Selective single molecule sensing using nanopores

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Since the turn of the century there has been a significant drive to deliver nanotechnological solutions to biosensing, yet there remains an unmet need in the development of lab-on-chip biosensors that are affordable, integrated, fast, capable of multiplexed detection and monitoring, and crucially to offer high selectivity for the specific detection of trace levels of analyte in biological fluids. Herein, these limitations are addressed by designing a new class of nanoscale sensors that combine the advantages of nanopore single molecule sensing, FETs and recognition chemistry. Specifically, we report on a polypyrrole functionalized biosensor, with controllable gate voltage that can switch on/off, and slow down single molecule DNA actively transported through the nanopore. This strategy enables higher molecular throughput, enhanced signal-to-noise and even heightened selectivity via functionalization with an embedded receptor. This is shown for sensitive and selective detection of an anti-insulin antibody in the presence of its IgG isotype as well as within complex mixtures such as blood serum.