

**Centennial Honors College Thomas E. Helm Undergraduate
Research Day 2025**

ABSTRACT

Major: Forensic Chemistry

Poster

Faculty Mentor(s): John Determan

**The Use of Silica Nanoparticles as Biosensors for the Detection of Illicit
Drugs**

Payton Wiggins

Illicit drugs are universal crisis, causing many mental health issues or death by overdose for many drug users. Many illicit drugs such as heroin, cocaine, and methamphetamine are mixed with small amounts of fentanyl that can go undetected and be deadly to users. Gas chromatography-mass spectrometry and Raman instruments are common testing techniques to detect illicit drugs, however, they are complex and not easily portable. Police officers and drug users can utilize effective and fast testing on substances to test for fentanyl and other drugs to help with this drug crisis.

In previous research, aptamer capped gold nanoparticles were used to detect the presence of illicit drugs. Gold materials for these nanoparticles are rare and expensive. The use of silica nanoparticles in our current study is more accessible, inexpensive, and abundant than the metal nanoparticles used previously. The procedure described by Zhixue Zhou, Yan Du, and Shaojun Dong will be used to produce the silica nanoparticles. These fluorescent filled nanoparticles will be topped with DNA aptamers and a biological fluorescent dye. These aptamers will only interact with the target molecules (illicit drugs in our studies) as they are biologically specific molecules. The aptamers will not interact with the target drug's legal analogs. The fluorescent dye will either enhance or quench when in the presence of the target drug, which will be measured through fluorescence spectroscopy. When the aptamer interacts with the target drug, the target drug will form a barrier around the silica nanoparticles causing the fluorescence to quench. The fluorescence will be detected using a fluorescence microplate reader.