocks') at the edges of the ocean or hypersaline lakes. In particular, we focus on the molecular structure elucidation of natural product macrocycles that have potential anti-cancer or antimicrobial applications because they affect the secretion of proteins from cells, which is important in all organisms.

RICHARD B. VAN BREEMEN, PH.D.

Dr. Van Breemen is currently Director of the Linus Pauling Institute at OSU. Aligned with the Linus Pauling Institute, research in the van Breemen laboratory concerns the discovery and development of natural products as chemoprevention agents and the investigation of mechanisms of action and safety of botanical dietary supplements. Our goal is to identify micronutrients and natural products that may be used to maintain optimal health and prevent cancer and neurological degenerative diseases. This research integrates the analytical tool of mass spectrometry into all aspects of the drug discovery and development from screening of botanical extracts for the identification of active natural products, to studies of drug metabolism and disposition, and to quantitative analyses of the bioavailability and pharmacokinetics of pharmacologically active compounds. These translational studies extend from basic science to clinical trials.

BENJAMIN PHILMUS, PH.D.

The Philmus lab is interested in the discovery and production of natural products, small molecules made by bacteria, fungi, plants and animals. We work primarily with cyanobacteria (formerly known as blue-green algae) as they are known to produce a wide range of natural products that have diverse biological activities. While bioactive cyanobacterial compounds can be obtained by collection and isolation of environmental samples or through chemical synthesis, our research focuses on establishing a lab-friendly, scalable surrogate bacterial host (Anabaena sp. PCC 7120) that we can use as an environmentally friendly compound production scaffold.
My lab is also researching how these complex structures are assembled and looking for ways to exploit these reactions and perform complex reactions in environmentally benign ways.

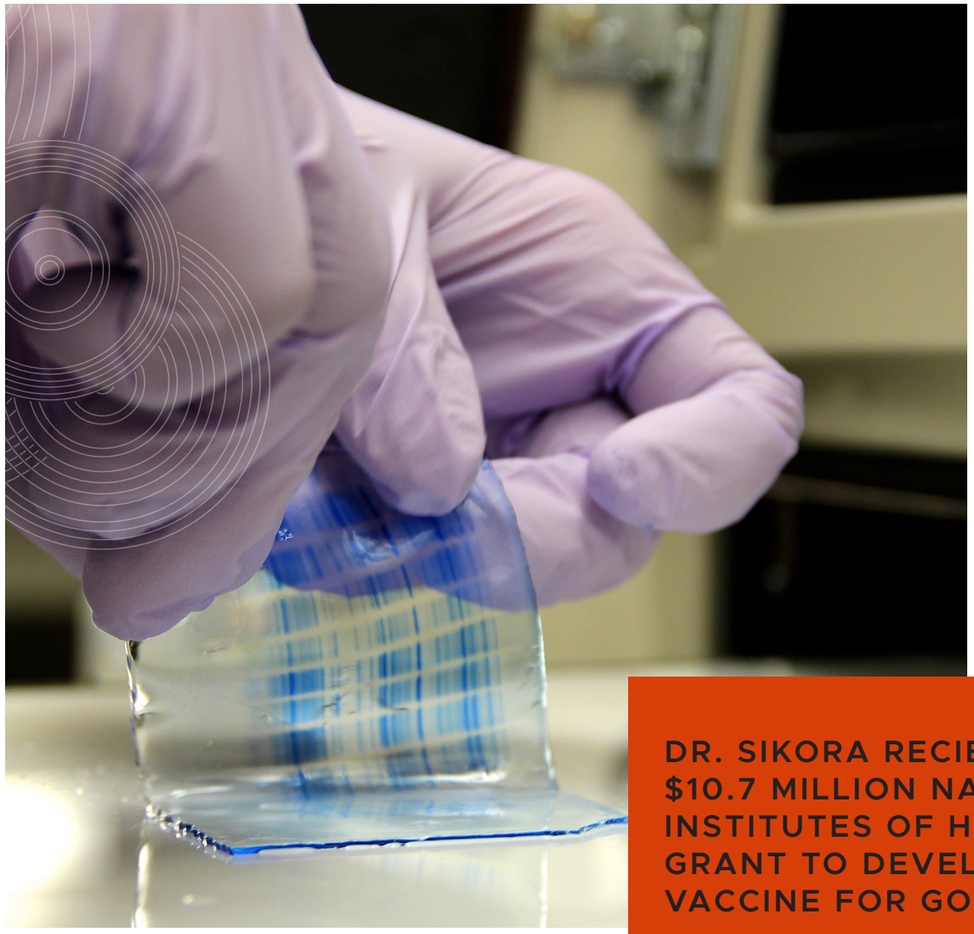
PHIL PROTEAU, PH.D.

The main projects being pursued in the Proteau laboratory involve aspects of the chemistry and biology of natural products. One project is aimed at the exploration of antibiotic compounds from cyanobacteria. Cyanobacteria produce a variety of peptide and amino acid derived compounds with antifungal/antialgal properties that are being investigated in collaboration with Dr. Benjamin Philmus. Another project involves characterization of fungal diterpene synthase products. Diterpenes are a class of compounds that often have interesting biological properties. The ability to predict a diterpene structure from the sequence of its corresponding diterpene synthase enzyme is not yet possible. However, by characterizing unknown diterpene synthase products, we hope to gain insight into this problem. (collaboration with Dr. Patrick Videau, Southern Oregon University).

RESEARCH FUNDING FOR THE COLLEGE OF PHARMACY INCREASED MORE THAN 4 FOLD (400%) IN FISCAL YEAR 2019

PHARMACEUTICAL MICROBIOLOGY

Good and bad, bacteria live with us. Faculty in pharmaceutical microbiology are searching for new ways to treat gonorrhea and other infectious diseases that are becoming resistant to existing antibiotics. Faculty are also curious about how the trillions of bacteria that live with us in our gut and elsewhere alter our susceptibility to diseases such as advanced cervical cancer, anxiety, or diabetes. As described in the next section, a couple of our computational and systems biology researchers in Pharmaceutical Sciences are also a part of the Pharmaceutical Microbiology group.



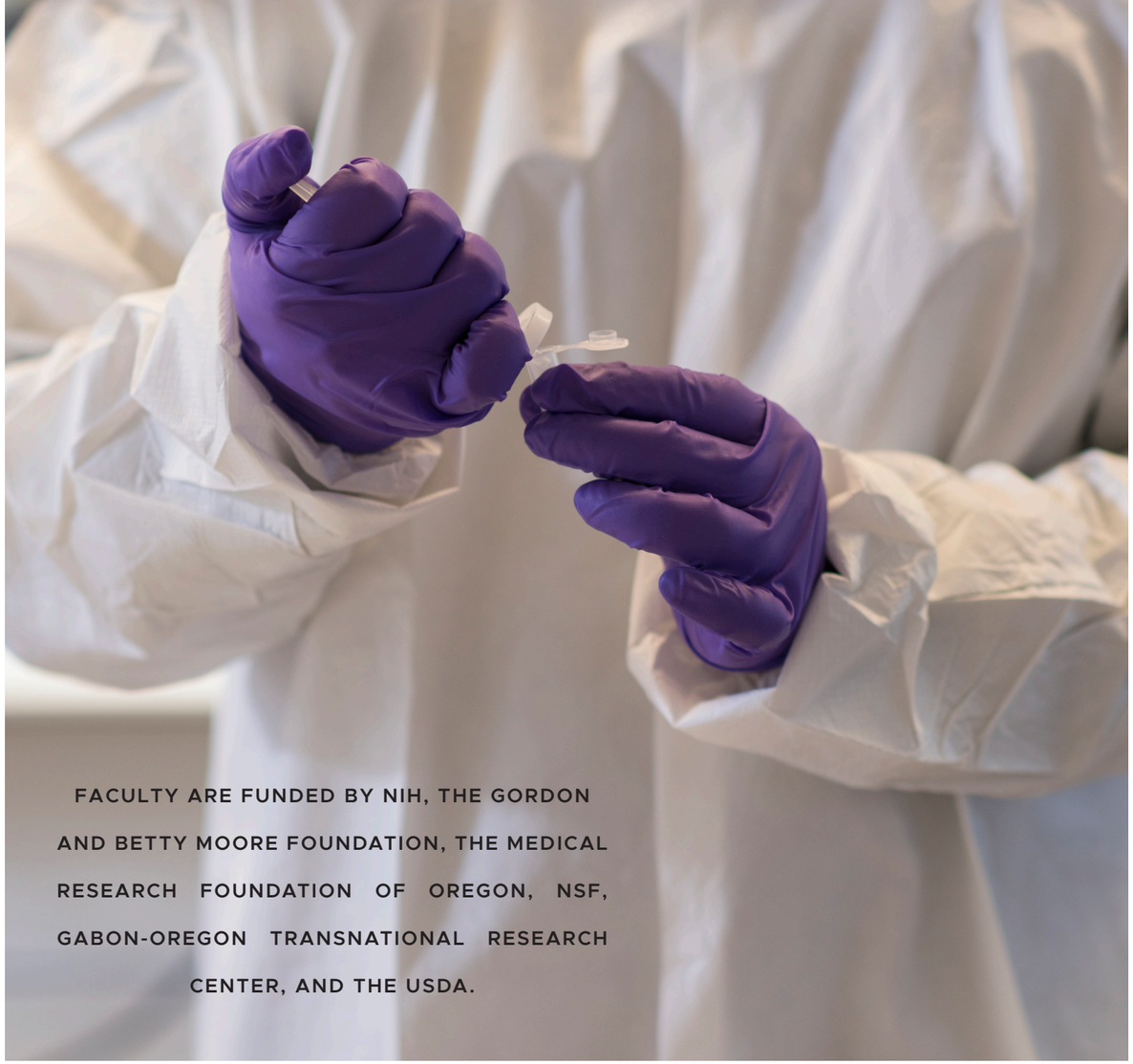
DR. SIKORA RECIEVED A $10.7 MILLION NATIONAL INSTITUTES OF HEALTH GRANT TO DEVELOP A VACCINE FOR GONORRHEA.

ALEKSANDRA SIKORA, PH.D.

The Sikora research team takes multi-disciplinary approaches to develop therapeutic interventions against sexually transmitted infection, gonorrhea. Gonorrhea affects nearly 78 million of people worldwide and has serious consequences on reproductive and neonatal health. There is a dire possibility of untreatable gonorrhea due to rapid increase in antibiotic resistance. Accordingly, to develop gonorrhea vaccine(s), we apply antigen discovery program which includes comprehensive proteomics coupled with bioinformatics. Candidate antigens are assessed for their suitability for inclusion in a vaccine. We further assess their structure-function to learn about the fascinating biology of the bacterium responsible for gonorrhea. Drug discovery through high-throughput screening of small molecule inhibitors that target central players in bacterial physiology and pathogenesis are a second focus of the Sikora laboratory.

COMPUTATIONAL AND SYSTEMS PHARMACEUTICAL SCIENCES

Faculty with expertise in statistics and computational approaches are mining large data sets to better understand the relationship between molecular events, the bacteria that live in us, and our susceptibility to diseases.



FACULTY ARE FUNDED BY NIH, THE GORDON AND BETTY MOORE FOUNDATION, THE MEDICAL RESEARCH FOUNDATION OF OREGON, NSF, GABON-OREGON TRANSNATIONAL RESEARCH CENTER, AND THE USDA.

ANDREY MORGUN, PH.D.

Efforts in the Morgun lab are focused on the understanding how the interplay between host and microbiota contributes to pathogenesis and treatment of diseases such as type 2 diabetes, immunodeficiency, and cervical cancer. The key questions are: 1) Which components of microbiota drive specific immune and other host functions; 2) Which of those mechanisms play role in diseases we study; 3) Do environmental factors such as antibiotics and other drugs as well as host genetics alter microbiota in a manner that it acquires properties which are harmful or beneficial to host? To answer these questions we use Systems Biomedicine approaches by combining large scale omics and network biology with gnotobiotics/ germfree experimentation.

"My laboratory works on modelling gut microbiota interactions with the environment and its host, to unravel how it impacts our behavior" -Maude David

MAUDE DAVID, PH.D.

Dr. David's laboratory studies gut-brain interactions to understand how the gut microbiota can impact our behavior, specifically in Autism Spectrum Disorder and Generalized Anxiety Disorder. She uses a crowd-sourced approach to collect lifestyle information, dietary habits, and microbiome samples. Her team also works on identifying bottlenecks in microbiome data exploration and has been developing new biocomputing methods to improve sequencing data annotation and analysis. Her interest lies in using machine learning algorithms to extract meaningful information from massive datasets already publicly available such as the Human Microbiome Project.

KEVIN BROWN, PH.D.

Dr. Brown is a complex systems scientist. He studies complex biological systems, particularly those arising in systems biology,systems neuroscience, and cognitive science. He is the originator of "Sloppy Models," a theory of parameter space geometry in large nonlinear models with many underdetermined parameters, such as those that arise when modeling signaling dynamics in biological cells. He studies networks in molecular biology, neuroimaging, and cognitive science, and is particularly interested in trying to determine the link between structure and function in complex networks. He employs both data-driven and model-driven approaches to problems, and he has many productive collaborations with experimentalists.

GRADUATE STUDENT AWARDS

BRIANNA COTE

PHARMD/ PH.D.

A Ph.D. degree candidate in Dr. Adam Alani's Pharmaceutics lab who holds a Pharm.D. degree, Brianna Cote is the recipient of successive nationally-competitive fellowships. Dr. Cote was awarded an American Association of Pharmaceutical Sciences (AAPS) Graduate Student Fellowship last year. This year, she was the recipient of the Dr. Paul B. Myrdal Memorial Pre-Doctoral Fellowship in Pharmaceutics from the American Foundation for Pharmaceutical Education (AFPE). In addition, Dr. Cote has also received an Oregon Lottery Scholarship.

DAVID GALLEGOS

PH.D.

A recently graduated PhD student from the natural products laboratory of Dr. Kerry McPhail, won the Kilmer Prize from the American Society of Pharmacognosy, a nationally competitive award with a single recipient every year.

EVAN CARPENTER

PH.D.

A 4th year PhD student in the skin cancer lab of Dr. Arup Indra, won the Eugene M. Farber Travel Award for Young Investigators to attend the Society for Investigative Dermatology national meeting.

DANIEL NOSAL & LUYING CHEN

PH.D.

Both advanced PhD transfer students in the van Breemen laboratory, won Young Investigator travel awards to attend the conference and short course on "Mass Spectrometry: Applications to the Clinical Lab" in 2019.

ADEL AL FATEASE

PH.D.

A 5th year PhD student in the Nanotherapeutics lab of Dr. Oleh Taratula, won the Holt Fellowship award from the College of Pharmacy and the "Outstanding podium presentation" award at the OHSU research week in May 2018.

GENETIC MODELS OF DISEASE & DRUG TARGET DISCOVERY

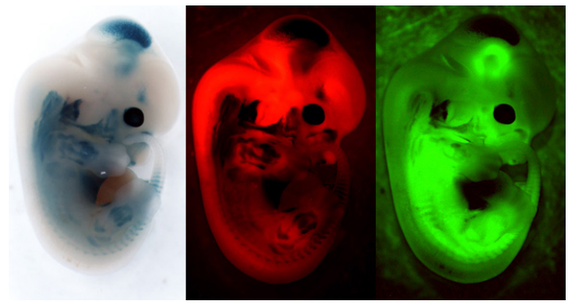
The hunt for new disease treatments requires an understanding of disease and development at the molecular levels. Faculty in pharmacology are studying development and growth of muscles, skull bones, skin and thymocytes to better understand congenital birth defects, type II diabetes and obesity, wound-healing, leukemia and skin cancer.

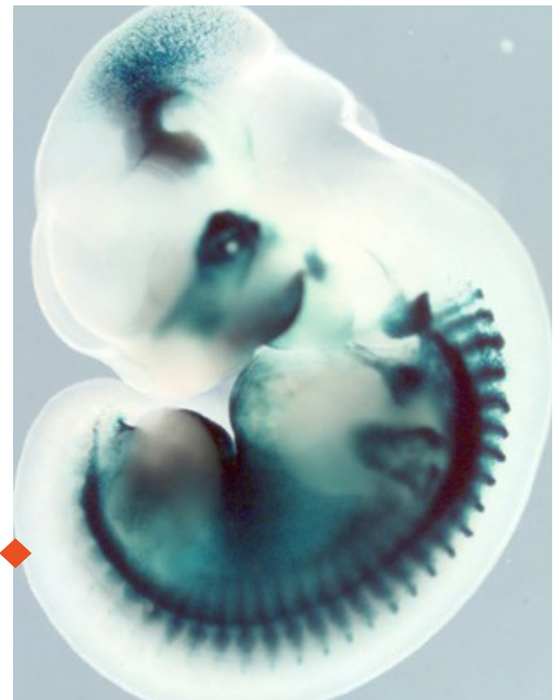
MARK LEID, PH.D.

The Leid laboratory is focused on the role of the transcription factor CTIP2/BCL11B in development of the craniofacial skeleton and maintenance of sutural plasticity. Mice lacking BCL11B, which were created in the lab, are a model for the human disease known as craniosynostosis, a condition characterized by premature ossification of cranial sutures. We are defining the BCL11B interactome and mechanisms by which post-translational modifications, such as phosphorylation, sumoylation, and ubiquitination, control the transcriptional regulatory activity of BCL11B in all cell types.

CHRISSA KIOUSSI, PH.D.

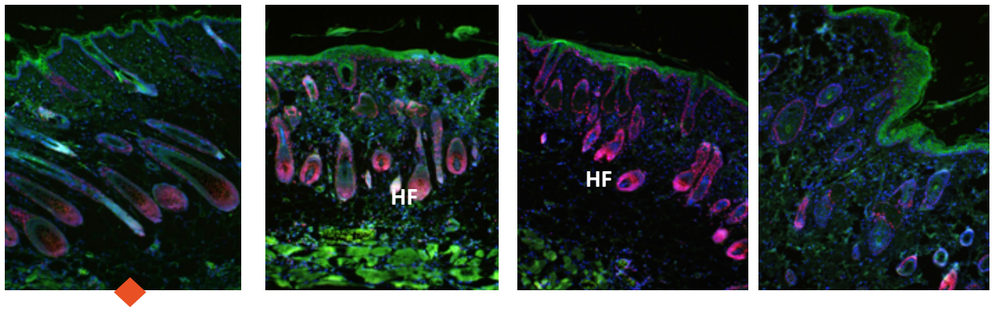
The Kioussi laboratory is interested in defining the gene regulatory networks involved in muscle development and energy balance systems towards the goal of developing new strategies to treat dystrophies and metabolic syndromes. A complex transcriptional network transforms stem cells, through an organized series of embryonic cell types, into adult cell types. Genetic variation is a major cause of development, diversity and disease susceptibility. Epigenome determines the pattern of gene expression and gives the cell its distinct characteristics, function and behavior. We use a combination of biochemical, genetics, genomic and computational approaches to dissect the roles of transcription factors involved in organ development and tissue regeneration. Our studies will serve as the foundation for development of future strategies and pharmacological interventions that influence the maintenance and differentiation potential of cell populations in patients with disrupted metabolic fuel homeostasis and muscle atrophy.





Transgenic mouse embryos. Colors indicate the expression profile of genes in the nervous and muscular systems.

COLLEGE INVESTIGATORS SUBMITTED 99 GRANT PROPOSALS, REQUESTING OVER $58M IN TOTAL COSTS.



Co-expression of Stem cell marker Keratin 15 and Proliferation cell nuclear antigen (PCNA) during wound healing process.

NUMBER OF PROPOSALS AND THE TOTAL FUNDS ↑ 30%

GITALI INDRA, PH.D.

Indra lab focuses on wound healing and regeneration process and particularly studies the effects of adult bulge hair follicle stem cells (HFSC) in wound healing and also identifying the molecular and cellular mechanism of repair in acute and chronic wounds. Lab has identified several molecules consisting of growth factors and cytokines. The lab is currently using new generation materials such as electro-spun nanofibers which are coated with these identified molecules for advanced applications such as in diabetic and chronic wound model to promote healing process. Splinting Strategies are also being used to overcome wound contraction in animal models so that it can relate to healing mechanism in humans. Working in Collaboration with Drs .Xie, Gombart, Indra A and Leid.

ARUP INDRA, PH.D.

My laboratory is interrogating how skin "stem cells" suppress inflammatory skin disease (e.g. eczema) and protect against infections by regulating lipid metabolism and modulating cell-cell communications. Using genetic tools and molecular approaches we discovered new pathways controlling formation of a healthy skin, and investigating how "lipids" act as precision biomarkers for eczema progression and utilized for therapeutic interventions. We are studying the protective role of skin pigmentation against deleterious effects of UV-radiation e.g. photoaging and melanoma skin cancer. Mechanisms of immune-evasion in different cellular compartments to promote melanoma invasion and metastasis are actively explored. We have generated pre-clinical models mimicking atopic dermatitis, skin pigmentation disorder, and melanomas in humans. Collaborators include scientists from OSU, OHSU, Yale, Harvard and UC Berkeley.

THERESA FILTZ, PH.D.

Research in the Filtz lab focuses on better understanding the means by which cells respond to signals that cause them to alter their activities or states. Cells receive message from the outside at receptors on the cell membrane and then a series of intracellular events converts those messages to changes in protein activities and/or changes in gene transcription programs. We search for new drug targets by trying to better understand the array of changes called post-translational modifications that may alter gene transcription. We are currently interested in a transcription factor known as Bcl11b that is highly modified and that is associated with lymphomas and childhood leukemia.

HIGH-THROUGHPUT DRUG DISCOVERY LABORATORY

Research in the department and college is supported by the High-throughput Drug Discovery Laboratory in which biochemical and cell-based assays are completed with the aid of robotic liquid handlers, a high-content imaging system, and screening analysis software to identify biomodulators.

DYLAN NELSON

The College's High-Throughput Screening Services Laboratory was established in 2016 to provide the research community with access to robotic systems and chemical libraries for drug discovery. Located on the first floor of the Pharmacy Building on the Corvallis campus, the chemical libraries total about 300,000 compounds and include FDA approved drugs, characterized bioactive molecules, uncharacterized small molecules, and chemical extracts from biological sources such as fungi, bacteria, and plants. The robotic systems allow researchers to test thousands of samples per day. The lab is available to academic, non-profit, and for-profit researchers. Graduate students and post-doctoral researchers are able to be trained to work in the lab and develop valuable skills in automation and modern drug discovery methods.

PHARMACEUTICS & NANOTHERAPEUTICS

Novel types of drugs such as antibodies and RNA require new methods to deliver these agents effectively and selectively in the body. Faculty are using nanotechnology to encapsulate anti-cancer drugs and target specific tissues, build nanoscale particles to light up and kill cancer cells with heat, help reverse muscle wasting in cancer chemotherapy, find new ways to deliver gene therapy to cystic fibrosis patients, and limit side effects from radiation therapy.

OUR RESEARCHERS AUTHORED OR CO- AUTHORED

19 BOOK CHAPTERS

RESEARCH PUBLICATIONS

↑ 33%

ADAM WG. ALANI, PH.D.

Dr. Alani's research focuses on the design of nanoscale drug delivery systems for therapeutic and diagnostic applications. The work in his lab involves the field of designing and formulating nanoscale systems for the delivery of difficult to formulate molecules for the treatment of cancer and other diseases. He has been directly involved in nanoscale formulation, characterization, toxicity, efficacy, pharmacokinetics evaluation both in vitro and in vivo models and scale-up. He views his work as translating bench side research into viable treatment options. Currently the work in the Alani lab focus on cancer therapy, specifically utilizing nanotherapy for targeting tumor microenvironment and small molecules delivery to the lymphatic system.

J. MARK CHRISTENSEN, PH.D.

Recently retired as an Emeritus Professor, Dr. Christensen continues research focused on biopharmaceutics, pharmacokinetics and drug formulation. In response to the growing demand for drug therapy for animals, Dr. Christensen studies drug disposition in various animals in collaboration with faculty from the College of Veterinary Medicine. Similar techniques are applied to determining appropriate drug dosing and drug disposition in humans, including the means and routes of absorption, metabolism and elimination. Research into the sustained action of oral dosage forms with respect to performance, production, and in vivo characteristics is another area of interest.

FACULTY FILED 11 PATENT APPLICATIONS LAST YEAR AND SIGNED NEW LICENSING AGREEMENTS.

OLEH TARATULA, PH.D.

The research in Oleh Taratula's Lab, located in the Robertson Life Sciences Building in Portland, focuses on the development of nanomaterial-based, multifunctional drug delivery systems for application in diagnosis and treatment of cancer, endometriosis, and cachexia. Employing nanomaterials to overcome drug delivery obstacles is a promising approach for transporting agents of interest (drugs, genes, imaging probes, hyperthermia, etc.), specifically to targeted cells or proteins. The lab collaborates within the OSU College of Pharmacy, and externally with the Earle A. Chiles Research Institute at Providence Portland Medical Center, Oregon National Primate Research Center, the Department of Pediatrics in the School of Medicine, and others. The primary goal is translation of the developed nano-drugs to clinical use.

OLENA TARATULA, PH.D.

Olena Taratula's research utilizes an interdisciplinary (organic chemistry, biochemistry, and nanotechnology) approach toward the development of effective imaging agents and nanomedicines, particularly for cancer. This includes the development of photo-theranostic agents for use in image-guided surgery and intraoperative therapy. The main objective is to assist in the accurate diagnosis/location of cancer tissue using innovative nano-imaging probes, with subsequent immediate treatment. Collaborations with the Carlson College of Veterinary Medicine, OHSU Biomedical Engineering, and OHSU Dotter Interventional Institute provide the opportunity for testing nano-agents in various animal models, including rodents, rabbits, and domestic dog patients.

GAURAV SAHAY, PH.D.

With members of his lab Dr. Sahay has unlocked the molecular mechanisms involved in the intracellular delivery of nanoparticles and designed new materials that target subcellular compartments. The Sahay Lab has deployed non-viral vectors for gene therapy applications for treatment of cystic fibrosis and other rare disorders. Dr. Sahay is the past winner of AAPS and CRS Post Doc Award and received New Investigator Awards from AACP and MRF. Sahay lab has been supported through NIH, Cystic Fibrosis Foundation, OSU Foundation and several companies. Dr. Sahay serves as a consultant to biotech firms and is on the Scientific Advisory Board of Oncorus Therapeutics. He has over 30 publications in top tier journals including Nature Biotechnology, Nano Letters, Nature Nanotechnology etc., and chaired the 2018 International Nanomedicine and Drug Delivery Symposium.

CONROY SUN, PH.D.

The Sun laboratory is focused on applying materials science and nanotechnology toward unmet needs in cancer care. Our expertise lies in the development of novel biomaterials for tumor targeted drug delivery and molecular imaging. In this work, we exploit the multifunctional capabilities of nanoparticles to combine conventional therapies, such as radiation and chemotherapy, to achieve a synergistic treatment response or combine treatment with medical imaging modalities, such as image-guided drug delivery. We are also developing imaging probes and techniques to improve detection, diagnosis, and evaluation of cancer treatments. As interdisciplinary scientists, we maintain active collaborations spanning the basic sciences (chemistry, physics and biology) to clinicians (radiology, radiation oncology and surgery) with the goal of translating novel technologies to patients.

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