## DNA Sensing Based on Gold Nanoparticles and Silicon Nanopores Keio Univ. °Toshiharu Saiki, Hirohito Yamazaki, Takaha Mizuguchi, and Keiko Esashika E-mail: saiki@elec.keio.ac.jp

A robust method to distinguish isolated single gold nanoparticles (AuNP monomers) and their dimers under Brownian motion is described as a key technique for ultrasensitive homogeneous bioassays, including AuNP sandwich assays. To detect dimers and distinguish them from a larger number of monomers in aqueous solution, single-particle polarization microscopy was performed. For the accurate detection of individual particles, the optical anisotropy and rotational diffusion time are measured because a dimer is much more anisotropic than the nearly spherical monomer and the rotational diffusion time of a dimer is four times that of a monomer. By employing an autocorrelation analysis, we defined a measure of distinguishing that simultaneously enables high detection probability and low error probability. The detection platform offers homogeneous DNA hybridization assays and immunoassays at the subpicomolar level.

We also propose a new optical measurement scheme for nanopore-based DNA detection and sequencing. We use ultraviolet light for excitation of a fluorescent probe attached to DNA and a silicon nanopore membrane that has a significantly large refractive index and an extinction coefficient at ultraviolet wavelengths. Numerical electromagnetic simulation revealed that the z-polarization component of the electric field was dominant near the nanopore and generated a large electric field gradient at the nanopore exit, typically with a decay length of 2 nm for a nanopore with diameter of 10 nm. The large extinction coefficient contributed to reduction in background noise coming from fluorophore-labeled DNA strands that remain behind the membrane. Employing this approach, an optical microscopic measurement with 100-nm and 100-µs resolution is demonstrated to observe DNA coiling immediately after translocation and its motion. The effect of salt concentration and counter-ion species on the translocation speed and dwell time in the observation volume is also investigated.