

APTAMER ENCODED NANOPORES AS SINGLE MOLECULE SENSORS

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ABSTRACT

We have created a low noise, calibrated, molecular-scaled pore. The nanopore is formed either by micro-forge polishing or external penetration of the nanocavity sealed in the pipette terminal. The nanopore fabrication is both cost-effective and time-efficient. The uniform profile of the nanocavity is imaged by a scanning electron microscope (SEM). It suggested a molecular scale pore size and conical pore shape. By correlating pore size and conductance, we have established a method for calibrating pore size by conductance level. The pore diameter was further verified by the translocation of double-strand DNA (dsDNA), which has a known size ~2nm.

Our study shows that glass nanopore can be modified with DNA/RNA aptamer as a promising biosensor. Single molecules (IgE, Ricin and streptavidin/biotin) were detected rapidly and sensitively in real time electrical measurement. Simultaneous recording showed a dynamic process in molecule recognition and interaction. This demonstrated that a glass nanopore could impact single protein molecule detection for medical and biothreat applications.

One of the exciting observations is a single restriction enzyme (*HindIII*) activity within nano-confinement. The duration of event could indicate the strength of the interaction and the amplitude of the event could indicate different protein conformations. We demonstrated the ability of a functionalized nanopore to measure the recognition and interaction on a single molecule scale. It can provide deeper insight and understanding of the stochastic interaction of various biomolecules.