The purpose of this project is to develop solid-state, organic device structures capable of efficiently converting analyte detection into an attenuation in an electrical signal. The main advantage to using organic materials is that they are synthetically flexible and can be tailored to respond to specific analytes. Our proposed device structure is a heterostructure consisting of an optically active, chemosensing layer and a charge-transport layer arranged in a lateral photoconductor-style device (Figure 1A). The advantages to physically separating the sensing and transport functions in chemical sensors include: 1) the ability to optimize the transduction of luminescence to device current, and 2) the development of a reusable device platform for a variety of chemosensing applications.

In addition to developing a novel device platform for chemical sensing, we are using this novel structure to study charge transport and exciton dynamics in organic thin films (Figure 1B). The devices consist of a series of gold interdigitated fingers (W x L = 1500 µm x 4 µm) spaced 10 µm apart (Figure 1A). The gold electrodes are photolithographically defined on glass before the organic layers are thermally evaporated. Locked-in measurements of the photocurrent spectra suggest external quantum efficiencies ranging from 10-15%. Initial experiments indicate an enhancement in photoresponse of the heterostructure devices over devices made from bulk films of both materials (Figure 2).