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WASEDA ONLINE

Research

Knowledge Co-Creation - Profiles of researchers

Unlimited Potential in Marine Microorganisms
- Metagenome analysis evolves -

Haruko Takeyama

Haruko Takeyama
Professor, Department of Life Science & Medical Bio-Science, School of Advanced Science & Engineering of Waseda University

Marine Biotechnology

Among other fields of biotechnology (bioengineering), I specialize in marine biotechnology focusing on marine life. The field aims, in a word, to apply a diversity of mechanisms in marine life to human society.

In the field, the study of metagenomes has attracted a great deal of attention in recent years. Only 0.1% of microorganisms in our planet can be taken out of their environments for their cultures to be cultivated in a laboratory, and the rest 99.9% are still unknown. 70 percent of our planet's surface is covered by the ocean, in which more nonculturable microorganisms live than in land. These precious natural treasures remain untouched though they have undeveloped potential: they will be helpful for treatment of malignant diseases, solution to energy problems, or production of new materials.

Recently, however, the study of microorganisms has developed a new method for genetic research and

What's New!

- Should we simply focus on educating children to have command of the Japanese language?
- Using coupling analyses of structures and fluids to bring about engineering functionality for complex physical phenomena
- Using teamwork to be the first to achieve four consecutive intercollege wins since the team's founding
- "Student Battlefield -70 Years After the War-" Exhibition
- Gustave Courbet in 21st-Century France and Japan

CAMPUS NOW

The latest title! Early Spring Issue (Apr. 2015)

It introduces the latest information of Waseda

development. It is the study of genetic material recovered directly from a group of microorganisms in soil or water. The genetic material consisting of the genomes of many individual microorganisms is called metagenome, while the study of metagenomes metagenomics. For the development of metagenomics, we have to establish a database of metagenomes of marine life. In effect, Dr. Craig Venter, an American biologist who played a leading role in mapping the human genome, now carried out his marine microbial genome sequencing project to establish a database, leading to vigorous worldwide competition in the approach.

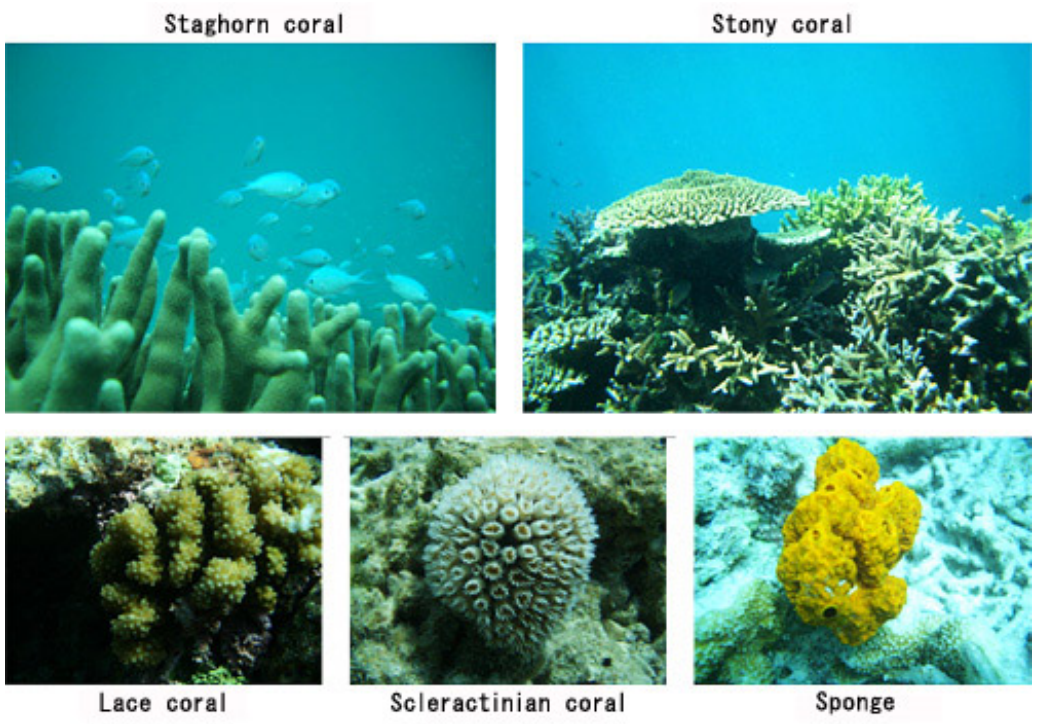
Our research is part of such effort to establish a database of metagenomes, focusing on those of symbiotic/coexistent microorganisms. Specifically, we extract genes from symbiotic bacteria in sponges and corals and analyze their mechanisms for establishing a metagenome database called Xana Meta DB.

While, in the United States, there are government-based or organization-based large projects, most research in metagenomics in Japan is conducted on an individual basis. Accordingly, we have to develop focused unique strategies and promote collaboration with national and international researchers. In effect, in joint research with Japanese universities and private companies, we have discovered gene clusters involved in salt resistance and concentration of heavy metals as well as new enzymes used in chemical process. We also often discovered unexpected mechanisms in known genes. We are now planning to publish a vast amount of data obtained from our projects to companies so that they can evaluate the mechanisms for the development of enzymes for industrial application.

University five times a year. [Index]

Events

ISAR&GCOE International Symposium



70 percent of our planet's surface is covered by water, which contains treasures of marine life. The mission of marine biotechnology is to explore their potential for its application to human society.

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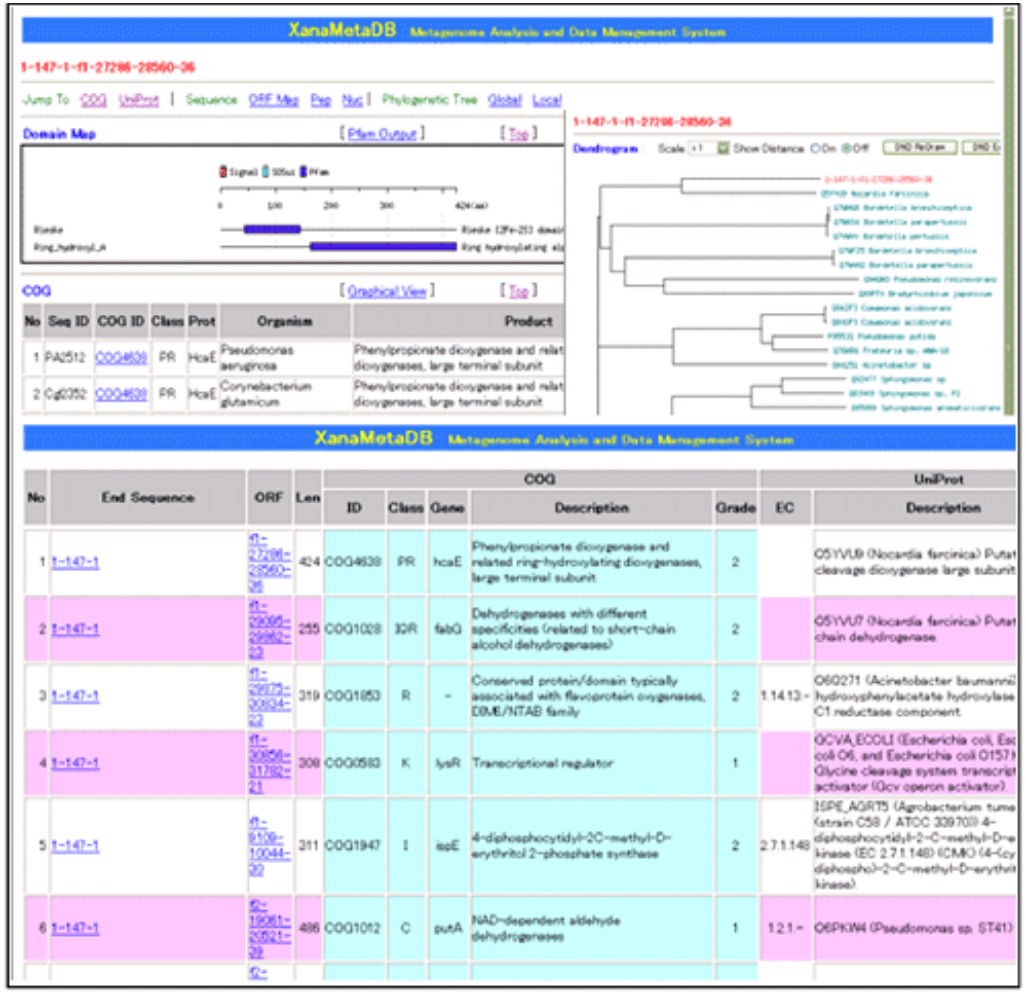


A screen of Xana Meta DB, a metagenome database established by Prof. Takeyama et al.

Natural Transition from Agricultural Science to Engineering

I graduated from the Department of Environmental Science and Conservation, Faculty of Agriculture. Being a first-year and second-year undergraduate student, I was involved in research activities in different laboratories, including research in monkeys and antelopes as well as in self-cleansing mechanism that rivers have. That gave me a glimpse into how animal protection activities were conducted. I was so much interested in animal protection, but the idea of animal management as seen in the United States at that time was not yet popular in Japan, and I felt it would be difficult to earn a living by specializing in animal

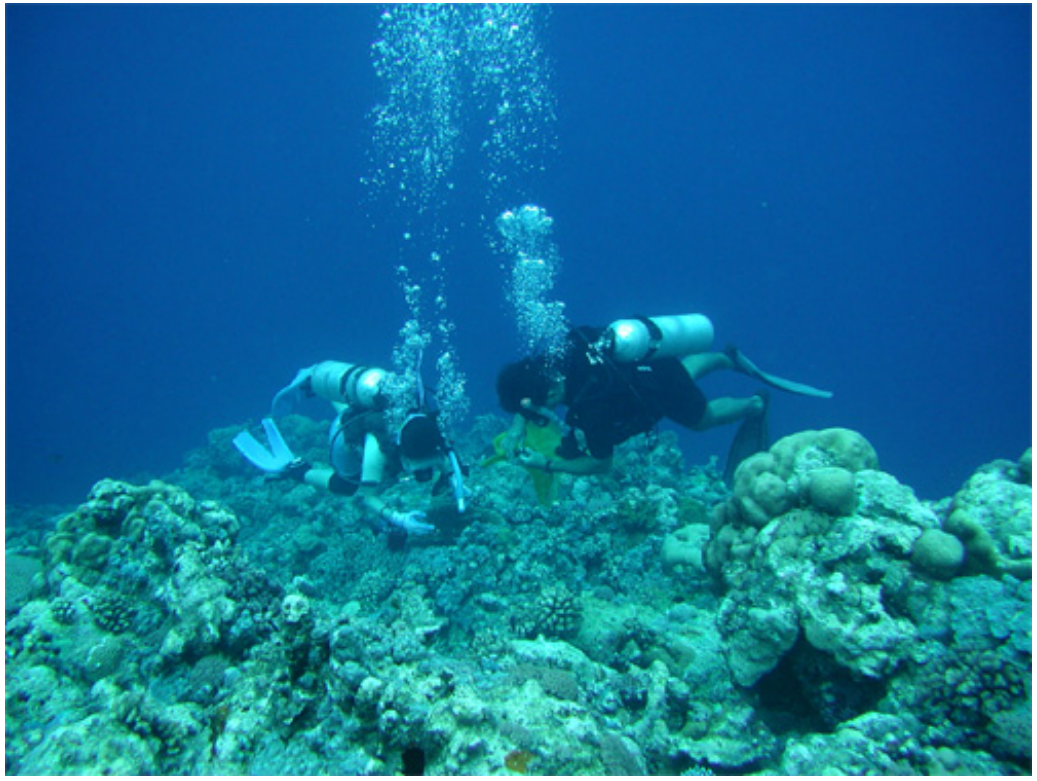
protection issues.

While wondering in what field my lifelong career should be, I happened to see the world of microorganisms. Having been long interested in the study of microorganisms, I was now more interested in its application to environmental purification. Consequently, I joined a laboratory that investigates the use of microorganisms for environmental purification.

For my bachelor's degree and master's degree, I studied respectively thiocyanate decomposition in the activated sludge and the effects of light, nitrogen, phosphorus, etc. on the occurrence of the blue-green algae water bloom (outbreaks of microalgae in Kasumigaura in summer). After completing my master's degree, I joined a bioengineering company and was engaged for some three years in the company's joint research in marine microalgae with Tokyo University of Agriculture and Technology.

Specifically, I joined the laboratory of Prof. Tadashi Matsunaga, a pioneer in marine biotechnology in Japan. Then, I decided to leave the company to attend the newly established doctoral courses of the Department of Engineering. Prof. Matsunaga also urged me to do so. Starting from basic study of microorganisms, I was engaged in its social and industrial application. As a natural result, I got a doctoral degree in engineering.

While completing my doctoral dissertation, I was employed as a postdoctoral researcher by Rosenstiel School of Marine and Atmospheric Science, University of Miami, where my study was on biological production of hydrogen; producing hydrogen from marine microalgae and converting it into energy. It was a wonderful environment with a beach in front of the School. And I enjoyed reading books on the beach and diving as well.



Survey in Palau; Collection of corals in water; naturalistic biological collection called Culture Collection is one of the important activities in marine biotechnology.

Twenty-Year Weekend Marriage with Co-Researcher

My collection made in Miami includes not only marine microorganisms but also my husband (laughter). He also was a postdoctoral researcher in the same School but came back to Japan when he was employed at one of the National Research Institutes of Fisheries Science in Japan. After one-year long-distance relationships, our wedding ceremony was held in the United States. I stayed in Miami alone for my continued research and returned to Japan when I was seven months pregnant, the latest a pregnant woman can fly on a plane.

Although I once gave up my career for taking care of my baby in Shizuoka, where my husband worked, it was for five months at longest that I could play the role of a full-time homemaker (laughter). As soon as I was informed Prof. Matsunaga's laboratory has a vacancy for an assistant, I came to Tokyo with my baby, leaving my husband, who was willing to support me in my decision and encouraged me too. We've been

married for 16 years but lived under the same roof just for 5 successive months in Shizuoka. For the rest, and currently as well, we are a weekend-marriage couple.

Although there are a relatively large number of women researchers in bioengineering, there are not many Japanese women in science and technology. The biggest challenge for women hoping to continue their research is work-life balance. While it is important to provide them with assistants in research and experiments, support for women in raising children and providing nursing care is much in need. If a woman stays strong physically and mentally, she could not maintain a healthy work-life balance without understanding and cooperation on the part of her family. It is of vital importance to create better working environments for women who are married and raising their children.

Indeed, my husband helps me a lot but my mother gave me most practical assistance. As we lived together, she took care of my daughter and did all the housework herself. One year ago, however, she was hospitalized following a stroke. And now, my husband does a much larger part of the housework. On weekends, we do cleaning, washing and shopping for one week together. In this way, we can help each other partly because we both prefer this way but mainly because we understand each other as researchers in the same area of specialization. In effect, we sometimes conduct joint research.

Due to decline in the birth rate, Japanese universities have great difficulty in attracting students. It is said that popularity of a university mostly depends on whether it can attract as many female students as possible. That is why many universities now have clean lavatories and even powder rooms. More discussions are needed as to what research organizations should be so that they can be available for women.

Human Resources Development in a Bid to Boost International Influence

I'll be making efforts for research and development aiming at the preservation and protection of the global environment. Amid discussions on the issue of global warming and climate change, it will be very important to closely monitor the entire global environment, notably the marine environment. As a metagenome was unimaginable some years ago, we now have many high-technology measuring tools. By monitoring the environment using the tools, we need to detect any serious change and immediately respond to it. And, for this purpose, we have to arrange beforehand necessary procedures and systems.

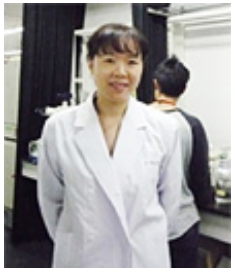
I want to have a deeper understanding of sociology, politics and economics so that I can explore environmental issues from a more comprehensive perspective. In the research of marine biotechnology, international conferences are regularly held by scientists from all over the world. While being opportunities

for research exchange between nations as well as between scientists, the conferences sometimes involve some aspects of political negotiation. Since we conduct our research at government expense, we are expected to make optimal use of the outcome for the common good. For this purpose, scientists also are required to have international negotiation skills, which, unfortunately, Japanese scientists lack.

Another point is the number of female experts. It is increasing in foreign countries but close to zero in Japan. Some say to me, "You're the first Japanese woman professor that I have a talk with." To enhance Japan's research capability, it is imperative, in addition to increasing the number of researchers in science and technology, to train them so that they can have international influence, to widen researchers' career path at a social level, and to create better working environments for women researchers.

Prof. Haruko Takeyama Laboratory Official Website
http://www.f.waseda.jp/haruko-takeyama/

Haruko Takeyama/ Professor, Department of Life Science & Medical Bio-Science, School of Advanced Science & Engineering of Waseda University



March 1992 Completed Doctoral Course in Materials Science and Bioengineering, Graduate School of Engineering, Tokyo University of Agriculture and Technology; Researcher at Rosenstiel School of Marine and Atmospheric Science, University of Miami; Assistant, Associate Professor, and Professor at Department of Materials Science and Bioengineering (now Department of Biotechnology and Life Science), Faculty of Engineering, Tokyo University of Agriculture and Technology; April 2007 Professor at Department of Life Science & Medical Bio-Science, School of Advanced Science & Engineering, Waseda University, Affiliate Professor at Faculty of Engineering, Tokyo University of Agriculture and Technology; Specialty in marine biotechnology, genetic engineering and microbiological engineering

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