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Nanobioelectronic device composed of hybrid materials for biosensor and biocomputing system

Nano-level bioelecronic device based on hybrid material had emerged as the breakthrough with tremendous potentiality for generation of new concepts and technologies to develop new age bioelectronic devices. The biomaterial such as protein and DNA can be used as a functional component in the bioelectronic device. To alter the silicon-based electronic devices, major challenges in bioelectronic device involve the miniaturization, and the demonstration of various functions generated from biomaterial. The conceptual biomemory device based on Metalloprotein was developed to demonstrate memory characteristics including 'write', 'read', and 'erase' function. Furthermore, multi-bit memory function and nanoscale memory function were developed. Afterwards new hybrid material constituted with metalloprotein/DNA/nanoparticle was developed to construct the bioprocessing device to demonstrate various functions. The metalloprotein with redox property was introduced as a biomemory signal source, and various nanoparticles conjugated with complementary DNA and metal ions were introduced as input signals to obtain processed output signals. By this process, various functions including 'information amplification', 'information reinforcement' and 'information regulation' were accomplished in this processing device. Also, hybrid material composed of RNA composite/quantum dot was developed to demonstrate the nanoscale resistive biomemory function. The spectroelectrochemical analysis in the cell chip has been developed as a valuable biosensing technique using nanobioelectroic technology. The electrochemical property and differentiation control in neural stem cell on the chip, and synthesis property of nanoparticle in human cells have been investigated. The proposed hybrid material-based nanobioelectronic device by the integration with neural cell should be the new type of platform to develop the biosensor and biocomputing system. Acknowledgement: This research was supported by the Leading Foreign Research Institute Recruitment Program, through the National Research Foundation of Korea (NRF), funded by the Ministry of Science, ICT and Future Planning (MSIP) (2013K1A4A3055268).

Biography

Jeong-Woo Choi is a Professor in the Department of Chemical & Biomolecular Engineering and a Director of Institute of Integrated Biotechnology, Sogang University, South Korea. He received his PhD in Rutgers University (USA), DEng in Tokyo Institute of Technology (Japan) and DBA in University of Durham (UK). He was a Visiting Scientist in IBM Almaden Research Center and Mitsubishi Electronics Advanced Technology R&D Center. He has published more than 380 articles in peer-reviewed international journals including Science and 21 international patents in biomaterials, biosensor and bioelectronics fields, and he has edited/authored 24 books on advanced biomaterials and biosensors.

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