The 13th NIBB Bioimaging Forum "Behavioral and Recognition Research upon the Platform of Vision and Color-Recognition Studies and its Interdisciplinary Merging with Bioimaging"

Organizing Committee: Yasuhiro Kamei, Shoji Fukamachi, and Hideaki Takeuchi

February 12 (Tue)–13 (Wed), 2019

The 13th NIBB Bioimaging Forum was held in conjunction with the achievement briefing meeting conducted by the priority collaborative research project led by Prof. Fukamachi entitled "Toward Construction of a Research Platform of Vision and Color-Recognition Studies -Upon the Model of Medaka Whose Behaviors are Dominated by Vision- ". This collaborative research project was aimed at establishing methodologies for analyzing issues ranging from individual behaviors to molecular mechanisms of vision, which also use imaging technologies such as virtual reality and aerial imaging. As bioimaging aims to improve observation technologies, this joint meeting was viewed as a good opportunity for exchanging study results and other information.

In particular, rhodopsin (and other opsins) is a key substance combining the two participant groups. This is due to it being directly related to vision. It also can be used as a tool in optogenetics, itself a cutting-edge bioimaging methods. Additionally, Medaka have been used as a model organism for more than a hundred years in Japan, and have become popular as pets due to the many color variations they produce through cross-breeding.

We made this symposium open to public for the purposes of disseminating of knowledge on the research uses of Medaka and their history as a model organism, something which has likely benefitted historically. It was unfortunate that two of the invited speakers withdrew due to cancelling caused by an influenza epidemic, but their absence was covered by two young participants in a similar research field. This shows a large pool of researchers active in this field.

I would like to thank all the speakers and the project members for their contribution.

(Yasuhiro Kamei)

The NIBB Genome Informatics Training Course

The NIBB Core Research Facilities regularly organizes a series of training courses on up-to-date research techniques. The NIBB Genome Informatics Training Course (GITC) is specially designed for biologists who are not familiar with bioinformatics. In 2019, we held three sets of training courses on RNA-seq analysis. Each set of the RNA-seq analysis course was made up of two 2-day programs: one was a preparatory course concerning the basics of UNIX and R, and the other was a practical course to learn the pipelines of RNA-seq analysis using next-generation sequencing data. These GITC courses offered lectures and hands-on tutorials.

Introduction to RNA-seq: From the Basics of NGS to de novo Analyses

■ Organizers: Dr. Shuji Shigenobu and Dr. Ikuo Uchiyama (NIBB Core Research Facilities)
■ Lecturers: Dr. Shuji Shigenobu, Dr. Ikuo Uchiyama, Dr. Masanao Sato (Hokkaido Univ.), Dr. Katsushi Yamaguchi, Ms. Hiroyo Nishide, Mr. Takanori Nakamura, Mr. Takahiro Bino, Mr. Hiroki Sugiura (NIBB Core Research Facilities)

February 21 (Thu)–22 (Fri), 2019

(Preparatory Course) Basics of UNIX, R, and NGS
■ 30 participants (including 2 from NIBB)
■ Program:
 1. UNIX for Beginners
 2. Editor and Scripts
 3. Introduction to "R"
 4. NGS Basic Data Formats and NGS Basic Tools
 5. Text Processing
 6. Exercises

March 14 (Thu)–15 (Fri), 2019

(Practical Course) RNA-seq Analysis Pipeline
■ 28 participants (including 1 from NIBB)
■ Program:
 1. Introduction to RNA-seq
 2. NGS Basic Data Format and Basic Tools
 3. Visualization of NGS Data
 4. Introduction to Statistics
 5. RNA-seq Pipelines: Genome-Based and Transcriptome-Based Approaches
 6. Multivariate Statistics
 7. Functional Annotation and Gene Ontology
 8. Exercises

May 16 (Thu)–17 (Fri), 2019

(Preparatory Course) Basics of UNIX, R, and NGS
■ 28 participants (including 3 from NIBB)

May 30 (Thu)–31 (Fri), 2019

(Practical Course) RNA-seq Analysis Pipeline
■ 30 participants (including 4 from NIBB)

May 16 (Thu)–17 (Fri), 2019

(Preparatory Course) Basics of UNIX, R, and NGS
■ 26 participants (including 6 from NIBB)
* Practical Course was postponed due to the COVID-19.

The 7th Bio-imaging Data Analysis Training Course

Organizers: Dr. Kagayaki Kato, Dr. Hiroshi Koyama, Dr. Takashi Murata, Dr. Yasuhiro Kamei, and Dr. Shigenori Nonaka
Supervisors: Prof. Naoto Ueno, Prof. Toshihiko Fujimori, and Prof. Shinji Takada

December 10 (Tue)–12 (Thu), 2019

The 7th Bio-imaging Data Analysis Training Course was held jointly by the Exploratory Research Center on Life and Living Systems (ExCELLS), JSPS KAKENHI Platforms for Advanced Bioimaging Support (ABiS) and NIBB. This course was designed for biologists who are relatively new to analyzing datum obtained through advanced microscopy. Therefore, the focus of the training related to learning about image processing and analytical techniques through "solving simple problems with image analysis" and "understanding appropriate methods and necessary preparation for consulting experts in technically advanced imaging challenges". Forty three people applied for the course, which had an announced capacity of 16 participants. Considering the high demand for courses on these subjects, we accepted 18 participants.

This course's lectures were conducted with the aim of guiding participants towards keeping in mind the series of steps essential to fundamental image processing and analysis while obtaining images to be used (workflows). In addition, we loaned PCs pre-installed with ImageJ, a typical open-source software package for biological image processing and analysis, to the participants in addition to images which were used for practice. Also, lectures were given on how programming of simple "macro language", which uses these workflows in ImageJ allows automation; itself being a necessity for the large capacity and high-dimensional throughput of microscopic imaging which has become common in recent years.

At the conclusion of the course, each of the students gave commentary and discussed the methods used with examples of actual images from their own research. Every year after the course, participants express feeling "pretty tired, but satisfied". It certainly is beneficial in terms of their image analysis as they became more familiar with these techniques. In addition, we expect that this course will increase opportunities for joint research relating to biological image analysis.

(Kagayaki Kato)

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