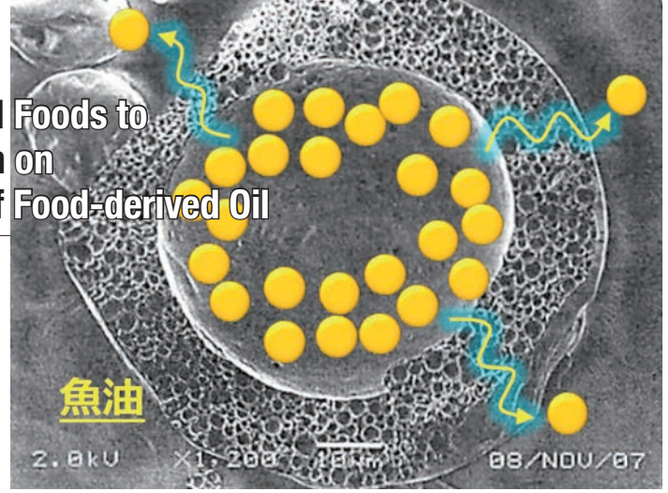
Development of Fish Oil Powder

Aiming to Export Processed Foods to the World through Research on Antioxidation Technology of Food-derived Oil

The sustained-release fish oil is a smooth and dry white powder. It is expected to be used for processed foods, supplements, and health foods for the elderly.



The cross-linked structure of the gelatin containing transglutaminase is epoch-making. Being cut off from oxygen prevents oxidization, and the fish oils can be released gradually. Depending on the mesh size of the cross-linked gelatin, the amount of fish oil released is controlled.

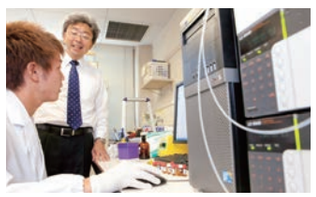
In 2000 at Jean Mayer Human Nutrition Research Center of Aging, Tuffs University and at Massachusetts General Hospital in Boston, Professor Miyazawa performed high precision analysis of plasmalogens, which are brain phospholipids associated with Alzheimer's disease, and revealed their relationship with dementia. His achievements were highly regarded as a breakthrough in dementia treatment. There are many kinds of food oils. In particular, fish-derived lipids (fish oils) contain many high polyunsaturated fatty acids (DHA and EPA) that when consumed are expected of significantly maintaining healthy brain functions in addition to reducing cholesterol levels and blood pressure. However, fish oils are easily oxidized, have a strong smell and are liquid, which makes them difficult to process into powder.

Professor Miyazawa has become the first in the world to develop a fish oil powder called "sustained-release fish oil powder." The fish oil is clathrate in a cross-linked gelatin which contains the enzyme, transglutaminase. Because of this structure, the fish oil resists oxidation and can be released little by little in the human body. Depending on the size of the mesh of the cross-linked gelatin, the amount of fish oils released is controlled. When this fish oil power is consumed, the fish oil is released slowly and efficiently absorbed into the body. Large companies are paying attention to this ingredient. The fish oil powder has been made into a product in a joint development with a local enterprise and its basic patents have been applied for.

"Tohoku must not be a mere food supply base. Value-added food processing industry is important. Presently, a plan is progressing to open a research platform for developing advanced processing technology in collaboration with local enterprises. Tohoku University's research development capability in food bioscience is internationally at the highest level. To give birth to new foods that will contribute to people's health and longevity in the world by integrating Tohoku's abundant food materials, local enterprises and the university's research development capability. That is my dream and goal," says Professor Miyazawa.

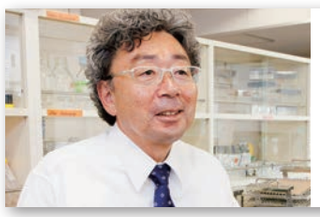
He continues, "In my laboratory, I challenge both undergraduate and graduate students to grapple freely with new research themes. What is important is not only to cope with assigned tasks, but to be aware of problems themselves and maintain a positive attitude toward the research. Overcoming a setback or experiencing a sense of achievement when they have made a breakthrough by themselves is the way to foster excellent researchers."

In collaboration between the Graduate School of Agricultural Science, the New Industry Creation Hatchery Center and Tohoku's food industries, it is planned to open a new laboratory in Tagajo City, Miyagi Prefecture that will act as a center for research on food development.



The high-precision analyzer that was developed has been commercialized and sold.

At the laboratory, 18 graduate students are doing research creatively in an independent and supportive environment.



**Food and Biodynamic Chemistry Laboratory,
Division of Bioscience and Biotechnology for Future Bio-industries,
Department of Applied Bioorganic Chemistry,
Graduate School of Agricultural Science**

Professor

Teruo Miyazawa

In 1982, he finished his doctoral course at the Graduate School of Agricultural Science, Tohoku University, specializing in food chemistry. After serving as an assistant and associate professor of the Graduate School of Agricultural Science, Tohoku University, he has been in his present position since 1998. Since 2013, he has also served as a professor and leader of the Food Biotechnology Project at Tohoku University's New Industry Creation Hatchery Center(NICHe). He is a Council member of the International Union of Nutritional Science(IUNS), President of the Japan Society of Nutrition and Food Science, and member of the Science Council of Japan.

http://www.agri.tohoku.ac.jp/kinoubunshi/index-j.html

Linear Collider Collaboration

Playing a Central Role in the Development of Detectors for the Next-generation Large-scale Linear Particle Accelerator – the ILC

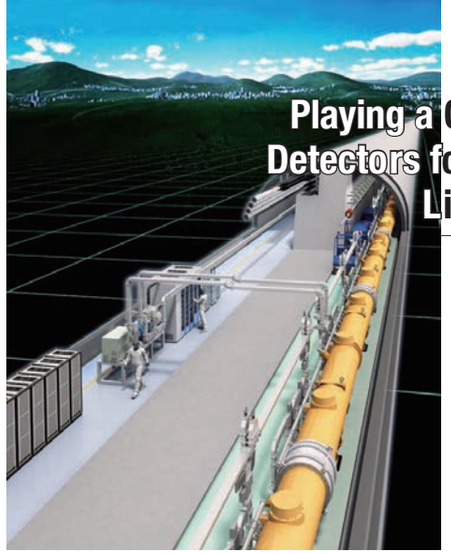
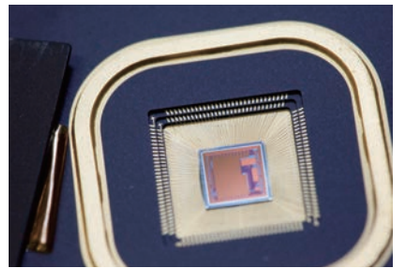


Image of the ILC project with the particle accelerator located in a straight 30-50 km tunnel excavated underground through the stable bedrock.

Prototype CCD image sensor using SOI technology, for the eye of ILC.



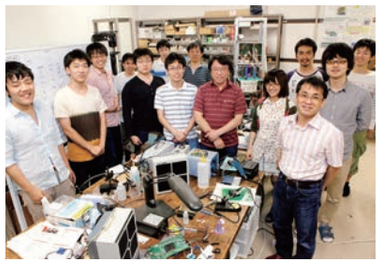
In 2012, the Higgs boson, as predicted by the standard model of particle physics, was discovered at the European Organization for Nuclear Research in Geneva, Switzerland. This was hailed worldwide as the discovery of the century, which will lead to great progress in the field of particle physics, although there remain more than a few questions yet to be solved.

To promote this research, the Linear Collider Collaboration was formally inaugurated in February 2012, and commenced its activities in June. The main goal of the project is to construct the International Linear Collider – a particle physics research facility to be constructed only one in the world. Professor Yamamoto is a director leading the section for physics and detectors, and is playing an important role in the research of the silicon tracker system and the design of the ILC detector. He is also extensively involved in developing new analysis techniques using physical detectors.

The ILC project is moving ahead with Japan as its primary candidate host and the Kitakami mountain range in Tohoku was chosen as its candidate site. The shape of the planned ILC accelerator is straight and long, extending over a length of 30-50 km. It will require excavation of a tunnel through the stable bedrock.

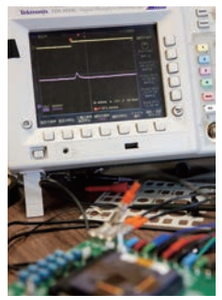
Professor Yamamoto's laboratory is presently developing a new sensor "silicon-on-insulator (SOI) image sensor." Their challenge is to develop a sophisticated sensor with ultra-high resolution that can withstand radiation in a high-energy environment.

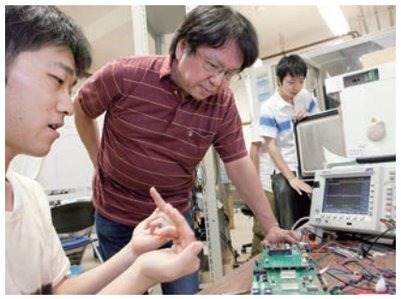
"One of the achievements derived from elementary particle research is that, based on pure scientific findings, we can understand the origin of the universe. That gives us a glimpse of the roots of us human beings as well as a better understanding of nature. Another is that new technologies and detectors developed during research have useful applications in society. For example, miniaturization of heavy ion radiotherapy medical equipment and the image sensor mounted in the digital cameras that we use in everyday life are products that have been realized during research on high-performance accelerators. The economic benefits of such products to society are difficult to predict. And there is the feature of elementary particle research that challenges the unknown world," says Professor Yamamoto. Through Science Café for junior and senior high school students and the general public, he is continuously working to arouse interest in particle physics and educate about it.



It is expected to take about 25 years for the completion and commencement of operation of the ILC. Using the completed facility, some of his laboratory members may make the great discovery of the century.

Presently, SOI is at the phase of evaluation testing.





SOI was fabricated by research students under the guidance of Professor Yamamoto.

**Experimental Particle Physics,
Department of Physics,
Graduate School of Science**

Professor

Hitoshi Yamamoto

Born in 1955 in Osaka Prefecture. He graduated from Kyoto University Faculty of Science in 1978. He graduated from California Institute of Technology Graduate School in1985. Professor Yamamoto began working as research associate at Stanford Linear Accelerator Center in 1986, and as senior research associate in 1989 at University of Chicago Enrico Fermi Institute, as assistant professor in 1991 and as associate professor in 1993 at Harvard University and as full professor at University of Hawaii in 1998. He has been in his current position since 2001.

http://epx.phys.tohoku.ac.jp/eeweb/