PBS Faculty Mentors

The following faculty members have active labs in the Pharmaceutical and Biomedical Sciences Department:

Dr. Michael Bartlett, Associate Dean and Georgia Athletic Association Professor in Pharmacy

The Bartlett lab's research centers around applications of analytical chemistry to study biological problems. Currently, he and his team are studying the absorption, distribution, metabolism and excretion (ADME) of drug substances and environmental toxicants with the goal of developing novel methods to address significant questions in the biomedical sciences. In collaboration with other faculty they aim to provide realistic risk assessments for common environmental contaminants and also study many compounds shown to affect memory and cognition.

Dr. Houjian Cai, Assistant Professor

The goal of the Cai lab is to interrogate the molecular mechanisms in facilitation of tumor progression and provide the scientific rationale for using small molecule inhibitors for cancer treatment. Numerous oncogenic proteins require fatty acyl modifications to carry out their functions in cancer cells. Protein acylation, including myristoylation and palmitoylation, is particularly essential for leading these proteins to the correct location at the cytoplasmic membrane, thereby facilitating molecular functions.

Dr. Brian Cummings, Interim Department Head, Professor and Director, Interdisciplinary Toxicology Program

Dr. Cummings' laboratory studies molecular mechanisms involved in cell death, with a particular emphasis on the role of lipids. The laboratory uses lipidomic approaches, such as two-dimensional, high performance, thin-layer chromatography in tandem with electrospray ionization mass spectrometry (2D-HP-TLC-ESI-MS), to identify lipids altered in prostate cancer cells exposed to anti-cancer agents. Recent work has also used lipidomics to determine mechanisms of lipid-based drug delivery by nanoparticles. They hope to use these data to design and track novel nanoparticulate drug carriers and understand their mechanisms of action.

Dr. Deborah Elder, Clinical Associate Professor

Dr. Elder is PBS's only clinical faculty member. Her current research projects focus on the preparation of extemporaneously prepared sterile and non-sterile pharmaceutical products, beyond-use-dating (expiration) of compounded non-sterile pharmaceuticals, drug formulation for individualized patient care, and the use of technology in teaching and assessing pharmacy skills.

Dr. Shelley Hooks, Associate Vice President for Research and Associate Professor

The Hooks laboratory studies the molecular mechanisms by which cellular signaling regulates cell function, and how these signaling mechanisms go awry in cancer and central nervous system disorders. Specifically, they study G-protein signaling cascades and their dynamic regulation by activating receptors and deactivating RGS proteins (Regulator of G-protein Signaling proteins). They have a long-standing interest in a family of receptors activated by Lysophosphatidic Acid (LPA) and Sphingosine 1-phosphate (S1P), which are important bioactive lipid growth factors that play important roles in normal physiology and in the

development of cancer and inflammatory/immune diseases. They are also exploring the ability of RGS proteins to attenuate these effects and impact disease progression. Their current focus is on defining the function and regulation of RGS proteins in cancer and neuroinflammatory disease using a combination of cellular, molecular, and genetic approaches.

Dr. Eileen Kennedy, Associate Professor

The protein kinase superfamily comprises one of the largest gene families encoded in the human genome. A comprehensive understanding of kinase activity under normal and disease states is critical in order to identify targets for disease intervention. However, studying kinase signaling is inherently challenging since there are more than 500 kinases in the human genome, and as a result, there is significant crosstalk among multiple kinases for phosphorylation targets. Additionally, multiple isoforms exist for many kinases, thereby making it nearly impossible to address the question using genetic knockdowns/knockouts since other genes will compensate with altered expression levels. To address this question, the Kennedy lab is developing novel chemical biology strategies to synthetically disrupt protein:protein interactions (PPIs) using chemically stabilized peptides. This methodology allows for the development of investigative tools that can be applied to elegantly and selectively manipulate protein-protein interactions that are involved in signaling pathways within a cellular environment. The long-term goal of the lab is to develop synthetic biologics that can be used to probe cell signaling events that are mediated by kinases.

Dr. Dexi Liu, Panoz Professor of Pharmacy

The Liu laboratory is interested in the use of gene/protein as a drug for prevention and treatment of obesity, diabetes, cancer and other diseases. Our emphasis is on identification of genes that code for a therapeutic protein and on illustration of its mechanisms of action. We employ gene cloning, biochemical, cell biological, immunological, and gene delivery/transfer techniques to conduct basic research in cell culture and in animal models.

Dr. Mandi Murph, Associate Professor

Dr. Murph's laboratory focuses on therapeutic questions of two diseases, melanoma and serous epithelial ovarian carcinoma. For both malignancies, treating patients is coupled with major clinical frustrations, like chemoresistance; this is where science can aid in developing therapeutics and molecular strategies to overcome such obstacles. Enormous progress has been made in the fight against breast and prostate cancer, and childhood leukemia that it is time all cancer subtypes mimic that success. Recently, drugs such as vemurafenib, dabrafenib, trametinib, ipilimumab, pembrolizumab and nivolumab, which treat melanoma, bolster the hope that additional options will soon become available.

Dr. Scott Pegan, Associate Professor

Regulation of the Human Innate Immune System - To gain a greater understanding of the mammalian innate immune response and how it is modulated, as well as develop new therapeutic templates for emerging diseases, the Pegan lab's on-going intent is to investigate the anti-viral type I response through the structural and kinetic study of proteases and ligases involved in the immune response signaling pathway. ***Discovery of new therapeutics for nerve and pesticide agent poisoning*** - The potential threat of an intentional release of chemical nerve agents along with thousands of fatalities in developing countries every year caused by pesticide poisoning has

made treatments for these types of poisonings a persistent focus for therapeutic intervention. Using various biochemical and biophysical methods they intent to generate novel biologic and small molecule molecules of therapeutic value in order to address the current medical shortcomings. ***Discovery of new antibiotics for use against Tuberculosis*** - TB is one of the most prevalent infections in the world, and a leader among the causes of mortality in developing countries. With a rise in new cases of active TB and emergence of multidrug resistant strains, MDR-TB and XDR-TB, there is a strong need for development of antibiotics targeting novel pharmacological targets within Mycobacterium tuberculosis. Using the latest in structural biology and drug discovery techniques, they intend to generate novel chemical compounds that have potent anti–bacterial features for therapeutics targeting TB and other pathogenic bacteria.

Dr. Gurvinder Singh Rekhi, Director, B.S. Program

Nanotechnology – absorption of low solubility / permeability drugs; Immediate and controlled-release dosage forms;Topical and Transdermal Dosage Forms; In vitro in vivo correlation (IVIVC); Chemistry Manufacturing Controls (CMC), Technology transfer; Regulatory Submissions; Patent – Development (US, EP), Interference, Litigation, Expert.

Dr. Arthur Roberts, Assistant Professor

The Roberts lab seeks to advance technology and approaches that accelerate the development of drugs to treat major diseases such as cancer, heart disease and AIDs. To accomplish this goal, the laboratory uses biophysical techniques such as solution NMR, computer modeling and fluorescence spectroscopy to study drugs. They are particularly interested in studying drugs with membrane-bound proteins. These proteins often serve as drug targets for human disease and have numerous important biological functions such as cell signaling, transport and immune recognition. Specifically, they study drug interactions with the multiple drug resistance (MDR) transporter. Additionally to these research goals, they are developing creative and novel teaching methods to train students of different skill levels in the laboratory. To ensure the success of these students, they put considerable effort into their professional development, including having them meet with world-renowned scientists at national and international conferences. Achieving these research and teaching goals will not only advance medicine and improve drug therapies, but will also prepare students well for industry or academic careers in the 21st century.

Dr. Catherine White, Associate Professor

Dr. White's research focuses on the influence of age and gender on the disposition of drugs and toxicants, and their subsequent therapeutic or toxic outcomes, and the physiological-based pharmacokinetic modeling for utilization in predicting toxicity and exposures. She also studies drug:drug interactions occurring at the maternal-placental-fetal interfaces, and pre-clinical evaluation of pharmacokinetics and toxicity of new drug entities. She is also searching for educational strategies that enhance active learning for pharmacy students.

Dr. Yao Yao, Assistant Professor

The Yao Lab is interested in basement membrane (BM) biology with a focus on the CNS and skeletal muscle. Specifically, the Yao Lab has been studying: (1) how the BM regulates the Blood Brain Barrier (BBB) integrity in both physiological and pathological conditions; (2) how the BM regulates the stemness (proliferation, differentiation, and fate determination) of pericytes and muscle development & regeneration after injury. The goals of the Yao Lab are to fully

understand the biological functions of the BM and develop novel therapies for various neurological disorders & muscular dystrophy. The BBB is a dynamic structure that maintains the homeostasis of the CNS. BBB breakdown has been found to be not only the result but also a cause of various neurological disorders. The BBB is mainly composed of brain microvascular endothelial cells, pericytes, astrocytes, and a non-cellular component—the BM. The BM is a highly organized special extracellular matrix containing laminin, collagen, nidogen, and heparan sulfate proteoglycans. Among these components, laminin is the only one that is absolutely required for BM formation. The Yao Lab is investigating how individual laminin isoforms regulate BBB maturation and BBB integrity under physiological conditions using various (endothelium-, pericyte-, and astrocyte-specific) conditional laminin knockout mouse-lines.

Dr. Jason Zastre, Associate Professor

Impact of vitamin B1 supplementation on cancer progression: Vitamin B1 (thiamine) is an essential enzyme cofactor intersecting multiple metabolic pathways within the glycolytic metabolism network. Maintaining thiamine homeostasis requires the activity of two SLC transporters THTR1 and THTR2 to facilitate the intracellular uptake prior to activation into the coenzyme thiamine pyrophosphate (TPP) by thiamine pyrophosphokinase-1 (TPK1). Vitamin B1 is an essential enzyme cofactor for 3 key metabolic enzymes, pyruvate dehydrogenase (PDH) and alpha-ketoglutarate dehydrogenase (a-KGDH) in the tricarboxylic acid cycle (TCA), and transketolase (TKT) within the pentose phosphate pathway (PPP). The overall research objectives are i) characterize the differences in thiamine homeostasis between cancer and normal tissue. ii) determine the impact of vitamin B1 supplementation on cancer cell survival and metabolism. III) Develop strategies to reduce thiamin mediated effects on malignant progression. The results of this research will link dietary influences on cancer progression with alterations in the homeostatic regulation of vitamin B1. In addition the research will contribute new insight into the pro-survival and pro-apoptotic effects of a physiologically and pharmacologically important enzyme cofactor. Overall, the outcomes of this research will require a critical rethinking of the usage and composition of dietary supplements and implementation of nutritional monitoring protocols for cancer patients.

Dr. Y. George Zheng, Associate Professor and Graduate Coordinator

Dr. Zheng's research lab works on the forefront area of chemistry, biology and medicine. They are particularly interested in addressing critical problems and challenges in the rapidly evolving field of epigenetics that describes gene expression profile changes that are irrelevant to genomic sequence. Mounting data show that epigenetic processes play pivotal roles in transforming normal cells into malignant tumors and in various other human pathologic conditions. Abnormality in epigenetic landscape presents characteristic biomarkers for disease diagnosis. Therefore, identifying key chromatin regulatory factors such as histone modifying enzymes and chromatin remodeling complexes, understanding their activity, specificity and functional roles, and inventing potent and selective drug compounds embody demanding needs in today's biology and pharmaceutical research. The lab is innovating and applying advanced chemical and biological strategies, tools and agents to elucidate functions of epigenetic enzymes in disease mechanism and meanwhile provide new diagnostic and therapeutic regimens. Current active research areas include: (1) development of potent and selective epigenetic therapies, and (2) design of chemical biology strategies and probes to interrogate protein acetylation- and methylation-regulated disease processes.