Nanoscale Biochip for Electronics and Diagnosis

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Bottom-up approaches for realizing ordered nanoscale functional structures are currently gaining in popularity. By mimicking the organization of biological molecules, nanoscale devices for electronics and diagnostics can be constructed and applied to semiconductor research, panel immunoassay, pharmaceutical screening processes, and so on.

In this study, the nanoscale biochip consisting of protein hetero layer is investigated for the construction of nanoscale biodiode. Self-assembled monolayer of thiol modified electron acceptor protein was formed on Au substrate, and then sensitizer protein was adsorbed for the hetero protein layer. The organized protein hetero layer can be investigated based on scanning tunneling microscopy (STM) I-V characteristics[1]. By using the hybrid STM/current-voltage (I-V) system, the photoswitching and rectifying properties of the fabricated protein hetero layer was observed. It is suggested that the proposed molecular array of protein hetero layer could be applied to the nanocale electronic device.

The proposed self-assembly technology for the bioelectronic device using protein hetero layer can be applied for the organization of nanoscale biochip for diagnosis. The nanoscale biochip pave the way for the construction of high density addressable protein array. In this study, oligonucleotide was introduced for the fabrication of nanoscale protein array. the molecular charge of the oligonucleotide and the generation of electric field using STM makes it possible to print ligand biomolecules with nanoscale. The proposed bio-surface fabrication and miniaturization using STM will offer the promise of alleviating many of the bottlenecks such as protein activity, array size, and standardization.

Reference

1. Jeong-Woo Choi *et al.*, Rectified Photocurrent of Molecular Photodiode Consisting of Cytochrome *c*/GFP Hetero Thin Films (2001), Biosensors and Bioelectronics, 16, 819.