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Development of a nanopore-based electrical device for controlling the translocation of DNA with single base resolution and mass-production methods for sub-5 nm nanopores HONGBO PENG, STEPHEN ROSSNAGEL, STANISLAV POLONSKY, GUSTAVO STOLOVITZKY, IBM T.J. Watson Research Center — During the last 10 years, nanopores have been proposed or demonstrated as sensors for rapid analysis of biomolecules (DNA, RNA, protein, etc.) or interactions between these biomolecules. Application of nanopores to low-cost DNA sequencing is particularly attractive as there is great need to reduce the cost for sequencing a whole human genome to $1000. A key issue in the field of nanopore DNA sequencing is to control the DNA translocation. Here we will report the development of what we call a DNA transistor: a nanopore-based electrical device for controlling the translocation of DNA with single base resolution. The key part of this device is a free standing membrane, made of metal/dielectric/metal/dielectric/metal, with the thickness of each layer about 2 or 3 nm. A nanometer size (about 3 nm) pore is made through the membrane. Voltage biases are applied on the metal layers to modulate electrical field inside the nanopore. Our ongoing experiments test if the modulated electrical field can trap or translocate DNA in a controllable way. We will also report the development of methods to make uniform sub-5nm nanopores across standard 200 mm Si wafers using an industrial processing facility.

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