ANALYTICAL SEMINAR

Andie Meyer

Graduate Student
Reppert Group
Purdue University

"Sensing Stress in Sweat: A Wearable Multi-Hormone Biosensor"

Stress can affect both mental and physical health, but current methods for evaluating stress often rely on subjective questionnaires or indirect physiological measurements such as heart rate, which do not directly measure stress-related hormones. Wearable biosensors offer an alternative for the detection of stress hormones due to their ability to detect biomarkers in biological fluids such as sweat. However, many existing wearable systems focus primarily on one hormone, cortisol. Epinephrine and norepinephrine, hormones involved in faster, more acute stress responses, are challenging to detect due to their much lower concentrations in sweat and rapid enzymatic degradation. Competitive electrochemical immunoassays address these challenges, enabling sensitive, time-resolved detection of all three hormones in a single wearable device. The analytical performance and application of this approach will be examined, including its ability to provide measurements in a wearable format and its agreement with conventional laboratory measurements.

ANALYTICAL SEMINAR

Gabe Putman

Graduate Student
Simpson Group
Purdue University

"Seeing the Unseen: Undetected Photon Imaging in the Mid-IR"

Obtaining high-resolution images in the mid-IR region is challenging due to limitations in detectors capable of efficiently detecting light at these wavelengths. Quantum ghost imaging has sought to overcome this challenge by exploiting quantum correlations between entangled photon pairs generated through spontaneous parametric down-conversion (SPDC). One photon, known as the idler photon, interacts with the sample at the desired wavelength, while its entangled partner, the signal photon, travels along a separate path at a different wavelength. The quantum correlations between the photons allow information about the sample to be encoded in the detected signal, enabling an image to be reconstructed. However, quantum ghost imaging still requires the idler photon to be detected with a bucket detector, meaning a mid-IR detector is still necessary. Undetected photon imaging eliminates this requirement by using a nonlinear interferometer to exploit the correlations between the signal and idler photons while detecting only the signal photons. This enables imaging at a wavelength that is more easily detected while maintaining the wavelength-selective interaction of the undetected photon with the sample.