

## **Activity Report for FY 2016**

From April 1, 2016  
To March 31, 2017

June 2017

Nakatani Foundation for Advancement of Measuring Technologies  
in Biomedical Engineering  
Art Village Osaki Central Tower  
1-2-2, Osaki, Shinagawa-ku, Tokyo

## Activity Report for FY2016

Amidst science technologies which create new leading industries becoming increasingly important, one of the considerable subjects is promoting the development of fundamental technology in the field of biomedical engineering measurement. The Nakatani Foundation for Advancement of Measuring Technologies in Biomedical Engineering, since its establishment in 1984, has carried out grant programs to encourage the development of leading technologies and technology exchanges in the field of measuring technologies as well as educational programs to foster future science-related researchers. Since FY2016, we have launched new grant programs; a grant program to support elementary-school students and teachers for science education, and the Grant Program for Global Research Internship to support overseas stays of undergraduate students in science-related majors. We are also setting up new programs for FY2017, such as scholarships for graduate students (master's course/doctoral course) and a grant program for long-term research. Furthermore, we are preparing to revise existing programs to implement more productive activities. Meanwhile, the programs described below were carried out in FY2016.

### **I. Grant Program for the Development of Technology**

Biomedical engineering measuring technologies are basic technologies; therefore, it is quite important to promote the development of its leading technologies. The grant program for the development of technology in the field of biomedical engineering measuring technologies is our core project and we focused on this activity this year as well. In FY2014, we initiated a Grant Program for Special Research to grant subsidies of up to 30 million yen over two years for the research which is expected to produce outstanding results and lead to practical uses.

#### 1. Invitation for Applications

Biomedical engineering measuring technologies cover a broad range of fields. They overlap the boundaries of science/engineering and medicine/biology as the field of technology development expected to play an important role in building a healthy and hopeful world. We invited applications from universities and equivalent research institutes for the research subjects for the grant, "Biomedical Engineering Measuring Technologies Related to the Living Body," for which the social need has been growing as an academic research subject. The invitation was given in the same way as in the preceding year: by sending out letters and posting on our website to reach as many people as possible.

[Invitation] Started from July 2016 ⇒ Mailed invitation letters and posted on our website

[Due date for applications]

Grant for Special Research: Closed on August 31, 2016

Grant for Development and Encouragement of Research: Closed on September 5, 2016

#### 2. Screening

Members of the selection committee (consisting of Mr. Kajiya, Chairperson, and 12 other members), which is set up in the Nakatani Foundation for Advancement of Measuring Technologies in Biomedical Engineering, carefully screened the applications from universities, etc. and chose 30 cases (17 for development of research, 8 for encouragement of research, and 5 for special research) that were expected to contribute to the development of leading technologies in the field of biomedical engineering measuring technologies.

[Screening procedures]

- Primary screening (paper)
  - Grant for Special Research
  - Grant for Development and Encouragement of Research
- Secondary screening (paper)
  - Grant for Special Research
  - Grant for Development and Encouragement of Research
- Third screening (interview)
  - Grant for Special Research
- Final screening: At the selection committee meeting in December 2016

### 3. Ceremony to Present the Grant for Development of Technology

A ceremony was held on February 24, 2017, at the MANDARIN ORIENTAL TOKYO to present the FY2016 Nakatani Award and the grants to the recipients of the FY2016 Nakatani Research Grants and to hear their research presentations. The grant for the development of technology, amounting to 235.88 million yen in total (FY2016), was presented to the following 30 researchers and 7 researchers who had won the grant program for special research in FY2015:

#### Recipients of FY2016 Nakatani Research Grants

#### 【 Technology Development Research Grants 】

##### Development Research Grants

Unit: 1,000 Japanese yen

Recipient	Position and Affiliation	Research Theme	Amount
Masahito Yamanaka	Assistant Professor Department of Quantum Engineering, Nagoya University	High-resolution multimodal imaging for deep tissue imaging and analysis	2,980
Prabhat Verma	Professor Department of Applied Physics, Graduate School of Engineering, Osaka University	Development of tip-enhanced super-resolution Raman microscopy in liquid to reveal cell membrane functions	3,000
Yukio Kawahara	Professor Department of RNA Biology and Neuroscience, Graduate School of Medicine, Osaka University	Development of a method for the quantification of RNA methylation using artificial nucleic acid probes	3,000
Kiyotaka Sasagawa	Assistant Professor Nara Institute of Science and Technology	Development of implantable fluorescence imaging device with ultra-low invasiveness and high sensitivity	2,960
Toshiyuki Hamada	Visiting Professor Hokkaido University Graduate School of Health Science	The development of the system detecting cancer by novel genes expression tracing technique	3,000
Takashi Ushida	Professor Department of Mechanical Engineering, School of Engineering, University of Tokyo	Development of Hybrid System of TeraHertz Spectroscopy with Circular Dichroism Spectroscopy	3,000

Niraula Madan	Associate Professor Nagoya Institute of Technology, Graduate School of Engineering, Faculty of Electrical and Mechanical Engineering	Development of highly sensitive large-area imaging array for medical applications using epitaxially grown CdTe layer	3,000
Reiko Arakawa	Assistant Professor Institute of Medical Genetics, Tokyo Women's Medical University	Development of next generation diagnostic agents for spinal muscular atrophy (SMA)	3,000
Yuhei Miyauchi	Associate Professor Institute of Advanced Energy, Kyoto University	Bioimaging using upconversion fluorescence of carbon nanotubes	3,000
Hiroimi Imamura	Associate Professor Division of Systemic Life Science, Graduate School of Biostudies, Kyoto University	Visualization of branched-chain amino acids inside living cells with fluorescent biosensors	2,980
Yasuhiro Kazuki	Associate Professor Chromosome Engineering Research Center, Tottori University	Generation of a system for the evaluation of time-dependent induction of drug metabolizing enzyme by chromosome engineering technology	3,000
Yumi Tohyama	Professor Division of Biochemistry, Faculty of Pharmaceutical Sciences, Himeji Dokkyo University	Development of early detection method of thrombus formation by analyzing neutrophil extracellular traps (NETs)	3,000
Kazuhide Miyamoto	Associate Professor Pharmaceutical Sciences, Himeji Dokkyo University	Simplified detection system of ubiquitination using an artificial ubiquitin-ligase	3,000
Tatsuo Michiue	Professor Department of Life Sciences, Graduate School of Arts and Sciences, The University of Tokyo	Establishment of novel strategies for measuring cell tension using multiple FRET tension probes	3,000
Koji Matsuura	Associate Professor Department of Biomedical Engineering, Faculty of Engineering, Okayama University of Science	Signal Transduction Analyses of Mammalian Embryos <i>in Vitro</i> Cultured Using Dynamic Culture System	3,000
Kazuo Tanaka	Associate Professor Graduate School of Engineering, Kyoto Univ.	Development of detection system for a trace amount of biomolecules with <sup>19</sup> F MR Probes	3,000
Toshiro Ohashi	Professor Division of Human Mechanical Systems and Design, Faculty of Engineering, Hokkaido University	Development of migration assay of cancer cells with application of mechanical stress and measurement of traction forces	3,000

**Grants for Encouragement of Research**

Unit: 1,000 Japanese yen

Recipient	Position and Affiliation	Research Theme	Amount
Yoshimitsu Sagara	Assistant Professor Laboratory of Smart Molecules, Research Institute for Electronic Science, Hokkaido University	Development of Supramolecular Mechano-sensing Probes to Evaluate Forces Generated by Integrins	1,500
Yasuaki Kumamoto	Assistant Professor Department of Pathology and Cell Regulation, Graduate School of Medical Sciences, Kyoto Prefectural University of Medicine	Unmyelinated nerve detection by a multipoint Raman scattering measurement technique	1,500
NGUYEN THANH VINH	Project Researcher The University of Tokyo, IRT Research Initiative	Small volume measurement of blood viscosity using piezoresistive force sensor	1,500
Shogo Watanabe	Senior Assistant Professor Department of Medical Technology, Graduate School of Health Sciences, Okayama University	Development of a device for vascular treatment to realize a safe intervention guided by 3-dimensional CT image	1,500
Hiroyuki Watanabe	Assistant Professor Department of Patho-Functional Bioanalysis, Graduate School of Pharmaceutical Sciences, Kyoto University	Development of near-infrared/two-photon fluorescent probes for detection of amylin aggregates and its application to the pathologic clarification of diabetes	1,500
Kenta Shimba	JSPS Research Fellow School of Engineering, Tokyo Institute of Technology	Development of a novel intracellular recording method with membrane proteins	1,500
Kazuki Nagayasu	Program-Specific Assistant Professor Center for the Promotion of Interdisciplinary Education and Research, Kyoto University	Development and application of multicolor microendoscope for deep brain imaging	1,500
Moeto Nagai	Lecturer Department of Mechanical Engineering, Toyohashi University of Technology	Massively Parallel Single-Cell Printer for High-Throughput Cell Function Analysis	1,500

**Special Research Grants: multi-year grants (two years)**

Unit: 1,000 Japanese yen

Recipient	Position and Affiliation	Research Theme	Amount
Tetsuo Kobayashi	Professor Graduate School of Engineering, Kyoto University	Development of novel neuroimaging technologies based on neural magnetic fields measured by super-sensitive optically pumped atomic magnetometer modules	30,000
Hiroyuki Michiue	Assistant Professor Department of Physiology, Okayama University Graduate School of Medicine, Dentistry and Pharmaceutical Sciences	The development of <i>in vivo</i> non-invasive boron ( $^{10}\text{B}$ ) concentration measurement technique with neutron-induced prompt gamma-ray analysis toward boron neutron capture therapy(BNCT) clinical application	30,000
Naoya Yahagi	Associate Professor Nutrigenomics Research Group, Faculty of Medicine, University of Tsukuba	Measurement of nuclear signals controlling energy metabolism through new approaches of nutrigenomics	30,000
Haruhiko Bito	Professor Department of Neurochemistry, Graduate School of Medicine, The University of Tokyo	Development of all-optical interrogation of long-term memory mechanisms using next-generation calcium indicator proteins	30,000
Shigeori Takenaka	Professor Department of Applied Chemistry, Faculty of Engineering, Kyushu Institute of Technology	Development of electrochemical chip for cancer diagnosis	29,650

**II. Commendation Program (Nakatani Award)**

The Nakatani Award, in expectation of dramatic advances in the development of technology in the field of biomedical engineering measuring technologies related to the living body, was instituted to recognize researchers who had achieved the outstanding works. We selected the candidates for the prize after careful screening among the applications with recommendations received via our open invitation and presented the Nakatani Award grand prize and encouraging prizes to the winners at a ceremony.

## Recipients of FY2016 Nakatani Awards

**Grand Prize**

Unit: 1,000 Japanese yen

Recipient	Position and Affiliation	Prize Theme	Amount
Seiryō Sugiura	Project Professor Dept. of Human and Engineered Environmental Studies, Graduate School of Frontier Sciences, The University of Tokyo	A heart simulator "UT-Heart" facilitates our understanding of the pathophysiology by integrating experimental observations made at multi-levels of biological system.	5,000

## Encouraging Prizes

Unit: 1,000 Japanese yen

Recipient	Position and Affiliation	Prize Theme	Amount
Shoji Takeuchi	Professor Center for international research on integrative biomedical systems, Institute of Industrial Science the Univ. of Tokyo	Membrane protein-based sensors using microfluidic device technology	2,500
Takufumi Yanagisawa	Endowed Research Division Associate Professor Global Center for Medical Engineering and Informatics, Endowed Research Division of Clinical Neuroengineering / Department of Neurosurgery, Graduate School of Medicine, Osaka University	Motor reconstruction by ECoG/MEG-BMI neuroprosthetic hand for severely paralyzed patient and the application for phantom limb pain treatment	2,500

[Invitation] Started from July 2016 ⇒ Mailed invitation letters and posted on our website

[Due date for applications] Closed in October 2016 ⇒ Application with recommendation

[Screening procedures]

- Primary screening (paper)
- Final screening: At the selection committee meeting in December 2016

### III. Grant Program for Technology Exchanges

Along with the development of nanotechnology and biotechnology in recent years, academic areas related to development and research of technology have become increasingly complicated and diverse. Thus it becomes more important to promote technology exchanges among researchers in Japan and overseas. In FY2016, therefore, we conducted the grant programs for Dispatch to Overseas, Invitation to Japan, Overseas Training, Overseas Study, and Study in Japan for technology exchanges and subsidized them as follows:

[Invitation] Posted on our website

[Acceptance of Application] Anytime in every quarter of a year (Twice a year for Overseas Study and Study in Japan)

[Screening procedures] by exchange screening committee members

[Screening results]

Unit: 1,000 Japanese yen

Program	Case	Amount
Dispatch to Overseas	31	5,670
Invitation to Japan	4	1,310
Overseas Training	7	9,540
Overseas Study	7	10,000
Study in Japan	3	3,000

#### IV. Grant Program for Research Study

Since there are various challenges in the field of biomedical engineering measuring technologies related to the living body, grant programs that the result of research is utilized broadly in a society have an important implication. We did the screening in the same way as the program for the development of technology and determined to subsidize the following research.

Investigative Research Grants			Unit: 1,000 Japanese yen
Recipient	Position and Affiliation	Research Theme	Amount
Kazuo Umezawa	Assistant professor Department of Emergency and Critical Care Medicine, Tokai University School of Medicine	The verification of diagnostic method for the pesticide poisoning by volatile skin gas analysis to practical use.	3,000
Yasuki Kobayashi	Professor Department of Public Health, Graduate School of Medicine, The University of Tokyo	Study on the relationship between arterial stiffness and dementia using non-invasive Arterial Velocity pulse Index (AVI) measurement	3,000

[Invitation] Started from July 2016 ⇒ Mailed invitation letters and posted on our website

[Due date for applications] Closed on September 30, 2016

[Screening procedures]

Primary screening, Final screening (at the selection committee meeting in December 2016)

#### V. Gathering and Providing Information on Biomedical Engineering Measuring Technologies

In order to promote the broad use of information regarding biomedical engineering measuring technologies related to the living body, we compiled data of the foundation's activities, such as the results of our grant programs for the research and technology exchanges, and issued our Annual Report No. 30. It was distributed widely to related facilities and has been opened as a database of biomedical engineering measuring technologies on our website. Researchers can obtain useful information using its retrieval function.

[Publication] Annual Report No. 30 vol.1 and vol.2

- Vol.1 : Issued in December 2016
- Vol.2 : Planned to be issued in June 2017
- Printed copies: 800
- Distribution to: Persons concerned, universities, related corporations, etc.
- Annual report is provided free of charge



## VI. Grant for the Promotion of Science Education

We think that raising children to have logical thinking skills and creativity will help not only the progress of science technology but also the development of Japan. Hence, we have sponsored a grant program for the promotion of science education in middle schools and high schools since FY2014.

### VI-1. The 3rd (FY2016) grant for science education

[Individual] Planning and practice of science classes, club activities, etc. that may help increase students' interest in science at educational facilities, such as middle school and high schools. (up to 300,000 yen/case)

[Program] Programs jointly planned and run by educational facilities such as schools, museums, science education centers, research facilities such as colleges and universities, school boards and so on. (up to 1 million yen/case, 2-year limitation)

[Program to support elementary-school teachers]

Activities to support elementary-school teachers who are actively working on the improvement of teaching techniques and development of learning methods that encourage children to improve their understanding of science (up to 1 million yen/case, 2-year limitation)

Grant Program	No. of Cases/Amount of Grant
Individual	57/16.88 million yen
Program (1st year)	27/25.57 million yen
(2nd year)	12/11.85 million yen
Program to support elementary-school teachers (1st year)	6/3.78 million yen

### VI-2. Grant Program for Global Research Internship (Nakatani RIES Fellowship)

The purpose of the Grant Program for Global Research Internship (Nakatani RIES Fellowship) is to provide Japanese and foreign undergraduate students with an opportunity to learn foreign languages and culture via a training program or exchange activity as well as an experience to study and see cutting-edge research at the labs of foreign colleges while on a short-term study trip during summer vacation. It also aspires to foster researchers who can work globally in the future. As our first program of this grant, we have held the Japan-US international exchange program in FY2016.

The first Nakatani RIES fellows, 14 American students and 8 Japanese students, had cross-cultural experiences while doing research internships in colleges in Japan and the U.S., respectively. We feel that the experience they had will greatly help their future work on both cultural and research aspects and allow them to play active roles as global researchers in the future.