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Bioelectronic Sensors and Devices

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Nanoscale electronic devices have recently enabled the ability to controllably probe biological systems, from the molecular to the cellular level, opening up new applications and understanding of biological function and response. This talk reviews some of the advances in the field, ranging from diagnostic and therapeutic applications, to cellular manipulation and response, to the emulation of biological response. In diagnostics, integrated nanodevice biosensors compatible with CMOS technology have achieved unprecedented sensitivity, enabling a wide range of label-free biochemical and macromolecule sensing applications down to femtomolar concentrations. These systems have demonstrated integrated assays of biomarkers at clinically important concentrations for both diagnostics and as a quantitative tool for drug design and discovery. Cellular level response can also be observed, including immune response function and dynamics. Finally, the field is beginning to create devices that emulate function, and the demonstration of a solid state artificial ion channel will be discussed.