Title: Stealing nature’s tricks to build better biosensors.

Recent years have seen the development of a broad class of optical and electrochemical sensors in which the binding of a specific molecular target is signaled via a large-scale conformational change in a protein- or nucleic-acid-based receptor. The reagentless, rapidly reversible nature of this signaling mechanism supports continuous, real-time measurement of a wide variety of analytes, and, when coupled to electrochemical read-outs, its extraordinary selectivity allows this detection to be performed in even the most grossly complicated samples, such as flowing, undiluted blood serum. Like all processes reliant on single-site binding, however, these sensors still suffer from two potentially significant limitations: the useful dynamic range of single-site receptors is centered at a fixed target concentration (defined by the receptor’s dissociation constant) and spans a fixed width (defined by the hyperbolic shape of the Langmuir isotherm). In this talk, I describe the various mechanisms that evolution has invented in order to circumvent these very same limitations (e.g., allostery, cooperativity, etc.), and demonstrate their value in improving the utility of a wide range of artificial biosensors.