The Center for the Development of New Model Organisms Training Course "Technical Workshop on Microinjection Techniques Using New Model Organisms"

Instructors: Ken-ichi Suzuki, Shuji Shigenobu, Teruyuki Niimi, Kiyoshi Naruse
Lecurers: Ken-ichi Suzuki, Tatsuma Mohri, Masato Ohtsuka
Organizers: Ken-ichi Suzuki, Shuji Shigenobu, Naoto Ueno

The development of new model organisms has enabled the outstanding recent progress of genome sequencing and editing technologies. In keeping with this, the stable rearing and reproduction of animals, the preparation of genetic information, and especially the establishment of experimental protocols for functional analyses is necessary for the establishment of new model organisms. Microinjection is a fundamental technique found among these protocols, which itself is used in many functional operations, *e.g.* genome editing and RNAi. However, the development of microinjection techniques, presents an obstacle to developing new organisms, due to these type of techniques requiring intensive optimization for each new organism. With this in mind, The Center for the Development of New Model Organisms of NIBB organized a technical workshop during 2019 concerning microinjection techniques in order to promote and share said techniques among the scientific community.

We welcomed fourteen participants from various backgrounds, including academic researchers, students, and researchers from private companies. Participants were divided into three groups, each of which worked for two days with either amphibians (Iberian ribbed newt), insects (aphids and silverfish), or fish (medaka). Participants learned and practiced the basics of injection techniques as they were optimized for each organism. They ultimately joined together for a debriefing session where their individual experiences were shared. We also had a lecture session regarding functional analyses techniques by the application of microinjection. Four lectures, that were mostly run by invited extramural researchers, outlined the history of microinjection and genome editing. Researchers from a private company developing and manufacturing microinjection instruments also joined in with these sessions, thereby facilitating an informative exchange between users and developers.

This course successfully provided a valuable opportunity for participants to share microinjection techniques. One of the participants said those present could "acquire skills not provided in published textbooks or papers. As such, I felt the course was very informative". Another attendee stated that they "could exchange information with lecturers and other participants, and felt the conversations I was able to have were valuable". Although microinjection is a classic technique, it no doubt grows even more important as it is required in the application of cutting-edge technologies such as genome editing. We at the Center for the Development of New Model Organisms, NIBB, continue to focus on the improvement and promotion of this both old yet new technique, while keeping an eye on the collective needs of researchers.

(Shuji Shigenobu)

Advanced Bioimaging Support (ABiS)

The demand for bioimaging has increased in recent years in the field of life science. However, due to advances in imaging technologies, such as the diversification and specialization of imaging equipment, increasingly complex operations, increased equipment and running costs, as well as the growing need for image data analysis, individual research institutes and universities are increasingly encountering difficulties related to the introduction, maintenance, and operation of imaging equipment.

ABiS was launched as one of the designated "Platforms for Advanced Technologies and Research Resources" during fiscal year (FY) 2016 under the new framework of the Grant-in-Aid for Scientific Research on Innovative Areas (Leader: Prof. Masanobu KANO, NIPS/The University of Tokyo). This program aims to contribute to the further development of academic research in Japan through the provision of cutting-edge equipment and methodologies to individual KAKENHI (Grants-in-Aid for Scientific Research) research projects by the Ministry of Education, Culture, Sports, Science and Technology (MEXT) under the Grant-in-Aid for Scientific Research on Innovative Areas (FY2016-FY2021).

Cooperating with domestic partner organizations that own and operate multiple types of advanced specialized imaging equipment, ABiS provides cutting-edge instruments for light microscopy, electron microscopy, magnetic resonance imaging, and other methods through its network. It aims to provide comprehensive support for advanced imaging in the field of life science. NIBB, together with NIPS, contributes as a core institute in the ABiS network. Among the various support activities that ABiS performs, NIBB is tasked with the following:

- ■ Light microscopy
  - 4D microscopy administered by Prof. Toshihiko FUJIMOIRI
  - IR-LEGO microcopy administered by Assoc. Prof. Yasuhiro KAMEI
  - DSLM administered by Assoc. Prof. Shigenori NONAKA
- ■ Imaging analysis
  - Development of image processing/analysis algorithms for biological data administered by Prof. Naoto UENO, Assist. Prof. Kagayaki KATO and Assist. Prof. Yusaku OHTA.
- ■ Training
  - Training for image analysis administered by Assist. Prof. Hiroshi KOYAMA and Prof. Naoto UENO

To organize and coordinate ABiS activities, two secretariat offices were established at NIBB (Assoc. Prof. Shoji MANO) and NIPS, respectively, under the control of the general support group (Individuals in charge at NIBB; Director-general Prof. Kiyokazu AGATA, Prof. Naoto UENO, Prof. Shinji TAKADA, Assoc. Prof. Shoji MANO). General support provided includes budget planning and management of ABiS activities. In particular, we promote ABiS

activities via its associated website and other media, so that KAKENHI researchers make full use of the ABiS platform to accelerate their research projects. In addition, we organize technology training sessions, workshops, and symposia to disseminate advanced imaging technologies and share information about them. We also coordinate with the other three platforms (Platform of Supporting Cohort Study and Biospecimen Analysis, Platform of Advanced Animal Model Support, and Platform for Advanced Genome Science) to provide both multidisciplinary and international support.

Euro-Bioimaging (EuBI) is the largest and most well-established imaging network in Europe, and has been expanding globally to form the Global Bioimaging (GBI) network which boasts participants from areas such as India, Australia, Singapore, the Republic of South Africa, Canada, Mexico, USA, and some Latin American countries. In 2018, ABiS joined the GBI project representing the Japanese bioimaging community. It is hoped that through GBI, ABiS will be able to raise the quality of present support to that of the currently accepted international benchmarks, and that further observations, data analyses and research methods will be able to be better shared globally. Furthermore, it is also hoped that this collaboration will lead to set up a better environment for bioimaging research in Japan. This will be achieved not only by providing international training courses for young researchers and the staff of imaging facilities, but also through discussions about the implementation of career paths; a common problem in this field.

GBI also aims to establish an image data sharing infrastructure system, promote academic/industrial cooperation and formulate a global strategy for bioimaging research. It has been decided that the GBI event "The Fifth Exchange of Experience (EoE)" hosted by ABiS, will be held in Okazaki, Japan during the autumn of 2020.

Image Competition Held During The 57th Annual Meeting of The Biophysical Society of Japan (BSJ)

September 24 (Tue)–26 (Thu) 2019

ABiS held the 'ABiS Image Competition' as a special joint event in collaboration with BSJ during the 57th annual meeting of BSJ in Miyazaki (Chair: Dr. Takeharu NAGAI) to encourage researchers, especially students, graduate students, and young researchers, to present their work to the research community. Winners were selected from the categories of 'Humor', 'Intellectual' and 'Beauty' on the basis of votes collated from attending participants, and were publicly commended by ABiS and the 57th Annual meeting of BSJ (Figure 1). All photographs and videos are available to the public on the annual meeting's website (https://www2.aeplan.co.jp/bsj2019/abisicontest/57_abisimagecontest_list).

Figure 1. Award giving ceremony. Prof. UENO (Center) awarding prizes to winners of the image competition. Osaka University's Prof. Takeharu NAGAI (Left) chaired the meeting.

Training Course for AI-based Bio-image Analysis

August 29 (Thu)–30 (Fri) 2019

In addition to the support given by cutting-edge imaging research technologies, ABiS holds various training courses for image acquisition, processing and analysis to further disseminate imaging techniques every year. ABiS held 10 training courses on light microscopy, immunoelectron microscopy, MRI and imaging analysis in 2019. Among them, AI-based bio-image analysis was held at Kumamoto University, which was organized by Assoc. Prof. Takumi HIGAKI (Kumamoto Univ.), Assist. Prof. Kagayaki KATO (NIBB), Assist. Prof. Yusaku OHTA (NIBB) and Prof. Naoto UENO (NIBB). Prof. Seiichi UCHIDA (Kyushu Univ.) and Prof. Akira FUNAHASHI (Keio Univ.), who are recognized for their expertise in software and algorithm creation in the field of imaging analysis, and AI-based systems biology, respectively, were invited lecturers (Figure 2).

Figure 2. Training course session at Kumamoto University. Fifteen participants were selected via examination of their respective applications, and received lectures on AI-based machine learning for bio-image analysis.