Science and Technology Group
Annual Report FY2023

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1 Introduction

I continued to engage in two independent research projects during FY2023, namely, engineering of functional RNAs with Yokobayashi Unit (2A) and investigations on natural fibers (e.g., Bashofu, as a PI, 2B).

2 Activities and Findings

<u>A. Engineering functional RNA projects (Yokobayashi Unit)</u>

(1) Our research about small RNA ligase was published and this was presented at ISNAC 2023 (**1, 3 in Section 4**).

(2) Alternative splicing is an important mechanism in mRNA processing in eucaryotes. Recently, we have focused on exon-skipping regulated by an RNA aptamer AC17-4 that binds to ASP2905 (Fukunaga et al., 2023, *J. Am. Chem. Soc.* 145(14), 7820-7828). ASP2905 is a small molecule with low toxicity and high permeability to mammalian cells.

As a new attempt, we tuned the expression level of EGFP by mutating the base P1 stem of AC 17-4 (Fig.1). The result depicted in Fig.2 suggests that the riboswitch response was dependent on the stability of the P1 stem that blocks the 5' splice site. We are now preparing the paper on this result with other results, e.g., application of phenotype regulation of mammalian cells.

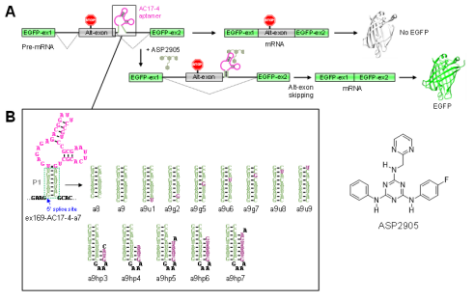

Fig.1. Regulation of exon skipping by the AC17-4 aptamer (A), and P1 stem variants (B).

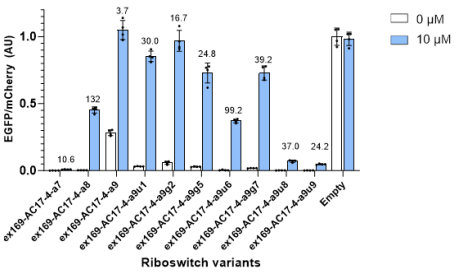

Fig.2. Function of riboswitch variants with different P1 sizes (ex169-AC17-4-a7/8/9) and with G-U pair(s) introduced in ex169-AC17-4-a9.

<u>B. Natural fiber projects (KAKENHI projects)</u>

(1) KibanC19K02308 (FY2019-2022): We presented a paper about an application of a facile fiber extraction (Kakihara et al., 2021, *J. of Home Econ. Japan* 72(12), 818-828.) to edible banana plant (**4 in Section 4**), and we published the cultural history study regarding Bashofu textiles in each class of the Ryukyu Kingdom (**2, 5 Section 4**).

(2) KibanC 20K02354: We proposed a minimal improvement to the traditional method (Important Intangible Cultural Property). We isolated *Stenotrophomonas* sp. from a local material banana field to degrade fatty acid esters in an unwanted hard part of the materials, plant cuticle layer. The material treated by this strain was thinner and softer, which allowed easy mechanical separation of the fibers from the materials. Moreover, our microscopic observation showed that the morphology of extracted fibers was not affected by this treatment. A manuscript describing these findings was submitted to *J. of Natural Fibers*, and the manuscript is currently under at a stage of minor revision.

We also continued to scientifically explore high-quality Bashofu fibers from careful observations of either raw or traditionally extracted fibers (paper in preparation).

(3) Exploratory Research 22K18489: We continued to develop an accurate and noninvasive identification method for Ryukyuan textiles.

(4) I organized a seminar and a small meeting (**6, 7 in Section 4**), and engaged in outreach related to our Bashofu research (**8, 9 in Section 4**)

3 Collaborations

Scientific Imaging Section Dr. K. Koizumi, Bashofu Textile Studio (Kijoka), Japan Women's

University Prof. R. Mori (historian) and Ms. F. Kakihara, Nigata University of Pharmacy and Medical and Applied Life Sciences Assoc. Prof. H. Kawasaki.

4 Publications and other output

Peer reviewed publications

1. Yoko Nomura & Yohei Yokobayashi. RNA ligase ribozymes with a small catalytic core. Published on May 26, 2023. *Scientific Reports* **13**, 2023, Article number: 8584. https://www.nature.com/articles/s41598-023-35584-9.
2. Rie Mori, Fumiko Kakihara, Yoko Nomura. Premium Bashôfu and rough Bashôfu: producing, wearing, and discussing bashôfu, a traditional banana fiber textile from Okinawa in the twentieth century. Accepted. *J. Asian Conf. Des. Hist. Theory*, No. 5, 2024, accepted.

Peer reviewed presentation

3. Yoko Nomura, Yohei Yokobayashi. RNA ligase ribozymes with a small catalytic core. The 50th International Symposium on Nucleic Acids Chemistry ISNAC 2023, Miyazaki Civic Plaza, Miyazaki, Nov 1-3, 2023. Poster presentation 1P-46. https://web.apollon.nta.co.jp/isnac2023/files/List_of_Poster_Presentations_1020.pdf
4. Yoko Nomura, Fumiko Kakihara, Yayoi Maehara, Koji Koizumi. Facile fiber extraction from *Shimabanana.* The 75th annual meeting of the Japan Society of Home Economics, Tokyo Kasei University, Tokyo, May 26-27, 2023. Poster presentation P-065. https://confit.atlas.jp/guide/event/jshe75/subject/P-065/category?cryptoId=
5. Rie Mori, Fumiko Kakihara, Yoko Nomura. Premium Bashôfu and Rough Bashôfu: Producing, wearing, and discussing bashôfu, a traditional banana fiber textile from Okinawa in the twentieth century. Asian Conference of Design History and Theory 2023 TOKYO, Tsuda University, Tokyo, Sept 16-17, 2023. Oral presentation. Session IV 12. https://acdht.com/download/2023/program2023.pdf

Organizer & lecture

6. The Japan Society of Home Economics, The Division of Coler and Design, FY2023 Summer public lecture "Ryukyu Dyeing and Weaving from the Perspective of Color and Design". Lecture 3. Change in color of Bashofu fibers by the process of extraction and modification. Okinawa Prefectural Museum and Art Museum, Sept 6, 2023. https://shikisai-isyou.sakura.ne.jp/
7. Science/history/art related to indigenous clothing in Japan and Canada, OIST, Dec 25, 2023.

Outreach

8. Esse-sense FORUM2023, speaker in session 3-D. Tokyo, Sept 22, 2023. https://esse-sense.com/forum2023
9. "The Japan crafts museum, R5 Autumn Special Exhibition: The Story of Kijoka Bashofu" Official cooperation by OIST, Lecture etc. Osaka, Oct 15, 2023. https://www.mingeikan-osaka.or.jp/2023/08/04/3564/

Fundings

KAKENHI KibanC 20K02354 (co-PI, 2,860,000 yen, over 4 years, FY 2020-2023)
KAKENHI Exploratory Research 22K18489 (PI, 6,370,000 yen, FY2022-2024)