

## 複数種類のセンサーを配置した DNA ナノ構造体の構築

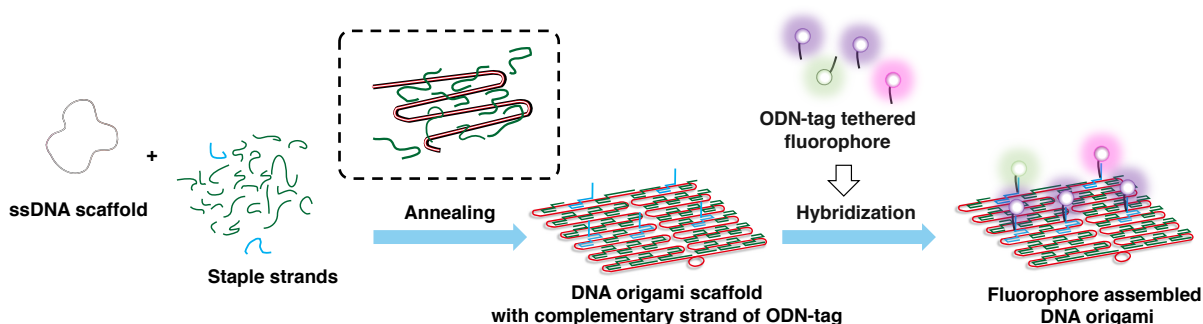
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**Development of a multiple-target detectable sensor based on DNA nanostructure** (Institute of Advanced Energy, Kyoto University<sup>1</sup>) ASIF, Mashal<sup>1</sup>; NAKATA, Eiji<sup>1</sup>; GERELBATAAR Khongurzul<sup>1</sup>; SHIBANO Yuya<sup>1</sup>; MORII, Takashi<sup>1</sup>

Accurate detection and monitoring of physical parameters, such as intracellular pH, are of great importance in understanding various cellular processes and the internal dynamics of living cells. By incorporating various fluorescent probes onto DNA nanostructures, innovative analytical tools that can simultaneously detect and identify various parameters, such as pH changes and enzymatic activity at a specific location, would be possible.

Compared to conventional single molecule-based sensors, the assembly of multiple fluorescent sensors on a DNA scaffold offers distinct advantages. DNA nanostructures serve as an ideal framework to spatially organize molecules with nanometer precision, taking advantage of their sequence-driven programmability<sup>1)</sup>. In this study, the DNA origami technique<sup>2)</sup> was used to meticulously assemble a controlled number of different fluorophores. Based on the fluorescence ratio of two different fluorophores, pH-sensitive fluorescein (CF) and pH-insensitive tetramethylrhodamine (CR), attached to the DNA nanostructure, ratiometric detection was demonstrated with different responses to pH changes<sup>3)</sup>. In addition, the detection range of pH was extended by incorporating multiple sensors with different pK<sub>a</sub> values, i.e., Oregon Green (OG) was combined with CF and CR, onto the DNA nanostructure. This strategy could be used not only for pH changes but also for different targets by combining appropriate fluorescent probes, e.g., fluorescent probe for enzyme activity<sup>4)</sup>. Progress in this direction will be discussed in this presentation.



**Fig. 1.** Rectangular DNA origami scaffold assembled with multiple fluorophores modified with ODN-tag.

- 1) As the review: T. A. Ngo, H. Dinh, T. M. Nguyen, F. F. Liew, E. Nakata, T. Morii, *Chem. Commun.* **2019**, 55, 12428-12446.
- 2) P. W. K. Rothemund, *Nature* **2006**, 440, 297-302.
- 3) E. Nakata, H. Hirose, L. Gerelbaatar, J.V.V. Arafiles, Z. Zhang, S. Futaki, T. Morii, *Chem. Sci.*, **2021**, 12, 8231-8240.
- 4) Z. Zhang, E. Nakata, Y. Shibano, T. Morii *ChemBioChem* **2022**, 23, e202200319.