2022 ABI Summer Internship Mentor List

Emily S. Bellis, PhD Assistant Professor of Bioinformatics
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Deep neural networks are computer architectures that have led to many important advances in the field of artificial intelligence (AI). These networks include layers of 'neurons' with connections from input (e.g. an image of a cat) to multiple hidden layers and finally an output layer that can assign labels to the input (e.g. the label 'cat'). Through the process of training the network, appropriate weights for the connections are learned so that labels can be determined at high accuracy. The architectures of modern deep neural networks are inspired by the structure of the human brains, allowing for interpretation of complex data structures such as images, however a diversity of nervous system architectures have arisen over the course of animal evolution. For example, the phylum Cnidaria which includes sea anemones, corals, and jellyfish, is one of the only non-bilaterian groups to have a nervous system. Since they diverged from other animals >700 million years ago, their nervous systems are very different from humans and exist as diffuse nerve nets that are highly plastic with bidirectional synapses.

The intern recruited for this project will 1) conduct literature reviews to identify the main ways in which cnidarian nervous systems differ from the human brain, both at molecular and system levels, 2) choose several of these differences to incorporate into the design of new types of neural network architectures for computers, and 3) implement these architectures using a programming language of choice to evaluate the unique, emergent properties of these networks.

ABI Mission Statement: "to improve the health of Arkansans through new and expanded agricultural and medical research initiatives." Artificial intelligence is an important technology to further both agricultural and medical research. This project is in line with the ABI mission statement by helping to develop new machine learning algorithms applicable to multiple fields including agriculture and medicine.

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Andrew Sweet, PhD; Assistant Professor, Department of Biological Sciences
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Research in my lab focuses on the relationships between hosts and their parasites. We are interested in questions such as: What types of factors are most responsible for shaping these interactions (environment, human activity, etc.)? How do these relationships change over time? To answer these questions, my lab combines field, genetic, and lab techniques. One of our specific interests is on the parasitic mites of insects. These small arthropods are often overlooked, but can be very important for understanding how parasites and pathogens are transmitted among different hosts and habitats. Students involved with this project will have the opportunity to collect insects and their mites from different locations in northeast Arkansas, identify and observe the behavior of mites using microscopes, work with the insect collection at Arkansas State, and learn molecular techniques to sequence genes in mites collected from different species of insects.

This project is consistent with ABI's mission in several ways. First, the project focuses on mites and insects that are native to Arkansas. Second, the project focuses on the diversity and transmission of parasites, which can have direct implications for understanding how zoonotic diseases and parasites are transmitted to humans. Third, the results from this project links to understanding how agricultural land use effects parasite diversity and transmission.

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Kyle D Gustafson, PhD, Assistant Professor of Parasitology, Curator of Mammals, Department of Biological Sciences, Arkansas State University
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1) The American red wolf, A-State's mascot, is the most endangered wolf in the world. Habitat loss and fragmentation and predator control programs led to its extirpation in 1980, but captive-breeding and reintroduced populations remain. It is well established that the American red wolf readily hybridizes with its relative, *Canis latrans* (the coyote), resulting in viable hybrid offspring. Through repeated hybridization and backcrosses between the American red wolf and coyote, portions of the American red wolf genome have integrated into the coyote genome, representing historic genetic diversity that no longer exists in the contemporary population (i.e., "ghost DNA"). Our lab is currently conducting a statewide survey of Arkansas's coyote populations to determine 1) genetic structure and metapopulational dynamics of Arkansas coyotes, 2) whether American red wolf "ghost DNA" exists within these populations, and 3) the genetic loci responsible for morphological differences observed in coyotes, American red wolves, and hybrid individuals.
2) Interns will take part in genomic DNA extraction, gel electrophoresis, polymerase chain reactions, basic sequencing, skull imaging for 3D morphometric analysis, American red wolf dissection, opportunistic roadkill sampling, skull cleaning with flesh-eating beetles, and more. Students will learn how to keep a scientific notebook, read scientific literature, present research, and will participate in data analysis.
3) ABI Mission Statement: "to improve the health of Arkansans through new and expanded agricultural and medical research initiatives." This project is in line with the ABI mission statement for several reasons. This project will directly benefit Arkansans through the very first genetic assessment of coyotes in Arkansas. These data will establish a foundation for understanding the role coyotes play in the transmission of diseases like heartworms, chronic wasting disease, sarcoptic mange, and parvovirus. This project will also help us understand and mitigate coyotes as disease reservoirs for household pets, people, and potential reintroduction efforts tied to the American red wolf. Finally, the ultimate goal of this research is to genetically restore the American red wolf using ghost DNA. The conceptual and molecular approaches necessary to complete such a task will have direct applications to agricultural and medical problems in the state and beyond.

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ABI Summer Internship Program – Troy Camarata, PhD
tcamarat@nyit.edu

1.) a short paragraph describing the research/work the student would be doing
Currently, we have a poor understanding of how the kidney responds to acute kidney injury and how it can lead to chronic kidney disease. Additionally, the only major therapies that exist are dialysis or transplantation, neither of which are long term solutions or reverse disease. Developing new treatments, such as cell-based therapies, will be key to reducing the burden of kidney disease. Mammals, including humans, are born with a finite number of functional units in the kidney, called nephrons. If nephrons are damaged, for example from drug induced toxicity or trauma, they can repair and the kidney can compensate for loss of function. However, the damaged tissue does not undergo true regeneration as the human kidney does not possess adult stems cells like those found in other parts of the body such as the intestine. Such acute kidney injury significantly increases the risk for chronic kidney disease and organ failure. Reptiles such as alligators, lizards, and turtles possess a similar type of kidney as humans. Amazingly, the reptilian kidney does possess adult kidney progenitor cells throughout life, suggesting reptiles may be able to truly regenerate damaged tissue. Our lab is currently focused on understanding the embryonic development of the kidney in reptiles using the turtle as a model system. This will allow for a direct comparison of kidney progenitor cells niche between the embryonic and adult turtle kidney. Research within the lab will provide critical insights into why this progenitor cell population is maintained in reptilian kidneys and not in mammals and may provide a foundation for developing future medical therapies.

2.) some description of what the intern would learn and experience if they choose to work with you this summer

Students in the lab will learn and apply fundamental principles of developmental biology, molecular and cell biology, and genetics. Laboratory experiments will include RNA isolation, gene cloning, PCR, gel electrophoresis, antibody immuno-staining, sectioning, and histology techniques. ABI interns are also able to interact and work with medical and graduate students.

3.) details of how your research/project/creative work adheres to the ABI Mission Statement
ABI Mission Statement: "to improve the health of Arkansans through new and expanded agricultural and medical research initiatives." Kidney disease is the 8th leading cause of death in the State of Arkansas and the state ranks 3rd in the United States in deaths caused by kidney disease. Currently, we have a poor understanding of how the kidney responds to acute kidney injury and how it can lead to chronic kidney disease. Additionally, the only major therapies that exist are dialysis or transplantation, neither of which are long term solutions and they do not reverse disease. Understanding how the kidney develops will provide key insights into new therapies such as progenitor cell transplantations. This research is needed to provide a fundamental understanding so that future therapies have the intended positive outcomes without inducing unintended disease such as cancer.

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Mohammad Abrar Alam, Ph.D., Associate Professor of Chemistry
Department of Chemistry & Physics
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Synthesis of novel small molecule heterocycles as potent anticancer and antimicrobial agents

In my group, we synthesize small molecules such as pyrazole, thiazole, imidazole, 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. Several lead compounds are 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.

Finding new antibiotics and anticancer agents is extremely important to save lives and alleviate the sufferings of millions of people. My group's research is in consistent with the ABI mission to improve the health of Arkansans through medical research initiatives.

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Sudeepa Bhattacharyya, PhD, Associate Professor of Bioinformatics and Data Science
Arkansas Biosciences Institute & Dept of Biological Sciences, Arkansas State University
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What we do:
We are a dry lab working at the cutting edge of bioinformatics and data science to study diseases like mental health disorders from a clinical as well as a public health perspective. Our current ongoing projects are 1) examining the impact of mother's mental health and substance use disorders on child's health. 2) assessing the impact of socio-economic and other factors, known as Social-Determinants-of-Health (SDOH), in predicting outcomes of Covid-19 in Arkansas. 3) studying racial and other disparities in drug-treatment completion rates among pregnant women. 4) studying the molecular mechanisms of depression and anxiety disorders in neurodegenerative diseases using multi-omics. 5) we are also starting on a collaborative project (with the college of Nursing and Health Sciences) related to prevention of suicidal ideation in rural veterans through surveys and biochemical mapping. Any new student entering the lab can pick up and work on a specific part of any one of the above ongoing projects.

What will the student learn: The student will gain hands on experience in handling, storing, analyzing, visualizing and interpreting real world, health-related data using open-source programming and statistical/machine learning tools. In any health-related research field, a young scientist who wants to work right at the cutting edge – which will require dealing directly with rapidly changing technologies, generating biological data at an increasingly fast pace and in constantly evolving formats - basic informatic skills, including at least basic programming skills and concepts in applied statistics and/or machine learning, will make him/her a far more productive scientist. In addition, the student will also learn general scientific skills like reading scientific papers/abstracts, preparing effective power point presentations and presenting in a scientific forum.
Statistics or programming backgrounds are not needed; what we need is a passion for learning new skills and a curious mind!

How does our work align with ABI Mission: Our work aligns with ABI's mission to improve the health of Arkansans through medical research initiatives! All our projects center around either improving patient health and related disorders or probing for factors that contribute to public health issues in Arkansas including Covid-19.

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Dr. Lori Neuman-Lee, Assistant Professor of Physiology, lneumanlee@astate.edu

1) The innate immune system clears the majority of potential pathogens and is required for complete immune system activation, but it is still poorly studied. One way to learn more about the innate immune system is to examine its functioning in reptiles, which rely almost exclusively on this arm of immunity. The Neuman-Lee lab focuses three primary objectives: 1) isolating and identifying reptilian immune cells, 2) examining functional immune responses in reptiles, and 3) testing the influence of different endocrine and environmental factors on the immune response. Students working in the Neuman-Lee lab would expect to gain experience using the flow cytometer and cell sorter, making and processing blood smears, and conducting immunological assays on blood samples.
2) The intern would join an active lab group that emphasizes the benefits of collaboration and teamwork. Any intern would have opportunities to learn skills and techniques outside their direct project, such as handling reptiles, processing blood, sonography, and hormone analyses. The intern would learn about the scientific process, the value of presentation skills, and basic statistical analyses.
3) This work addresses ABI's mission by using innovative methods to study the innate immune system, which can be very difficult in mammalian models. By increasing our understanding of this arm of the immune system, we may be able to better develop therapies and novel approaches to improve health outcomes.

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Fabricio Medina-Bolivar, Professor of Plant Metabolic Engineering
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Lab website: https://www.fabriciomedinabolivarlab.com

1. Research Project:

Discovery and 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 to produce a class of biologically active natural products known as stilbenoids. These

compounds have potential applications as preventive and therapeutics agents for cancer and cardiovascular diseases. The interns will be involved in different aspects of the research including production, analysis and purification of stilbenoids in hairy root cultures, 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 cardiovascular diseases. 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, do research as part of a team, and present the results of their research in laboratory and scientific meetings. The interns will also learn how to communicate their research to the general public.

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Dr. Maureen Dolan, Therapeutic Protein Production using Plants as "Biofactories"
Email: mdolan@astate.edu; **Phone:** 870-680-4359

The most rapidly growing sector of the human/animal pharmaceutical market is protein-based drugs (protein biologics). Undergraduate research scholars joining our lab will be a part of a research team focused on using plants as "factories" and recombinant DNA techniques to produce animal and human protein biologics. An important issue in human and environmental health is development of antibiotic resistance significantly impacted by the misuse/overuse of antibiotics in livestock production. Our lab team is exploring the utility of plants as biofactories for producing more targeted, safer, protein-based therapeutics as alternatives to antibiotics in controlling disease outbreaks in farmed raised fish (aquaculture) and poultry. Recombinant proteins for therapeutic use in animals often require complex host systems for synthesis. While mammalian cell culture is most commonly used, plants have the capability to synthesize these complex animal proteins similar to an animal cell and thus plants and plant cells have emerged as a viable production platform for therapeutic proteins.

Student researchers will have opportunity for hands-on experience using some of the skills and techniques seen/learned in your lab courses including buffer preparation, pipetting, molecular cloning, PCR, DNA and protein extraction/chromatography, electrophoresis and animal cell culture. Student scholars are paired with senior researchers in the lab to train in the techniques they will use to carry out their research project.

This project aims to contribute innovations to the fastest growing sector of the pharmaceutical market, protein biologics, and thus aligns with several ABI Research Mandate Areas addressing agricultural bioengineering for improved animal health implications and enabling technology serving the aquaculture and poultry industries; important agriculture sectors in Arkansas.

If this type of project interests you, please contact me!

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Asela Wijeratne– Assistant Professor, Bioinformatics
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1) Research Project:
By 2050, the world is estimated to have 10 billion more human beings. Therefore, we must increase agricultural productivity to meet food demands for this increasing population under changing climate conditions. However, plant

disease can result in significant crop losses; mitigating losses is one way to increase productivity. Currently, one can use chemicals to control plant diseases, but pathogens get adapted to the chemical when they are overused. In addition, the use of chemicals can lead to environmental pollution. Therefore, our research aims to find a more durable and environmentally friendly solution for these debilitating diseases.

2) Description of what the intern would learn and experience:
Interns will learn a wide variety of laboratory techniques, including DNA/RNA extractions, Polymerase Chain Reaction (PCR) based genotyping. These techniques are highly demanded by academia and industry and will prepare interns well for their next career move. In addition, interns will learn how to maintain a laboratory notebook, communicate with other researchers and work collaboratively, and present their research work in various meetings. A laboratory manager will work with students on new techniques before expecting them to perform them in the lab.

3) ABI Mission compatibility:
Our research aims to address the ABI Mandated Research Areas 2: Bioengineering research that expands genetic knowledge & creates new applications in agriculture/medicine. Our long-term goal is to understand how pathogens interact with microbes in the vicinity of soybean roots for infection and colonization. This research will help us discover novel bio-based materials for biocontrol of PSR and contribute to the long-range improvement in and sustainability of US agriculture and food systems**.**

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Jianfeng Xu, PhD, Research Professor of Biomolecular Engineering, ABI
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1) Research in the Xu lab aims to effectively produce recombinant proteins of potential pharmaceutical or industrial applications (e.g., vaccines, interleukins and enzymes) with plant cell/tissue culture. The ABI intern will make two or three gene constructs encoding Tumour Necrosis Factor alpha (TNFα) inhibitor. The intern will stably transform the gene constructs into tobacco BY-2 cells and bacteria and characterize the gene expression. The intern will purify the recombinant proteins from tobacco cell culture media and bacteria and test their functions.

2) The intern will learn standard molecular cloning technique; plant cell culture and genetic transformation; recombinant protein detection such as Western blotting and ELISA, mammalian cell culture, etc.

4) ABI Mission Statement: My research exploits plant cell/tissue culture as a safe and cost-effective bioproduction "factory" to produce protein therapeutics, such as antibodies, vaccines, interleukins and enzymes. It supports the ABI Mission Statement to "improve the health of Arkansans through new and expanded agricultural and medical research initiatives". Successful completion of ongoing or upcoming projects will facilitate availability of high-quality low-cost protein therapeutics to the state and to the country. Particularly, ABI at A-State selects "Plant-based production of medicinal molecules" as one of major research growth areas and my research projects dovetails nicely with this effort.

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Dr. Richard Segall, Professor of Information Systems and Business Analytics
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Visualization and Interpretation of Big Data for Clinical Diagnosis for different types of Cancer, COVID-19 and other diseases.

1. **Short paragraph describing the research /work the student will be doing:**

The student will create visualizations using Tableau (A software tool used to analyze data and create Visualizations). This software is available at Neil Griffin College of Business for students at A-State both in the computer lab and also for personal computers with a year free use. Potential Datasets that can be used includes:

- Epidemiology of seven cancer sites: breast, colorectal, kidney, esophagus, ovarian, pancreas, uterine from 1985-2017 with 36,000+ data values available at URL: https://data.world/datagov-uk/bb1561fa-2697-476d-ae93-0a9e047b635
- Diagnostic Wisconsin Breast Cancer Database from 1990 – 2017 with 210,478 data values https://data.world/uci/breast-cancer-wisconsin-diagnostic
- Cervical cancer risk factors with estimate of 800+ data available at URL: https://data.world/uci/cervical-cancer-risk-factors
- Data on the daily number of new reported COVID-19 cases and deaths by EU/EEA country with 75,000+ data values available at URL: https://www.ecdc.europa.eu/en/publications-data/data-daily-new-cases-covid-19-eueea-country

2. **Some Description of What the intern would learn and experience if they chose to work with you this summer:**

- Generates new knowledge using data visualization techniques for big data in Biosciences, in this case with clinical diagnosis.
- Also be able to contribute towards anticipated output of publishable papers/articles which the student would be co-authored.

3. **Details of how your research/project/creative work adheres to the ABI Mission Statement:**

- This project aligns with ABI's mission statement in that it improves the health of Arkansans through new and expanded medical research initiatives" by analyzing and visualizing data about different clinical diagnosis that might help in improving and understanding the medical care for the Arkansans in the near future."
- This project might help in deeper understanding of different clinical diagnosis for Arkansans.

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Elizabeth E. Hood, PhD; Distinguished Professor of Plant Biotechnology; College of Agriculture
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1) Plants provide food, feed, fiber and fuel to the world. One of the unique features of plant cells is their walls that keep them upright and sturdy. Plant cell walls are composed mostly of carbohydrate and lignin, the latter of which is undigestible. Cell walls also have structural proteins that add strength. They could possibly be substituted for lignin to make cell walls more digestible for people as well as for biofuel substrates. One such protein, hydroxyproline-rich glycoprotein or HRGP, in corn (maize) is accumulated in several tissues. These tissues include the embryo during development with very low levels, but very high levels in other tissues such as vascular tissue, epidermal tissue, pericarp (seed coat) and silk (the pistil of the flower). Previous studies have identified this diversely expressed protein to be a single gene in maize. This is highly unusual for several reasons—most genes are represented by families and maize is an ancient tetraploid, implying that all genes would be represented by more than one member. Our hypothesis is that the gene's promoter is responsible for these diverse locations of the protein.
2) The project would involve several laboratory techniques in plant biotechnology in which the intern would participate. First, general laboratory techniques such as pipetting, preparing solutions, and bacterial and plant media would be learned. Then, several plant biotech-specific methods would be on the table. We produced a plasmid (small piece of DNA) with the HRGP promoter (regulates when and where a gene is expressed) driving expression of a gene that makes an enzyme (GUS—stains tissues blue) and made a few transgenic plants. However, to truly explore the activity of the promoter, we want to produce more plants—so we will be performing corn transformation and tissue culture, involving sterile technique and bacterial genetics. We have seed from previously generated plants that we will plant. Different tissues

from these plants will be stained for the GUS protein activity, showing where the promoter is active. We will also extract protein for protein gels and Western blots with antibodies against GUS and HRGP. It's a treasure hunt for blue to help us learn about a neat corn promoter and gene!

3) ABI Mission Statement: "to improve the health of Arkansans through new and expanded agricultural and medical research initiatives." This project is in line with the ABI mission statement, with particular regard to improving plant productivity for food, feed, fiber and fuel—potentially making plants more digestible for food and fuel.

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Jennifer Yanhua Xie, PhD, Associate Professor of Basic Sciences, NYITCOM-Arkansas, Department of Basic Sciences
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1. **Current research projects at Xie lab**:

The long-term goal of Xie lab is to seek novel, non-opioid analgesics to treat chronic pain. Currently we are focusing on *utilizing fetal stem cells to treat trauma-induced neuropathic pain at the central nervous system or peripheral nervous system.* We are trying to apply neural stem cells *in vivo* to promote regeneration and/or prevent degeneration of neurons. We are collaborating with the bioengineers at the University of Arkansas to make biocompatible 3D or 2D scaffold to be implanted into the spinal cord or around the sciatic nerve after injury. These scaffolds will support the stem cells to survive and flourish in the hostile environment after injury so they can replenish/restore the damaged neurons or axons to mitigate chronic neuropathic pain and functional deficits. We will use *behavioral, cellular, molecular, electrophysiological,* and *immunohistochemical* methods to assess the regeneration of the damaged nervous system and identify the interactions between the grafted cells and the host cells.

2. **What the students will do/learn in Xie lab:**

The interns joining our lab will learn various techniques involving *in vivo* preclinical research including, but not limited to, *behavioral testing, rodent surgeries, transcardial perfusion of the animals, tissue collection and dissection, electromyogram recording, cell culture, and Western Blot*, etc. All lab members are expected to attend weekly lab meetings to discuss the experimental design, review the results, troubleshoot any issues, as well as critique relevant journal articles. Students take active roles intellectually and are offered opportunities to *attend national and international meetings* and present their results (*authorship for abstracts guaranteed*). If sufficient contribution, *authorship for manuscripts will be awarded* as well.

3. **ABI Mission Statement:**

In light of the national crisis of opioid pandemic, seeking new, non-opioid analgesics as well as non-pharmacological therapies for chronic pain has never been more important. Our research is in line with the ABI mission "to improve the health of Arkansans through new and expanded agricultural and medical research initiatives." It will help facilitate the discovery of new drug targets that are non-addictive and complementary with minimal side effects to help alleviate patients' sufferings and improve the quality of healthcare.

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Philip Tew, PhD / JD
Associate Professor of Finance, Department of Economics and Finance, Neil Griffin College of Business
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1) Health Literacy is widely defined as "the degree to which individuals can obtain, process, and understand the basic health information and services they need to make appropriate health decisions." Health literacy has been called the "silent epidemic" that "exacerbates health inequality". The association between the poverty levels of individuals and their health is strong – greater poverty is intertwined with poorer health. Initial research has focused on a small sample of students at A-State to determine their health literacy. This research expands on that initial work to focus on all incoming first year students, as well as residents in northeast Arkansas.
2) Interns would be involved in developing a series of data collection devices that would focus on two different populations – new students at a university and non-student, residents of northeast Arkansas. The interns would

then collect the data, and analyze it for use in future research presentations, conferences, journal articles, and external grant submissions. In addition to learning new techniques to collect data, the students will learn basic econometric techniques to be able to model the data.

3) ABI Mission Statement: "to improve the health of Arkansans through new and expanded agricultural and medical research initiatives." This project is in line with the ABI mission statement, regarding "improving the health of Arkansans". This project will help develop an understanding of the relationship between socioeconomic factors and health literacy factors, specifically for those from primarily rural environments.

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Viswanathan Rajagopalan, Ph.D., FCVS (APS), Associate Professor
NYIT College of Osteopathic Medicine & Faculty at Arkansas State University
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The students in Dr. V. Raj's laboratory gain hands-on experience in **cutting-edge biological/medical technologies** in molecular and cell biology, genetics, biotechnology, clinical sciences, biochemistry, physiology, pharmacology, histology, diagnostics, therapeutics, surgery, invasive and non-invasive methods, engineering, etc. The interns learn teamwork, maintaining laboratory notebook, scientific presentation skills, and opportunities to actively participate in lab meetings. Substantial student contributions may also yield opportunities to co-author presentations beyond the school level. A-State undergraduate students in the lab have won multiple **awards/fellowships including at national and state levels**. The research exposure and experience gained by the intern will be highly valuable to pursue **graduate studies, medical education, paramedical/allied health programs in academic or industry settings.**

The **consistently leading cause of death in Arkansas (both males and females), the United States and worldwide is Cardiovascular disease**. For COVID-19, these disorders can be both a risk factor and a complication. The laboratory investigates mechanisms of cardiovascular disorders and strategies to improve heart health using **animal (in vivo), cellular (in vitro), patient-based** and **computational** approaches. Various conditions studied include, but are not limited to, heart attack, heart muscle disease, heart failure, associated disorders such as hormonal disorders, obesity, diabetes, high blood pressure, etc. Particularly, a major area of Dr. Raj's laboratory is related to the role of novel **noncoding ribonucleic acid**, ncRNA molecules in cardiovascular disorders associated with hormonal abnormalities using **CRISPR** technology. Another area is **human stem cells and differentiation**. A collaborative project on **plant-derived products** for cardiovascular applications is also ongoing.

In alignment with the ABI's mission, the projects in the laboratory involve **improving the health of Arkansas** through new and expanded **biological, medical, and plant-based** research initiatives. The diagnostic and therapeutic agents studied and developed are expected to benefit our state and beyond.

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