Young Career Focus: Professor Yuuya Nagata (Hokkaido University, Sapporo, Japan)

Background and Purpose. SYNFORM regularly meets young up-and-coming researchers who are performing exceptionally well in the arena of organic chemistry and related fields of research, in order to introduce them to the readership. This Young Career Focus presents Professor Yuuya Nagata (Hokkaido University, Sapporo, Japan).

Biographical Sketch

Prof. Y. Nagata

Yuuya Nagata was born in 1980 in Kagawa, Japan. He received his B.Sc. and Ph.D. degrees from Kyoto University (Japan) in 2003 and 2008, respectively, under the supervision of Prof. Yoshiki Chujo. In April of 2008, he worked at Kyoto University as a postdoctoral fellow in the group of Prof. Yoshiki Chujo for a month. In May of 2008, he joined the group of Prof. Michinori Suginome at Kyoto University as an assistant professor. In December of 2019, he joined the Institute for Chemical Reaction Design and Discovery (ICReDD) at Hokkaido University (Sapporo, Japan) as a specially appointed associate professor. His research interests are in organic synthesis, polymer science, theoretical chemistry, and automated synthesis using robots.

INTERVIEW

SYNFORM *What is the focus of your current research activity?*

Prof. Y. Nagata My current interest is focused on organic synthesis using robots. So far, robotic synthesis has been used for high-throughput screening; however, it is still difficult to cover all combinations of substrates and reaction conditions. We are now working on theoretical chemistry and cheminformatics to be applied to robotic synthesis. I believe that this approach will make organic chemistry smarter and more successful.

SYNFORM *When did you get interested in synthesis?*

Prof. Y. Nagata I became interested in chemical synthesis – and chemistry in general – when I was at elementary school. I read some books to carry out quite simple experiments, such as beautiful color changes in an extract of a flower by adding vinegar or soapy water. I felt at first it was a sort of magic, and then I became interested in the detailed mechanism of color change reactions. That was the starting point for my interest in organic synthesis.

SYNFORM *What do you think about the modern role and prospects of organic synthesis?*

Prof. Y. Nagata In recent years, the role of organic synthesis has been growing in importance in various fields. In particular, I consider that organic chemistry should make a greater contribution to environmental preservation. To date, organic chemistry has produced various artificial chemicals, which sometimes cause environmental pollution. Therefore, organic chemists have a responsibility to solve this kind of problem. For example, the development of biodegradable plastics, carbon dioxide fixation, and energy-efficient chemi-

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cal transformations will contribute to environmental preservation via organic chemistry.

SYNFORM *Could you tell us more about your group's areas of research and your aims?*

Prof. Y. Nagata Our group will demonstrate the importance of artificial intelligence in chemical reaction design and discovery using an automated robotic system designed for organic synthesis, which can quickly validate new chemical reactions suggested by the artificial intelligence. We also aim to build a framework that automatically evaluates unknown reaction products with multiple analytical instruments, which are directly connected to the robot, and accumulates the experimental results as a database.

SYNFORM *What is your most important scientific achievement to date and why?*

Prof. Y. Nagata Before I moved to my current position, I worked on the control of chirality of helical polymers, poly(quinoxaline-2,3-diyl)s. Although we found that the polymer, having chiral side chains, exhibits a helix inversion dependent on the solvent (e.g., right-handed helix in tetrahydrofuran (THF) and left-handed helix in 1,1,2-trichloroethane) in 2010, its detailed mechanism had not yet been clarified.[1,2] In 2018, we got the chance to collaborate with physicists in quantum beam science and the structures of the polymer in solution were revealed, allowing us to investigate the mechanism of the helix inversion (Figure 1).[3] This study firstly revealed that a small difference in solvent effect can cause a large structural change of the helical main chain. Furthermore, I would like to emphasize that neutron beam science, which is unfamiliar in synthetic organic chemistry, was very powerful and useful in this research project.

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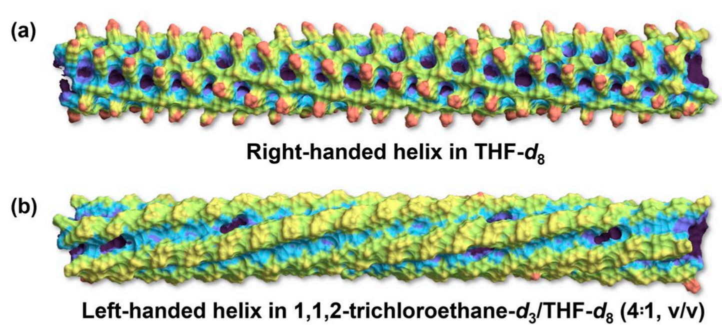

Figure 1 The solvent-excluded surfaces of poly(quinoxaline-2,3-diyl) having (*R*)-2-octyloxymethyl side chains revealed by small-angle neutron scattering measurements. (a) Right-handed helical structure in THF-d_8. (b) Left-handed helical structure in 1,1,2-trichloroethane-d_3/THF-d_8 (4:1, v/v).

