

Faculty Member Contact Information

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Contact Info	
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Department	Chemistry

1 Funded, 2 Unfunded URCA Assistant

	This position is ONLY open to students who have declared a major in this discipline.	M
	This project deals with social justice issues.	
✓	This project deals with sustainability (green) issues.	
	This project deals with human health and wellness issues.	
	This project deals with community outreach.	
✓	This mentor's project is interdisciplinary in nature.	I

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 CHEM 296, CHEM 396, and CHEM 496 CHEM 296 (0-1 cr), CHEM 396 (2cr), and CHEM 496 (2 cr)

Location of research/creative activities:

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

Understanding Molecular Interactions and Chemical Dynamics of Polar Components in Crude Oils and Microemulsion through Spectroscopic Studies

Enhanced oil recovery (EOR) using surfactant flooding critically depends on the in-situ formation of microemulsions that reduce oil–water interfacial tension (IFT) to ultralow values, alter wettability, and mobilize residual hydrocarbons. The fundamental molecular mechanisms governing microemulsion stability and their interactions with polar crude oil fractions remain to be explored to design surfactant formulations rationally. This project establishes a structure–function framework by integrating surfactant formulation in microemulsion formation, photophysical interrogation, and nanoscale characterization. Nonionic (Tween, Triton series) and cationic (quaternary ammonium) surfactants spanning hydrophile–lipophile balance (HLB) values of 8–18 will be systematically paired with organic solvents to generate Winsor type III bicontinuous microemulsions. Formulation variables (e.g., chain length, ethylene oxide number, head group, and salinity) will be tuned to enlarge the middle phase and minimize water demand. This unified workflow will link surfactant HLB, oil-phase chemistry, and polar aromatics to design rules for efficient EOR.

Brief description of student responsibilities?

Role of the Research Scholar:

1. During their time, the researcher will review the relevant literature to plan out the methodology for preparing the microemulsion.
2. They will be working towards generating pilot data on this research by:
 - (a) synthesizing oil-in-water emulsion using micelles and organic solvents
 - (b) characterize the emulsions using UV-Vis spectroscopy and, dynamic light scattering techniqueunderstand the fluorescence properties of the molecules under study in a micellar environment
- (c) assess the binding mechanism of the polar molecules in oil-in-water microemulsion using UV-Vis and fluorescence spectroscopy

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?

Yes

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:

I will work inclusively with students to set their timings. Given the safety of the students in a chemistry lab, the recommendation is adjusted times on weekdays (M- F) between 8 am and 5 pm.

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

A part of the research project will include the use of testing outside of the facility in the building. The students must be able to provide their own transportation in such circumstances.

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

Completed CHEM 241 A/B and 245.

Other requirements or notes to applicants:

Taking either the CHEM 245 or the Analytical Chemistry classes during the URCA application process