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2013~Present	Professor, University of Toyama, Japan
2004~2013	Associate Professor, Kyushu University, Japan
2003~2004	Visiting Researcher, ETH Zurich, Switzerland
2000 Dr (Sci)	Kyoto University, Japan
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Research Interests:

RNA nanostructure, Ribozyme, Riboswitch, RNA modular engineering

Selected Publications:

1. Siddika MA, Oi H, Hidaka K, Sugiyama H, Endo M, Matsumura S, **Ikawa Y***, Structural expansion of catalytic RNA nanostructures through oligomerization of a cyclic trimer of engineered ribozymes, ***Molecules*** **2023**, 28, 6465

2. Ueda T, Nishimura K, Nishiyama Y, Tominaga Y, Miyazaki Y, Furuta H, Matsumura S, **Ikawa Y***, Pairwise engineering of tandemly aligned self-splicing group I introns for analysis and control of their alternative splicing, ***Biomolecules*** 2023 13, 654

3. Islam MD, Hidaka K, Suzuki Y, Sugiyama H, Endo M, Matsumura S, **Ikawa Y***, Box-shaped ribozyme octamer formed by face-to-face dimerization of a pair of square-shaped ribozyme tetramers, ***J Biosci Bioeng*** **2022**, 134, 195

4. Yu K, Hidaka K, Sugiyama H, Endo M, Matsumura S, **Ikawa Y***, A hexameric ribozyme nanostructure formed by double-decker assembly of a pair of triangular ribozyme trimers, ***ChemBioChem*** **2022**, 23, e202100573

5. Mori Y, Oi H, Suzuki Y, Hidaka K, Sugiyama H, Endo M, Matsumura S, **Ikawa Y***, Flexible assembly of engineered *Tetrahymena* ribozymes forming polygonal RNA nanostructures with catalytic ability, ***ChemBioChem*** **2021**, 22, 2168

Multi-molecular catalytic RNA nanostructures formed through assembly of modular ribozymes

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Abstract

Self-folding RNAs with defined three-dimensional (3D) structures offer promising platforms for creating functional nanoscale RNA objects. The modular architecture of the *Tetrahymena* group I ribozyme (ca. 400 nucleotides) enables the formation of its large and complex 3D structure. By separating the *Tetrahymena* ribozyme into two structural modules (ΔP5 and P5abc) and reassembling them artificially, we have designed unit ribozymes with oligomerization ability to form polygonal shapes such as ribozyme triangles, squares, pentamers, and hexamers (***ChemBioChem*** **2021**, 22, 2168). Further engineering of the ribozyme trimers has enabled them to dimerize through the pillar units to form double-decker hexamers (trimer+trimer), demonstrating enhanced catalytic efficiency (***ChemBioChem*** **2022**, 23, e202100573). Additionally, the incorporation of kissing loop interactions to the ribozyme trimers has facilitated the formation of higher-order assemblies of the ribozyme trimers, including open-chain and branched oligomers, as well as large, closed tetramers with 12 ribozyme units (***Molecules*** **2023**, 28, 6465). The hierarchical assembly of these RNA nanostructures, observed through techniques like atomic force microscopy (AFM) and electrophoretic mobility shift assays (EMSA), highlights their potential for expanding the complexity and functionality of RNA-based nanomaterials. These findings open new avenues for designing RNA nanostructures with diverse shapes and catalytic functions.