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Research Trend Information
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Research Hall of Fame

2019 Shigeyoshi Matsumae Award awarding/conferring ceremony with President Tatsuro Matsumae

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Tokai University held the awarding/conferring ceremony for the 2019 Shigeyoshi Matsumae Award winners on January 15, 2020. The Shigeyoshi Matsumae Award is named after the founder of the university and recognizes achievements by students from kindergarten to university, alumni, and professors, who have distinguished themselves exceptionally in the fields of culture, sports, and academic research in keeping with the spirit in which the university was founded. This year (as of January 15, 2020), a total of 627 groups and individuals have been recognized. The awarding/conferring ceremony was held at the Tokai University Club in Kasumigaseki, Tokyo, and it was attended by President Tatsuro Matsumae, the various educational bodies within the university, and numerous academic deans.

The academic department was recognized in the 1st award ceremony for the academic year of 1991. Since the 20th ceremony in 2010, both the Shigeyoshi Matsumae Academic Award and the Shigeyoshi Matsumae Academic Promotion Award have been conferred upon its members. There have been a total of 79 recipients so far, including three individuals recognized at the 29th ceremony for the academic year of 2019.

2019 Shigeyoshi Matsumae Academic Award

Center for Liberal Arts
Associate Professor Shinichiro Higashi
"Theories of mathematics during the Renaissance: history of early modern science"

2019 Shigeyoshi Matsumae Academic Promotion Award

Department of Preventive Medicine, Faculty of Medicine, School of Medicine
Junior Associate Professor Hitoshi Endo
"Advancement of molecular preventive medicine research with respect to molecular interactions in the body's biological environment"

Department of Bioscience, School of Agriculture
Associate Professor Kazunari Yoneda
"Structural biotechnological study of the novel NAD-dependent dehydrogenase with a unique amino acid sequence"

2019 Shigeyoshi Matsumae Award awarding/conferring ceremony, held on January 15, 2020.

Shinichiro Higashi

Associate Professor, Center for Liberal Arts

"Theories of mathematics during the Renaissance: history of early modern science"

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In his research, Dr. Higashi explored arguments concerning the logical structure and subject matter of mathematics in 16th century Europe, and the historical backdrop in which these arguments took place. In his 2018 French publication *Penser les mathématiques au XVIe siècle (Theories of Mathematics in the 16th Century),* he demonstrates how Renaissance discussions concerning mathematics developed within a philosophical tradition going back to ancient Greek philosophy. His research also reveals new perspectives with which to look at the birth of modern science in the 16th and 17th centuries. His aforementioned book received high praise from the Académie française (the French Academy), and in 2019, Dr. Higashi became the first Japanese person ever to receive the *Prix Monseigneur Marcel* (Monseigneur Marcel Prize), which is awarded to excellent Renaissance-related research.

On Receiving the Shigeyoshi Matsumae Academic Award

The history of science is a relatively new branch of study which developed rapidly over the course of the 20th century, particularly in the United States of America. It explores how nature has been studied over various eras and in different societies, and seeks to deepen our understanding of the workings of natural science. My research within this field has so far focused on the history of the theories of mathematics. It is a historical study of the different theories and debates concerning the question *"what is mathematics?"*

Mathematics is an indispensable tool in present-day science. But back in the 16th century, just before the birth of modern science, there were debates on whether mathematics should be regarded as 'knowledge' in the strict sense. In Aristotelian philosophy, which was widely accepted and taught at the time, knowledge was defined as an understanding of the causes of phenomena. However, mathematics seemed independent of physical causality. Because of this, some philosophers argued that mathematics should not be considered 'knowledge'. However, others saw mathematical figures as existing independently of the human mind and argued in favor of the scientific status of mathematics.

Research on such debates is not new. When I was studying in France and reviewing the literature on the problem, I realized that I had to gain a great amount of basic knowledge in the history of European thought and the Renaissance. I also realized that the existing literature on the problem regarded it from the point of view of questions such as *'what brought about the era of Galileo and the modern mathematical sciences?'* In other words, the contemporary context in which the debates on mathematics developed had not yet been fully studied. Over the course of my research, I became aware of the differences between the history of science and that of European philosophy. I realized that the important task for me was to find a way to establish a unique point of view with which to understand the Renaissance debates on mathematics.

Modern science was not born in Japan; it was imported from the West. The Japanese people accepted it as something basically useful for life and industry, as something essentially tied to technology. They had not given enough thought to the philosophical or humanistic issues underlying European science. One of the motivations for my research was to discover, from a historical perspective, the foundational issues concerning science as a human and social endeavor; issues which, perhaps, remain largely unknown among the Japanese.

The Center for Liberal Arts is a center whose mission is to provide education in the liberal arts. At the center, experts from various fields share specialized content with freshman students. I have profited from my work here because, while preparing my courses, I was obliged to review my research from a broader perspective. Through my courses, I try to convey that a deeper understanding of history or philosophy can be exciting and worthwhile. I hope that in the future some of my students will undertake research that will change established views of humanity and the world.

Career Summary

April 2003: Full-time Lecturer at the Liberal Arts Education Center, Tokai University
April 2006: Associate Professor at the Liberal Arts Education Center, Tokai University
April 2016: Associate Professor at the Center for Liberal Arts, Tokai University (to date)
(April 2007 to March 2008: Visiting Researcher at the Center for Higher Studies in the Renaissance, François Rabelais University of Tours [France])

Hitoshi Endo

Junior Associate Professor,
Department of Preventive Medicine, Faculty of Medicine, School of Medicine

"Advancement of molecular preventive medicine research with respect to molecular interactions in the body's biological environment"

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Through his research, Dr. Endo aims to elucidate the molecular mechanisms and key molecules involved in the onset and development of diseases, specifically focusing on the biological environment of the body and its interactions with these molecules. One of his representative studies, conducted in 2013, involved efforts to curb nonalcoholic fatty liver disease (NAFLD) progression. With that study, Dr. Endo became one of the foremost scientists in the world in his field to show that improving the intestinal environment through the use of probiotics could potentially suppress the progression of a fatty liver to liver cancer. At present, he is primarily engaged in evaluating the relationship between the environment within cancer tissue and the development of malignancy. His current research also concerns the impacts of the environmental conditions of a mother's body and uterus on her child.

On Receiving the Shigeyoshi Matsumae Academic Promotion Award

My research focuses on the prevention of cancer progression and evaluation of the environment within a mother's body with respect to its impact on her child. I think that when we approach these subjects from a different and more general perspective, such as that of the biological environment, we can see the matter of the disease in a new light.

When cancer cells multiply to form a large mass, the environment within the mass degrades, as not enough nutrition or oxygen reaches inside. Normal cells die under conditions of insufficient nutrition or oxygen. But cancer cells, I've learned—like a large family that moves into a new home when space runs out—invade and metastasize under these conditions. They characteristically take in a large amount of sugar, and PET scanning, which is considered effective for the early diagnosis of cancer, is based on this characteristic. However, cancer that invades or metastasizes comprises of cells from an environment with insufficient sugars; they possibly lose their sugar-loving property in the process of metastasis. In light of this, another look at cancer cell nutrition and metabolism, and the methodologies of examination of cancer cells is warranted.

To evaluate the impact of the environment within a mother's womb on her child, I worked with a group of rats known as the Tokai High Avoider (THA) rat. In normal rat groups, it is considerably difficult to prove that an offspring's character or capacity changes with change in the mother's womb environment. I used the THA rat because about forty years ago, the first professor at the Public Health Department of our university, Prof. Sadayoshi Shigeta, had bred several generations of rats, resulting in a line of rats that perform very well in a particular test after birth. A change in an offspring's aptitude towards the test will indicate that it has been affected by changes in the mother's womb environment.

To evaluate the impact of a chemical compound on the offspring, I administered a small amount of the chemical compound (within permitted limits) on a parent rat. I then examined her offspring to check for its aptitude. I found, in certain test cases, that the chemical compound had impacted the child even though the amount of the compound was within the permitted limits. To understand the impact of surrogacy on an offspring, which has increased for livestock in recent years, I transplanted a THA rat embryo into a non-THA rat. Although the DNA of the mother and the embryo were not independent of each other, the aptitude of the offspring appeared to have been impacted by its surrogate mother. This study cannot be directly extended to humans. But such a study can be the basis for reviewing permitted limits for chemical exposure and reconsidering the impact of surrogacy on a child.

At the School of Medicine at Tokai University, I feel that there is not much of a wall between different departments and fields. Rather, the atmosphere of interaction makes it easy for people to request for help and cooperation whenever the need arises. I primarily conduct my research independently, and upon receiving this award, I felt, once again, that this university is open to recognizing and appreciating independent research activities. I intend to venture far, wide, and deep with my future research.

Career Summary

March 2009:	Doctorate degree, completed PhD at the Graduate School of Medicine, Asahikawa Medical University
April 2009:	Specially Appointed Associate Professor at the Department of Health Science, Asahikawa Medical University
October 2009:	Assistant Professor at the Department of Public Health, Faculty of Medicine, School of Medicine, Tokai University
April 2014:	Junior Associate Professor at the Department of Public Health, Faculty of Medicine, School of Medicine, Tokai University
April 2017:	Due to reorganization: Junior Associate Professor at the Department of Preventive Medicine, Faculty of Medicine, School of Medicine, Tokai University; additionally Graduate School of Medicine, Tokai University (to date)

Kazunari Yoneda

Associate Professor, Department of Bioscience, School of Agriculture

"Structural biotechnological study of the novel NAD-dependent dehydrogenase with a unique amino acid sequence"

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Dr. Yoneda's field of specialty is structural biotechnology. He engages in the X-ray analysis of the crystal structures of enzymes and their biochemical functions, seeking a path to their industrial application. In particular, he is actively attempting to elucidate the structures and functions of novel enzymes with unique amino acid sequences. Through his research, he has clarified the new structures of many dehydrogenases and provided insights essential to their application in pharmaceuticals and agriculture. To find ways to compensate for certain weaknesses of certain enzymes, such as low stability or heat tolerance, Dr. Yoneda has turned his attention to highly thermostable enzymes, such as those produced by thermophilic bacteria living in hot springs.

On Receiving the Shigeyoshi Matsumae Academic Promotion Award

Enzymes are proteins made up of hundreds of amino acids. They cannot be observed under a microscope; so more advanced methods, such as X-ray crystal structure analysis and X-ray crystallography, are required to magnify the three-dimensional structures of enzymes. In our research, by understanding enzyme structures at the atomic level, we were able to learn about their functions, which enabled us to develop enzyme-specific inhibitors for pharmaceuticals and pesticides.

To view and analyze the three-dimensional structures of enzymes, one must crystallize them. For this, one must first determine its functions and condition of stability; the characteristics of each protein are unique. One must also identify the right condition from among thousands or tens of thousands of possibilities for crystallization. In addition, a significant volume of enzymes is necessary for crystallization to be successful. To ensure sufficient volume, it is essential to perform enzyme and genetic engineering. In our research, once crystallization is complete, we take the structure to the High Energy Accelerator Research Organization in Tsukuba city and irradiate it with X-rays with the aim of obtaining the data we need for three-dimensional structural analysis.

When I arrived at the Aso campus in 2007, I wanted to use my skill and expertise for structural analysis that would be applicable to the field of agricultural science. As part of a joint research project at the Research Institute of Agriculture, I began research on an enzyme that specifically expresses itself in the fatty liver of chickens. Since this enzyme's structure was unlike any previously known structure, we were unable to estimate its function from its sequence. We worked together with graduate students to purify the enzymes and conducted X-ray crystal structure analysis. We discovered that it was an NADPH-dependent carbonyl reductase. We found that this enzyme catalyzes certain reactions with high reactivity, which can be useful for industrial applications; namely, it could be used to synthesize substances applicable to anticancer and hyperlipidemia drugs.

We helped in the development of selective pesticides that target plant disease fungi (filamentous fungi)—which cause leaves and fruit to rot—via the structural and functional analysis of enzymes unique to plant disease fungi. We succeeded in discovering several candidate compounds for enzyme inhibition, which only act on plant disease fungi and do not affect humans or other organisms in the soil.

This prestigious award is great encouragement for my educational and research activities, and for those who have been helping us continue our research as well. Enzymes are widely useful not only to living organisms, but also have a wide array of industrial applications. Though they are nothing but a small protein molecule, they are incredibly interesting, if they are studied thoroughly. Going forward, with enzymes at the core of our research, we plan to conduct multiple joint projects within and beyond the university.

Career Summary

March 2007:	Doctorate degree, completed PhD at the Department of Life Systems, Institute of Technology and Science, Tokushima University
April 2007:	Enrolment in post-doctoral studies at the Graduate School of Bioresource and Bioenvironmental Sciences, Kyushu University
October 2007:	Assistant Professor at the Department of Bioscience, School of Agriculture, Kyushu Tokai University
April 2009:	Lecturer at the Department of Bioscience, School of Agriculture, Tokai University
April 2014:	Associate Professor at the Department of Bioscience, School of Agriculture, Tokai University (to date)