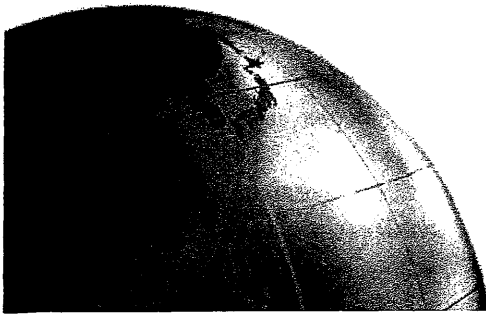


Special Feature ▶

How will the International Linear Collider (ILC) change Iwate?

A large-scale underground experimental facility is built under the Kitakami Mountains. It is the only one of its kind in the world. An international research city forms as a place where researchers from all over the world gather. This futuristic city may sound like something out of a science fiction novel but there is a real possibility of it happening in Iwate. The plan for the International Linear Collider states that the Japanese candidate site will be decided in the summer of 2013. What will this mean for Iwate? And what effect will this have upon us? This special feature will talk about the connection between the sciences and the internationalization of Iwate.

◀ **Interview** ▶ President of Shibaura Institute of Technology in Tokyo **Dr. Masato Murakami**

—When did you first become interested in foreign countries?

When I was in high school, I studied abroad for one year in an American high school. I had never been outside the prefecture before so all of my information came from books and the like. At the time, America was leading the rest of the world and I had a vague hope that I would get to see the world. I was able to experience real American abundance, which was different from all that I had heard and read about. It was also very useful to talk with other high school students from all over the world. I think the most important thing for Iwate's internationalization efforts is to understand the diversity of the world. My study abroad experience in high school was a truly great way for me to do that.

—Why did you become interested in the sciences?

Ever since I was a small boy, my father told me how important the sciences were. The progression of science will lead to easier lives - I was interested in a career in science so that I could contribute to society. There were simple experiments in the appendices of my science magazines so I looked forward to receiving them every month. It was all still so new, so I was always impressed - "That's so cool!"

—Please tell us about Iwate's current efforts to attract the Linear Collider to the prefecture.

Everyone wants to know what the building blocks are that make up all of the things the universe, us humans included. As science progressed, we discovered that everything is made out of atoms. Atoms are also called elements. Atoms are comprised of electrons and a nucleus, and the nucleus is made of neutrons and protons. Electrons are fundamental particles, but scientists discovered that protons and neutrons can be broken down even further. They thought that if they crashed protons

and neutrons together to break them apart, their fundamental particles would come flying out, so they started experimenting. In English, "to collide" means to crash together so we call the machine that crashes particles together a "collider." Scientists devised an accelerator machine to perform the experiments.

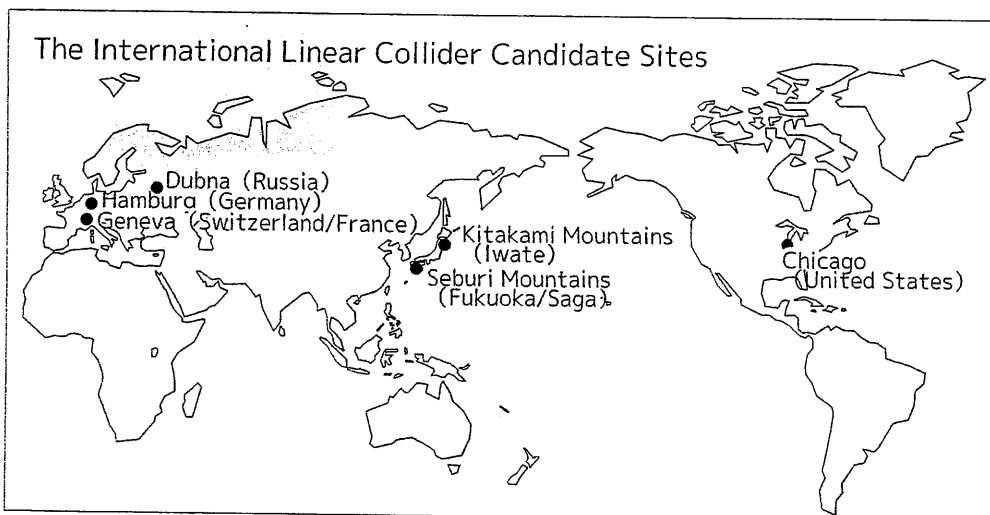
They looked very closely at the results of crashes in the accelerator, and they found that protons are made up of many particles. Whether those particles are the smallest possible fundamental particles or not, we still do not know.

But there is a theory. The field of elementary particles has progressed with theories and experiments since Dr. Hideki Yukawa, a famous theoretical physicist. In a theory also contributed to by Japanese researchers, there is supposedly a particle called the "Higgs particle," the last remaining fundamental particle. CERN (European Organization for Nuclear Research) has discovered traces of the particle, which was a momentous event. Scientists can search the remains of collided particles, but the Higgs particle often joins with other particles so it is very complicated. Experiments and analysis are also difficult. This is why CERN has said that it thinks it found the Higgs particle, but it cannot say for certain.

There will be no progress unless scientists figure out the fundamental building blocks of everything on this planet, so they are working very hard to understand this particle. Currently, circular accelerators have been constructed with the cooperation of many countries. You must have a very large distance in order to accelerate particles - the distance



between the Earth and the Sun is not even enough. But there is no end to a circular structure, so you can loop particles around many times with no limit to the acceleration. Particles are extremely small so they are collided in clusters, but that makes it very hard to analyze the results of a collision. It is also difficult to have thousands of researchers cooperate in operating the experiments and analysis. If possible, it would be easier to collide two fundamental particles together and then see what happens. A line-shaped accelerator – a linear collider – would make that possible. A linear shape would make experiments easier to control, and make it possible to collide small particles that scientists have not been able to collide before. I hope that the researchers of the world make this experiment a reality. Finding the Higgs particle is only the beginning, not the end. If and when scientists find the particle, they must then analyze its properties. If they can use a linear accelerator to collide fundamental particles, it will be much easier to analyze them. The only thing that will make that possible is the Linear Collider. Once the researchers of the world find the Higgs particle, the Collider is the next step. And Iwate is ready to be home to that next step.



—Why was Iwate chosen as a candidate site?

A long tunnel must be dug in the ground, and that ground must be strong against earthquakes. Candidate sites were searched for throughout the world, but the only candidate that truly fits the geological conditions (concerning the bedrock) is Japan. Within Japan, there are only two places with bedrock stable enough for the equipment during an earthquake, and they are Iwate Prefecture and Fukuoka Prefecture. I have not looked closely at Fukuoka Prefecture's data, but I have known since I was a boy that Iwate's Kitakami Mountain region has strong granite bedrock. I think Iwate is perfect as a candidate site.

—What kind of future will the Linear Collider lead to?

Finding the origin of all things will have a direct effect on the energy crisis. New types of energy may be discovered. We must always keep in mind how new discoveries may be practically applied, but the best thing about science is that scientific advancement leads to humans living richer, better lives. Humans crave to understand the unknown. The Linear Collider will be a place that answers those questions. It is important to plainly discuss its usefulness, but from a global perspective, the fact that a machine in Iwate Prefecture may help humanity unearth a new discovery is huge. Also, if you look at CERN as an example, researchers from all over the world have gathered and brought their families with them. From that perspective, Iwate may become a progressive example of internationalization that Japan has never seen before. That is a tremendously big deal for Iwate.

—Once an international technological research city has become a reality, it will lead to the development of a younger generation with an interest in the outside world. Aside from living environments or language barriers, what are some things that we have to be aware of?

It's not a matter of whether you are good or bad at English – you must be able to understand other people. People are diverse. According to a certain economist, in the past, when American companies would devise a global strategy, they would go to other countries to try to instill their own values into others. But this only drew ire and rejection, and many of these companies failed in the end. You must truly understand the differences in

culture and customs between countries, and work your hardest to integrate into the community, or "internationalization" will be extremely difficult. There are examples of this in the past. Language skills will eventually come if you are capable and flexible, but trying to understand other people is how you really communicate: this is the most important thing, in my opinion. Currently, my university plans events where students can meet people from other cultures. In the past I planned events where Japanese students and foreign students from Southeast Asia would go on an overnight trip to observe a Japanese factory. A Japanese student and a foreign student would stay together in the same hotel room. Even though their customs and religions are different, the next morning they

would be the best of friends and communicating in basic English. The Japanese students would say, "I'm so glad I got to hear things about Thailand and Vietnam that I never knew before." They became friends, and I just thought that youth is so amazing. Your point of view can change in a single evening. It was a great experience.

—The percentage of foreign students in Japanese universities is growing. Can you tell me about their reception?

I think that universities should accept as many foreigners as they can, including foreign exchange students. What makes that difficult is the fact that the paperwork and procedures are all in Japanese. We have an international exchange center with staff who can communicate in other languages, but I think the university as a whole should be like that. Japan is delayed in this regard.

—Foreign students move to other countries to find an environment where they can perform their research. Can you tell me about Japan's efforts on this front?

It is often said that innovative research is born from America, but that is because America takes in researchers from all over the world. Those researchers gather at tea time and come up with original ideas from their discussions. If they stayed in their own country, they may not be able to come up with ideas that break the mold, but a lot of the time talking with people with different historical perspectives leads to the birth of new ideas. This is particularly important in the sciences.

—What are some specific steps Japan could take in that area?

Currently my university tells its students to study abroad, even if it's only for a short time. We are moving forward on improving our system and other measures so that we can invite students from other countries. If you look at it from a global perspective, there are hardly any foreign teachers in Japan. Academic fields are actually easier to make more international, so there must be more done to encourage foreign people to work here. Private companies are now globalizing at an extremely fast pace, which has led to my university moving forward on globalization. Students with no global perspective will find it hard to find work, so we must respond to this. Nobody will change if there is no need to change. Put in other words, now is our perfect opportunity to change.

—What is necessary for going abroad and interacting with people from different countries?

I am actually quite shy around new people, and I'm better at independent research than exchanging ideas with different people. But I suppress that fear and try to interact with as many people as I can. It was hard at first, but I've worked to overcome that obstacle. It's fun once you start speaking to someone. Once you make friends, it just grows from there. An international network is necessary for scientific research. If you listen to people who have attained groundbreaking results, you'll find that they took advice from many other fields.



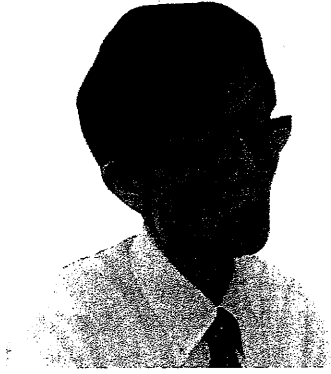
Dr. Masato Murakami

Murakami was born in Morioka City in 1955. While he was a student at Morioka Daiichi High School, he spent one year in San Francisco as an AFS exchange student. After graduating from Tokyo University, he finished his doctoral program at the same university. He was hired by the Nippon Steel Corporation and he was involved with research on superconductivity and shape-memory alloy at the No. 1 Laboratory. Following that, he became a director and then general director at the Superconductivity Research Laboratory. He also was a professor at Nagoya University and Iwate University. In April 2003, he became a professor at Shibaura Institute of Technology. In April 2008, he became vice president, and became president of the Institute in April 2012.

He succeeded in being the first to determine that humans could levitate through superconductivity, and received the Nikkei-BP Award and the 1991 World Congress Superconductivity Award of Excellence. He also developed the strongest superconducting bulk magnet in the world, and published his research in *Nature*. That article is one of the top ten most-quoted articles in the field of superconductivity.

Office of Policy Promotion, Department of Policy and Regional Affairs, Iwate Prefectural Government

Chief in charge of ILC Promotion **Hisashi Odaira**



There are 6 candidate sites for the International Linear Collider (from hereon, "ILC"), including the Kitakami Mountains of Iwate Prefecture, and the Seburi Mountains (Fukuoka and Saga Prefectures). Iwate Prefecture is working hard to attract the ILC to build an international research and technology city with the ILC at the center. We asked Mr. Odaira of the ILC Promotion Section of the Prefectural Government to see what this means for the people of Iwate Prefecture.

A Multi-national Science City

Around 3,000 researchers would come from all over the world if a research facility is constructed in Iwate, and including their families this would be approximately 10,000 people. The ILC will be an academic research facility, so there will not necessarily be any new industry developed. But there will be these scientists and researchers and a world-class research facility, so we can surmise that good effects will spread to the regional community. The candidate site is on the eastern side of the Kitakami Mountains, so it is comparatively close to Rikuzentakata and other disaster-affected areas. We are planning ways to optimize the good effects from the ILC on industry to aid in the reconstruction of the affected areas. One of our plans is a science and technology industrial park. At this park, we'd like to develop programs focused on human resource development and mutual research. A 10,000-person increase in population will lead to an estimated 2,100 new houses being built. This would not be a walled-off community of foreigners, but a coexistence with the Japanese community. Our concept is a world-class, cutting edge urban area that will be a leader in scientific creation and technological innovation through the coexistence of people of many nationalities.

The ILC and the Reconstruction

The electrical industry is now focused outside of Iwate Prefecture. We must think of a replacement for that industry. The ILC will be a cutting-edge accelerator machine. People might not know just what an accelerator is, but even currently the scale of the accelerator industry and its related industries in Tohoku is 6 trillion yen, and contributes to the industrial fields of radiological technology, tire manufacture, medical equipment, and even shampoo. The accelerator industry has become a necessity to our lives. The construction period of the ILC will be 10 years, and the operating period will be 20 years – the positive effects on the economy from both the construction and operating periods are estimated in around 4.3 trillion yen in induced production value, and around 250,000 people hired in relation to the project.

Cost of the ILC

The cost of building the ILC will be around 800 billion yen. Half of that cost will be borne by the host country, and the rest by the U.S.A. and other countries participating in the research. However, it will be necessary

for local municipalities to take on the costs of new roads and community centers to a degree. We are planning to spread the word throughout the region to encourage private investment and the like. Currently, the prefecture's greatest concern is the reconstruction effort. Iwate's Reconstruction Plan is ongoing for the 8-year period that started in 2011. Next summer, either Fukuoka or Iwate will be selected as the ILC candidate site within Japan. The soonest construction would start is 2018, and the accelerator will be turned on at some point after 2025. After our reconstruction has ended, new industry will come to Iwate. We are trying our hardest to be the ILC site, because this is something we must do. We want to create a new Tohoku with the ILC at its nucleus to reinvigorate the region.

The Need for the ILC

There are many ways for Iwate University, Tohoku University, Ichinoseki Vocational School, and other regional entities to participate in the accelerator industry. The data shows that the population of surrounding towns increased when CERN (European Organization for Nuclear Research) was built in Geneva, Switzerland. The performance of automobiles on the market improved with the introduction of the racing car, of which there are only a few in the world; new materials were created due to the Apollo space program. In the same way, the ILC will pass on good things to industry.

There is a risk associated with radiation from the ILC, but let's look at hospitals for example: When a person has an x-ray, he's placed into a separate room with a radiation mark on the door. The risk is properly managed. One may not enter the tunnel while the ILC is in operation, but people can come and observe the inside facility whenever it is inactive. A smaller type of apparatus is installed in the science city in Tsukuba City, Ibaraki Prefecture, and normal high school students go to see it and come back impressed.

Bringing Science Closer To Us

In the near future, a grandmother may say, "Let me tell you about the Higgs particle" to her grandchild as they eat a meal together. We hope that the young people of Iwate Prefecture realize the excitement of knowing the unknown. We want to feed their curiosity and bring the ILC to their backdoor.