COLLEGE OF
PHARMACY
UNIVERSITY OF UTAH

L. S. SKAGGS PHARMACY INSTITUTE

College Of Pharmacy

Faculty Research Publication

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FACULTY IN MEDICINAL CHEMISTRY

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Professor of Medicinal Chemistry

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Education & Training:

- M.S., 1994, Indian Institute of Technology, Madras
- Ph.D., 2000, University of Iowa
- Post-Doctoral Training, 2001-2004, MIT

Research Interests:

HEPARAN SULFATE PROTEOGLYCANS: Biosynthesis, Structures and Functions.

In the post-genomics era, it is now accepted that complex glycoconjugates such as proteoglycan regulate numerous patho-physiological processes in all living species. They carry enormous structural information in terms of sulfation, epimerization, domain organization, chain length, number of chains and type of chains along with their core proteins. Production of proteoglycans with such high complexity occurs in template-independent fashion seamlessly, yet our understanding of their biosynthesis, structures and functions is somewhat incomplete and imperfect. We are developing a wide variety of chemical biology tools to define the biosynthetic pathways of heparan sulfate and related glycosaminoglycans (GAG) such as chondroitin sulfate and dermatan sulfate. We synthesize heparin and heparan sulfate structures with a dozen recombinant enzymes to define the structural basis for the interactions of growth factors and Heparan sulfates and the subsequent biological actions. We recently found that a library of click-xylosides produce distinct GAG chains in cellular systems and proposed a GAGOSOME model for the dynamic regulation of combinatorial GAG biosynthesis. These molecular tools are currently used in the lab to define the snap shots of biosynthetic events and signaling events that are associated with development and diseases with a final goal to advance the study of heparanomics.

Amy Barrios

Professor of Medicinal Chemistry

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Education and Training:

- B.S., 1995, University of Utah, Salt Lake City, UT, Chemistry
- Ph.D., 2000, Massachusetts Institute of Technology, Cambridge, MA, Inorganic Chemistry
- NIH Postdoctoral Fellow, 2000-2003, Department of Pharmaceutical Chemistry, University of California, San Francisco

Research Interests:

Chemical probes for visualizing PTP activity: Protein tyrosine phosphatases (PTPs) play critical roles in cellular signaling, regulating tyrosine phosphorylation through hydrolysis of the tyrosine phosphate in a temporally, spatially and regioselectively controlled manner. In contrast to their counterparts, the protein tyrosine kinases (PTKs), the substrate selectivity, biological regulation and specific roles of PTPs are relatively poorly understood. However, aberrant phosphotyrosine-dependent cellular signaling plays an important role in many human diseases, including cancer, diabetes and autoimmunity. PTK-targeted drugs have hit the market with considerable success as anticancer agents, but no PTP-targeted drugs have been developed to date. In this project, our aim is to develop novel PTP-targeted chemical probes that can be used to elucidate the biological roles of PTPs and can serve as lead compounds in the development of PTP-targeted therapeutics. For example, we designed the phosphocoumaryl amino acid pCAP as a fluorogenic phosphotyrosine mimic. This probe has been invaluable in allowing us to profile the substrate selectivity of PTPs, perform several high-throughput screens to identify novel PTP inhibitors, and visualize PTP activity both directly in cells and in cell lysates through polyacrylamide gel electrophoresis. Current work includes characterizing and optimizing the new inhibitors we have discovered and developing novel activity-based probes for PTPs.

Understanding the biological action of metal-based drugs: While the majority of drug molecules are organic compounds, several very successful drugs contain metal ions. Certainly the most well-know (and well-studied) example is cisplatin, a platinum containing anticancer agent, but other examples include auranofin, a gold-containing antiarthritic agent; Pepto-BismolÂ®, a bismuth-containing treatment for gastrointestinal problems; and imaging agents such as magnevist (a gadolinium-based MRI contrast agent) and cardiolyte (a technetium-based radioimaging agent). In our lab, we have been studying the ability of auranofin and auranofin analogs to inhibit enzyme activity as one possible mechanism of action in the body. Au(I)-based compounds such as auranofin inhibit thiol-dependent enzymes, and we have demonstrated that, by tuning the ligands bound to the Au(I) ion, we can tune the selectivity and potency of the Au(I)-mediated inhibition. The relative potencies and selectivities of the new complexes hold up not only in vitro but also in vivo.

Designing redox sensors: A recent area of emphasis for our lab is the development of fluorogenic chemical probes that can be used to image the production of redox active species in vivo. Our first efforts in this field are aimed at developing hydrogen peroxide sensors that can be delivered to a specific subcellular location (i.e. the cell surface, the cytosol, the mitochondria, etc.) and at developing hydrogen sulfide sensors based on fluorogenic organometallic compounds.

Grzegorz (Greg) Bulaj

Associate Professor of Medicinal Chemistry

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Education and Training:

- M.Sc., 1989, Biochemistry, University of Wroclaw
- Ph.D., 1993, University of Wroclaw, Poland

Research Interests:

To mitigate limitations of pharmaceutical drugs (e.g. non-adherence, drug-resistance, adverse effects, affordability) for epilepsy, pain, depression or cancer, our research is focused on creating digital therapeutics (mobile medical apps). Digital therapeutics are mobile apps which receive the FDA regulatory status of “software as a medical device” to treat specific disorders. To improve therapy outcomes, mobile medical apps can be combined with pharmaceutical drugs yielding drug-device combination products. The long-term goal of our research is to develop drug-device combination therapies which target chronic diseases at both pharmacological and behavioral levels.

Examples of our projects include:

1. Development of mobile medical apps for the treatment of epilepsy: https://www.frontiersin.org/articles/10.3389/fnhum.2018.00171/full
2. Development of music streaming as adjunct digital therapies for depression:https://www.frontiersin.org/articles/10.3389/fpubh.2016.00217/full
3. Development of a mobile game coupling physical exercise and empowerment for children with cancer undergoing chemotherapy:https://www.frontiersin.org/articles/10.3389/fped.2018.00069/full
4. Preclinical study of music-enhanced neuropharmacology as surrogate for advancing drug-digital combination therapies for chronic pain: https://www.frontiersin.org/articles/10.3389/fneur.2019.00277/full

Tom Cheatham III

Professor of Medicinal Chemistry;
Director, Center for High Performance Computing;

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Education and Training:

- B.S., 1989, Middlebury College, Middlebury, VT, Chemistry (Honors)
- B.S., 1989, Middlebury, VT, Mathematics and Computer Science
- Ph.D., 1997, University of California, San Francisco, Pharmaceutical Chemistry
- Post. Doc., NHLBI, National Institutes of Health

Research Interests:

The people in our lab use and develop molecular dynamics, free energy simulation, and trajectory analysis methodologies in applications aimed at better understanding biomolecular structure, dynamics and interactions on large scale computational resources. A strong focus of our funded efforts centers on the reliable representation of nucleic acid systems (DNA and RNA) in solution. For example, we helped solved the NMR structure of the drug-bound Hepatitis C virus IRES structure; based on this (and related structures), we can now apply CADD methods and simulation to better understand and design potential new Hepatitis C therapeutics. In addition, large efforts are underway to better characterize RNA structure and force fields through simulation of a large number of commonly observed RNA structural motifs and a large variety of NMR and crystal structures. We are also involved with international collaborative efforts to understand DNA structure, for example through the ABC consortium and long simulations of DNA...

Critical to reliable representation of the structure, dynamics and interactions is not only trying to simulate the biomolecules in their native solution environment but to also both critically assess and validate the simulation results with experiment. Our group focuses on both brute-force and enhanced sampling/ensemble-based simulation using available high performance computational resources at the University of Utah (www.chpc.utah.edu) and elsewhere. With these resources we also are able to expose and overcome limitations in the methods and force fields. Our group also collaborates on a number of design projects with various experimental groups in the College of Pharmacy.

Darrell Davis

Professor and Chair of Medicinal Chemistry

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Education and Training:

- B.S., 1982 Chemistry, University of Puget Sound
- Ph.D., 1988, Organic Chemistry, University of Utah

Research Interests:

In studies of benzimidazole compounds that bind to the HCV RNA, we have identified candidate antivirals that interfere with viral RNA translation. Subsequent research has indicated that these antiviral compounds inhibit an early step in viral protein synthesis common to more than 15 RNA viruses, including Coronaviruses, Zika, Dengue, Yellow Fever, West Nile, Chikungunya, and EEEV viruses. The potency of our lead compound against these diverse viruses ranges from 40-580 nM, with the potency against SARS-CoV-2 = 142 nM. These important human pathogens are all RNA viruses and represent diverse viral families (flavivirus, togavirus, bunyavirus, arenavirus, and β-coronavirus).

The lead compound, DD011-E2 belongs to a chemical class found in FDA approved effective and well-tolerated therapeutics (for example, omeprazole). The lead compound has an in vitro EC_{50} that is >5-fold more potent than remdesivir, and we have demonstrated effectiveness in vivo against a lethal Zika virus infection mouse model.

Studies in our laboratory have established that DD011-E2 inhibits viral replication by a host-targeted mechanism, explaining the unprecedented broad-spectrum activity. Our research involves in vitro and in vivo antiviral evaluation against diverse viruses important to human health such as coronaviruses COVID-19 and hCoV-OC43. Components of this research involve investigations of fundamental viral replication mechanisms, as well as the development of potent antivirals with the potential to become therapeutic agents.

Katharine Diehl

Assistant Professor of Medicinal Chemistry

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Education and Training:

- B.S. (Chemistry), 2010, University of North Carolina at Chapel Hill
- Ph.D. (Chemistry), 2015, University of Texas at Austin
- Postdoctoral fellowship (Chemical Biology), 2019, Princeton University

Research Interests:

Dr. Diehl is broadly interested in understanding the biochemical mechanisms of epigenetic regulation by post-translational modifications (PTMs) of chromatin and chromatin-associated proteins. In particular, her research seeks to elucidate links between gene expression and metabolism via these chromatin PTMs. To do so, her lab is developing and deploying chemical tools to study these PTMs in biochemical and cell-based assays. Importantly, dysregulation of these PTMs is known to play a role in a number of diseases including cancer and metabolic and developmental disorders. By understanding how chromatin PTMs are regulated and how they impact gene expression, Dr. Diehl's work seeks to identify new therapeutic strategies for targeting epigenetic dysfunctions.

Raphael Franzini

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Education and training:

- M.Sc., 2005 Ecole Polytechnique Fédérale de Lausanne
- Ph.D., 2010 Stanford University
- Postdoctoral Fellow, 2012-2015, ETH Zürich

Research Interest:

My research group is active at the intersection of Chemistry, Biology and Pharmaceutical Sciences with the aim of developing novel therapeutic agents, imaging probes and diagnostics. Of particular interest to us is the discovery of drugs for treating and molecular tools for studying aging related chronic diseases and cancer. First, we are aiming at identifying molecules that can modulate proteins related to NAD^+, because this cofactor is known to play central roles in the progress of aging and the etiology of many diseases. Second, a research focus is the development of tools to study the effect of oxidative stress in aging and disease. Third, we are exploring methods for localized drug delivery. Underlying these translational research projects are efforts to advance relevant technologies. One particular research goal is the development of DNA-encoded chemical libraries as prospective tools for drug discovery and their application to lead development for aging- and cancer-associated targets. DNA-encoded libraries are collections of compounds in which each small molecule is uniquely encoded by a covalently linked DNA sequence and that allow identifying drug leads using a straightforward protocol. A set of dissociative bioorthogonal reactions was further developed in my group to enable releasing bioactive molecules in vivo.

Margo Haygood

Research Professor of Medicinal Chemistry

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Education and Training:

- B.A., 1976, magna cum laude, Harvard University, History and Science
- Monbusho scholar,1979-1981, Tokyo University
- Ph.D., 1984, Marine Biology, Scripps Institution of Oceanography, University of California, San Diego

Research Interest:

Marine microbiology and marine biotechnology:
Marine Invertebrate symbioses: Well known for in-depth studies of marine invertebrate symbioses, particularly the association between the bryozoan Bugula neritina and its symbiont Endobugula sertula, which produces the anticancer bryostatins to protect the bryozoan's offspring from predation. Due in large part to our work, this is now the best-understood example of a marine chemical defense symbiosis. More recently, demonstrated that shipworm symbionts, in addition to their known nutritional role, also contribute bioactive secondary metabolites to the association, for example:
Elshahawi, S., A. Trinidade-Silva, A. Hanora, A. Han, M. Flores, V. Vizzoni, C. Schrago, C.A. Soares, G.P. Concepcion, D. Distel, E. Schmidt, and M.G. Haygood. 2013. A boronated tartrolon antibiotic produced by symbiotic cellulose-degrading bacteria in shipworm gills. PNAS, January 22, 2013 vol. 110 no. 4 E295-E304. 10.1073/pnas.1213892110 article online

Iron acquisition by marine bacteria:
Long term collaboration with Alison Butler of UC Santa Barbara on siderophores, molecules used in iron binding and transport, in marine bacteria. Established the prevalence of a new class of amphiphilic siderophores typical in marine bacteria, for example:
Martinez, J.S., J.N Carter, E.L. Mann, J.D. Martin, M.G. Haygood and A. Butler. 2003 Structure and dynamics of a new suite of amphiphilic siderophores produced by a marine bacterium. PNAS 100:3754-3759. article online

Eric Schmidt

Professor of Medicinal Chemistry

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https://sites.google.com/site/ericschmidtlab/

Education and Training:

- B.S., 1994, University of California at San Diego
- Ph.D., 1999, Scripps Institution of Oceanography
- NIH Fellowship, 1999-2001, Johns Hopkins University

Research Interests:

Secondary metabolites (natural products) are central both to interactions between organisms and to human health. The goals of my lab are (i) to understand the basic biology and chemistry of secondary metabolism; (ii) to apply that understanding to synthetic biology and metabolite engineering; (iii) to understand the chemical mechanisms of biosynthetic enzymes; and (iv) to discover and develop new drug lead natural products.

Research area 1. Biosynthesis of natural products in animals.
Marine animals are renowned sources of natural products with pharmaceutical potential. Research shows that several compounds are not made by the animals themselves, but rather by symbiotic bacteria. My lab is working to achieve a fundamental understanding of the players involved in synthesizing secondary metabolites in marine animals. We apply this knowledge in the discovery and engineering of small molecules with therapeutic potential. Animals also encode many fascinating and almost wholly unknown pathways in their genomes, which we express and use in biochemical studies.

Research area 2. Natural products drug discovery
We discover new compounds that act on targets of interest to human health. These compounds originate in collections of marine animals and their symbiotic bacteria, or in synthetic biology libraries created in the lab. Currently, our focus is on creating new compounds that target intractable pain, in an effort to help fight the opioid crisis.

Jaclyn M. Winter

Assistant Professor of Medicinal Chemistry

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Education and Training:

- B.S., 2004, State University of New York College at Fredonia, NY, Chemistry and Molecular Genetics
- Ph. D., 2010, Scripps Institution of Oceanography, UCSD, Marine Natural Product Biosynthesis
- Postdoctoral Fellow, 2010-2011 Leibniz Institute for Natural Product Research and Infection Biology, Hans Knöll Institute, Germany
- Postdoctoral Fellow, 2011-2014, University of California at Los Angeles

Research Interests:

Secondary metabolites are specialized small molecules produced in nature and often possess a variety of biological activities that can be used toward improving our quality of life. These molecules possess exquisite chemical diversity and are often an inspiration for the development of new pharmaceutical agents. At a time when antibiotic resistant bacterial infections are reaching epidemic proportions, there is an urgent need to discover new therapeutic agents. It has been shown that biological pressures influence the structural diversity of compounds produced in nature and marine-derived microorganisms often contain specialized enzymes not found in their terrestrial counterparts. Thus, these specialized microorganisms serve as an ideal resource for drug discovery efforts and for the characterization of novel biosynthetic enzymes.

Our lab is focused on 1) elucidating the biosynthetic blueprint that nature uses for assembling biologically active compounds in bacteria and fungi, 2) manipulating and reprograming biosynthetic systems to generate new compounds with enhanced biological activities and 3) developing individual enzymes that carry out complicated reactions into renewable and environmentally friendly biocatalysts. These enzymes can be engineered to enhance the efficacy of existing therapeutics or be used in the synthesis or semisynthesis of pharmaceutically important compounds.

FACULTY IN PHARMACEUTICS & PHARMACEUTICAL CHEMISTRY

You Han Bae

Distinguished Professor of Pharmaceutics and Pharmaceutical Chemistry

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Education and Training:

- B.S., 1980, Seoul National University, Seoul, South Korea, Chemical Engineering
- Ph.D., 1988, University of Utah, Salt Lake City, UT, Pharmaceutics

Research Interests:

Our main research interests are as follows:

- Polymeric delivery systems for low molecular and macromolecular drugs and cells.
- Tumor pH targeting
- Oral delivery of genes, biologics and anticancer drugs

Mingnan Chen

Assistant Professor of Pharmaceutics and Pharmaceutical Chemistry

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Education & Training:

- B.A., 1996, Jimei University, Xiamen, China, Aquaculture
- M.Sc., 1999, Peking University, Beijing China, Biological Sciences
- Ph.D., 2007, University of Connecticut, Storrs, CT, USA, Pharmaceutical Sciences

Research Interests:

Dr. Mingnan Chen is interested in the development and study of protein therapeutics that are able to modulate immunity or treat immune disorders. In the last several years, his research program has fruited in three research areas: 1) developing better therapeutics for patients with autoimmune diseases, 2) developing cancer immunotherapeutic for patients who do not respond to existing immunotherapeutics, and 3) developing biocompatible polypeptides as formulation materials for vaccines and cancer chemotherapeutics.

In the first area, Dr. Chen's laboratory was able to create a PD-1 immune cell-targeted therapy to treat autoimmune diseases. The therapy not only reverses the course of the disease progression but also avoids immune deficiency that is often associated with the treatment of autoimmune disease (Nature Biomedical Engineering (2019) 3, 292-305). Thus, the therapy is likely a better therapeutic option for autoimmune disease patients. In the second area, the research team led by Dr. Chen developed an innovative approach to "tag" tumor cells that otherwise are indivisible to immune recognition and hence resist to existing cancer immunotherapy. Benefited by this tagging approach, these cancer patients may benefit from a wide range of cancer immunotherapies. In the third area, Dr. Chen's group invented a new class of biocompatible materials /polypeptides, iTEPs. iTEPs have been proven to be instrumental as drug formulation materials that potentiate cancer vaccines and chemotherapeutics (Biomaterials (2018) 182, 92-103).

Dr. Chen's research is currently supported by the National Institute of Health and private research foundations such as the National Multiple Sclerosis Society.

Shuyun Dong

Research Assistant Professor of Pharmaceutics & Pharmaceutical Chemistry

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Education and training:

- M.D., 1993, West China University of Medical Sciences, Chengdu, China
- M.P.H., 1996, in Environmental Health, School of Public Health, Sun Yat-sen, University of Medical Sciences, Guangzhou, China
- Ph.D., 2008, in Molecular Genetics and Microbiology, University of Massachusetts Medical School, Worcester, MA

Research Interests:

My long-term goal is to conduct research that aims to improve our understanding and treatment of neurologic diseases and cancers through manipulating RNA. During my Ph.D. work, I systematically studied several key events in mRNA life cycle including: splicing, localization, translation and degradation. My original findings were published in Molecular Cell and PLOS Biology. My postdoctoral research focused on understanding the alternative splicing of RNA and developing novel therapeutics for RNA splicing related diseases. My postdoctoral works were published in journals including Nature Molecular Page, Nature Protocols, Molecular Biosystems, and The Journal of Biological Chemistry. One of my articles was selected as Paper of This Week by The Journal of Biological Chemistry.

My present research interests at the University of Utah include:
Engineering and delivering therapeutic RNA-binding proteins, developing therapeutic approaches based on mechanics of RNA alternative splicing and degradation.

Darrell R. Galloway

Research Professor of Pharmaceutics and Pharmaceutical Chemistry

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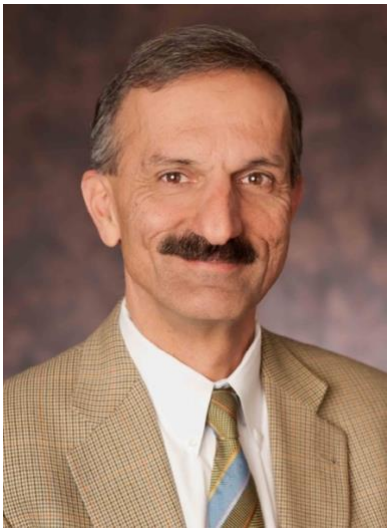
Education and training:

- B.S. Microbiology, 1972, California State University, Los Angeles, CA
- Ph.D., Biochemistry, 1977, University of California, Riverside, Ca
- Postdoc, Immunochemistry, 1980 Scripps Clinic & Research Foundation, La Jolla, CA

Research Interests:

Dr. Galloway's research interests have always centered around studies of infectious disease, principally vaccine development and/or immunotherapy. He is a recognized expert in the field of bacterial toxins where he has published extensively on structure-function studies of Pseudomonas exotoxin A, as well as genetic regulation of exotoxin production. Current project work includes a study of how the CD4 T follicular helper cell response in the germinal centers of lymph nodes helps to establish a long term memory response to two plague vaccines formulated with novel adjuvants. This work is contributing significantly toward the development of a plague vaccine, as there is currently no licensed plague vaccine in the world. By extension, this project is more broadly concerned with the process of rational vaccine design by understanding the details of cellular interactions following vaccine immunization.

A more recent interest involves studies to determine the basis of microbial persistence, which is felt to be a significant factor in the realm of antibiotic resistance. Microbial persistence, which is widely recognized yet not well understood, is associated with chronic infection, as well as being a form of antimicrobial resistance and thus constitutes a major area of clinical concern for many bacterial pathogens. The development of therapeutic strategies to identify and target persistent forms of microbial pathogens is a goal of these studies. Current studies are being conducted with *Borrelia burgdorferi*, the causative agent of Lyme Disease, and *Burkeholderia thailandensis*, a model for *B. mallei* (mellioidosis).



Hamid Ghandehari

Professor and George S. & Dolores Doré Eccles Presidential Endowed Chair of Pharmaceutics and Pharmaceutical Chemistry
Professor, Biomedical Engineering

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Education and Training:

- B.S., Pharmacy, University of Utah
- Ph.D., Pharmaceutics and Pharmaceutical Chemistry, University of Utah

Research Interests:

- The main focus of research in the Ghandehari laboratory is the development of novel methods for controlled delivery of bioactive agents. Our lab is exploring localized delivery of anti-inflammatory agents for the treatment of radiation-induced proctitis, targeted drug delivery for the treatment of chronic rhinosinusitis, and understanding the toxicity of inorganic nanoparticles. The overarching goal is to improve the efficacy and reduce toxicity of drugs.

David W. Grainger

University Distinguished Professor of Pharmaceutics and Pharmaceutical Chemistry;
University Distinguished Professor of Biomedical Engineering;
Past Inaugural George S. & Dolores Doré Eccles Presidential Endowed Chair of Pharmaceutics and Pharmaceutical Chemistry;
2008 Elected Fellow, American Association for the Advancement of Science;

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Education and Training:

- B.A., 1983, Dartmouth College, Hanover, NH, Engineering and Chemistry
- Ph.D., 1987, University of Utah, Salt Lake City, UT, Pharmaceutical Chemistry
- Alexander von Humboldt Postdoctoral Fellowship, 1988-89, Mainz, Germany

Research Interests:

Bioanalytical sensing and microarrays, cell-surface interactions, infection and bacterial-surface interactions, drug delivery, antibody drugs, novel vaccines

Our primary research interests currently are:

- Human cell therapies for regenerative medicine
- Nanomaterials toxicology
- Antimicrobial medical device strategies against infection
- Novel live vaccine delivery
- Diagnostic sensing technologies

James N. Herron

Associate Professor of Pharmaceutics and Pharmaceutical Chemistry;
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Education & Training:

- B.S., Biology, University of Illinois Urban-Champaign, 1976
- M.S., Microbiology, University of Illinois, Urban-Champaign, 1979
- Ph.D., Microbiology, University of Illinois Urban-Champaign, 1981

Research Interests:

Dr. Herron is interested in translational research – specifically, translating innovative near-patient diagnostics technologies from the laboratory into the clinic. Presently, his research is focused in three areas: 1) optical biosensor applications in biodefense, diagnostics, companion diagnostics, environmental and food testing, and personalized medicine; 2) high-throughput homogeneous fluorescence assays for use in biodefense, diagnostics, and quality control and assurance; and 3) dynamic light scattering as a means of detecting intravenous (IV) drug incompatibilities, when co-administered through the same IV line. He has published 113 full-length research articles and 107 abstracts. He also edited a book entitled “Physical Methods to Characterize Pharmaceutical Proteins.”

Dr. Herron has 32 US and 41 foreign patents, and has co-founded three different point-of-care diagnostics companies to commercialize biosensor technology developed in his laboratory. He has also consulted for 3M Corporation, Abbott Laboratories, Agri-Analysis, ARUP Laboratories, Echelon Biosciences, Johnson & Johnson, Kansas Technology Enterprise Corporation, and mBIO Diagnostics. He also chaired the translational development subcommittee of the Rocky Mountain Regional Center of Excellence in Biodefense and Emerging Infectious Disease (RMRCE), a NIH-sponsored center that supports basic and translational research in biodefense and infectious disease, with focus on developing countermeasures for both.

Paris Jafari

Research Assistant Professor of Pharmaceutics and Pharmaceutical Chemistry;

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Website: https://nanoinstitute.utah.edu/research/ustar-clusters/ghandehari-lab/ghandehari-lab.php

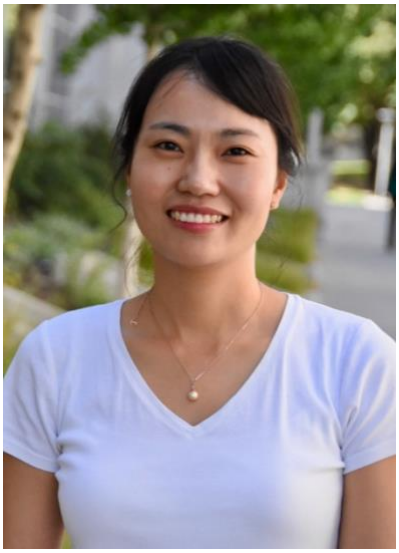
Education & Training:

- PharmD., 2002, Mazandaran University of Medical Sciences, Pharmacy
- MSc.,2010, University of Geneva, Cellular Biology
- Ph.D., 2014, University of Lausanne, Neurobiology

Research Interests:

Dr. Jafari is a Pharmacist-Biologist and a Research Assistant Professor at the Department of Pharmaceutics and Pharmaceutical Chemistry in the College of Pharmacy.

Developing smart, bioresponsive biomaterials is the main focus of the research projects being developed by Dr. Paris Jafari. She is interested in the design, evaluation, and application of the next generation bioresponsive matrices for cell therapy and tissue regeneration. Self-assembly behavior of recombinant protein polymers, along with the possibility to control their biological and biomechanical properties make them ideal biomolecules for tissue engineering applications. Dr. Jafari is interested in translating these characteristics into smart bioinks for biofabrication of tissues through 3D and 4D bioprinting. Her current projects that are funded by internal grants from the University of Utah are: i) The development of injectable antibacterial dressings for the treatment of Chronic Rhinosinusitis and ii) Matrix-mediated gene delivery for the treatment of glioblastoma. She is also developing recombinant smart bioinks for the 3D bioprinting of vascular grafts.



Kyungsook Kim

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Education & Training:

- B.S., 2007, Chemical engineering, Pukyong National University, Korea
- Ph.D., 2013, Bioengineering, Tokyo Women's Medical University, Japan
- Postdoctoral fellow, 2015, Biomedical Engineering, Tufts University, USA

Research Interests:

Dr. Kim is a biomedical engineer in the College of Pharmacy's Department of Pharmaceutical Chemistry who serves as a co-investigator for CSTEC@Utah's University Technology Acceleration Grant (UTAG). Dr. Kim's current research is developing allogeneic cell sheets, which have shown high transplantation efficacy to targeted tissues and release anti-inflammatory and anti-fibrotic cytokines continuously to damaged organs. This cell sheet tissue engineering technology has a wide range of applications, including the treatment of renal fibrosis, partial thickness cartilage defects, and salivary gland disorders. Dr. Kim is collaborating with the School of Medicine and the School of Dentistry at The University of Utah to develop and translate allogeneic cell sheet technology for a variety of clinical applications.

Jindřich Henry Kopeček

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Distinguished Professor of Bioengineering;

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Education & Training:

- M.S., 1961, Institute of Chemical Technology, Prague, Macromolecular Chemistry
- Ph.D., 1965, Institute of Macromolecular Chemistry, Prague, Macromolecular Chemistry
- Postdoctoral Fellow, 1967-1968, National Research Council of Canada, Ottawa
- D.Sc., 1990, Czechoslovak Academy of Sciences, Chemistry

Research Interests:

Biorecognition of Macromolecules; Bioconjugate Chemistry; Self-Assembly of Macromolecules; Drug Delivery Systems.

Current projects in the laboratory:

- Backbone degradable polymer-anticancer drug conjugates
- Combination chemotherapy and immunotherapy with polymer nanomedicines
- Transport of macromolecules across the blood-brain barrier
- Crosslinking-mediated endocytosis
- Drug-free macromolecular therapeutics – a novel paradigm in macromolecular therapeutics where apoptosis is induced following biorecognition events at cell surface without the need for low molecular weight drugs

Carol S. Lim

Professor of Pharmaceutics and Pharmaceutical Chemistry
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Education and Training:

- B.S., 1987, Purdue University, W. Lafayette, IN, Pharmacy
- Ph.D., 1996, University of California, San Francisco, CA, Pharmaceutical Chemistry
- Post-Doc, 1999, National Institutes of Health, NCI, Bethesda, MD; PRAT Fellow

Research Interests:

- Novel gene therapies for cancer treatment
- Protein/peptide-based therapeutics for cancer

The Lim Lab creates and develops novel cancer therapies through innovative pharmaceutical research using genetic engineering, biochemistry, molecular targeting, and in vitro/in vivo disease models. Applying these techniques, coupled with the latest drug delivery strategies, we aim to generate clinically relevant therapeutics that will ultimately save patient lives.

Our lab develops novel therapies for cancer treatment in collaboration with clinicians at the HCI. Current targets involve proteins involved in cancer (tumor suppressors or oncogenes). We focus on understanding the molecular mechanisms of signal transduction pathways in cancer, and use peptides or genes as novel therapeutics to disrupt oncogenesis or induce apoptosis. Our current projects include development of therapeutics for cancers that are “untreatable” or those that exhibit drug resistance. We have developed a p53-Bad gene therapy construct that combines the power of p53 tumor suppressor with apoptotic Bad (Molecular Pharmaceutics, 2019, 16(8):3386-98). We are currently testing this also in hepatocellular carcinoma, the third most common cause of cancer death globally. We also are testing a peptide-based coiled-coil therapeutic for treatment of CML, or chronic myeloid leukemia (Leukemia, 2015, 29(8):1668-75; J Phys Chem B. 2018, Apr 12;122(14):3864-3875) that is primed for clinical translation. Certain point mutations in CML render standard tyrosine kinase inhibitors ineffective; our coiled-coil inhibitors circumvent the drug resistance problem.

John W. Mauger

Professor of Pharmaceutics and Pharmaceutical Chemistry

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Education and Training:

- B.S. Pharmacy, 1965, Union University Albany College of Pharmacy
- M.S., 1967, University of Rhode Island
- Ph.D., 1971, University of Rhode Island

Research Interests:

Dr. Mauger's research is focused on developing standards for pharmaceutical dosage forms that can be used to assure safe and effective medicines. In particular, the application of sound and innovative measurement science to test the dissolution properties of solid dosage forms remains as one of the most useful tools for quality control purposes to assure that the active ingredient is released for therapeutic effect. These standards and tests are recognized for their importance to public health by the United States Pharmacopeia and the U.S. Food and Drug Administration.

Shawn C. Owen

Assistant Professor of Pharmaceutics and Pharmaceutical Chemistry

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Education and Training:

- B.S., 2005, in Chemistry; B.A. in Chinese, 2005, University of Utah
- Ph.D., 2009, in Pharmaceutics and Pharmaceutical Chemistry, University of Utah
- Postdoctoral Fellow, 2009-2013, University of Toronto

Research Interests:

Antibodies are important biological scaffolds used in biotherapeutics and diagnostics. The utility of antibodies can be expanded by coupling them with small-molecule drugs or proteins. Using both protein engineering and bioconjugation chemistry, we have created a series of highly-characterized antibody-conjugates that simultaneously deliver multiple drugs to induce new forms of synthetic lethality. Using these platforms, we can significantly increase the amount of drug that reaches a therapeutic target and demonstrate the applicability against HER2 positive cancers, as well as, drug-resistant bacteria. In separate approaches, we are utilizing split-enzyme technology to construct a new class of antibody-mediated diagnostics. These 'wash-free' homogenous immunoassays are as sensitive and more rapid than current technologies, without cumbersome processing steps. We have successfully constructed assays to measure protein biomarkers to follow cancer treatment and assays to monitor therapeutic drug levels. We are currently applying our platform to investigate important protein-protein interactions.

Jiyuan (Jane) Yang

Research Professor of Pharmaceutics and Pharmaceutical Chemistry

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Education and Training:

- B.S., 1986, Tsinghua University, Beijing, China, Chemical Engineering
- M.S., 1989, Dalian Institute of Technology, China, Polymer Materials
- Ph.D., 2001, Peking University, China, Biomedical Polymer Science
- Postdoctoral Fellow, 2002-2003, Institute Curie, Paris, France, Liquid Crystal Elastomers (Artificial Muscle)

Research Interests:

Having been working on biomaterials and drug delivery nearly 30 years, I have expertise in the design, synthesis and characterization of polymers and bioconjugates. From injectable biodegradable vaccine-delivery microspheres to new constructs of antibody-drug conjugates, I have accumulated a broad background with specific expertise in the synthesis and evaluation of various nanomedicines, in particular *N*-(2-hydroxypropyl)methacrylamide (HPMA)-based bioconjugates. For example, a patented technology relevant to more effective 2nd generation HPMA-based polymer-drug conjugates has been developed in our laboratory. This new synthetic strategy endorses inert HPMA polymer with biodegradability, which permits to prepare high molecular weight HPMA-drug conjugates with simple linear architecture while maintaining good biocompatibility. Various preclinical studies demonstrate distinct advantages over current clinical chemotherapeutic agents on tumor inhibition, indicating great potential to enhance cancer therapy.

I also work on new combination treatment strategies. In addition, our recent work on new construct of antibody-drug conjugates has won '2017 Best Research Paper in European Journal of Pharmaceutical Sciences', in which I served as corresponding author. This design integrates the high specificity of antibody-drug conjugates with advantages of macromolecular therapeutics.

FACULTY IN PHARMACOLOGY & TOXICOLOGY

Louis Barrows

Professor of Pharmacology and Toxicology

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Education and Training:

- B.S., 1975, California Polytechnic State University
- Ph.D., 1980, University of California, Irvine, Pharmacology.

Research Interests:

My laboratory is dedicated to the discovery of new anti-cancer and anti-infective agents. Much of what we do can be considered natural products drug discovery. We identify new drug leads based on their novel chemical structure or mechanism of action. Extracts of macro- and microorganisms from coral reefs and tropical rain forests provide the new molecules we isolate and evaluate. Determination of the molecular actions of new molecules and determination of the precise cellular consequences of their activity is often the basis of student doctoral projects. We take bioactive organisms and molecules all the way from the source to the sequencing gel, and then into animal models of human disease.

Our recent major projects are focused mostly around antimicrobial drug discovery. We are developing models to assess drug action on intracellular bacterial pathogens, such as Mycobacteria or Francisella, in order to understand pathogen and host cell responses in the context of drug efficacy. Other models we are developing involve HIV-1/TB coinfection, in which we can define selective antiviral or antibacterial drug action on the various host cell populations of singly-, doubly- or un-infected macrophages in the co-culture systems. These model systems allow us to identify new and unanticipated drug activities that serve as the basis for further research. We are also using these co-culture model systems to inform omics analyses of patient samples from TB or HIV/TB infected individuals. While this is just beginning, we have been able to generate single cell RNA sequencing libraries from nodal granulomas of TB patients in Papua New Guinea. Key transcriptional markers identified in our model systems are helping to understand cellular composition and infection status of these patients. It is hoped that such transcriptomic and genomic analysis will also identify drug resistance in these patients and personalize their therapeutic regimen.

Donald Blumenthal

Associate Professor of Pharmacology and Toxicology;
Associate Dean for Interprofessional Education;
Adjunct Associate Professor of Biochemistry;
Adjunct Associate Professor of Biomedical Informatics;
Associate Editor of Goodman & Gilman's The Pharmacological Basis of Therapeutics, On-line edition

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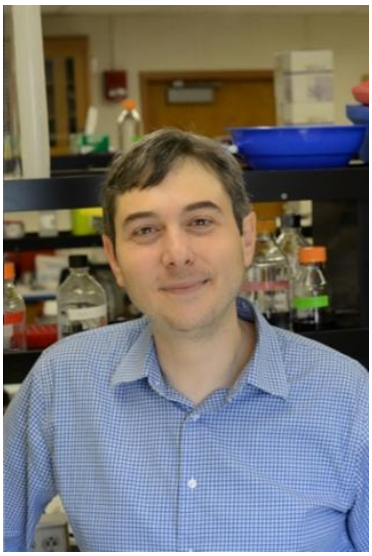
Education and Training:

- B.A., 1975, University of California, San Diego
- Ph.D., 1980, University of California, San Diego, Physiology and Pharmacology

Research Interests:
Much of my laboratory's current basic research efforts are directed towards biophysical studies of protein kinases and other signal transduction molecules using fluorescence, circular dichroism (CD), small-angle x-ray (SAXS) and neutron scattering (SANS), and molecular dynamics (MD). We are using these methods to better understand the large-scale dynamic properties of these important drug targets and their role in normal cell function and disease.

We have also recently begun to study human acetylcholinesterase, the enzyme that hydrolyzes the neurotransmitter acetylcholine. This enzyme is the target of nerve gas agents and several drugs that have therapeutic application in treating glaucoma and Alzheimer's disease. We are interested in developing better antidotes to inhibitors of this enzyme by studying the conformational dynamics of the protein using techniques such as SAXS, MD simulations, and neutron and X-ray diffraction.



Marco Bortolato

Associate Professor of Pharmacology and Toxicology

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Education and Training:

- M.D., 2000, University of Cagliari, Italy
- Ph.D., 2004, Pharmacology, University of Cagliari, Italy
- Specialization in Neurology 2009, University of Cagliari, Italy

Research Interests:

My research is primarily focused on the characterization of the biological bases of neurodevelopmental disorders through the employment of behavioral tests in animal models. In particular, my key scientific interest is the identification of the mechanisms of interaction between lipid mediators (including neuroactive steroids and endocannabinoids) and key brain neurotransmitters, such as dopamine and serotonin. To this end, we employ a broad array of behavioral, biochemical and molecular biological techniques, as well as stereotactic surgery and HPLC.

The long-term goal of this research is the development of novel therapeutic agents for the treatment of pathological aggression, autism-spectrum disorder, Tourette syndrome, schizophrenia and impulse-control disorders (such as pathological gambling).

My laboratory is currently involved in two major translational research projects. The first target of our investigations is the characterization of the molecular substrates of gene x environment interactions in impulsive aggression. The second aim of our research is the development of novel steroid- and cannabinoid-based tools for the therapy of impulse-control disorders, Tourette syndrome, autism and schizophrenia. Both projects involve multiple collaborations with several basic and clinical scientists in US, Canada, Italy, France and Germany.

TingTing Hong

Associate Professor of Pharmacology and Toxicology

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Education and Training:

- M.D. 1997, Beijing Medical University (Peking University Health Science Center), Beijing, China
- M.S, 2000, Peking University, Beijing, China
- Ph.D., 2005, University of Michigan, Ann Arbor
- Postdoctoral Fellow, 2007-2013, University of California, San Francisco

Research Interests:

Dr. Hong is a cardiovascular pharmacologist who is an associate professor in the Department of Pharmacology and Toxicology in the College of Pharmacy, an investigator in the Nora Eccles Harrison Cardiovascular Research and Training Institute (CVRTI), and a faculty member of the Diabetes & Metabolism Research Center (DMRC) at the University of Utah. Dr Hong's research focuses on understanding the regulation and remodeling of membrane microdomains of cardiomyocytes during heart failure progression. The Hong Laboratory studies how cardiomyocyte surface microdomains are organized to concentrate ion channels and signaling proteins for proper function and regulation in normal and failing hearts. The research interested includes the mechanisms of scaffolding protein and cytoskeleton-based maintenance of membrane structures and subdomains important in calcium signaling, turnover mechanisms of microdomains, and the mechanisms of heart failure progression. The goal is to identify, at the bench, new molecular and cellular targets that can be translated to develop new diagnostic and therapeutic tools for clinical management of heart failure.

Kristen Keefe

Professor of Pharmacology and Toxicology

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Education and Training:

- B.S., 1984, Case Western Reserve University
- M.S., 1989, University of Pittsburgh
- Ph.D., 1992, University of Pittsburgh
- Post-doctoral fellow, 1992-1995, NIMH

Research Interests:

My laboratory is interested in the structure and function of the basal ganglia, a group of subcortical nuclei in the brain involved in the control of movement and cognition. The importance of the basal ganglia for normal behavior is highlighted by the profound deficits observed in patients with Parkinson's disease, Huntington's disease, schizophrenia, and drug addiction -- diseases that are associated with dysfunction in the basal ganglia. Our work determines the influence of both endogenous and exogenous chemicals on the function of neurons in the basal ganglia in an attempt to better understand 1) the role that glutamate (via NMDA receptors) and monoamines (dopamine and serotonin) play in regulating the activity of basal ganglia nuclei;, 2) the mechanisms by which drugs of abuse that affect the basal ganglia exert both their acute and long-lasting adverse effects, with a particular emphasis on how the function of astrocytes at the tripartite synapse are altered in the setting of drug addiction and contribute to development of habitual control over behavior; and 3) the mechanisms by which the function of the basal ganglia can be beneficially altered by drugs to better treat sequelae associated with dysfunction in these nuclei. We use numerous techniques to examine the effects of both endogenous and exogenous drugs on basal ganglia function. These techniques include: 1) Neurochemical approaches in the brain of awake animals to examine changes in the release of amino acid, monoamine, and neuropeptide neurotransmitters. 2) In situ hybridization histochemistry to measure changes in the levels of messenger RNAs in brain neurons to examine short- and long-term changes in gene expression in neurons of the basal ganglia. 3) Immunohistochemistry and western blotting to examine changes in protein expression in defined basal ganglia neurons and nuclei. 4) Behavioral analyses of learning and memory processes mediated by corticostriatal circuits. 5) Electrophysiology and imaging in collaboration with the Wilcox and West laboratories to assess changes in neuron and astrocyte functions. Coupling these techniques, we can begin to understand how neurotransmitters and drugs acutely affect the function of basal ganglia neurons and the neuroadaptive changes that occur in response to neural injury in the basal ganglia and exposure to therapeutic and abused drugs.

Mei Yee Koh

Assistant Professor of Pharmacology and Toxicology

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Education and Training:

- PhD 2004, University of Manchester, Molecular Pharmacology
- BSc (Honors) 2000, University of Manchester, Biochemistry with Biotechnology

Research Interests:

All solid tumors and their metastases suffer from regions of oxygen deprivation, also known as hypoxia. This occurs as a result of the diffusion limitation of oxygen, and to the highly proliferative nature of cancer cells. Hypoxic tumors are intrinsically resistant to radiation and chemotherapy, and patients with these tumors are likely to have a poorer prognosis. My lab aims to determine how tumor hypoxia, and the hypoxia-inducible factors, **HIF-1** and **HIF-2,** drive outcomes that promote cancer progression and resistance to therapy. These outcomes include 'reprogramming' of cancer cells to favor increased growth (such as through increased iron uptake), reversion to a multipotent stem-like (and more aggressive) phenotype, and increased metastasis. The hypoxic tumor microenvironment also alters the patient's immune cells that are in proximity to the tumor, suppressing their ability to eliminate cancer cells. The overall goal of my lab is to identify new therapeutic strategies for cancer by targeting components of the tumor and the tumor microenvironment that drive cancer progression.

Tumor site-specific research programs are described at
https://pharmacy.utah.edu/pharmtox/faculty/current-faculty/koh-mei.php

Cameron S. Metcalf

Research Assistant Professor of Pharmacology and Toxicology;
Associate Director, Anticonvulsant Drug Development Program;

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Education and Training:

- B.S., 2001, University of Utah, Salt Lake City, UT, Biology and Human Development/Family Studies
- Ph.D., 2008, University of Utah, Salt Lake City, UT, Pharmacology

Research Interests:

Dr. Metcalf is a Research Assistant Professor in Pharmacology and Toxicology. He is also a Co-Investigator and the Associate Director of the Anticonvulsant Drug Development Program.

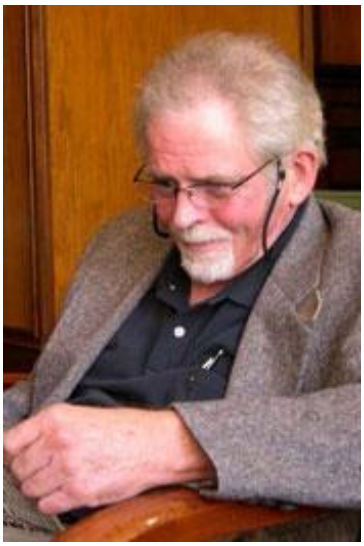
Dr. Metcalf's primary research interests include the evaluation and advancement of novel therapies for the treatment of epilepsy and pain. This work also involves ongoing efforts to identify and validate new animal models that can be used to screen and differentiate lead compounds.

Approximately one-third of patients with epilepsy continue to have seizures despite treatment with one or more drugs. In addition, there are several special populations of epilepsy patients, including pediatric epilepsies and genetic syndromes, for which there are little or no effective therapies. Therefore, the development of new compounds for various forms of epilepsy is of critical importance for the ongoing treatment of epilepsy.

For several years, Dr. Metcalf has also been interested in the development of neuropeptide compounds for the treatment of epilepsy and pain. Both epilepsy and pain are conditions where currently available treatments are often inadequate for many patients, and novel targets for therapies such as neuropeptides may offer new therapeutic opportunities.

Dr. Metcalf's work in this area has included both pre-clinical screening of novel compounds and the late-stage testing of lead candidate compounds. Dr. Metcalf's ongoing work in this area includes testing of analogs of the neuropeptide galanin, alone and in combination with other drugs, in models of epilepsy and pain, in order to identify a lead compound for progression into clinical testing.

Finally, Dr. Metcalf is also interested in the mechanisms of and potential clinical interventions for sudden unexpected death in epilepsy (SUDEP). While it is known that individuals with epilepsy, and particularly those with poorly controlled seizures, are at an increased risk for SUDEP, the mechanisms for this condition are not well understood. Therefore, understanding of risk factors, biomarkers, and potential clinical interventions to prevent SUDEP are an area of unmet need in epilepsy.



David Moody

Research Professor of Pharmacology and Toxicology

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Education and Training:

- B.A., 1972, University of Kansas, Chemistry
- Ph.D., 1977, University of Kansas, Experimental Pathology
- Postdoctoral Fellow, 1977-1980, University of California

Research Interests:

Our laboratory has used the power of mass spectrometry (MS) coupled to liquid or gas chromatography to measure amounts of drugs, drug metabolites and other xenobiotics in biological samples. We often use this technology to provide analytical services to other investigators, either commercially or collaboratively. When funding for research is obtained, we have used MS techniques to study in vitro drug metabolism. This includes use of animal models, human liver microsomes, cDNA-expressed drug metabolizing enzymes and human clinical studies. We have examined the role of cytochrome P450s (CYP) 2D1 in rat metabolism of amphetamine, the involvement of different in CYPs in the metabolism of l-acetylmethadol (LAAM) and methadone, and the involvement of both CYPs and glucuronosyltransferases (UGT) in the metabolism of buprenorphine. Currently we are studying in vitro inhibition of the metabolism of oxycodone, methadone and buprenorphine.

Philip Moos

Associate Professor of Pharmacology and Toxicology

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Education and Training:

- B.S., 1989, University of Colorado, Boulder, CO. Aerospace Engineering Sciences,
- M.S., 1990, University of Colorado, Boulder, CO. Aerospace Engineering Sciences,
- Ph.D.,1994, Kansas State University, Manhattan, KS. Biology,

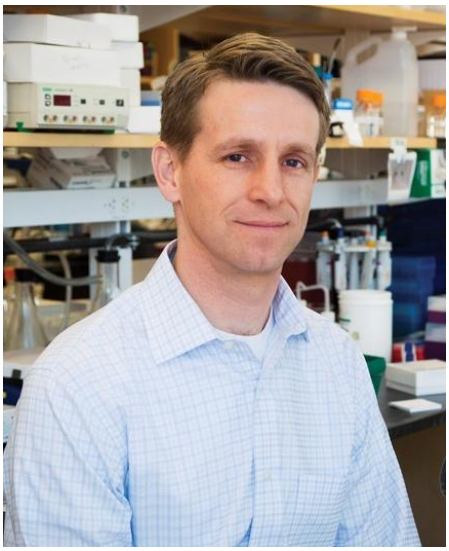
Research Interests:

The Moos laboratory is broadly interested in understanding cancer susceptibility and the development of resistance. Research efforts are focused on cancer genomics, mechanisms of disease, modifiers of cancer risk, and drug susceptibility.

Current work is primarily in three arenas: 1) tumor heterogeneity and the role genotype and phenotype in the response to therapeutics during cancer progression, 2) combining genomics and drug screens to identify novel therapeutic agents, and 3) genomic evaluation of nanoparticles for inflammatory potential or other toxic adverse effects.

The first and second area of research are collaborations with Dr. Bild and focus on tumor heterogeneity. Most tumors are thought to have monoclonal origin but by the time they are diagnosed, they are heterogeneous in terms of the subclonal structure driving their growth. We are involved in a collaboration where we are using various genomic strategies, from whole genome sequencing to single cell-RNA sequencing to elucidate the subclonal structure and pathways that dominate the subclones. We are also testing unique drugs and drug combinations to identify new potential strategies for therapeutic intervention.

The third and newer, area of research utilizes transcript profiling and apoptotic studies to evaluate particulate matter toxicity and inflammatory potential. We have found that certain metal oxide manufactured nanoparticles have significant toxicity and induce a cellular response to the stress of the nanoparticles. Nanomaterials provide many benefits and are being utilized more broadly so it is important to understand the potential toxicities, and mitigation strategies prior to use. Therefore, we collaborate with Dr. Ghandehari to understand the basis of the toxicology of materials with the potential for biomedical application. We also collaborate with Dr. Reilly to evaluate the genomic consequences of airborne pollutants that are risk factors for diseases like asthma.



Randall T. Peterson

L. S. Skaggs Presidential Endowed Chair and Dean, College of Pharmacy;
Professor of Pharmacology and Toxicology;

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Education and Training:

- B.S., in Molecular Biology, Brigham Young University
- Ph.D., in Biochemistry, Harvard University
- Postdoctoral Fellow, Massachusetts General Hospital and Harvard Medical School

Research Interests:

Developmental Biology: Small molecules are powerful tools for studying developmental biology because they provide timing and dosage control over developmental pathways that is difficult to achieve with genetic mutations. Unfortunately, only a handful of developmental pathways can currently be targeted with small molecules. We are discovering novel chemical modifiers of developmental pathways by exposing zebrafish embryos to libraries of structurally diverse small molecules and identifying those that induce specific developmental defects. Using screens of this type, we have discovered dozens of compounds that cause specific defects in hematopoesis, cardiac physiology, embryonic patterning, pigmentation, and morphogenesis of the heart, brain, ear, and eye and germ cell lineage.

Disease Physiology: One focus of our group is modeling human diseases in zebrafish. We then use the models to screen large chemical libraries for small molecule modulators of the disease-related phenotypes. The compounds we discover help us elucidate disease mechanisms and serve as starting points for developing new drug candidates.

Disease physiology is often complex and involves interactions between multiple organs and tissue types. Consequently, many diseases cannot be studied effectively using in vitro assays. The zebrafish is an excellent vertebrate model system to study many complex, non-cell autonomous diseases because the diseases can be studied in a native, whole-organism setting. In addition, compounds discovered in zebrafish screens have the advantage of having been selected for their ability to be active, efficacious, and well tolerated in animals.

Neuroscience & Behavior: Behaviors are accessible readouts of the molecular pathways that control neuronal signaling. Our group develops tools and techniques for comprehensive and high-throughput behavioral phenotyping in the zebrafish. These tools have some potential to improve our understanding of the neuronal signlaing and may accelerate the pace of neuroactive drug discovery.

Zebrafish Reverse Genetics: Zebrafish have proven to be a powerful genetic tool over the years, primarily through forward genetic screens where fish are mutagenized (typically with chemical agent) and screened for obvious defects. We are now on the verge of the next exciting step in zebrafish genetics: reverse genetics! Using targeted DNA disruption, we are now making designer mutations in specific genes of interest. Here are some of the resent papers describing three different processes.

Christopher Reilly
Professor of Pharmacology and Toxicology

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Education and Training:

- B.S., 1994, University of Utah. Biology, minor in Chemistry
- Ph.D., 1999, Utah State University, Toxicology

Research Interests:

My laboratory has three areas of research: TRP ion channels in lung physiology and disease, mechanistic studies of drug metabolizing enzymes, and biological applications of mass spectrometry.

1. TRP ion channels are a family of proteins that exhibit unique functional properties and associated physiological functions. We are interested in how TRP channels regulate physiological and adverse events in the lung, with particular emphasis on the ability of these channels to elicit deleterious pulmonary inflammation and lung cell death when activated by endogenous and/or exogenous agonists; pulmonary inflammation and acute lung damage are two critical components of lung diseases such as asthma, chronic obstructive pulmonary disease (COPD) and emphysema, fibrosis, and acute lung injury/ARDS. Our research is to establish roles of different members of the TRP ion channel family in the development and progression of lung injury and diseases and we have an active research program investigating receptor targets of pneumotoxicants and potential therapeutic inhibitory chemicals, the identification of specific cellular pathways that modulate deleterious and/or beneficial responses of lung cells to TRP channel agonists, and evaluation of TRP channel-dependent pathways in adverse outcomes in experimentally-induced disease states. Currently we are funded by the National Institute of Environmental Health Sciences (NIEHS) to determine how different components of polluted air adversely affect the human respiratory system.
2. Xenobiotic metabolism is a collective process by which chemicals that enter our body are modified. We are interested in how human cytochrome P450 enzymes transform chemicals to pharmacologically and/or toxicologically inactive vs. toxic reactive intermediates that damage cellular macromolecules, cells, and organ systems. We have two primary areas of focus: 1) enzymatic and chemical mechanisms of oxygenation vs. dehydrogenation of substrates and analysis of modified biological macromolecules (i.e., DNA and protein) by electrophiles, particularly with respect to such processes in lung tissue; and 2 the elucidation of how variations in drug metabolism mechanisms and efficiency dictate the pharmacological and/or toxicological properties of inhaled and/or systemically-delivered therapeutic drugs. Currently research in this area is supported by grants from the National Institute of General Medical Sciences (NIGMS) and Eunice Kennedy Shriver National Institute of Child Health and Human Development (NICHD).
3. Mass spectrometry is a versatile and powerful analytical technology that has revolutionized mechanistic pharmacology and toxicology studies. We use mass spectrometry to quantify a variety of substances in diverse matrices, to establish structures and metabolic origins of drug metabolites in P450 reactions, to discover unknown bioactive substances that have measurable biological activity using metabolomics-based methodology, and to identify macromolecular targets of toxic electrophiles generated by P450s. Mass spectrometric analysis is a routine approach used by our laboratory and it is supported by a variety of research grants, sub-contracts, and collaborations.

Joseph Rower

Research Assistant Professor of Pharmacology and Toxicology
Associate Director, Center for Human Toxicology

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Education and Training:

Board Certification

- American Board of Clinical Pharmacology

Postdoctoral Fellowship

- University of Utah, Pediatric Clinical Pharmacology
- University of Colorado Anschutz Medical Campus, Antiviral Pharmacology
- University of Colorado Anschutz Medical Campus, Systems Biology

Doctoral Training

- University of Colorado Anschutz Medical Campus, Pharmaceutical Sciences

Undergraduate

- California Lutheran University Chemistry, Mathematics

Research Interests:

Dr. Joseph Rower is a Research Assistant Professor in the Department of Pharmacology and Toxicology. The major focus of my laboratory is using clinical pharmacology techniques to optimize drug dosing, especially in children. A primary project in the lab is the development of a precision medicine tool to guide tacrolimus therapy in pediatric transplant. We are currently combining pharmacokinetic, pharmacogenomic, and pharmacodynamics techniques to assess the potential for this precision medicine tool to improve the longevity of heart transplants in children. Additionally, we utilize mass spectrometry and other bioanalytical techniques to quantify drug concentrations in blood/tissue to generate data defining how drug moves through the body. Of particular interest in our lab are studies using dried blood spots (DBS), a novel, low blood volume sampling technique ideal for collecting samples in neonates. We have used these skills to support clinical trials on the glucocorticoid budesonide, the steroid oxandrolone, and the antiviral ganciclovir.

Misty D. Smith

Research Assistant Professor of Pharmacology and Toxicology

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Education and Training:

- B.S., 1996, Muskingum University, OH, Biology
- Ph.D., 2001, University of South Carolina, Biomedical Sciences (Pharmacology
- and Physiology)
- Postdoctoral Training, 2002-2004, University of Utah (Pharmacology and Toxicology)

Research Interests:

Dr. Smith is a Research Assistant Professor in the Department of Pharmacology and Toxicology in the College of Pharmacy whom serves as a Co-Investigator in the NIH/NINDS contract site for the Epilepsy Therapy Screening Program (ETSP). Her primary research interests include the evaluation and advancement of novel therapies for the treatment of epilepsy and pain. A focus of her research is the investigation of the therapeutic potential of novel compounds, such as cannabidiol, for the treatment of chronic neurological disorders and their comorbidities, as well identifying potential drug-drug interactions of cannabidiol with other concomitant therapeutics. With nearly two decades experience as a behavioral pharmacologist, Dr. Smith's research also contributes to ongoing efforts by the ETSP to develop and validate new animal models which can be used to screen and differentiate lead compounds for the treatment of epilepsy. Additional related research interests of Dr. Smith include (1) the pharmacotherapeutic potential of novel neuropeptides in the treatment of chronic pain, substance abuse and other neuropsychiatric conditions and (2) sex differences in disease pathophysiology, behavior and drug responses. In addition to her contributions to the Department of Pharmacology and Toxicology in the College of Pharmacy, Dr. Smith holds a joint appointment as a Research Associate Professor in the Oral Biology, Medicine, and Pathology Section of the School of Dentistry at the University of Utah.

Shawshank Tandon

Research Assistant Professor of Pharmacology and Toxicology

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Education & Training:

- B.Sc. (Hons.) (Human Biology), All India Institute of Medical Sciences, India, 2001
- M.Sc. (Physiology), All India Institute of Medical Sciences, India, 2003
- PhD (Neuroscience), National Brain Research Centre, India, 2010

Research Interests:

My research focuses on understanding the neural correlates of reward and aversion and how they play a role in modulating appetitive and consummatory behavior for natural rewards and drugs of abuse. To this end, I am employing electrophysiological and behavioral techniques in rats to determine the brain mechanisms mediating appetitive behavior which drives intake of highly palatable high fat/sugar food as well as drugs of abuse. Specifically, I have been interested in determining the role of opioid signaling in the nucleus accumbens (NAcc), an important node in the reward pathway, in normal feeding and binge eating behavior. My current research focuses on the brain circuitry regulating ethanol intake, with a goal of determining the role of the lateral habenula (LHb), a crucial area in which aversive stimuli are encoded, in regulating voluntary ethanol consumption during early and late stage of alcohol abuse. My long-term research goal is to determine the neural mechanism through which different factors (e.g. stress, negative affective state) can increase vulnerability to develop drug addiction as well as increase risk for chronic relapse in post-dependent state.

Alessandro Venosa

Assistant Professor of Pharmacology and Toxicology

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Education & Training:

- Pharm.D., 2009, Universita' degli Studi di Urbino, Italy
- Ph.D., 2015, Rutgers University, NJ, Toxicology

Research Interests:

Dr. Venosa is a pulmonary immunotoxicologist in the Department of Pharmacology and Toxicology. His research focuses on examining the effects of air pollution and other environmental toxicants (ozone, particulate matter, cigarette smoke) on susceptible populations, with particular interest for genetic variants associated with pulmonary fibrosis. To address these research questions, his group developed a novel murine model of spontaneous pulmonary fibrosis driven by mutation on the surfactant protein C gene. By combining a wide variety of techniques (cell lineage tracing, bulk and single cell RNA-sequencing, metabolomics, lipidomics, etc..) his group is investigating signaling pathways involved in epithelial-immune cell crosstalk which could hold therapeutic value in pulmonary fibrosis.

Peter West

Research Assistant Professor Pharmacology and Toxicology

Email: peter.west@utah.edu
Website: http://pharmacy.utah.edu/pharmtox/faculty/current-faculty/West-P.php

Education and Training:

- B.S., 1997, Lehigh University, Biochemistry
- Ph.D., 2003, University of Utah, Neuroscience

Research Interests:

Dr. West is interested in the pathophysiology and treatment of diseases that affect cognition. His research is conducted both independently and in collaboration with the Epilepsy Therapy Screening Program (ETSP, Principal Investigator: Karen Wilcox, Ph.D.) where he is a co-investigator. In this capacity, he directs studies developing novel animal models of pharmacoresistant seizures and determining the efficacy and cognitive side-effect profiles of proprietary investigational compounds. Dr. West's independently funded research is focused on understanding the pathophysiology of cognitive comorbidities associated with epilepsy. In order to identify novel molecular targets and test potential treatments, an understanding of the pathophysiological basis of cognitive deficit in epilepsy must first be obtained and preclinical model systems must be developed. Accordingly, studies intended to characterize synaptic plasticity deficits and cognitive dysfunction in animal models of Epilepsy are underway. Furthermore, his laboratory is developing the first rodent model of pediatric epilepsy due to abnormal hypothalamic development (hypothalamic hamartoma); one goal of this research is to better understand the developmental origin of gelastic (laughing) seizures in this patient population and their concurrent cognitive dysfunction. Dr. West's laboratory employs genetic, electrophysiological, pharmacological, immunohistochemical, and behavioral techniques to achieve these goals. Of particular note, the lab uses specialized equipment which allows the experimenter to perform simultaneous recordings from multiple brain slices, thus allowing for the high-throughput evaluation of numerous electrophysiological phenomena associated with learning and memory (e.g. synaptic plasticity).

Karen Wilcox

Professor of Pharmacology and Toxicology

Email: kwilcox@deans.pharm.utah.edu
Website: http://pharmacy.utah.edu/pharmtox/faculty/current-faculty/Wilcox-K.php

Education and Training:

- B.A., 1981, Allegheny College
- Ph.D., 1993, University of Pennsylvania

Research Interests:

The Wilcox laboratory is interested in understanding basic mechanisms underlying epileptogenesis, seizure generation, and therapy-resistance to anticonvulsant drugs. To achieve these goals, we use electrophysiological, calcium imaging, pharmacological, behavioral, genetic, immunoblot, and immunohistochemical techniques in a variety of in vitro preparations and animal models of epilepsy. Our working hypothesis is that insight into disease-induced changes in neuronal and glial function will provide new avenues for therapeutic interventions in patients at risk for developing epilepsy or those patients who are refractory to current treatment options. To that end, I am also the Director of the Anticonvulsant Drug Development (ADD) Program which serves as the contract site for the Epilepsy Therapy Screening Program at NINDS at the National Institutes of Health.

FACULTY
IN
PHARMACOTHERAPY

Jennifer Babin

Assistant Professor (Clinical) of Pharmacotherapy

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Website: https://pharmacy.utah.edu/pharmacotherapy/faculty/babin.php

Education & Training:

- B.S., 2009, University of Alabama, Tuscaloosa, AL, Biology
- Pharm.D., 2013, Auburn University, Auburn, AL
- PGY1 Pharmacy Practice Residency, 2014, Greenville Health System, Greenville, SC
- PGY2 Internal Medicine Residency, 2015, University of Utah Health Care, Salt Lake City, UT

Research Interests:

Dr. Babin is a clinical pharmacist practicing at the University of Utah Hospital in internal medicine. Her research interests include topics relating to the care of internal medicine patients and pharmacy education.

Elizabeth Bald

Assistant Professor (Clinical) of Pharmacotherapy

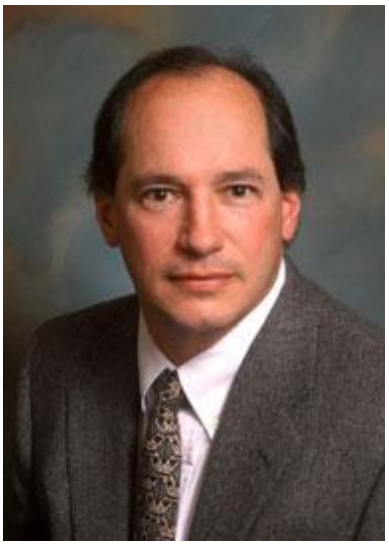
Email: elizabeth.bald@pharm.utah.edu
Website: https://pharmacy.utah.edu/pharmacotherapy/faculty/bald.php

Education & Training:

- PharmD, 2017, Drake University, Des Moines, IA
- PGY1 Pharmacy Practice Residency with an Ambulatory Care Focus, 2018, University of Iowa Hospitals and Clinics, Iowa City, Iowa
- PGY2 Ambulatory Care Residency, 2019, University of Iowa Hospitals and Clinics, Iowa City, Iowa

Research Interests:

Dr. Bald is a clinical pharmacist practicing at the University of Utah Madsen Family Medicine Clinic. Her research interests include chronic disease state management, diabetes, health coaching, and pharmacy policy and advocacy.



Joseph Biskupiak

Research Professor of Pharmacotherapy;
Director, Pharmacotherapy Outcomes Research Center;

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Website: https://pharmacy.utah.edu/pharmacotherapy/faculty/biskupiak.php

Education & Training:

- B.S., 1979, University of Connecticut, Chemistry
- M.B.A., 1995, Seattle University
- Ph.D., 1985, University of Utah, Medicinal Chemistry

Research Interests:

Outcomes research, health services research, US health care delivery system.

Diana Brixner

Professor of Pharmacotherapy;
Executive Director, Pharmacotherapy Outcomes Research Center;
Adjunct Professor, Department of Population Health Sciences;
Adjunct Professor, Department of Pediatrics, Division of Clinical Pharmacology;
Associate Member, Huntsman Cancer Institute Cancer Control and Population Sciences;
Member, Center for Genomic Medicine;
Past President, Academy of Managed Care Pharmacy (AMCP);
Past President, International Society of Pharmacoeconomics and Outcomes Research (ISPOR);

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https://www.ncbi.nlm.nih.gov/pubmed/?term=Brixner+D

Education & Training:

- B.S., 1982, University of Rhode Island, Pharmacy
- Ph.D., 1987, University of Utah, Medicinal Chemistry

Research Interests:

Currently, I am a Professor in the Department of Pharmacotherapy, Adjunct Professor in the Department of Population Health Sciences and Pediatrics in the Divisions of Health Systems Innovation Research and Clinical Pharmacology and Executive Director of the Pharmacotherapy Outcomes Research Center at the University of Utah. My research focus is on the design, conduct, and communication of pharmacoeconomic and outcomes research studies to demonstrate the value of pharmaceutical and related therapies from the perspective of the private and public payer. I am also a Research Associate at the Institute of Public Health, Medical Decision Making and Health Technology Assessment in the Department of Public Health and Health Technology Assessment at UMIT - University for Health Sciences, Medical Informatics and Technology in Hall i.T., Austria. This appointment supports my international collaborations in oncology research, personalized medicine and value assessment. During my career, I have published over 150 articles in peer-reviewed journals, authored three book chapters, have one issued patent, and have been an invited speaker at a variety of national and international professional meetings. I am a founding member, served on the Executive Board, as well as the Health Policy and Science Council and am a past president of the International Society of Pharmacoeconomics and Outcomes Research (ISPOR). In addition, I am a long-standing member and past president of the Academy of Managed Care Pharmacy (AMCP), currently serve as a Director on the Board of the AMCP Biologics & Biosimilars Collective Intelligence Consortium (BBCIC), and have been named as a fellow of the Academy.

Nathorn Nui Chaiyakunapruk

Professor of Pharmacotherapy

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Education & Training:

- B.S in Pharm Sciences, 1994, Chulalongkorn University, Thailand
- Pharm.D., 1997, University of Wisconsin, Madison,
- Ph.D., 2001, University of Washington, Seattle, Pharmaceutical Outcomes Research and Policy

Research Interests:

Dr. Chaiyakunapruk's expertise is in Health Technology Assessment. He has applied several HTA methodologies (Health Economics, Real World Data Analysis, and Evidence Synthesis: systematic review and classical/network meta-analysis) to support national and global policy, especially his contributions to the World Health Organization. Dr. Chaiyakunapruk's current research is in investigating the clinical impacts of intermittent fasting on microbiome, metabolic effects, and clinical outcomes. Other research interests include economic burden and outcomes of herpes simplex and zoster infection and COVID-19.

Nicholas Cox

Assistant Professor (Clinical) of Pharmacotherapy;
Clinical Pharmacist, Westridge Health Center, University of Utah Health;

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Website: https://pharmacy.utah.edu/pharmacotherapy/faculty/cox.php

Education & Training:

- PharmD, 2015, University of Utah, Salt Lake City, UT
- PGY-1 Pharmacy Practice Residency, University of Utah Health, Salt Lake City, UT
- PGY-2 Ambulatory Care Pharmacy Residency, University of Utah Health, Salt Lake City, UT

Research Interests:

Dr. Cox is a clinical pharmacist whose current research interests and projects involve quality improvement initiatives, chronic pain, primary care, scholarship of teaching and learning, and others.

Karen M. Gunning

Professor (Clinical) of Pharmacotherapy;
Adjunct Professor of Family & Preventive Medicine;
Associate Dean of Community Engagement;
Clinical Pharmacist – Sugarhouse Health Center Family Medicine;

Email: karen.gunning@pharm.utah.edu
Website: http://pharmacy.utah.edu/pharmacotherapy/faculty/gunning.php

Education & Training:

- B.S., 1995, Oregon State University, Pharmacy
- Pharm.D., 1997, University of Utah
- Specialized Residency in Family Medicine, 1998, University of Washington

Clinical Specialty: Family Medicine

Research Interests:

- Population health and continuous quality improvement for chronic conditions in primary care
- Medication safety in the ambulatory care setting - particularly in pain management, and diabetes.
- Scholarship of teaching and learning as it relates to family medicine residents and pharmacy students and residents.
- Women's and Men’s health, Care of Transgender Patients.

Lauren Heath

Assistant Professor (Clinical) of Pharmacotherapy

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Education & Training:

- B.S. in biochemistry, 2010, University of Michigan – Ann Arbor, MI
- Pharm.D., 2014, University of Michigan College of Pharmacy, MI
- PGY1 Pharmacy Practice Residency, 2015, University of Southern California, CA
- M.S. in Clinical Science, 2017, University of Colorado Denver, CO
- Outcomes Research Fellowship in Ambulatory Care, 2018, Kaiser Permanente Colorado and University of Colorado School of Pharmacy, CO

Research Interests:

Research interests include health services research, implementation science, and evidence-based health care. Other interests include evaluating the impact of comorbid conditions on clinical and health care outcomes and the public and other healthcare professional's perceptions of clinical pharmacists.

Amberly R. Johnson

Assistant Professor (Clinical) of Pharmacotherapy

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Education & Training:

- A.A., 1999, Dixie State College, St. George, Utah
- B.S., 2002, Southern Utah University, Cedar City, Utah, Pharmacy
- Pharm.D., 2013, University of Utah, Salt Lake City, Utah
- Clinical Toxicology Fellowship, 2013-2015, Utah Poison Control Center, Salt Lake City, Utah.

Research Interests:

Dr. Johnson is the Director of the Utah Poison Control Center and a board certified clinical toxicologist. Her research interests include topics related to poison control center operations, utilization, and value and poison-related exposures.

Kibum Kim

Research Assistant Professor of Pharmacotherapy

Email: kibum.kim@pharm.utah.edu
Website: https://pharmacy.utah.edu/pharmacotherapy/faculty/kim.php

Education & Training:

- 2016-2018, Post-Doctoral Fellow, Pharmacotherapy Outcomes Research Center, University of Utah, Salt Lake City, Utah
- 2011-2016, PhD in Pharmacy specialized in pharmacoeconomics and outcomes research, University of Illinois at Chicago, Chicago, Illinois
- 2006-2008, Master of Science in Pharmacy specialized in Pharmacokinetics and Pharmacodynamics, Catholic University of Daegu, Gyeongbuk Province, South Korea
- 2002-2006, Bachelor in Pharmacy, Catholic University of Daegu, Gyeongbuk Province, South Korea

Research Interests:

Kibum Kim is a Research Assistant Professor in the Department of Pharmacotherapy and at the Pharmacotherapy Outcomes Research Center, University of Utah. He graduated from University of Illinois at Chicago with his PhD in Pharmacy, specialized in pharmacoeconomics and outcomes research. Prior to working at University of Utah, he interned at Abbvie, Inc., Takeda Pharmaceuticals, and eMax Health Company where he assisted multiple market access projects. He also had years' practical experience from community pharmacies. Dr. Kim's research interest includes contemporary trends in medication utilization, outcome analysis using sophisticated statistical approach and model-based cost-effectiveness analysis.

During his career, Dr. Kim has presented and published his researches in clinical and economic outcomes of treatment options for diabetes, cardiovascular disorders, and oncology. His recent studies focus on the clinical utility of molecular diagnostics, therapeutic drug monitoring, and precision medicine.

Main research interests are as follows:

- Utility of precision medicine and molecular diagnostic testing
- Utilization and outcomes of antiplatelet therapy and anti-coagulation management
- Glycemic control associated with anti-diabetic agent use and concurrent medication to prevent patient from long-term complications
- Resource utilization and healthcare cost across multiple chronic conditions
- Research methods in health outcomes research using real-world databases

Joanne LaFleur

Associate Professor of Pharmacotherapy

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Education & Training:

- B.S., 2001, University of Utah, Salt Lake City, UT, Pharmacy Practice
- Pharm.D., 2003, University of Utah, Salt Lake City, UT, Pharmacy Practice
- M.S.P.H., 2005, University of Utah, Salt Lake City, UT, Public Health

Research Interests:

- Pharmacoeconomics Outcomes research
- Patient adherence and persistence
- Medicaid and public health policy
- Chronic pain syndromes
- Primary and secondary prevention of cardiovascular disease
- Risk factors for osteoporotic fracture

Alisyn May
Assistant Professor (Clinical) of Pharmacotherapy

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Website: https://pharmacy.utah.edu/pharmacotherapy/faculty/may.php
Education & Training:
- B.S., 2011, in Chemistry/Health Sciences, Wayne State College, Wayne, NE
- PharmD, 2013, University of Nebraska Medical Center, Omaha, NE
- PGY1 Pharmacy Practice Residency, 2013-2014, University of Utah Hospitals & Clinics, Salt Lake City, UT
- PGY2 Ambulatory Care & Family Medicine Residency, 2014-2015, University of Utah Hospitals & Clinics, Salt Lake City, UT

Clinical/Research Interests:
- Research in the area of ambulatory care, family medicine, and chronic disease state management.
- Interested in studying the role of pharmacist in the primary care setting, novel ways to engage patients in their healthcare, and resiliency & burnout in clinical and faculty pharmacists.

Research interest in transitions of care, resiliency/burnout, shared decision making, diabetes, chronic disease state management

Daniel Malone

Professor of Pharmacotherapy;
Director, Graduate Program, Department of Pharmacotherapy;

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Website: https://pharmacy.utah.edu/pharmacotherapy/faculty/malone.php

Education & Training:

- B.S., 1987, University of Colorado Health Sciences (Pharmacy)
- M.S., 1990, University of Texas, Austin, TX (Social and Administrative Pharmacy)
- Ph.D., 1993, University of Texas, Austin TX (Social and Administrative Pharmacy)

Research Interests:

Dr. Malone's research interests broadly include health economics and outcomes research, with a specific focus in drug safety and reducing adverse drug events. In addition, he is developing strategies using health information technologies and large datasets to provide meaningful decision support to clinicians. His current research includes identifying risk factors for drug interactions, developing computer algorithms to implement such risk factors within clinical health records, and conducting studies in a learning healthcare network to reduce excessive alerts while appropriately identifying patients at risk of harm. He is also leading a study that will disseminate a clinical decision support algorithm that uses a risk scoring algorithm to predict patients at risk drug-induced prolonged QTc interval, with the goal of reducing excessive lengths of hospitalization and fewer sudden cardiac deaths. He has experience in conducting clinical trials, observational studies, and various other types of study designs. Dr. Malone has over 180 peer-review publications and is past President of the International Society for Pharmacoeconomics and Outcomes Research.

Krystal Moorman

Assistant Professor (Clinical) of Pharmacotherapy

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Website: http://pharmacy.utah.edu/pharmacotherapy/faculty/moorman.php

Education & Training:

- PharmD, 2000-2004, Medical University of South Carolina
- PGY-1 residency, 2004-2005, Medical University of South Carolina
- PGY-2 residency in Drug Information Practice, 2005-2006, Medical University of South Carolina

Clinical Specialty: Community Practice

Research Interests:

Dr. Moorman has research interests in medication safety, medication therapy management, community pharmacy practice, and drug information.

Mark Munger

Professor of Pharmacotherapy;
Adjunct Professor, Internal Medicine (Cardiology);
Associate Dean, College Affairs, CoP;

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Website: http://pharmacy.utah.edu/pharmacotherapy/faculty/munger.php

Education and Training:

- B.S.(Pharmacy), 1980, Oregon State University
- Pharm.D., 1984, University of Illinois at Chicago
- Clinical Pharmacology Research Fellowship, 1988, Case Western Reserve University School of Medicine

Research Interests:

The Munger Research Group is focusing on repurposing drugs to address major public health concerns, unique value propositions and differentiation, with the potential for commercial product value. Currently we have two drugs in research development. A second focus is conducting research on the expanding use of medical cannabis in the State of Utah.

1. NSAID-induced cardiovascular and renal adverse effects are associated with the mortality of approximately 8 million lives yearly. Our research has focused on reducing these effects by biologically affecting the underlying drug-induced physiology. Through combining a prostaglandin E2 analog with the NSAID diclofenac we have been able to beneficially reset cardiovascular and renal hemodynamics; and to show that cardiovascular and renal induced events are statistically and clinically improved. This agent is currently in the pre-IND stage of FDA approval.
2. We have also developing a drug for the treatment of atrial fibrillation. In collaboration with The Ohio State University and colleagues in Italy we have developed an agent that physiologically affects Na+ channels which co-localize with ryanodine receptors Ca2+ release channels and the Na+/Ca2+ exchanger. These findings have translated into a clinical setting of a community-based historical cohort that revealed patients treated with the agent evidenced lower incidence of arrhythmias including atrial fibrillation.
3. The University of Utah Departments of Medicine (Anesthesiology and Internal Medicine), Pharmacology and Toxicology (Center for Human Toxicology), and Pharmacotherapy in collaboration with Zion Alchemy, LLC. and UU ARUP Laboratories have developed a study of using micro doses of THC while maintaining CBD physiological dosing that more closely mimic the natural biologic effects on the endocannabinoid receptor in the human body. This may allow realization of therapeutic benefit without adverse effects that can lead to disease, dependency, environmental and legal issues.

Nancy Nickman
Professor of Pharmacotherapy

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Website: http://pharmacy.utah.edu/pharmacotherapy/faculty/nickman.php
Education & Training:

- RPh License, 1982, Minnesota; 2011 Utah
- B.S., 1982, University of Montana, Pharmacy
- ASHP Accredited Administrative Residency 1982-1984, United & Children's Hospital
- M.S., 1984, University of Minnesota, Hospital Pharmacy
- Ph.D., 1987, University of Minnesota, Social & Administrative Pharmacy

Research Interests:
Dr. Nickman's teaching and research expertise includes patient-centered outcomes research to improve provision and quality of patient care based on application of industrial engineering and economic analyses. Publications and presentations include work sampling evaluations of institutional pharmacy services for re-design of structural and functional activities, pre-post analyses of the impact of technology on the practice of health professionals, simulated time-and-motion evaluations coupled with microcost analyses of issues related to medication preparation and administration, and analysis of devices intended for medication self-administration. Since 2012, Nancy has served as a Clinical Coordinator for Analytics and Outcomes for Pharmacy Services, University of Utah Health Care. For 2016-17, she is serving as co-Chair of the ASHP Section on Pharmacy Informatics and Technology (SOPIT) Pharmacy Operations Automation (POA) Section Advisory Group (SAG). From 2013-2016, she co-chaired the "Automation of the Pharmacy Enterprise" subgroup of the POA SAG and has been a POA member since 2010.

Heather Nyman

Assistant Professor (Clinical) of Pharmacotherapy

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Website: http://pharmacy.utah.edu/pharmacotherapy/faculty/nyman.php

Education & Training:

- B.S., 2000, Brigham Young University, Provo, UT, Chemistry.
- Pharm.D., 2004, University of North Carolina at Chapel Hill, Chapel Hill, NC
- PGY1 Pharmacy Practice Residency, 2005, University of Utah Hospitals and Clinics, Salt Lake City, UT

Research Interests:

Dr. Nyman is a clinical pharmacist practicing at the University of Utah Hospital in internal medicine. Her research interests are in the area of nephrology, including management of anemia of chronic kidney disease and measures of kidney function for drug dosing. Current projects include an analysis of data from the VA system to compare drug dosing when using the CKD-EPI, MDRD, and Cockcroft-Gault equations.

Patricia Orlando

Professor (Clinical) of Pharmacotherapy

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Website: http://pharmacy.utah.edu/pharmacotherapy/faculty/orlando.php

Education & Training:

- B.S. Pharmacy, 1982, University of Montana
- Pharm.D., 1985, University of Utah
- Pharmacy Practice Residency, 1985, University of Utah Hospital,
- Residency, 1986, SLC Veterans Affairs Medical Center, Geriatric Pharmacy
- Fellowship, 1987, UCLA, Infectious Diseases Pharmacotherapy

Clinical Specialty:

Geriatric Infectious Disease Pharmacotherapy
Dr. Orlando is a clinical pharmacy specialist for Infectious Diseases at the George E. Wahlen Veterans Affairs Healthcare System in Salt Lake City, Utah

Research Interests:

Role of pharmacy interventions in outpatient parenteral antimicrobial therapy (OPAT) and transitionary care for the geriatric patient with infection requiring extended therapies; Antibiotic pharmacy monitoring systems for OPAT; Antibiotic education models for geriatric patients with infections; Pharmacotherapy role of pharmacy students in the management of geriatric infections.

Hanna Raber

Assistant Professor (Clinical) of Pharmacotherapy

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Website: http://pharmacy.utah.edu/pharmacotherapy/faculty/raber.php

Education and Training:

- Pharm.D., 2014, Drake University, Des Moines, IA
- PGY-1 and PGY-2 Ambulatory Care Residency, 2016, Saint Joseph Regional Medical Center, Mishawaka, IN

Research Interests:

Dr. Raber is a clinical faculty member who provides patient care at the University of Utah Centerville and Madsen Family Medicine Residency Clinics. Her research interests include health communication, global health, and preventative medicine.

James Ruble

Associate Professor (Clinical) of Pharmacotherapy

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Website: http://pharmacy.utah.edu/pharmacotherapy/faculty/ruble.php

Education & Training:

- B.S., 1989, University of Utah College of Science, Biology
- B.S., 1992, University of Utah College of Pharmacy, Pharmacy
- Pharm.D., 1994, University of Utah College of Pharmacy
- J.D., 2002, University of Utah College of Law

Clinical Practice and Research Interest:

- Pharmaceutical compounding, including USP Chapters <795>, <797>, <800>
- Ethical dilemmas in health care
- Moral reasoning, moral distress, and moral fatigue in health care professionals
- Communication and Conflict Management in Health Care
- Legal requirements in health care, professional standards of care and risk management
- Intellectual Property and equipoise in healthcare and pharmaceutical research

Natalia Ruiz-Negrón

Research Assistant Professor of Pharmacotherapy

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Education & Training:

- B.S. Chemistry (biology emphasis), 2012, University of Utah, Salt Lake City, UT
- Pharm.D., 2016, University of Utah, Salt Lake City, UT
- Health Economics & Outcomes Research Fellowship, 2018, Pharmacotherapy Outcomes Research Center, University of Utah, Salt Lake City, UT

Research Interests:

- Pharmacoepidemiology
- Health disparities research
- Pharmacoeconomics
- Health outcomes modeling
- Chronic diseases, including diabetes, hypertension, and hyperlipidemia

Linda Tyler

Professor (Clinical) of Pharmacotherapy;
Associate Dean, Pharmacy Practice;
Chief Pharmacy Officer, University of Utah Health Care;

Email: Linda.Tyler@hsc.utah.edu
Website: http://pharmacy.utah.edu/pharmacotherapy/faculty/tyler.php

Education & Training:

- B.S., 1978, University of Utah, Pharmacy
- Pharm.D., 1981, University of Utah
- Residency, 1978-1979, University of Nebraska Medical Center, Hospital Pharmacy

Research Interests:

Dr. Tyler's interests include health system pharmacy administration, drug information, medication safety, medication use and policy development, adverse drug reactions, drug shortages, literature evaluation, evidence based medicine.

Dr. Tyler serves as residency program director for the Health System Pharmacy Administration Residency (2 year program with MS degree) and co-director of the MS in Health System Pharmacy Administration.

Kyle Turner

Assistant Professor (Clinical) of Pharmacotherapy
Co-Director, Clinical Innovation Fellowship Program

Email: Kyle.Turner@pharm.utah.edu
Website: http://pharmacy.utah.edu/pharmacotherapy/faculty/turner.php

Education & Training:

- PharmD, 2010-2014, University of Utah College of Pharmacy
- Pharmaceutical Care Leadership Residency, 2014-2016, University of Minnesota College of Pharmacy

Research Interests:

Dr. Turner is a clinical pharmacist practicing in primary care at the University of Utah Westridge Clinic. His teaching and scholarly interests include development and impact of innovative primary care pharmacy services, interprofessional education, continuous quality improvement, and health professional leadership development. He is currently Chair of Student Hotspotting within the University of Utah Interprofessional Education program which engages student teams with patients who have high health care utilization in an effort to reduce cost and improve outcomes. He is also the co-director of the Relational Leadership Initiative, an interprofessional, cross-generational leadership learning collaborative designed to enhance the skills of health science learners, staff and faculty.

Daniel M. Witt

Chair and Professor (Clinical) of Pharmacotherapy;
Assistant Dean for Clinical Affairs;

Email: dan.witt@pharm.utah.edu
Website: http://pharmacy.utah.edu/pharmacotherapy/faculty/witt.php

Education & Training:

- A.S., 1984, Snow College, Ephraim, Utah
- B.S., 1990, University of Utah, Salt Lake City, Utah, Pharmacy
- Pharm.D., 1992, University of Washington, Seattle, Washington
- Clinical Pharmacy Residency, 1990-1992, University of Washington and Harborview Medical Centers, Seattle, Washington.
- Advanced Residency in Primary Care and Family Medicine, 1992-1993, University of Washington, Seattle, Washington.

Research Interests:

I have been actively involved in conducting mentored research projects for more than 25 years, with the principal areas of focus being 1) documentation of the clinical and economic impact of clinical pharmacy services; 2) providing optimized management of anticoagulation therapy; and 3) providing practical evidence-based solutions to anticoagulation therapy stakeholders. I joined the faculty at the University of Utah College of Pharmacy in large part to expand anticoagulation therapy research opportunities, foster additional collaborative research relationships and teams, and expand my opportunities to mentor investigators in training. An example of recent success in this regard is the Transitions of Care for Venous Thromboembolism project. The dataset created for this project resulted in seven published research projects. In addition, I have strong relationships with researchers from Kaiser Permanente Colorado, Intermountain Health Care, the Veterans Administration, McMaster University, the University of Michigan, and the University of Utah.

David Young

Professor (Clinical) of Pharmacotherapy

Email: david.young@hsc.utah.edu
Website: http://pharmacy.utah.edu/pharmacotherapy/faculty/young.php

Education & Training:

- Pharm.D., 1995, Idaho State University, Pocatello, ID, Pharmacy
- Primary Care Specialty Residency, 1996, Idaho State University, Boise, ID

Research Interests:

Dr. Young is the clinical pharmacist at the University of Utah Adult Cystic Fibrosis and Asthma Centers. Dr. Young a member of the North American Cystic Fibrosis Foundation (NACFC) Annual Meeting Planning, Cystic Fibrosis Foundation (CFF) Clinical Research, and Cystic Fibrosis Foundation (CFF) Infection Research Initiative Review Committees. Dr. Young is the Co-director of the North American Cystic Fibrosis Foundation (CFF) Pharmacist Mentorship Program. Dr. Young is a member of the National Association of Boards of Pharmacy Multistate Pharmacy Jurisprudence Examination (MPJE) Committee. Dr. Young is the coordinator for PGY-2 Internal Medicine Pharmacy Residency at the University of Utah Health. Dr. Young is actively engaged in research regarding improving care for patients with cystic fibrosis and asthma.