**Job #13 (NOTE: This position has been filled.)**
***Material Science: Porous Materials***
**Alan Allgeier, alan.allgeier@ku.edu, Chemical and Petroleum Engineering**

In the field of material science, porous materials play many important roles. Separation of gas mixtures can be effected using porous materials with opening sizes similar to the diameter of the gas molecules, catalysts can be developed based on porous materials that enhance reaction rates and in biotechnology porous materials can be used as drug delivery agents or as tissue scaffolds. Our group has several tools for characterizing the size and volume of porous media.

Student will be responsible for learning about porous materials and conducting characterization of the materials using tools such as gas adsorption, nuclear magnetic resonance (NMR) and others. For these tests the students will weigh out the solids, and potentially do serial dilutions (for NMR) and operate the equipment. In doing gas adsorption the student will use vacuum ovens and measure weight loss on drying, install samples on a high vacuum line and operate the instrument which also uses liquid nitrogen. For NMR the student will make samples of a known polymer to water ratio and place them in the instrument, which uses magnetic fields to "look" at the water inside the pores. The work can easily be broken down into portions to facilitate student schedules during a day / week. After running the test, the student will tabulate data in Excel and work with grad student collaborators to understand how the pore size affects things like gas separation and reaction or, in the other project, drug delivery.

1) Majoring in Science or Engineering (engineering preferred).

2) High school chemistry and physics and 4 years high school math

3) Scheduling: minimum 4 hrs./week of total work with at least one 2 hr. block per week and one weekly 30 min work planning meeting with a graduate student supervisor

4) Familiarity with Microsoft Excel and Microsoft Operating System in general.

This would be an in-person position. Cross-listed with ES 1st Year program application

**Job #16**
***Undergraduate Project Assistant***
**Claudia Bode, bode@ku.edu, Kansas NSF EPSCoR Office**

Along with the opportunity to be involved in research activities related to our National Science Foundation-funded project, the Undergraduate Project Assistant may participate in the following activities:

1. Create project focused social media postings on Facebook, Twitter, and Instagram

2. Engage with community partners and team members in designing education, outreach, and research activities

3. Contribute to writing blogs

4. Participate in team meetings

5. Other tasks that spark the student's interest

- Interest and willingness to learn about resilience & social equity
- Interest in social media

6. Experience with Microsoft Word, Excel, Outlook, and PowerPoint

7. Student should be comfortable working independently with supervision as well as on a team

8. Interest in science communication.

This position could be done remotely or in-person. Cross-listed with ES 1st Year program application

**~~Job #17~~** NOTE: This position has been filled.)

***~~Characterization of contaminated soils~~***

**~~Justin Hutchison, jhutch@ku.edu, Civil, Environmental, and Architectural Engineering~~**

Emerging contaminants of concern in groundwater and soil affect human health. The health impacts manifest after consuming drinking water from contaminated groundwater or direct exposure in vulnerable populations, such as children playing in and consuming soil. Health impacts include developmental delays and liver and kidney damage. Engineered treatment of these contaminants is costly. For example, the American Water Works Association (AWWA) conservatively estimates that treatment may require $370 billion in capital investment with $12 billion in annual operation and maintenance costs to treat emerging contaminants of concern in the United States. Understanding and promoting the degradation of these contaminants in groundwater and soils could avoid these costs and lead to greater source water protection.

The research component of this emerging scholars project will characterize soil properties from soil cores taken in collaboration with the Kansas Geological Survey. The student will be able to use advanced analytical equipment such as ion chromatography, inductively coupled plasma optical emission spectroscopy, and optical spectroscopy. The Emerging Scholar will also have the opportunity to culture anaerobic organisms that can degrade emerging contaminants and learn to track microbial growth, perform contaminant-degrading enzymatic assays, and quantify proteins." The student will be responsible for characterizing soil cores taken in collaboration with the Kansas Geological Survey. The characterization will include established protocols currently used in the lab, including conductivity, pH, and texture.

Students should be willing to participate in in-person experimental activities. Students should be familiar with (or willing to learn) Excel to manage data. Students interested in Environmental Engineering or Environmental Science may find the work better aligned with their professional interests.

This would be an in-person position. Cross-listed with ES 1st Year program application

**Job #18**

***Evaluating dimensions of equity for drinking water distribution systems.***

**Justin Hutchison, jhutch@ku.edu, Civil, Environmental, and Architectural Engineering**

Rural water districts serve some of the most disadvantaged populations in Kansas and rely on extended distribution networks that pose chemical and biological hazards. These hazards arise due to extended water age that can climb to 28 days or longer in significant wet weather events (rural water networks also supply a portion for irrigation, and demand is reduced in wet weather events). Within the last ten years, there has been more evidence of pathogen growth within water distribution systems, especially if the residual disinfectant is reduced, including Legionella and Mycobacterium. This project seeks to address two fundamental research questions:

What is the threat of residual disinfectant breakdown and the rise of drinking water pathogens on rural water networks before, during, and post-disaster events?

How do water quality considerations integrate with measures of social equity to influence decisions related to the installation and maintenance of disinfection booster points?

The project will use open-sourced software to create drinking water distribution systems. The system performance will be evaluated for the decrease in residual disinfectant and the rise of opportunistic pathogens." The student will help create a water distribution system for one Kansas community. This network will be developed in US Environmental Protection Agency software, EPANet, and tested in the Water Network Tool for Resilience (WNTR). The student will be able to interact with a large team of researchers looking at Adaptive and Resilient Infrastructure driven by Social Equity (ARISE, https://nsfepscor.ku.edu/track-1-arise/). The Emerging Scholar would be paired with a senior undergraduate researcher to accomplish these tasks. Students should be willing to learn new software platforms, including EPANet. Students should be familiar with (or willing to learn) Excel to manage data. Students interested in Environmental Engineering or Environmental Science may find the work better aligned with their professional interests.

Remote work is possible if the student has computer resources. Computer resources will be provided to the student within the School of Engineering.

In-person project meetings will be held for the 2023-2024 year. Cross-listed with ES 1st Year program application

**Job #56**

***Genomes in conflict***

**Rob Unckless**, **unckless@ku.edu; Molecular Biosciences**

Organisms are constantly adapting to challenges in their environment. Less appreciated is the fact that organisms also must constantly adapt to intragenomic parasites that bias their own transmission without regard to the fitness of the host. Transposable elements are probably the best studied intragenomic parasites, but meiotic drive elements that break Mendelian laws of segregation are also ubiquitous and have the potential for catastrophic consequences to their hosts. A better understanding of the genetic mechanisms involved in meiotic drive systems would inform how they evolve, what aspects of gametogenesis they target, how the genome fights back, and how they contribute to important evolutionary processes including reproductive isolation, chromosome evolution and even extinction. Furthermore, our understanding of natural meiotic drive systems will inform the use of synthetic gene drives for pest control.

Our goal is to gain an understanding of the genes and mechanisms involved in both sex-ratio meiotic drive and resistance to drive in Drosophila affinis and to understand the genomic consequences of meiotic drive. Meiotic drive is loosely defined as any process that selfishly cheats during gametogenesis to produce a non-Mendelian distribution of gametes. In males, this often occurs after meiosis during spermiogenesis and is particularly striking when the driving machinery resides on a sex chromosome. This sex-ratio meiotic drive usually occurs on the X chromosome and results in males that sire mostly daughters. Sex-ratio meiotic drive is found in plants and animals. We study sex-ratio meiotic drive in D. affinis and previously identified an excellent candidate meiotic drive locus as well as Y chromosomes that are resistant to meiotic drive. An intriguing aspect of the D. affinis system is that males without a Y chromosome are fertile, and in such males, the sex-ratio X chromosome kills itself resulting in all male offspring. " They will learn to identify Drosophila species morphologically and learn about how distinguishing characteristics have important biological function. Through a series of crosses to in the lab, Scholars will identify deviations from the strongly female-biased sex ratio consistent with resistance. Scholars will then perform several crosses to determine whether resistance is Y-linked or autosomal. The level of sophistication of this project can grow with the Scholar. For example, Scholars could begin to map autosomal resistance genes.

Students should be interested in genetics and evolutionary biology, but need not have taken either class. Some ability to get around (drive a car) would be helpful, but not absolutely necessary. This project has the potential to involve field collections from Minnesota down to Texas, but that would be optional.

This would be an in-person position. Cross-listed with ES 1st Year program application