2018-19 ABI Undergraduate Research Scholar Mentor List

Lori Neuman-Lee – Assistant Professor, Biological Sciences
Contact Info: lneumanlee@astate.edu; 870-972-3111, Office LSE 320

1) Research Project: The Neuman-Lee lab focuses on the intersection of immunology and endocrinology. These two systems control our immune and hormonal responses. The Neuman-Lee lab typically examines how these systems interact during times of stress, which causes organisms to prioritize systems due to a limited amount of energy. While we typically examine reptiles and amphibians, these systems have applications to other vertebrate models, including humans. We work in the field and lab to collect samples and measure aspects such as steroid hormones (estradiol, testosterone, corticosterone, and progesterone) and innate immune function (bacterial killing assays, lysis, agglutination, and phagocytic ability).

2) ABI Mission compatibility: The Neuman-Lee lab adheres to the central mission of ABI to "improve the health of Arkansas through medical and agricultural research initiatives." By examining how these systems interact in vertebrate models, we increase the body of knowledge as to how the endocrine and immune system function in tandem. Because these vertebrate models have similar endocrine and immune components to humans, we can better understand wildlife and human physiology.

3) Contributions to the scholarly or creative community: The work that the URS mentor will do will be disseminated in both peer-reviewed journals and at national meetings. We continue to need to understand some of the basic research questions regarding the interaction of immune and endocrine functions in order to develop therapies and useful approaches.

Mohammad A. Alam - Assistant Professor, Department of Chemistry and Physics
Contact Info: **malam@astate.edu; 870-972-3319, Office LSW339C**

1. Research Project: Synthesis of novel small molecule heterocycles as potent anticancer and antimicrobial agents.

In my group, we synthesize small molecules such as pyrazole, thiazole, and androstane derivatives by using readily available starting material and mild reaction conditions. We have generated a library of small molecules to test their potential to treat different diseases. We have found several lead molecules as potent antibacterial and antimelanoma agents. Students doing their research in my group will get the opportunity to learn to synthesize new molecules by using commercially available substrates and reagents under mild reaction conditions. Based on their interest, students will also get the opportunity to test the compounds against different bacterial strains and several cancer cell lines. Experienced students will also get the opportunity to work on in vivo models.

My group's research is in consistent with the ABI mission to improve the health of Arkansans through medical research initiatives.

2. ABI Mission compatibility: My group's research is in consistent with the ABI mission to improve the health of Arkansans through medical research initiatives.

3. Contributions to the scholarly or creative community: In my group, we synthesize small molecules such as pyrazole, thiazole, and androstane derivatives by using readily available starting material and mild reaction conditions. We have generated a library of small molecules to test their potential to treat different

diseases. We have found several lead molecules as potent antibacterial and antimelanoma agents. Students doing their research in my group will get the opportunity to learn to synthesize new molecules by using commercially available substrates and reagents under mild reaction conditions. Based on their interest, students will also get the opportunity to test the compounds against different bacterial strains and several cancer cell lines. Experienced students will also get the opportunity to work on in vivo models.

Jianfeng Xu – Research Associate Professor, Arkansas Biosciences Institute
Contact Info: jxu@astate.edu, office phone: 680-4812, & office: ABI 306

1. Research Project:
   Research in the Xu lab aims to effectively produce recombinant proteins of potential pharmaceutical or industrial applications (e.g., vaccines, growth factors, interleukins, and enzymes) with plant cell/tissue culture. Specifically, we engineer novel glyco-peptides, called HypGPs, that can function as a "molecular carrier" to excrete tagged-proteins to plant cell culture media, which dramatically increases the secreted protein yields. Experiments are focused on understanding gene expression, protein synthesis and post-translational modification, protein separation/purification, and protein bioactivity. In addition, bioprocess engineering strategies are also utilized to maximize the protein production and scale up the process.

2. ABI Mission compatibility:
   My research exploits plant cell/tissue culture as a safe and low-cost bioproduction "factory" to produce high-value protein therapeutics. It supports the ABI Mandated Research Areas 2: Bioengineering research that expands genetic knowledge & creates new applications in agriculture/medicine. Successful completion of ongoing or upcoming projects will facilitate global availability of high-quality protein therapeutics. ABI at A-State selects "Plant-based production of medicinal molecules" as one of major research growth areas and the research projects in my lab dovetails nicely with this effort.

3. Contributions to the scholarly or creative community:
   Our proprietary *HypGPs* engineering technology has transformative potential to make the plant cell-based bioproduction platform economically feasible and competitive with current microbial and mammalian cell "factories". By working on this project, participating students will be exposed to a wide range of techniques, such as molecular cloning, cell culture, recombinant protein expression/detection, and biomedical assay, which will prepare them for the next phase in their careers.

Jennifer Yanhua Xie, Ph.D. – Assistant Professor, Basic Sciences Department, NYITCOM@A-State, affiliated faculty member at Arkansas State University (A-State)
Contact information: Jennifer.xie@nyit.edu, 870-680-8877, Wilson Hall, 144J

Xie laboratory is focusing on three main schemes: 1) Identifying new therapies, especially non-opioid molecules acting on novel targets, to relieve chronic pain in humans via preclinical tools in a wide variety of rodent pain models. 2) Elucidating the underlying mechanisms of the sensory and affective aspects of cephalic, neuropathic, inflammatory or cancer pain states and the potential mechanisms through which complementary therapies such as osteopathic manipulative treatments (OMT) or acupuncture relieve chronic pain. 3) Optimizing fetal stem cell differentiation to induce functional neurons and oligodendrocytes to promote neural regeneration.

In light of the opioid pandemic as the national crisis, seeking new analgesics has never been more important. Understanding the potential mechanisms that lead to pain chronicity will facilitate the discovery of new drug

targets that ultimately helps alleviating patients' sufferings. Non-pharmacological tools such as OMT and acupuncture have been shown repeatedly to be efficacious but their application has been hindered by the paucity of the scientific evidence. We'll also try to optimize the conditions for fetal stem cells to be differentiated into neurons or oligodendrocytes at will *in vitro* to enable application of cell-based therapy *in vivo* in different painful neuropathy conditions to not only alleviate chronic pain but also restore functions. With the growingly obese population, these new therapeutic strategies would be paramount to help improve the quality of life for a large percentage of patients.

Currently we have an open lab space at the ABI 2nd floor and a private space at the Animal Facilities at the 1st floor. And we are actively collaborating with professors Jason Zhou and others at the ABI and A-State to provide broader expertise to tackle these complex issues.

Undergraduate student scholars joining our lab will become a member of our diversified team which include graduate, undergraduate researchers and medical student doctors who are actively pursuing these goals.

Working in our lab will entail learning to do *in vivo* behavioral testing and injections with awake rats and mice; *in vitro* cell culture from cell lines and primary tissues; immunohistochemistry and microscopy, and molecular and biochemical analysis.

The student researchers are expected to play active roles intellectually including participate in the routine lab meetings whenever possible. Their intellectual input will be awarded by authorship for manuscripts, meeting abstracts and attending national and international meetings. Most importantly, the student scholars will be exposed to cutting-edge biomedical research that has important potential to be applicable to patients suffering from chronic pain.

Scott R. Doig – Assistant Professor, Department of HPESS
Contact Info: sdoig@astate.edu / x4857 / HPESS / Office 228

1. Research Project:

The effects of physical literacy, physical activity, and adverse childhood experiences on health-related lifestyles: The PLACES study

Adverse childhood experiences (ACEs) have been recognized as highly damaging to the early developing brain and affect a range of important functions such as learning, adaptation to stress, and adaptation to future adversity. According to a recent Child Trends report, 56% of children in Arkansas experience some form of ACE, much higher than the national average of 45%. However, physical activity (PA), observed as a way to combat the effects of toxic stress on the body, has not been explored to consider long-term beneficial health effects on populations with a high number of ACEs. In fact, physical inactivity during childhood has been shown to predispose children for detrimental health outcomes in both childhood and adulthood. A report funded by the Trust for America's Health and the Robert Wood Johnson Foundation suggested a need for interventions at the early childhood level due to 60% of children from the ages of three to five are cared for in an early childhood education (ECE) facility. The ages of 2-5 are a critical period for establishing healthy habits for PA, since childhood obesity is related with poor academic performance and risk for bullying and depression. By providing physical education to local preschool students, we hope to explore if exercise, recognized as medicine, can improve future health, academic, and social outcomes of youth who have had a difficult start to their lives.

2. ABI Mission compatibility:

By participating in this study, students will gain a better understanding of how the body and brain interact. Students with an interest in exercise science and physical education will experience the implementation of a PA intervention and collect data on how that intervention impacts the cognitive abilities of students. The

team will follow the students into later grades and be able to see how the intervention may impact participant behaviors far into the future. Participation in the study will help students explore the booming field of research in PA, and spark expanded curiosity in how such research could affect the undergraduate student's surrounding community.

3. Contributions to the scholarly or creative community:

To date, research in the area of PA has found relationships between PA and health outcomes in adults and youth. However, PA has only been used as a covariate (a variable to be removed to avoid confounding results) when examining ecological impacts on health. Arkansas ranks first in the nation for adult physical inactivity and top ten in the nation for both percentage of adults who are obese and percentage of children who are obese or overweight. Cunningham, Kramer, and Venkat Narayan (2014) found that children who were obese entering kindergarten were four times more likely to be obese in eighth grade. Obesity has a compounding effect in children and adults as fundamental motor skills are built through the process of PA. Due to having more difficulty with coordination tasks and moving a body through space, obese youth very likely find weight to be a barrier to PA (Malina, 2014).

Inactivity during childhood has been shown to predispose children for detrimental health outcomes in both childhood and adulthood (Clark & Blair, 1988; Durrant, Linder, & Mahoney, 1983). In recent years, research has shown PA to be imperative for, not only curbing the progression of the obesity epidemic, but also improvement of cardio-respiratory health (Donnelly et al., 2016; Martin et al., 2012), cognitive function in children and adults (Loprinzi & Kane, 2015), and improved academic achievement (Blom, Alvarez, Lei, & Kolbo, 2011; Donnely et al., 2016; Fedewa & Ahn, 2011).

The current study is intended to be a first step to filling the gap of research examining the relationship between ACEs and PA. The research group will fill the need for longitudinal research investigating the effect of PA interventions on preschool populations by providing physical education to local preschool students and following the effects of that intervention through time. Our findings will dramatically advance our understanding of the relationship between PA and ACEs and possibly provide an intervention to positively impact the health and academic achievement of almost 50% of America's future adults.

References:

Blom, L. C., Alvarez, J., Lei, Z., & Kolbo, J. (2011). Associations between Health-Related Physical Fitness, Academic Achievement and Selected Academic Behaviors of Elementary and Middle School Students in the State of Mississppi. *ICHPER -- SD Journal Of Research In Health, PE, Recreation, Sport & Dance, 6*(1), 13-19.

Clark, D. G., & Blair, S. N. (1988). Physical activity and prevention of obesity in childhood. In N. A. Krasneger, G. D. Grave, & N. Kretchmar (Eds.), *Childhood obesity: A biobehavioral Perspective* (pp. 121-142). Caldwell, NJ: Telford.

Cunningham, S. A., Kramer, M. R., & Venkat Narayan, K. M. (2014). Incidence of childhood obesity in the United States. *New England Journal of Medicine, 370*(5), 403–411.

Donnelly, J. E., Hillman, C. H., Castelli, D., Etnier, J. L., Lee, S., Tomporowski, P., … Szabo-Reed, A. N. (2016). Physical activity, fitness, cognitive function, and academic achievement in children: A systematic review. *Medicine and Science in Sports and Exercise, 48*(6), 1197–222.

Durrant, R. H., Linder, C. W., & Mahoney, O. M. (1983). The relationship between habitual physical activity and serum lipoproteins in white male adolescents. *Journal of Adolescent Health Care, 4*, 235-239.

Fedewa, L., & Ahn, S. (2011). The effects of physical activity and physical fitness on children's achievement and cognitive outcomes. *Research Quarterly for Exercise and Sport, 82*(3), 521–535.

Loprinzi, P.D. & Kane, C.K. (2015). Exercise and cognitive function: A randomized controlled trial examining acute exercise and free-living physical activity and sedentary effects. *Mayo Clin Proc, 90*(4), 450-460.

Malina, R. (2014). Top 10 research questions related to growth and maturation of relevance to physical activity, performance, and fitness. *Research Quarterly For Exercise and Sport, 85*(2), 157-173.

Martin, R., Buchan, D., Kulik, K. S., Kilgore, L., & Baker, J. (2012). *Cardio-respiratory fitness and muscular fitness levels of Scottish youth and their associations with* physical activity*. Journal of Biology of Exercise*, *8*(2), 32-46. DOI: 10.4127/jbe.2012.0058

Travis D. Marsico - Associate Professor of Biological Sciences

Contact Info: tmarsico@astate.edu, 870-680-8191, LSE 201A

1. Research Project: Georeferencing native and naturalized plant specimens in a highly agricultural landscape
2. ABI Mission compatibility: Mission 5—Conservation and weed management in a critical agricultural region.
3. Contributions to the scholarly or creative community:

Having a detailed understanding of native and naturalized plant species is critical for our understanding of biodiversity patterns on Earth. The Mississippi Alluvial Plain of eastern Arkansas is a highly productive agricultural region that produces significant food crop for the nation and world. Very little natural habitat remains in this highly productive region, so having an understanding of native plant distributions is critical for conservation efforts. Moreover, introduced plant species that have become naturalized threatened native species and can function as important agricultural weed pests that require control. At the Arkansas State University Herbarium (STAR), an important regional collection of plant specimen records, we have digitized specimen records of plants collected over the past 50 years. We now are using digital spatial technologies to precisely map these specimens in a process called georeferencing. Through the process of georeferencing we are able to determine specific localities and habitat requirements for rare species in need of conservation and invasive species that are expanding their geographic ranges in our region.

Tanja McKay – Professor in Biological Sciences

Contact Info: tmckay@astate.edu, 870-972-3240, LSE 313

1. Research Project: Working to help reorganize the Arkansas State University's insect collection housed in the Department of Biological Sciences.

Arkansas State University has an important regional collection of insect specimens, collected over the past 50 years. There are approx. 25,000 specimens (primarily pinned adults) resulting primarily from the work of Dr. Harvey E. Barton and his students from 1967-1991. Most specimen vouchers are from Arkansas, with others represented from surrounding states, Africa, and the Middle East. It has served as an important resource for outreach with local public schools and as a data source for the Arkansas Lepidoptera Survey, an online checklist of Arkansas' butterflies, skippers, and moths (http://arkansaslepidopterasurvey.net). We are currently reorganizing the insect collection and preparing a database to allow researchers from other institutions to be able access the data. We would like to see this collection to be used by other researchers in the US and even internationally. By organizing the specimens and creating a database will allow this collection to be used more efficiently by other researchers and will help to grow the collection in both numbers of specimens and in regional significance.

2. ABI Mission compatibility: ABI Mission Statement: to improve the health of Arkansans through new and expanded agricultural and medical research initiatives.

The collection of insect specimens includes many species that vector human and animal diseases (mosquitoes, flies of veterinary importance including house flies, stable flies). The collection also has the most comprehensive collection of stink bugs (Family Pentatomidae) in Arkansas which are serious pests of rice. Arkansas is the number one rice producing state in the US. With climate change issues being a major focus of research today, having this collection organized and catalogued will allow other researchers from other institutions to use this important collection to possibly see shifts in species distributions as it relates to disease vectors and pests of agricultural significance in Arkansas.

3. Contributions to the scholarly or creative community:

Students will have the opportunity to present the work at Create@state and possibly other venues including the Arkansas Entomological Society Annual Meeting.

Sharon D. James – Assistant Professor in Depart. of Management & Marketing
Contact Info: sjames@astate.edu; 870-680-8170; Bus 410

1. Research Project Description
   Targets' Voluntary Public Disclosure and Selection in Acquisitions (with Miguel Ramos, University of Texas at El Paso)

   Although there is a vast literature on target selection in acquisitions, the active role of the target in this process is under explored. Addressing this gap in the literature, we explore the effect of potential publicly traded targets' voluntary public disclosures on the likelihood of their selection in acquisitions. Because public disclosures tend to be credible, such disclosures are likely to reduce adverse selection in valuing targets, thereby increasing the likelihood of selection for disclosing firms. Controlling for geographic distance between targets and acquirers, we will test this prediction on a sample of R&D intensive firms in the *chemicals*, computer, and communications equipment industries. *The broad chemicals industry's two digit standard industrial classification code 28 includes pharmaceuticals, biotechnology, agricultural chemicals, and other industries in which products are derived from chemical compounds.*

2. Consistency of Research Project with the ABI Mission Statement
   The ABI Mission Statement is "to improve the health of Arkansas through new and expanded agricultural and medical research initiatives." This research project is consistent with the ABI mission in that it examines how firms in the chemicals industries can exploit product development opportunities that will most certainly improve the health and wellness of Arkansans. By examining how firms combine through acquisition, we can better understand how target firms gain access to research and development financial and scientific resources needed to make scientific discoveries and develop them into new products that enrich consumers' lives.

3. Contributions to the Scholarly and Creative Community
   This research project is currently in the stage of collecting missing patent data for acquiring firms. Completing this data collection will help us to develop technological similarity variables between the targets and the acquirers in the sample. The ultimate goal is to understand motivations for how and why firms combine their technological resources to develop new products, which will benefit consumers in Arkansas and beyond. *The research scholar will have the opportunity to participate in completing a work-in-progress, which we will submit to a top management journal within the next six months. The scholar will receive full credit for their efforts in helping to complete and publish the paper*.

Fabricio Medina-Bolivar, Professor of Metabolic Eng. in Depart. of Biological Sciences
Contact Information: fmedinabolivar@astate.edu; (870) 680-4319; BI 308
Lab website: https://www.fabriciomedinabolivarlab.com

1. Research Project:

   Bioproduction of medicinal compounds from plants. The Medina-Bolivar research team is involved in the discovery and bioproduction of bioactive plant compounds with medicinal applications. Our studies utilize "immortalized" root cultures (known as "hairy roots") as factories for a large diversity of plant natural products. Using a combination of molecular, cellular and biochemical approaches, our research team has developed strategies to increase the levels of selected natural products in hairy roots by more than 1,000 times when compared to the parental plant. Students that participate in the ABI Internship Program will work specifically with hairy root cultures of peanut to produce a class of biologically active natural products known as stilbenoids. These compounds have potential applications in cancer, obesity and Alzheimer's disease. The interns will be involved in different aspects of the research including production, analysis and purification of stilbenoids in hairy roots, and assessing their activity in chemical and cellular assays.

2. ABI Mission compatibility:

   The research focus of this internship is on production and bioactivity of novel plant compounds that have potential applications as preventive and therapeutic agents for cancer and obesity. These are major health concerns in Arkansas. To this end, this research adheres to the ABI mission to improve the health of Arkansans through new and expanded agricultural and medical research initiatives.

3. Contributions to the scholarly or creative community:

   Interns will learn the technical skills associated with a plant tissue culture/analytical/molecular and cellular laboratory. These include aseptic techniques, plant tissue culture, analysis of natural products by high performance liquid chromatography (HPLC) and mammalian cell culture. In addition the interns will learn how to maintain a research laboratory notebook, how to do research as part of team and how to present the results of the research in laboratory and scientific meetings. In addition, the interns will learn how to communicate the research to the general public

Brett J. Savary, Research Professor of Biopolymer Chemistry, Arkansas Biosciences Institute
Contact Info: bsavary@astate.edu, 680-4792, ABI office 307

1. Research Project: *Rice Bran Polysaccharide Chemistry for Dietary Innate Immune Responses*. My ABI research program investigates a plant polysaccharide called arabinoxylan that is present in rice bran. It is hypothesized to be a dietary component having anti-inflammatory and immunomodulatory functioning in the epithelial lining of the intestine/colon. Current research activities involve extracting arabinoxylan from rice bran fiber, treating it with enzymes to reduce the molecular size, and determining compositional profiles of separated oligosaccharide fractions. The undergraduate research scholar will gain an understanding of nutritional, immunological, and chemical properties of rice bran polysaccharides in the diet, while learning and applying bioanalytical (chromatography), biochemical, and cell culture techniques

used in my lab. Rice bran oligosaccharides we produce are evaluated in a human epithelial cell bioassay for innate immune responses. We also provide these materials to ABI collaborators who investigate other relevant biological properties of this interesting plant polysaccharide.

2. ABI Mission compatibility: My ABI research program addresses new agricultural and biomedical research for improving the health of Arkansans by investigating dietary fiber components from rice processing to determine their putative innate immune functioning in the gut epithelium. The long-term goal is to reduce the incidence of chronic inflammation-associated diseases (e.g., diabetes, obesity, and colon cancer) through dietary intervention with functional rice bran products.

3. Contributions to the scholarly or creative community: From their hands-on laboratory engagement, the URS scholar will obtain experience with publically communicating their research results. The student will present an oral talk or poster presentations at Create@State and at the ABI URS Program. Continuing undergraduate research experience is possible through course credit, an honors thesis or employment on a research grant. Original research contributions may be disseminated through participation at a national scientific meeting and/or through a peer-reviewed journal publication.