SUMMER 2024 – SC INBRE RET PROJECT DESCRIPTION FORM

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Research Subject Area	Nanoparticle-DNA aptamer conjugates as drug delivery vehicles against bacterial infections

A. Briefly describe overall research program at your laboratory:

The long-term goal of Fernandez lab is the fabrication of modular nanodevices that are tailored to target the desired antibiotic to a bacterial strain of choice using specific aptamers. The nanodevice uses silver nanoclusters (AgNC) as scaffold due to their affordability, antibacterial properties, and ease of conjugation with nucleic acid aptamers. The antibiotic specificity of the nanodevice is readily altered by exchanging the antibiotic binding aptamer to one specific to the desired antibiotic. Target selection is achieved by using an aptamer specific to the strain we wish to target. The modular nature of the device would make it readily tunable to destroy the desired strain.

Our focus for summer 2024 is to quantify the enhancement in bactericidal effect for antibiotic-AgNC conjugates compared to antibiotics alone. First, we will attach ampicillin, kanamycin, or tetracycline via drug-specific aptamers to Ag nanoparticles. Then we will measure the bactericidal effect of these conjugates against non-resistant, ampicillin resistant and kanamycin resistant *Escherichia coli* (*E. coli*) strains using solution-based minimum inhibitory concentration measurements. We hypothesize that that antibiotic-nanoparticle conjugates will have increased bactericidal effect compared to antibiotics alone. All organisms used are Biosafety Level 1 hence there is little to no risk of infection to the experimenter.

B. Briefly describe specific project(s) for your teacher:

Experiments will include synthesis of AgNCs, attachment of DNA aptamers to AgNCs and testing the growth inhibition effect of these conjugates using *E Coli* 29522, a non-pathogenic strain of *E Coli*. The growth inhibition assays are high-throughput solution-based assays use 96-well plate format. The teacher will have the opportunity to develop a nanoparticle/NC exploration activity that can be implemented into high-school curricula. These experiments require approximately 6-8 hours/day to perform Monday through Friday.

C. Will any other people (post docs, grad students, undergraduate students, colleagues, etc.) be involved directly with your teacher?

The Fernandez laboratory have 4-5 undergraduate students working on various projects related to nanoparticle-based drug deliveries and designing an RNA sensor for the neurotransmitter dopamine. The teacher may join the 2 students working on the nanoparticle-based drug delivery team then work alone to tailor the activity for high school students. This project is supported by funding from NIH-INBRE Developmental Research Project fund. The PI is also an active researcher in the lab.

D. Will you require any advanced reading/preparation for the teacher?

Some advanced reading will be expected before start of the experiments. Those manuscripts will be provided at the first introductory meeting.