Chemistry Departmental Colloquium

Utilizing Biocatalysis and Synthetic Chemistry to Access New Natural Products

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Natural products (NPs) are a bountiful source of bioactive molecules. Bioinformatics data suggest hundreds-of-thousands of novel NPs remain to be discovered. Unfortunately, many NPs are not produced under standard laboratory conditions. We are developing methods to access NPs from cryptic biosynthetic gene clusters (BGCs) utilizing a combination of bioinformatics, synthetic chemistry, and biocatalysis. Specifically, we are focused in two areas: cyclic peptides and γ-butyrolactone (GBL) hormones. For cyclic peptides, we recently developed SNaPP (Synthetic Natural Product Inspired Cyclic Peptides). SNaPP expedites bioactive molecule discovery by combining bioinformatics predictions of non-ribosomal peptide synthetases with chemical synthesis of the predicted natural products. SNaPP enabled us to discover several bioactive cyclic peptides. However, it also opened our eyes to the challenge of synthesizing small cyclic peptides. Using the results from SNaPP, we identified a PBP-like cyclase capable of performing challenging cyclizations, such as for tetrapeptides with a greatly expanded substrate scope that could have great utility as a biocatalyst. For GBLs, these molecules have previously been found to induce production of many bioactive NPs. Over half of Streptomyces strains are predicted to have GBL signaling pathways. Unfortunately, only a few GBLs and their cognate repressors are known because 1) GBLs are produced at very low quantities and 2) no rapid, efficient assays exist to identify them. We have used sequence similarity analysis to identify previously uncharacterized GBL receptors that we predict bind to known GBLs or close derivatives. We have developed synthetic and biocatalytic methods to access GBLs and derivatives in fewer steps and improved stereoselectivies. Finally, we have developed GFP-based assays that allow rapid identification of active hormones. This information will allow us to further explore the addition of exogenous hormones as a method to induce production of cryptic biosynthetic gene clusters.

Thursday, September 19, 2024 **4:30pm** **WTHR 104**

PURDUE UNIVERSITY | James Tarpo Jr. and Margaret Tarpo Department of Chemistry

Parkinson Bio

Betsy was born and raised in Greenville, MS. She attended Rhodes College, where she obtained her B.S. in chemistry in 2010. While in Memphis, she did undergraduate research with Dr. Philip Potter at St. Jude Children's Research Hospital on the discovery and development of specific carboxylesterase inhibitors for the amelioration of the dose limiting toxicity of the anticancer agent irinotecan. She conducted graduate research with Prof. Paul Hergenrother at the UIUC. While there, she discovered the mechanism of the selective anticancer natural product, deoxynyboquinone, and developed derivatives with improved solubility and tolerability. She also studied the mechanism of deoxynybomycin, a natural product antibiotic with specific activity against fluoroquinolone resistant bacteria, and developed more soluble derivatives. After obtaining her Ph.D. in 2015, she joined the laboratory of Prof. William Metcalf in Microbiology at UIUC. During her postdoctoral studies, she worked on a new method of identifying novel natural products called metabologenomics as well as studying the biosynthesis of phosphonate containing natural products. Betsy started her laboratory in the Departments of Chemistry and Department of Medicinal Chemistry and Molecular Pharmacology at Purdue University in the Fall of 2018. In her lab, research focuses on the identification of novel bioactive natural products from cryptic bacterial biosynthetic gene clusters as leads for challenging-to-treat diseases such as antibiotic resistant bacteria. Additionally, she studies the unique and challenging chemistries performed by natural product biosynthetic enzymes and develops the enzymes as biocatalysts.

Betsy's CV can be found at https://www.parkinsonlaboratory.com/betsy-1