

## **244e Digital Devices for the Identification and Quantification of Large Sets of Biomolecules Using Engineered Nucleic Acid Sensors**

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Technologies designed for rapid, reproducible quantification and identification of biomolecules in complex mixtures are essential research and diagnostic tools, particularly in understanding the systems-level behavior of biological ensembles. As biological phenomena are increasingly understood as the result of complex interactions of large gene, protein, and metabolic networks, the need for sensitive and quantitative profiling of individual components of these networks is an essential tool in biological engineering. Advances in nucleic acid engineering have made possible the construction of engineered molecules exhibiting unique activities, which in turn can be controlled by regulating their conformational dynamics. Nucleic acids, in the form of aptamers, can be used as sensor domains in these molecules for different types of analytes.

We present here a technology based on the engineered design of a modular, programmable DNA sensor platform that converts analog information about the concentration of a given analyte into a digital, amplifiable output signal. A nucleic acid platform developed in our laboratory will be described that converts information about the identity and concentration of a given biomolecule into a digital, easily detectable output. The output from this nanosensor device is incorporated into an amplification-based strategy to increase the sensitivity of detection. Data demonstrating the modularity of the sensor platform and its ability to be programmed to detect different concentration ranges of both protein and small molecule analytes will be presented. In addition, the application of these engineered sensor molecules to the simultaneous, multiplex detection of both small molecule and protein analytes in complex samples will be presented. The ability to design and fabricate these nanodevices will enable rapid elucidation of the interconnected networks that underlie much of biology. The application of these devices to the manipulation and reprogramming of cellular networks in health and disease will also be discussed.