

### **Faculty Member Contact Information**

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### **1 Funded, 4 Unfunded URCA Assistant(s)**

**Are you willing to work with students from outside of your discipline? If yes, which other disciplines?**

- Yes

**How many hours per week will your student(s) be required to work in this position?**  
(Minimum is 6 hours per week; typical is 9)

- 9

**Will it be possible for your student(s) to earn course credit?**

- Yes, in BIOL 493, 492, or 492M; CS 495; ENSC 498 or 499 for 0-3 credit hours.

**Location of research/creative activities:**

- SIUE Campus (Science West, Science East, or Biotechnology Laboratory Incubator)

**Brief description of the nature of the research/creative activity?**

- 1. Projects with genetic and environmental components. The biostatistical tools that we use are transferrable between species. We have a collection of corn datasets (mycotoxins, natural plant resistance, and nutraceutical compounds) that has been collected by our group that would be available for analysis. Likewise, there are a number of datasets that are available electronically across all species, especially humans. My interest is in learning how we can best build an applied analysis pipeline to analyze these data sources to answer complex phenotypic questions. The specific question can be flexible. Examples of projects that a student could undertake in this area of research include:
  - a. The development of machine learning models to predict sustainable cropping systems based on multiple environmental characteristics, plant traits, and human health impacts simultaneously.

b. The use of machine learning models to understand how various genetic, environmental, demographic, or behavioral factors may influence phenotypic outcomes, such as disease incidence and severity.

2. Developing new microbial or phytochemical assessment tools in order to monitor crop loss in horseradish. The horseradish industry is a staple of the agricultural economy in Southwestern Illinois. However, changing climatic conditions has created an environment that is beginning to favor new pathogens. Our goal is to identify the new pathogens that are emerging, and then to develop tools for monitoring and assessing disease prevalence.

3. Using spectral imagery to study the relationship between humans and their environment, especially their plant environment. Plants have a major impact on people. Impacts include being able to help regulate surface temperatures and providing positive psychological benefits, among many others. People, likewise, can have impacts on their surrounding environments. Some of these can be positive, like positive land management activities. Others can be negative, such as through urban encroachment. Negative human activities can destabilize environments and food supply networks. This project seeks to understand how remote sensing and machine learning tools can be used to monitor plant changes using spectral imagery and, ultimately, how this translates to threat assessments.

### **Brief description of student responsibilities?**

- Depending on the exact research project, the research may be solely computer based or may be a combination of computer-based and laboratory or community based. The student will be responsible for formatting and cleaning the research data, summarizing that data, running statistical models, and compiling research results. Students in remote sensing projects are likely to work solely in a computer laboratory setting. Students engaged in biochemistry research will be working in a laboratory setting for the majority of their project. Although students should feel comfortable with a computer, no prior coding experience is required, as this is something that can be learned during the research experience. Basic statistical experience is required (e.g., calculation of means and summary statistics), but advanced predictive modeling can also be learned during the research experience.

**URCA Assistant positions are designed to provide students with *research or creative activities* experience. As such, there should be measurable, appropriate outcome goals.**

**What exactly should your student(s) have learned by the end of this experience?**

- 1. Which software programs are commonly used for statistical, bioinformatics, and/or general data analysis.
- 2. How to write basic and intermediate commands in those software programs.

3. For epidemiology and statistical genetics projects, that the genotype-by-environment interaction influences complex traits (e.g. disease response) more than it does simple traits (e.g., blood type), and this can have an impact on which bioinformatics tools are best suited for a given circumstance.

4. How to recognize outliers and other troublesome data points, and how to perform data collection in a manner that reduces the error (i.e. background noise).

5. In the case of biostatistics students, how to perform common statistical analyses. In the case of biochemical students, how to perform common laboratory protocols while operating under standard safety procedures.

6. For remote sensing/spectral imagery students, how to handle different bands in spectral images and how to leverage these bands to visualize differences across geographic space.

7. How to interpret data and results.

8. How to summarize those analyses for presentation to a scientific audience

### **Requirements of Students**

**If the position(s) require students to be available at certain times each week (as opposed to them being able to set their own hours) please indicate all required days and times:**

- Schedules can be flexible.

**If the location of the research/creative activities involves off campus work, must students provide their own transportation?**

- If working on the phytochemical project, the student must provide their own transportation to the Biotechnology Laboratory Incubator (BLI). There is a bus stop directly across from the BLI, if needed.

**Must students have taken any prerequisite classes? Please list classes and preferred grades:**

- No prerequisite classes are required, although it might be helpful if students have taken introductory courses in mathematics and statistics.

**Other requirements or notes to applicants:**

- N/A