

Project No.:20002 Core Institution in Japan: School of Engineering, The University of Tokyo

JSPS Core-to-Core Program -Strategic Research Networks-
FY2010 Research Report

Project No.	20002
Research Theme	International Core Research Center for Micro/Nano Chemistry
Duration of Project	2010-2012
Core Institution in Japan	School of Engineering, The University of Tokyo

Implementing Organizations

Country	Japan
Core Institution	School of Engineering, The University of Tokyo
Co-Chair (name and title)	Prof. Takehiko Kitamori
Number of Cooperating Institutions	4
Cooperating Institutions	Kyoto University, Nagoya University, Waseda University, Japan Women's University

Country	Sweden
Core Institution	Uppsala University
Co-Chair (name and title)	Prof. Ulf Landegren
Number of Cooperating Institutions	2
Cooperating Institutions	Lund University, KTH
Matching Fund	1. The Swedish Governmental Agency for Innovation Systems (VINNOVA)•VINNOVA Berzelii Centers 2. European Union•7th Framework Programme 3. VINNOVA•Innovations for Future Health

Country	Australia
Core Institution	University of South Australia
Co-Chair (name and title)	Prof. John Ralston
Number of Cooperating Institutions	0
Cooperating Institutions	
Matching Fund	1. Australian Research Council•LP0667828 2. Australian Research Council•DP1094337

Country	The United States of America
Core Institution	IBM Watson Research Center
Co-Chair (name and title)	Watson Research Center•IBM fellow/Vice president• Dr. Tze-Chiang Chen
Number of Cooperating Institutions	0
Cooperating Institutions	
Matching Fund	IBM Corporation•Corporation money

Country	Singapore
Core Institution	Nanyang Technological University
Co-Chair (name and title)	Prof. Ai-Qun Liu
Number of Cooperating Institutions	0
Cooperating Institutions	
Matching Fund	Singapore Environment & Water Industry Development Council -IRIS Scheme•NRF-EWI Fund Project

Country	Switzerland
Core Institution	ETH
Co-Chair (name and title)	Prof. Petra Dittrich
Number of Cooperating Institutions	0
Cooperating Institutions	
Matching Fund	European Research Council•ERC Starting Independent Researcher Grant

Result of Program Implementation

In this program, based on the results obtained in the previous program cooperating with Uppsala University (Sweden) which has single molecule engineering and South Australia University (Australia) which has surface chemistry technology on both research and exchanging, we are constructing research/education core in the University of Tokyo. Fundamental scientific findings on single molecule analysis are being developed toward single cell and single molecule analysis, and for this purpose, we newly added IBM Watson Research Center (USA) which has MEMS and IT technology, Nanyang Technological University (Singapore) which has photonics technology, and Swiss Federal Institute of Technology (Switzerland) which has fluorescent molecule detection technology. By this, single cell and single molecule analysis device will be developed and the first core covering micro and nano chemistry fields and this will provide new analysis tools for medical and biological fields. From the view point of geometry, this program can cover Europe, Asia, Oceania and America. Since each institute is a hub in each area, this program can be a strong international network among these regions. Based on this network, young researchers can exchange internationally, and grow their discussion ability in English. Like this, this program are becoming a basis for both research and exchange, and has been constructing a continuous research exchanging system.

Achievements in FY2010 (Self Review)

Based on single molecule detection method established in the previous program using microchannels, we have constructed fundamental technologies on single cell analysis using extended-nano channels which is far smaller (10–100 nm size) than normal microchannels (10–100 μm size). Specifically, co-working with Uppsala University, we have developed single molecule analysis system in an extended-nano channel. Co-working with South Australia University, we have found several new properties in extended-nano channels such as conductivity increasing. Co-working with IBM, we developed low temperature glass bonding method for incorporating nanowire ion sensor in extended-nano channels. Co-working with Nanyang Technological University, we developed high sensitive protein analysis method in glass microchannels. Co-working with Swiss Federal Institute of Technology, we developed extended-nano continuous fluidic systems. By these results, basic technologies toward comprehensive single cell and single molecule analysis device. Furthermore, a student was dispatched to Switzerland, and a researcher from Australia has come. Like this way, we have interactively and intensively discussed about the collaboration themes and also learned each other's technique to promote research.

Future Plan (Measures toward Achieving Research Objectives)

Based on the established molecule detection and surface control methodologies, we will develop single cell and single molecule analysis method using extended-nanochannels. Continuing the exchanging will produce new fields by exchanging with completely different fields such as Uppsala university (Medicalbio), South Australia University (Surface chemistry) and IBM(IT, MEMS/NEMS). Nanyang Technological University and Swiss Federal Institute of technology are the same field, but exchanging their young researchers, young researchers' education network will be developed. The University of Tokyo will summarize these institutes, combine the research and develop single cell analysis devices for medical applications. The devices will be developed for Circulating tumor cell (CTC) analysis and stem cell (ES or iPS cells) analysis.