

Annual Report FY2025

Yoko Nomura
March 2nd, 2026

1. Introduction

I continued to engage in two independent research projects during FY2025, namely, engineering of functional RNAs with Nucleic Acid Chemistry and Engineering (NACE, Yokobayashi) Unit (**2A**) and investigations on natural fibers (e.g., Bashofu, as a PI, **2B**).

2. Research activities and findings

A. Engineering of functional RNAs

RNA aptamer for small molecules related to pharmaceuticals

This is collaborative research with a pharmaceutical company. Due to the research collaboration contract, we cannot release the details of the results in this report, but I can briefly mention the progress. We selected several RNA aptamer candidates by either the conventional SELEX or Capture SELEX (Systematic Evolution of Ligands by Exponential Enrichment, see FY2024 annual report). Through surface plasmon resonance (SPR), we analyzed the binding properties of these selected candidates and confirmed that some of them were activated in human cells.

Separately from the research above, I did mammalian cell experiments on RNA aptamers for small molecules synthesized by the Yokobayashi unit. We already reported the tight binding of a small molecule, ASP2905, to RNA aptamer AC17-4 in our previous publication (Fukunaga et al., *JACS* 145, 2023, pp.7820-28). Yokobayashi unit carefully modified ASP2905, and SPR analysis showed that some of the modified molecules had a higher affinity than that of the original ASP2905. I confirmed that these molecules were activated in mammalian cells. The result was presented at ISNAC 2025 (**4a**).

B. Natural fiber project (KAKENHI projects)

(a) Morphological analysis of Kimono grade Bashofu fiber

Our findings were published in Scientific Reports (**3a**). We carefully compared the morphologies of fine Bashofu fibers (Nahagu) of Kimono grade to those of other grades of Bashofu fibers (Waha and Nahau), and we concluded that thin cell wall thickness and smooth-white fiber surfaces were identified as important characteristics of Bashofu kimono fibers (Table 1).

Furthermore, the traditional material separation method based on artisans' sensory

Table 1. Cell wall thickness of Bashofu fibers

Thickness of cell wall (μm)	
Waha	2.37 ± 0.30 *
Nahau	1.59 ± 0.18 *
Nahagu Nuki	0.97 ± 0.20 *
Nahagu Hashi	1.42 ± 0.20 *

Average \pm Standard deviation ($n = 25$). t -test * $P < 0.05$.

Mahagu: Kimono-grade, Nahau: apparel-grade like Obi sash, Waha: interior materials. Nuki: weft, Hashi: warp.

(Table S2a in *Sci. Repos.* 15, 2025. Article number 38664)

perception in making Bashofu is reasonable from the point of view of plant anatomy science, as supported by various morphological analyses of raw materials from *Musa balbisiana*.

(b) New KAKENHI project

We started the new KAKENHI project “Analysis of traditional finishing processes of Ryukyu textiles” from FY2025. The goal of this project is to clarify how the different finishings were developed in various traditional Okinawan textiles, e.g., Bashofu.

We prepared finishing textiles, hemp, ramie, Bashofu, silk, and handmade spinning cotton, by a traditional beating technique called *Kinutauchi*, collaborating with an experienced artisan of the Hirota Tsumugi Company (Kyoto). Bashofu in Okinawa has been treated with chemical finishing, not with such a physical method. Apparent whiteness, an important criterion for high-grade Bashofu, was increased after *Kinutauchi* (L^* 62.4 before *Kinutauchi*, L^* 70.1 after *Kinutauchi*, L^* 100 is white). The morphological change caused by *Kinutauchi* may increase whiteness; threads were loosened, flattened, and the void part of the

textile decreased (Figure 1), while the FT-IR analysis did not show that *Kinutauchi* chemically affected the textile. We presented the result (4b) and started analyzing the smoothness and softness of *Kinutauchi* textiles with a collaborator KATO TECH CO., LTD.



Figure 1. Effect of traditional beat-treatment *Kinutauchi* on Bashofu
The treatment was applied to both sides (front and back) by an experienced artisan.

(c) Analysis of the coolness of Bashofu

Water transportation in textiles is strongly related to clothing coolness. Efficient moisture transport in textiles can accelerate the effective evaporation of sweat on human skin, which causes the human skin temperature to drop. The air permeability of textiles can also support the evaporation of sweat. We feel coolness due to a decrease in skin temperature in high-humidity, high-temperature environments like Okinawa. As a preliminary study, we measured the water vapor permeability of traditional Japanese textiles. The value for Bashofu was highest among the test textiles, including traditional ramie textiles (Jofu). We presented the results for the purpose of future applications in nursing and care settings (4c).

Next, the moisture regain of textiles under various humidities was investigated. Both the water vapor permeability (>20 % at 20 °C, 65 %RH) and moisture regain (15 % at 20 °C, 85 %RH) of Bashofu and Yaeyama jofu showed high values. Furthermore, KATO TECK CO., LTD and we measured the cool-touch sensation of Japanese traditional textiles. Although we did not obtain specific results of cool-touch sensation values for Okinawa’s traditional textiles, the air permeability of Bashofu was extremely

high. We are going to present the result at the annual meeting of the Japan Society of Home Economics in May 2026.

3. Peer-reviewed publications

(a) K. Koizumi, Y. Maehara, T. Sasaki, H. Shinzato, and Y. Nomura, Morphological Analysis of *Musa balbisiana* var. *liukuensis* Fibers for Kimono-grade Bashofu in Japan. *Scientific Reports* 15, 2025, Article number: 38664. <https://www.nature.com/articles/s41598-025-22757-x>. Corresponding author.

4. Presentations

(a) B. Zhu, Y. Nomura, and Y. Yokobayashi. Chemical Optimization of Small Molecules for Controlling Mammalian Synthetic Riboswitch. The 52nd International Symposium on Nucleic Acid Chemistry (ISNAC) 2025. Toyama, Nov 12th, 2025. Poster presentation 1P-18.

(b) Y. Nomura, Y. Maehara, K. Koizumi, F. Kakihara, H. Kawasaki, and K. Koizumi, Effect of traditional beating *Kinutauci* on Bashofu textile. The 69th annual meeting of the Kyushu Branch, the Japan Society of Home Economics. Nagasaki, Oct 4th, 2025. Oral presentation.

(c) H. Kawasaki, Y. Maehara, K. Koizumi, F. Kakihara, and Y. Nomura. Water vapor permeability of traditional textiles: for use in nursing and care settings. The 77th annual meeting of The Japan Society of Home Economics. Yokohama, June 1st, 2025. Poster presentation P-054.

5. Others

(a) Collaborators

OIST Scientific Imaging Section (Dr. Koji Koizumi); OIST Yokobayashi unit; KATO TECH CO., LTD.; Japan Women's University; Niigata University of Pharmacy and Medical and Life Sciences.

(b) Fundings

JSPS KAKENHI Kiban C (new). PI, ¥ 4,680,000 over 3 years, "Analysis of traditional finishing processes of Ryukyu textiles."

(c) Invited talk

Scientific investigation on Bashofu (芭蕉布の科学研究), Lecture at Kagoshima Prefectural Museum of Culture Reimeikan (鹿児島県歴史・美術センター黎明館) 講演会, June 29th, 2025. <https://www.instagram.com/p/DlknHg2BQ9g/>.

(d) Coverage of the Bashofu research published in Scientific Reports [3(a)].

Local newspaper articles: Ryukyu Shimpō on Nov 11th, 2025; Okinawa Times on Dec 6th, 2025.

Science clip in Science Portal, JST, https://scienceportal.jst.go.jp/gateway/clip/20260120_g01/.

(e) Service for research consortium

Secretary of the Kyushu Branch (Okinawa), the Japan Society of Home Economics.

The 10th Summer seminar (2027) by The Japan Society of Home Economics, Committee chairperson. ISNAC 2026 Local Committee member.