Title of Project：Development of Micro Arrays for Analyzing Small RNAs

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Research Area：Chemistry

Keyword：Nucleic Acids Analysis

【Purpose and Background of the Research】

DNAs and RNAs have been considered as molecules that store and carry genes as given in the central dogma of molecular biology. Recent researches have revealed that non-coding RNAs do have a very wide repertoire of biological functions. Methods for the analysis of DNAs have been extensively developed in the genome projects. Since PCR amplification method cannot be directly applicable to small-sized RNAs, development of effective analytical methods for small-sized RNAs is now the matter of great urgency. This study aims at development functional ligands that specifically bind to small-sized RNAs as well as new highly sensitive analytical methods for the detection of small-sized RNAs, by which highly sensitive micro arrays for RNAs would be developed.

【Research Methods】

This study includes the following researches.

(1) Development of fluorescent ligands that can recognize nucleobases: Rational design and synthesis of fluorescent ligands that have hydrogen-bonding ability are carried out, and their functions toward specific recognition of small-sized RNAs are examined. Selective recognition of the base sequences of RNAs is examined at the abasic (AP) site in RNA duplexes using developed ligands.

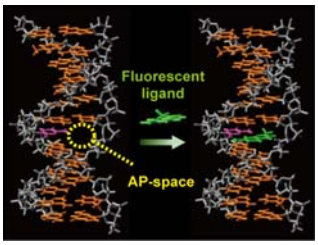

Fig.1 Schematics for selective recognition of base sequences at the AP site.

(2) Nucleobase recognition in nanopores: Short-stranded RNAs are immobilized on the wall surface of nanopores in nanoporous membranes to detect complementary small-sized RNAs with high sensitivity, by means of fluorescence and optical waveguide sensing.

(3) Development of micro arrays for RNAs

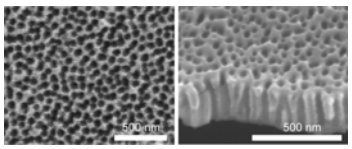

Fig. 2 SEM of nanopores

【Expected Research Achievements and Scientific Significance】

Based on our recent achievements on molecule recognition, gene analysis, and mesoporous membranes, a highly sensitive and selective detection method for small-sized RNAs is developed. It is highly expected this study would provide a useful strategy in nanobiochemistry. The researches achieved in this study will give impacts to the fields not only of analytical chemistry but also of supramolecular chemistry, chemical biology, nano-science and biotechnology.

【Publications Relevant to the Project】

・2-Aminopurine-Modified Abasic Site-Containing Duplex DNA for Highly Selective Detection of Theophylline, M. Li, Y. Sato, S. Nishizawa, T. Seino, K. Nakamura, N. Teramae, *J. Am. Chem. Soc.*, **131**, 2448-2449（2009）.

・Use of Abasic Site Containing DNA Strands for Nucleobase Recognition in Water, K. Yoshimoto, S. Nishizawa, M. Minagawa and N. Teramae, *J. Am. Chem. Soc*. **125**, 8982-8983 (2003).

・Self Assembly of Silica-Surfactant Nano-composite in Porous Alumina Membrane, A. Yamaguchi, F. Uejo, T. Yoda, T. Yamashita, T. Uchida, Y. Tanamura and N. Teramae, *Nat. Mater.* **3**, 337-341 (2004).

【Term of Project】 FY2010-2013

【Budget Allocation】 166,400 Thousand Yen

【Homepage Address and Other Contact Information】

http://www.anal.chem.tohoku.ac.jp/