Semiconductor Technologies for Biological Applications

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Abstract

The development of instrumentation and sensors for biological molecules has accelerated the speed of discovery and innovation in the field of biology and bioengineering. During the last decades, particularly the rapidly growing semiconductor technologies have supported such development. First, the improvements in diverse optoelectronic sensors, such as high-resolution position sensitive detectors, high-speed photodiodes, and large-area fast image sensors (e.g., CMOS, CCD), increase both quantity and quality of acquired biological data sets from instrumentation such as optical tweezers, magnetic tweezers, and atomic force microscopes. Second, the advanced semiconductor chip fabrication technologies have been applied to enable various nanoelectronic and nanophotonic biological sensors, for example, field-effect transistor- and nanopore-based sensors, respectively, down to single-molecule level. Third, the enhanced performance of computation and data transfer through advanced integrated chips in electronics (e.g., CPU, GPU, and RAM) allows the acquisition, processing, and storage of biological data sets with a higher spatiotemporal sampling rate and an increased level of multiplexing. Moreover, such advancement in computing performance has substantially expanded the capability of in silico approaches for biology and design of biological tools.

Keywords: *semiconductor, electronics, optoelectronics, micro/nano-fabrication, sensors, biology, single-molecule, in silico*

Biography

Seungkyu Ha developed diverse semiconductor-based nanophotonic devices at Seoul National University (MSc) and Korea Institute of Science and Technology (research scientist). He has been working on the development of single-molecule methods and instrumentation utilizing nanophotonics, micro/nano-fabrication, and surface functionalization, through his research at TU Delft (PhD) and KU Leuven (post-doctoral researcher).