INNOVATIVE NANO-BIODEVICES FOR DNA AND RELATED MOLECULES: STM AND GATING NANOPORE

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Abstract

Scanning Tunneling Microscope(STM) and Gating nanopores are the key Nano-Biodevices for third generation DNA sequencing technologies. These nanodevices will make sequencing kilobase length single-stranded genomic DNA or RNA or identifying individual small molecules using only electric currents and without fluorescent labels at low cost and unheard speeds. Nanopores approximately 1-5 nm in diameter are formed on a Si substrate, and nanogap electrodes with spacing equal to the diameter of the DNA molecules are fabricated in the Si3N4 membrane. This nanostructure is expected to detect molecules passing through the nanopore not by changes in the ionic current flowing parallel to the nanopore but by changes in the electric current flowing between the nanogap electrodes. The electric current passing between the nanoelectrodes comes from a tunneling current conducted via molecules.

We have demonstrated identifying single-nucleotides using nano-fabricated mechanically controllable break junctions (Nano-MCBJ) by tunneling current across the nanogap electrodes. We found that the single peak current on current histograms determines the single-molecule conductivity of the order of dGMP >dAMP >dCMP >dTMP, and rGMP > rAMP > rCMP > rUMP. Recently, we have succeeded in sequencing micro-RNA by assembling contigs using a pair of nanogap electrodes. These results provide an essential scientific basis toward constructing Innovative Nano-Biodevices for the emerging DNA and RNA sequencing technology.

Keywords: biosensors

LITERATURE:


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