gustav / January 28, 2010 04:59PM

[BioPhysical-chemistry] Silicon Nanowire Field-Effect Transistor Applied for the Detection of Protein-Protein Interactions, NTU's Interdisciplinary Research Published in 《PNAS》

[BioPhysical-chemistry] Silicon Nanowire Field-Effect Transistor Applied for the Detection of Protein-Protein Interactions, NTU's Interdisciplinary Research Published in 《PNAS》 (Chinese Version)

NTU Newsletter (Issue 994) The interdisciplinary research team led by Professor Yit-Tsong CHEN at Department of Chemistry, NTU, and Associate Professor Chien-Yuan PAN at Department of Life Science, NTU, has succeeded in applying silicon nanowire field-effect transistor (SiNW-FET) for the detection of protein-protein interactions. The team has developed several methods for this study and recently published an article“Label-free detection of protein-protein interactions using a calmodulin-modified nanowire transistor”in the January-19 Issue of Proceedings of the National Academy of Sciences USA, PNAS (Volume 107, pp 1047-1052).

In the post-genomic era, the understanding of protein functions and interactions is the key to unraveling the many puzzles that exist in the life sciences. Many techniques have been developed to analyze protein-protein interactions. The very widely applied method is immunoprecipitation, but this method often requires antibodies of high specificity and a massive volume of proteins. Besides, this procedure usually takes several days.

Professor Yit-Tsong CHEN's team concentrates on the study of basic principles and biological applications of SiNW-FET. When molecules touch the surface of SiNW-FET, its surface potential changes and so does its conductivity. In applying SiNW-FET as a bio-sensor, the electrical measurements were inevitably involved the complicated electrochemistry in the interface between the SiNW-FET and environmental biochemical/cellular solution. Nevertheless, with a deliberate design, the team has made SiNW-FET a highly sensitive bio-sensor for molecular or biological systems. Such a bio-sensor can be used for the detection of a specific target and exhibits fine performance in high selectivity, real-time response, label-free detection, small sample amount requirement, and rapid screening.

Associate Professor Chien-Yuan PAN's team mainly focuses on the neuron transmission using electrophysiology and fluorescence imaging. Recently, the team also finds interest in a family of calcium binding proteins which modulate the activities of various types of ion channels. It is discovered that some calcium binding proteins regulate the properties of the calcium channels, but the direct proof for the interaction is still missing. The teams find there might be an opportunity to solve the problem with the SiNW-FET bio-sensor, even though they knew that the interaction between proteins is much weaker than that between antigen and antibody.

The article published in PNAS presents the results of several experiments using a highly sensitive and reusable SiNW-FET for the detection of protein-protein interactions. The calmodulin-modified SiNW-FET exhibited selective electrical responses to Ca^{2+} (≧1 μM) and purified cardiac troponin I (~7 nM). The minimum concentration of Ca^{2+} required to activate the calmodulin-troponin I interaction was determined to be 1 μM. The N-type Ca^{2+} channels expressed in cultured 293T cells were able to be recognized specifically by the calmodulin-modified SiNW-FET. This sensitive SiNW-FET can serve as a high-throughput bio-sensor and can also substitute for immunoprecipitation methods used in the identification of interacting proteins.

Contact Information:
Yit-Tsong CHEN, Professor of Department of Chemistry, NTU, & Adjunct Fellow of Institute of Atomic and Molecular Sciences, Academia Sinica, ytchen@pub.iams.sinica.edu.tw

Further Information:
NTU Newsletter Issue 994 (Chinese)

Edited 4 time(s). Last edit at 02/02/2010 11:58AM by gustav.