

TOHOKU UNIVERSITY

# ANNUAL REVIEW 2015



Annual Review 2015  
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# History of Tohoku University

For more than a century, Tohoku University has embraced its role of not just grooming the next generation of leaders, but also arming them with the most innovative technology that the world's best research teams can produce.

And it achieved this by following the three tenets that have defined the university since its founding in 1907 – Research First, Open Door and Practice-oriented Research and Education.

Since the very beginning, the university's Open Door policy has allowed it to tap on valuable human resources. Departing from the norms of other imperial universities at the turn of the 20<sup>th</sup> century, Tohoku University accepted graduates from technical schools. And in 1913, it went a step further and – despite opposition from the government – became Japan's first university to accept female students.

Over the years, the university has been successful in attracting brilliant researchers from around the world. Following a Research First policy, these scholars pursued productive research and put their findings to work in the teaching of their students. This led to the spirit of Practice-oriented Research and Education that the university has become famous for.

Building on these three ideals, Tohoku University has consistently tried to use its research success to address both local and global problems, as well as to improve surrounding communities.

Since the 2011 Great East Japan Earthquake, the university has been providing expertise and support to the region through technological development and reconstruction efforts. More than five years on, Tohoku University remains committed to the recovery of the region.





## Top Global University Project

Tohoku University was selected by the Japanese government to be part of its Top Global University Project. To achieve the goal of ranking among the world's best 30 academic institutions, Tohoku University kicked off its own Global Initiative this year, with the wide-reaching International Joint-Research Programme at its foundation.



## General Assembly of T.I.M.E.

The university hosted the General Assembly of T.I.M.E., a network of 53 technical and engineering institutions from around the world. Members took the opportunity to strengthen bi-lateral ties and encourage more student mobility through the Double Degree Program.

## Heartpump Gains Traction

By using a monopivot bearing, researchers at the Institute of Development, Aging and Cancer, in cooperation with AIST, were able to greatly improve on the antithrombotic and haemolytic properties of the pump system, allowing for the production and eventual sale of a superior artificial heart pump system.



## Partnership Agreement with University of Melbourne

Tohoku University and the University of Melbourne signed a Strategic Partnership Agreement aimed at strengthening ties. Both universities have long histories of academic and research success, and it's hoped that the agreement will encourage future joint research activities and more exchanges among students, faculty members and staff.



## Pediatric Oncology Center Established

Tohoku University Hospital's brand new Pediatric Oncology Center became operational in January 2015. TUH is the only government-designated "Childhood Cancer Hospital Hub" within the Tohoku area. To strengthen cross-organizational childhood cancer treatment, a system to bring in patients from various locations has already been developed.

## Alliance Internationale Launch

University President Susumu Satomi attended the official launch of Alliance Internationale in France. Tohoku University also entered into a new agreement with the University of Lyon for a liaison office to be attached to INSA-Lyon.

## TUFSA's 50<sup>th</sup> Anniversary

Tohoku University Foreign Students Association celebrated 50 years of promoting cultural diversity in the community and welcoming students from all over the world into our Tohoku University family.



## Champions of the National Seven Universities Games

For the third year in a row, Tohoku University won the National Seven Universities Athletic Games. Tohoku University remains the only university to come in first each time it has hosted the games.



## UNWCDRR

Academics and experts on disaster management gathered in Sendai for the United Nations' 3<sup>rd</sup> World Conference on Disaster Risk Reduction. Tohoku University hosted key elements, including the opening keynote speech by UN Secretary-General Ban Ki-Moon, several panel discussions and exhibitions.



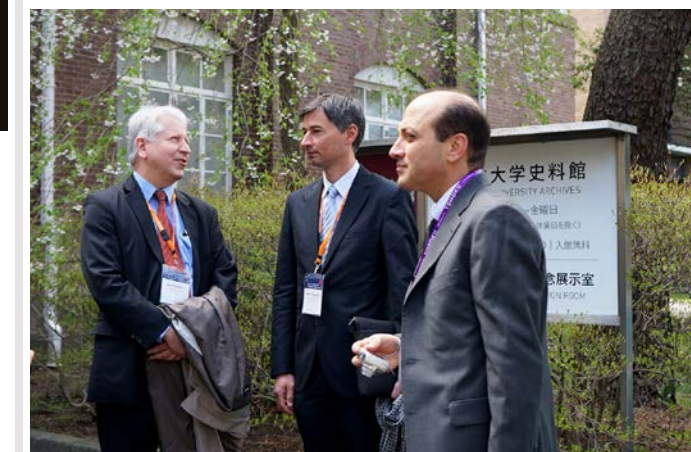
## Homecoming Day's Original Sweets

For Homecoming Day, the university teamed up with famous local sweet shops, to offer exclusive cakes and pastries filled with blueberry jam produced by the School of Agriculture.



## HeKKSaGOn Presidents' Conference

Members of the HeKKSaGOn university consortium gathered on campus for 2 days of workshops and meetings. Participants exchanged ideas and promoted research cooperation across a wide range of academic fields.





## TEAchnology on a Nano-micro Scale

A team of students took the traditional Japanese art of the tea ceremony, fused it with modern technology and went on to win first prize at the 2015 International Contest of Application in Nano-micro technology.



The winning invention  
Anywhere Sado



Team Sado from left to right:  
Junpei Masuho, Kaho Matsuda, Yusei Takahashi, Koichi Hiraoka

The contest, whose final was held in Alaska this past year, is open to students interested in translating rapidly evolving nano-micro technologies into commercial and industrial applications. Miniaturization used in the nano-micro field, offers giant possibilities for tiny devices to be used in biomedical and information technologies, energy systems and more.

For 3<sup>rd</sup> year engineering student Kaho Matsuda, the chance to use minute sensors came when she had the idea of creating a system to measure what is considered to be a perfect cup of tea.

Despite having studied the art of tea ceremony or "Sado" for 5 years, Matsuda says it's still hard to know how to make good tea. "Much of it is supposed to be through intuition, which is why it is really difficult for a learner to know where he or she should be making improvements," says Matsuda. So, as always when faced with a dilemma, she turned to

science.

She gathered three similarly inquisitive friends and formed Team Sado. Together, they came up with an innovative device, a sensor-embedded tea whisk called "Anywhere Sado." The point, Matsuda says, is to give anyone, anywhere, the chance to learn how to perfect the art of tea-making.

The device is a bamboo whisk used to make traditional tea, with three sensors embedded inside. The sensors monitor the stirring speed, the angle of the whisk and the temperature of the tea. When the tea is ready, electronic data on the user's tea-making technique is sent to a computer, where it is graded on a 100-point scale.

"We all brought different skills to the table in making this project successful," says teammate Junpei Masuho. The four-member team met at Natural Science, an NPO that runs science classes for elementary

and junior high school students. There, university students with an interest in education help to mentor their younger peers.

It was also through Natural Science that they heard about the iCAN contest. After winning at the nationals, they decided to go wireless with their device. "We had problems trying to downsize the internal components and get accurate results using lithium batteries," says engineering student Yusei Takahashi.

But they persevered, and went on to top the final field of 19 with their unique invention. The whole experience was one they could only have dreamt of, including the opportunity to eat Alaskan crab and reindeer. The team now has its sights on next year's iCAN final in Paris.

"It was very cool to discover that we could introduce Japanese culture through science," says Matsuda. "It would be nice to be able to continue along this theme."

## Flying High with the Windnauts

Tohoku University's Human Powered Aircraft Club took its fifth win at Japan's International Birdman Rally in 2015, cementing its position as champion of the propellor-driven long distance division.

This fun, and at times funny, competition is open to members of the public who create their own aircraft and compete for distance and time spent in the air. Every summer pilots launch their craft from the edge of Japan's largest freshwater lake, Biwa. And engineers wait anxiously on the sidelines to see whether their flying machines will glide effortlessly across the water, or plummet soon after takeoff.

While some are in it purely for the fun, Tohoku University's Windnauts have a strong winning tradition to uphold.

"Plans for the aircraft are openly published. But there are aspects, like assembly, that you can't see in a diagram, which require a lot of technical knowledge," says 3<sup>rd</sup> year engineering student Shuntaro Inoue. "We get a lot of questions from other teams."

While the basic design of the craft has changed very little over the years, it's the Windnauts' winning legacy that continues to inspire students during long hours of construction. "There's definitely pressure,"

says 2<sup>nd</sup> year engineering student Daisuke Yoshizawa. "But there's also the joy that comes with working and learning alongside senior team members."

Among those members is 3<sup>rd</sup> year student and pilot of the aircraft Kota Matsushima. The Windnauts' winning craft was specifically designed around his weight and body shape to maximise power and flight.

"There was no backup plan," he laughs. "I was it." But Matsushima's not so jovial when he talks about the gruelling diet and training schedule he underwent so as not to affect any of the aircraft's weight calculations. The craft was powered by constant pedaling.

The Windnauts launched more than a hundred test flights in the lead-up to the rally – often starting at 4am, before the students headed off to class.

On the day of the competition, the flight across the lake was filmed from inside the Windnauts' cockpit and broadcast on national TV. Viewers were taken on an emotional journey as pilot Matsushima strove

to stay in the air just that little bit longer.

"I couldn't walk after I got out of the craft. It took about 2 or 3 hours until I was able to start to walk. I wasn't back to normal for about three days," says Matsushima.

The Windnauts' winning distance this year was the second longest flight recorded in the history of Japan's Birdman Rally, falling short only to their own record flight of 36000.00m in 2008.

Matsushima admitted that he has never travelled overseas and in fact never flown in an aeroplane. "I'd definitely like to fly again," he chuckles. "But for once it would be nice if I didn't have to fly the plane."



Windnauts team members from left: Shuntaro Inoue, Kota Matsushima and Daisuke Yoshizawa







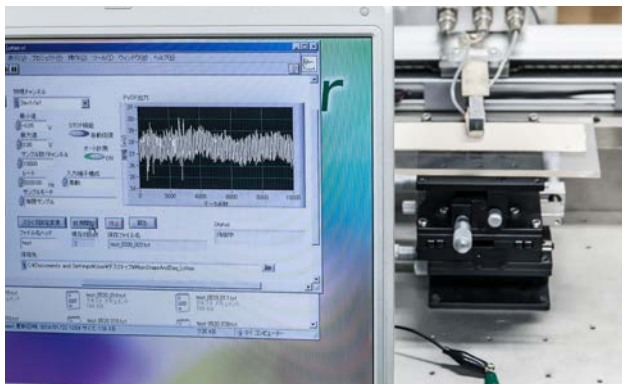
# Mami Tanaka

**Professor of Engineering**  
**Professor of Biomedical Engineering**

Mami Tanaka grew up in Mihata-cho in Yamagata. Her house backed up against a large ironworks, and she walked past another one every morning on her way to school. “I would stand out front and watch the iron being smelted and welded. It was beautiful and interesting.”

Not exactly high entertainment for most children, but for young Tanaka, it was a daily fascination. “I liked seeing things being made. Every day the workers would chase me away and tell me to go home. But I would ignore them.”

And so began a love affair with metalwork and engineering that would – some 30 years later – lead Tanaka to a highly successful career in the research labs of Tohoku University.



The sensor converts mechanical pressure into an electrical response that, once processed, correlates to a certain grade of roughness.

## Path to Engineering

Ironically, Tanaka’s first ambition was to be a doctor. She was often ill as a child and was greatly inspired by the doctors who had treated her in hospital. But in high school, she discovered a flaw in her plan. “I hated chemistry,” she says with a laugh. “I found physics so much more interesting, so I started thinking again about engineering. I still wanted to help people. But instead of treating them, I thought I could make something for them instead.”

To the dismay of her high school teachers - who did not think engineering was an appropriate field for women - Tanaka chose a career in mechanical engineering. She spent the next two decades at Tohoku University developing artificial sensors capable of measuring pressure, as well as more complex sensations such as pain, temperature and spatial orientation. More recently, Tanaka also developed a sensor that can objectively detect prostate diseases, from bone-hard cancerous tumors to softer hypertrophic tissue.

## ALicE and the Science Angels

Away from the lab, Tanaka is active in programmes that support women in science. Together with other members of the Science Angels, she gives lectures, plans science events and serves as a role model for young girls. The main message? That science is for everyone.

Indeed numbers do show that more women in Japan are choosing science and engineering fields. When Tanaka was a student at Tohoku University, a mere 3% of her fellow engineering students were women. In 2015, women made up more than 12% of the department.

“The number is still low but it will continue to rise as the image of engineering changes,” Tanaka says. “The old image was that you work long hours in a dirty factory. But now, engineers work on computers, they analyse, they design, they do research. Women can contribute and achieve a lot in this field!”

With more women now in science, Tanaka’s next goal is to make it easier for them to stay. In 2013, she founded the Association of Leading Women Researchers in Engineering. ALicE offers women the chance to have both a career and a family by providing funds for temporary research staff, as well as nursery care and babysitter grants.

Tanaka herself had benefited from such a system when she had her son nine years ago. “Women should be able to continue their work if they want to,” she says. “The goal is not to be perfect. I don’t aim to be a perfect working woman, or a perfect researcher or a perfect mom. I’m just a person doing my best at work and at home. And I’m happy.”



# Hiroo Sato

**Professor of History of Japanese Thought**  
**Dean of the Faculty of Arts and Letters**  
**Dean of the Graduate School of Arts and Letters**

When Hiroo Sato entered Tohoku University as a 19-year-old in 1972, the university was still in a state of unrest from the student movement of the late 1960s. A few years earlier students had occupied the General Education building, with many concerned about how the university should be run, as well as the Japan-US Security Treaty.

It was against this cultural backdrop that Sato and his peers formed a reading group, and were introduced to the People’s History movement. Its proponents questioned both Marxism and the modernization theory. Instead, they sought to make ordinary people the subjects of their own history, not just the objects of political authority.

This exposure triggered Sato’s interest in the history of Japanese thought – a field to which he has since contributed extensively. He has written on topics of global relevance including life and death, state and religion, and sacred sites. So far, his work has been translated into Korean, Chinese, English and Spanish.

## A Universal Framework

Sato’s passion for literature has kept him reading and researching across a range of disciplines. He has painstakingly reviewed historical texts to create a large narrative of Japanese intellectual history.

Challenging some of the prevailing theories of Japanese historians, Sato has noted their limited window of reference. On the other hand, he has questioned the homogenizing assumptions of traditional Western frame-

works - widely adopted for scholarship of the humanities.

“The humanities field is overwhelmingly influenced by Western methods of thought, and is unconsciously regulated by it,” says Sato. “Japanese researchers play according to the rules set by Western academia, but unfortunately remain mere players.”

At a time when the world is increasingly in need of culturally diverse critical thinkers to help tackle crucial issues such as conflict resolution and sustainability, Sato has proposed creating a new universal framework for study.

This is the motivation behind launching an international joint graduate program in Japanese Studies. And from 2018, the Graduate School of Arts and Letters will accept 10 students a year, with a balance of local and international students. The program will be an interdisciplinary field of humanities rather than a branch of area studies, inclusive of social sciences and visual culture courses.

“By creating a unique form of scholarship forged in the cultural climate of Japan, we hope to synergize study methods while providing multiple frames of reference,” says Sato. This, he adds, will enable Western scholars to reflect on current methods of thought, and ultimately contribute to the evolution of studies in the humanities.



## The Hasekura League

This past October, an international Japanese Studies network - the Hasekura League - was established at a kick-off symposium in Florence. Comprising the Graduate School of Arts and Letters, and 15 European universities, the league takes its name from a samurai retainer sent from Sendai in 1615 on a diplomatic mission to see the pope. A pioneer of his time, Hasekura initiated cultural exchange during the days of Japan’s seclusion policy.

Four hundred years later, Japanese culture, particularly subculture, is on an upward trend with European youths. Whatever their initial interest in Japan, it is hoped this new wave of culturists will contribute to discoveries about the human experience.





## Bringing the World to Sendai

In 2014, following its selection into the government's Top Global Universities project, Tohoku University reinforced its commitment to internationalization by launching the Tohoku University Global Initiative. The aim is to raise global leaders through creative education styles, opportunities to study abroad, and international collaborations.

Key elements of the initiative include partnerships with top universities through the International Joint Graduate Programme, and more courses taught in En-

glish through the Global Learning Centre's Future Global Leadership (FGL) programme.

There are currently some 1,700 fulltime international students from 100 countries at Tohoku University. Thousands more come to Sendai each year to participate in the short term summer programmes. In 2015, the Tohoku University Japanese Programme and the Engineering Summer Programme on Robotics were just two of several summer offerings that received a record number of applicants.



## International Festival 2015

One of the major highlights of the school calendar is the Tohoku University International Festival, which marked its 30<sup>th</sup> anniversary this year with a day of music, food and games at Kawauchi Campus.

Organised by the university's Foreign Students Association (TUFSA), in collaboration with community groups and local companies, the annual event aims to showcase various cultures, and celebrate both the diversity and common values of people around the world.

To raise awareness and funds for the Nepal earthquake victims, a special Project Nepal information booth was also set up.

As always, the highlight of the festival was the food. The traditional cuisines of some 24 countries were represented this year - including German schnitzel, Georgian lobio, Vietnamese pho, Iranian kebabs and Hawaiian pancakes - all prepared and cooked by the students themselves.

Adding to the cultural exchange and festive atmosphere of the event, the international students put on a fashion show of ethnic costumes, performed native folk dances and played instruments.

Not to be outdone, local Japanese groups also performed traditional entertainment for the crowd, and set up booths promoting Japanese calligraphy, tea making and regional travel.

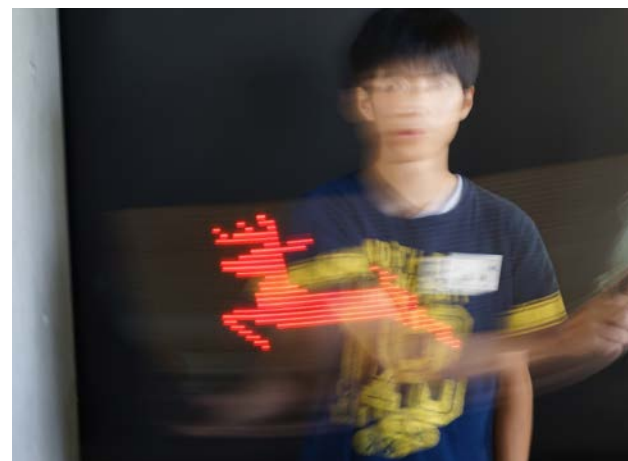




# Community Outreach @ Tohoku University

Community Outreach is important to everyone at Tohoku University.

Throughout the year, Tohoku University hosts various workshops and events aimed at promoting an interest in science among the region's youth, while demonstrating the potential impact that the university's research has on the wider community.



## Summer Science School

One of the most popular events in 2015 was the Summer Science School – an opportunity for junior high school students to explore different aspects of engineering through supervised hands-on experiments.

In line with the theme of “Light and Electronics,” participants attempted to build devices using robot control systems, and light and radio wave signals.

## Science Angels

Tohoku University has always been a strong supporter of women in science. And in 2015, seventy-six female graduate students from the university's various science departments were inducted into the Science Angels programme.

Now in its 10<sup>th</sup> year, the Science Angels Programme celebrates the dynamism of women in science, and encourages female graduate students to conduct research through engagement in outreach activities. Science Angels serve as role models for young girls, and regularly give lectures and demonstrations at science events for school-age children.



## TUFSA in Minamisanriku

It's not just through the classrooms and laboratories that Tohoku University made a difference last year. In June, some 40 students and staff went on a study tour of Minamisanriku, a coastal town that was badly hit by the Great East Japan Earthquake of 2011, and the devastating tsunami that followed.

Organized by TUFSA, Tohoku University's Foreign Students Association, the tour was a chance for international students to see first-hand the recovery efforts of the city and to find ways to contribute. For many, it was their first time in a disaster affected area.

Through the non-profit organization OGA for Aid, the students helped to farm green onions with Miyagi Green Farmers, a business which aims to revive and create a sustainable future for Minamisanriku's agriculture industry.

The students also spent two days interacting with local community members. They heard of the challenges still faced by residents and store vendors, but also found inspiration from the many anecdotes of strength and perseverance.



## Science Open House

Children and adults alike also made several visits this year to the university's laboratories and world-class research institutes for a behind-the-scenes look at how studies are conducted.



# Facing Forward, Looking Back

The Tohoku University School of Medicine hit another milestone in its long glorious history by turning 100 in 2015. In the past century, the school has produced many famous clinicians and educators, whose ground breaking research has changed the practice of medicine not just in Japan but around the world.



Surgical demonstration

1913

Atlas des Menschlichen Gehirn" or "Microscopic Atlas of Human Brain." He is also renowned for collecting the brains of over 200 species of mammals including dolphins, seals and Japanese wolves.

He worked long hours and had a reputation for being strict and demanding. But he was also thoughtful, as seen by his contribution towards the construction of the Showa-sha dormitory for medical students.

**Professor Koichi Motokawa** was the second Professor of the 2<sup>nd</sup> Department of Physiology, the 12th president of Tohoku University and a major player in the development of the first electroencephalograph in Japan. But he is perhaps still best known by his nickname "The Dynamite President" due to an explosive incident at his laboratory.

A mental health patient, convinced that hazardous radio waves from the university were harming his brain, left a bundle of dynamite



1926

Students studying in the anatomy room.

The Tohoku University School of Medicine was known as the Medical School of the Tohoku Imperial University when it was founded in 1915. It was the fourth medical school founded within the network of Japan's Imperial Universities at the turn of the 20<sup>th</sup> century.

The Tohoku Imperial University was reorganized into the current Tohoku University in 1947 and the School of Medicine was established under the new system of education in 1951. The Graduate School of Medicine was established in 1955

and expanded to include Disability Sciences (1994), Health Sciences (2010) and the School of Public Health (2015).

As the university looks forward to the possibilities of the next 100 years, it's worth remembering and honoring some of the remarkable men who have led the School of Medicine to the top of its class.

**Professor Gennosuke Fuse** was the first Professor of the Department of Anatomy. He is most famous for his collaboration with Constantin von Monakow on "Mikroskopischer

1937



Studying pathology



Students playing billiard

1937

sticks in Professor Motokawa's lab. Fortunately, the bomb was found in time and thrown out the window onto the courtyard below where it exploded. No one was killed but more than 500 windows from surrounding buildings were broken by the blast.

Professor Motokawa was proficient in drawing and calligraphy, and enjoyed discussing art with his students, often speculating on their personalities based on their choices.

**Professor Nakao Ishida** was the third Professor of the Department of Bacteriology and the 15<sup>th</sup> president.

He and his colleagues discovered the Sendai virus, which is used as a virus vector and for cell fusion. This was a major milestone in the research of viruses at Tohoku University. He found an anti-cancer antibiotic from the soil in Sendai and obtained its patent. He then established the Sendai Institute of Microbiology with the royalties earned.

Professor Ishida was considered a broad-minded person and was often described in myriad ways, from "quick, energetic and strict," to "friendly, helpful and a lot of fun." He was said to have a poetic soul and was known to be kind and compassionate, especially towards his students.

**Professor Jiro Suzuki** was the first Professor of the Department of Neurosurgery. He is most often

associated with the Moyamoya disease, which he named. The disease causes arteries in the brain to be impaired, and the collateral circulation develops small and weak blood vessels. These blood vessels appear like a puff of smoke (expressed as moyamoya in Japanese) on the conventional X-ray angiography.

Professor Suzuki was a veteran of the Japanese Navy and managed his laboratory in a military manner. All laboratory members took part in navy-style exercises every Wednesday morning. He left a legacy of "Eight Medical Commandments" such as "The human brain is wider than an ocean."

**Professor Morio Kasai** was the third Professor of the 2<sup>nd</sup> Depart-

ment of Surgery. He established the Kasai procedure for congenital biliary atresia. In the procedure, the blocked bile duct and gallbladder are removed and the small intestine is connected with the liver directly to drain bile. He saved many newborn babies with this procedure.

As one of the pioneering pediatric surgeons in Japan, he made great contributions in the areas of neonatal surgery, pediatric surgical nutrition and pediatric surgical oncology.

Professor Kasai was also an experienced alpinist. He successfully led a Tohoku University mountaineering party to the summit of the Nyenchen Tanglha Mountains (7,162 m) in the Tibetan Plateau in 1986.



Dr Oshitani's laboratory

2015



# Rising into Space

The Space Robotics Laboratory at Tohoku University has sent microsatellites into orbit and hopes to soon land a robot on the Moon.



Tohoku University's Space Robotics Laboratory, in partnership with Hokkaido University, developed the 43-kilogram, cube-shaped microsatellite Rising-2.

At midday on May 24, 2014, Professor Kazuya Yoshida and his colleagues at Tohoku University's Space Robotics Laboratory held their breath as a rocket from the Japan Aerospace Exploration Agency took off from the small island of Tanegashima.

The laboratory had a lot riding on the mission. On board was a small cube-shaped microsatellite called Rising-2, which the Tohoku team and a group from Hokkaido University had built over the previous five years. The team could not forget how its predecessor, Sprite-Sat, also known as Rising-1, had suffered irreparable damage to its control system on the ill-fated thirteenth day in orbit.

Named after Raijin, the Japanese god of lightning and thunderstorms, both Rising 1 and 2 were designed to study 'sprites' — bright-red electromagnetic bursts that flash above thunderclouds. Observing this elusive phenomenon could help scientists better understand the potentially disastrous heavy downpours that have been dubbed 'guerilla rain'.

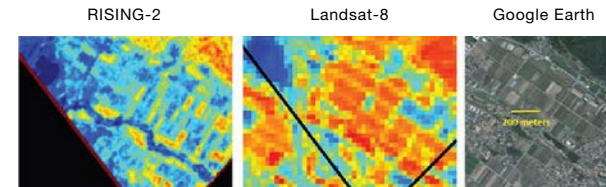
"Microsatellites have been a game-changing concept for space research," explains Yoshida, who founded the Space Robotics Laboratory in 1995. Instead of relying on national space agencies to engineer large spacecraft, small university laboratories can now build tiny space-ready satellites quickly and inexpensively, allowing them to conduct meaningful scientific reconnaissance.



Microsatellite Rising-2 was propelled into space by a rocket from the Japan Aerospace Exploration Agency on May 24, 2014. ©JAXA



A high-resolution remote sensing image of the rice field area of Miyagi prefecture, Japan, obtained by Rising-2 with 5m ground sample distance (GSD). ©Tohoku University/Hokkaido University



A comparison of the "vegetation index" map of a rice field area obtained by Rising-2 in 5m GSD and Landsat-8 in 30m GSD. ©Hokkaido University/Tohoku University

Since its launch, Rising-2 has delivered some of the most advanced images yet achieved by a satellite of its size, such as the "vegetation index" with 5m resolution of the ground surface, which shows the vitality and health of vegetation on Earth.

## Asteroid dust and lunar landings

Rising-2 is just one of the groundbreaking space-flight missions to which Yoshida's laboratory has contributed.

"Very few research groups are as actively involved in real space missions," he says. This gives his group's students unique opportunities to get involved in projects with real-life applications, whether supporting national aerospace agency initiatives or developing their own satellites and rovers that could end up in space.

Another recent project was the development of Japan's asteroid explorer, Hayabusa, which successfully landed on Itokawa, an asteroid 300 million kilometers away from Earth at the time. Yoshida helped design the

mechanism for collecting soil samples from the surface of Itokawa.

The successor mission, Hayabusa-2, is currently underway. In early December 2015, Hayabusa-2 successfully conducted an Earth swing-by, a necessary maneuver to boost its velocity and set it on a course towards asteroid Ryugu. Hayabusa-2 is expected back on Earth in 2020 with sample materials from the asteroid's surface.

Now, Yoshida and his colleagues are taking on the Google Lunar XPRIZE challenge, a worldwide competition for the first privately funded team to successfully land and drive a rover 500 meters across the surface of the Moon while broadcasting high-definition images back to Earth.

Spurred on by the promise of a 20 million U.S. dollar prize, the Space Robotics Laboratory has been working on prototypes for the only Japan-based team, Hakuto. Its robots, named MoonRaker and Tetris, have already been tested on some lunar analog sites on Earth.

In January 2015, the team won the prestigious Terrestrial Milestone Prize, worth half a million U.S. dollars, for the development of the rover's mobile technology.

For Yoshida, this project represents a big step towards fulfilling a personal ambition. "My dream is to someday visit the Moon," he says, "and to get an entirely new perspective on our Universe."

Kazuya Yoshida is director of the Center of Robotics for Extreme and Uncertain Environments (CREATE). He is a professor of mechanical and aerospace engineering.



Since its launch, Rising-2 has delivered some of the most advanced images yet achieved by a satellite of its size.



MoonRaker(4-wheel rover) in field tests over a sand dune in Japan ©Tohoku University/team HAKUTO



Tetris(2-wheel rover) in down-cliff tests hanging by tether from Moonraker ©Tohoku University/team HAKUTO



# Brain Training Turns Back Your Cognitive Clock

Ryuta Kawashima at Tohoku University’s Smart Aging International Research Center shows how simple mental exercises can reverse the effects of aging and dementia.

Ryuta Kawashima was sceptical when his research associate came to him with the results from their study into whether the effects of aging on the brain could be reversed. The neuroscientist at Tohoku University was so surprised by the outcome that he thought his colleague was joking.

The results, however, were real. They revealed that the effects of brain aging could be undone and Kawashima knew immediately that they would challenge widely held beliefs about aging and dementia.

But the scientist is no stranger to controversy. His earlier brain mapping studies challenged the assertion that playing video games could boost a child’s cognitive abilities when he discovered that solving simple maths problems used more brain power.

His latest study will probably have a more profound impact, and may ultimately change the way we manage the treatment of aging populations.



Neuroscientist Ryuta Kawashima studies how regular reading and writing exercises can reverse the effects of aging on the brain.

## Mind games

Anyone who has blamed their inability to recall a name on advancing age will find Kawashima’s results counterintuitive. Cognitive functions involving the front section of the brain, the prefrontal cortex, typically begin to decline from the age of 20. This area of the brain is involved in functions such as memory, imitation and reasoning. Deterioration is more pronounced in people with dementia.

Kawashima wanted to see if he could curb the decline using two simple brain exercises: reading out loud and basic arithmetic. These tasks require working memory, which stores and processes temporary information and cognitive speed. They are also known to activate the prefrontal cortex.

To test his hypothesis, Kawashima asked elderly patients with Alzheimer’s — a form of dementia — at a nursing home in the southwestern island of Kyushu, to perform the exercises regularly over six months, as fast as they could. Kawashima then assessed their cognitive abilities using a series of tests designed to measure frontal lobe activity, the region of the brain that houses the prefrontal cortex.

“We would have been happy to see their cognitive functions maintained,” says Kawashima. “Instead we saw them improve.”

Patients whose cognitive abilities had been measured along with the test subjects before the exercises began, but who did not receive the ‘learning therapy’, had a slight decrease in their scores.

Families and nursing staff observed other improvements in the patients who had participated in the study. Many could communicate better and some went from being bedridden to sitting in a wheelchair or walking. Some showed improvement in controlling their bowel movements.

Three months into the therapy, many patients appeared happier and more willing to try new things. One of Kawashima’s most astonishing cases was of an octogenarian who was thought to be in a coma-like state.

A caricature of Kawashima features in the best-selling Nintendo game *Brain Age*. © 2005 Nintendo



She started the therapy by following Japanese characters with her eyes, and went on to sit up and speak.

## Smart aging

None of these stories surprise Kawashima anymore. He has spent the last 20 years trying to convince governments, researchers and the public of the benefits of learning therapy.

His team at Tohoku University’s Smart Aging International Research Center has conducted numerous brain training studies on adults of all ages. Using magnetic resonance imaging, they have found evidence of neural changes in the brain known as brain plasticity, following training.



The brain training exercises work by activating a region of the brain known as the prefrontal cortex.

**Kawashima has spent the last 20 years trying to convince governments, researchers and the public of the benefits of learning therapy.**

The team is now trying to identify the molecular mechanisms underlying these changes in rats. They expect they will be linked to epigenetics — changes in gene expression that do not involve altering the underlying code.

Researchers at the center are also looking at how exercise, nutrition and social activities help to maintain a healthy aging population. They found that combining brain training and exercise had little success in elderly individuals: “While concentrating on the brain, their legs stopped, and while concentrating on the bike, their hands stopped.”

In 2005, Kawashima published the bestselling book, *Train Your Brain*. The head of video game company Nintendo then approached him about developing the game *Brain Age*, which sold 19 million copies worldwide. Three weeks before its release, software engineers at Nintendo showed Kawashima the digitized caricature they had secretly created of him to feature in the game

— much to his children’s embarrassment. Kawashima’s research has received global media attention, and was even recently featured in the BBC series *Horizons*.

At a cost of less than USD 200 per patient a year, around 15,000 dementia patients across Japan use learning therapy to read and calculate for just a few minutes a day. Around 20 nursing homes in the United States have also signed up to the program. But with nearly 5 million people with dementia in Japan and 44 million worldwide, Kawashima says the uptake is not enough. “To maintain such a superaged society, we need elderly people to be healthy.”

Dr. Ryuta Kawashima is director of the Institute of Development, Aging and Cancer.





# Muslims' Encounter with Modernity

Professor Takashi Kuroda explores the changing image of Islam and the early encounters of Islamic intellectuals with western societies.



The Agra Fort, also referred to as the "Red Fort."  
The impressive structure brings to life the bygone days of the 16<sup>th</sup> century and the Mughal Dynasty in its prime.

Thirty years ago, when Professor Takashi Kuroda first began teaching the fundamentals of Islam in a university general education course, the majority of his students associated Islam with the religion and culture of an exotic, distant place. Other students made the connection to oil, remembering when Japan was starved for energy resources and dependent on the Arab region.

However, as the 20<sup>th</sup> century turned into the 21<sup>st</sup>, Kuroda noticed that the students' image of Islam as an exotic culture in an oil-rich region started to change.

The World Trade Center attacks in New York on September 11, 2001, coupled with the war in Afghanistan, the Iraq War and the escalation of terror perpetrated by extremist groups, created a climate where people began associating Islam with violence, anti-Westernism and anti-modernity.

This association, says Kuroda, is unfortunate and largely inaccurate. "There are 1.6 billion followers of Islam today, representing a quarter of the world's population. Over 99% of Muslims are ordinary, peaceful citizens with no connection to terrorism or violence."

## Muslim intellectuals encounter the West

India was one of the first places where Muslim intellectuals encountered the West. The relationship between India and its colonial ruler Britain was not an equal one. And as such, the flow of people between them was also asymmetric. Over the years, the steady flow of British East India Company staff, military personnel, entrepreneurs, scholars and missionaries into India had produced volumes of journals and travelogues.

But, says Kuroda, among the Muslim civil servants and members of the literati who travelled to Europe, only about half a dozen are known to have written about their observations and experiences there. Their works, mostly written in Farsi, are therefore interesting to academics such as Kuroda, because they reflect how Muslim intellectuals at that time viewed foreign cultures and habits.

Mirza I'tesamuddin, who had accompanied a captain of the East India Company Army to Britain in 1766, wrote

*The Wonders of Vilayet* on his return to India. In it, he expressed his amazement at the streetlamps in London, the paved roads, the displays at the British Museum, the model of the solar system at Oxford University and popular entertainments such as the opera, theater and circus. British women also piqued his curiosity, contrasting as they did with the Islamic customs he knew.



The Urdu translation of *The Wonders of Vilayet: Being the Memoir, Originally in Persian, of a Visit to France and Britain*, by Mirza I'tesamuddin.

**“the recent trend of mutually judging each other in stereotypes has been very counterproductive and has led to a cycle of suspicion and antagonism.”**

Yet despite his generally positive feelings, he was simultaneously critical of some of the social values, particularly the attitudes towards promiscuity and self-indulgence. According to Kuroda, both the admiration and distaste for the cultural elements I'tesamuddin experienced in Europe is an important feature of his work, and possibly reflects a similar conflict of values experienced by other Muslim intellectuals at that time.

## Thoughts on the framework of Western society

Thirty years later, in 1799, Mirza Abu Taleb Khan, a Muslim scholar-bureaucrat, accompanied an officer of the East India Company to England. Dubbed the “Persian Prince” for his Iranian lineage, he spent two and a half years in England and made a splash in London society. He was acquainted with influential aristocrats, politicians and even royalty.

On returning to India, he authored *The Travels of Mirza Abu Taleb Khan*, a travelogue that included detailed observations of the social structures and political systems of English society. He pointed out the strengths of the British economy coming out of the industrial revolution, and was impressed by the fundamental liberties enjoyed by society. He noted how freedom of speech and expression, for example, allowed for comments and satire against poor leadership and misgovernment.

However, he also pointed out that England had a stratified society with a status gap twice as wide as that in India. Abu Taleb, writing in Farsi, urged Muslims to be proud of their religion and culture.

According to Kuroda, this pattern appears consistent among Muslim intellectuals who encountered the

West in the late 18<sup>th</sup> through early 19<sup>th</sup> centuries. It suggests Islam's adaptability and acceptance towards other ways of life in a fast changing world.

Which is why, Kuroda says, “the recent trend of mutually judging each other in stereotypes has been very counterproductive and has led to a cycle of suspicion and antagonism.”

Peaceful coexistence, he says, is possible with the understanding that both Muslim and non-Muslim societies are constantly evolving and go through many changes throughout history.



Portrait of Mirza Abu Taleb Khan

Takashi Kuroda is a professor at the Graduate School of International Cultural Studies. His field of research focuses on the Islamic world and Iranian modern history.



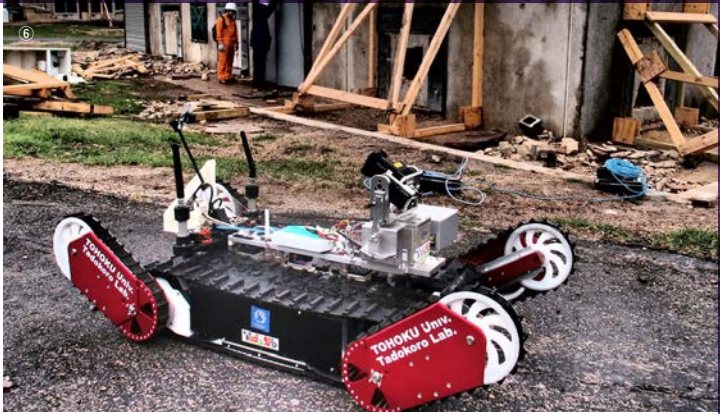


# Visual Report on Disaster Risk Reduction

In April 2011, in the wake of the Great East Japan Earthquake, Tohoku University created the Institute for Disaster Reconstruction and Regeneration Research to support recovery in the Tohoku region. In March 2015, the 3<sup>rd</sup> UN World Conference on Disaster Reduction was held in Sendai. As members of the planning committee, Tohoku University held and supported symposia, and reported on current reconstruction projects at the university.



Tohoku University has developed and implemented a program in Miyagi prefecture that provides religious leaders with clinical training. The aim is to promote a new awareness of the role of religious activity in spiritual wellbeing.



①The Marine Science project is promoting the restoration of the local coastal fishing industry. ②Reserachers investigate the effects of radioactive materials on animals in high risk areas. ③The Tohoku Medical Megabank Organization began cohort studies into the long-term health conditions of 12,000 people in Miyagi prefecture. ④Lessons on safety during a natural disaster were given at 70 elementary schools in Miyagi prefecture. ⑤The International Research Institute of Disaster Science (IRIDeS) was established to conduct research on natural disaster science and disaster mitigation. ⑥Tohoku University is actively involved in the research and development of disaster robots designed to assist with emergency rescue, response and disaster prevention. ⑦Ene Cafe Methane was opened by the Faculty of Agriculture. The café converts household waste into methane gas, which is then used to brew tea and coffee for the locals.



University President Su-  
sumu Satomi (left) shakes  
hands with Ban Ki-Moon  
(right) following the UN  
Secretary-General's keynote  
speech at the 3<sup>rd</sup> UN World  
Conference on Disaster  
Reduction.





# Campus Report

With the opening of the Tozai Subway Line on December 6, 2015 it's not just our students who have been enjoying a new lift. To accommodate construction of the train lines and stations that run through Aobayama and Kawauchi, our campuses there also got a bit of an upgrade this past year.



Kawauchi Station

## Kawauchi Campus

The campus is now served by the Tozai Line's Kawauchi station. Another new convenience is the outfitting of stairs on historic Ogisaka Hill. A scenic trail now connects the International Center to Hagi Hall, and provides better access to the popular Santaro no Shokei path.

On Kawauchi Campus, the old and cramped Administration Building has been renovated and expanded. Construction of the new Education and Student Support Services Center, a one-stop center for all student services, has also been completed.

The large lecture hall building on the south campus, which had suffered severe damage in the Great East Japan Earthquake, has been rebuilt. Named the Humanities Building, the exterior was designed with the concept of space, intellectual interaction and the historic view of Sendai Castle's "ninomaru" in mind.



Humanities Building

## Aobayama Campus



### ► Aobayama New Campus

As part of the relocation plans for the aging Amamiya Campus, construction of a brand new campus has begun. Tentatively called the Academic Science Commons, the new space will integrate lecture halls, cafeterias and shops. The University Library Agricultural Sciences Building and the Agricultural Studies Research Institute Building are also being built. The new campus is expected to be completed in 2017.



### ► Aobayama North Campus

With safety in mind, road heating has been added to the barrier-free pedestrian sidewalks near Aobayama Station. This is to prevent the accumulation of snow and ice during winter.

### ► Aobayama East Campus

The zelkova cerrata tree-lined sidewalks on the East Campus have been expanded to accommodate more foot traffic heading towards Aobayama Station.

## Katahira Campus

The south side of Katahira Campus has a new look, as the main building of the Research Institute of Electrical Communication (RIEC) was finally completed after more than a year of construction work. The building, which faces the main road, is designed for easy access.

The TOKYO ELECTRON House of Creativity is also a new feature of the campus. It is home to the Tohoku Forum for Creativity (TFC), the first international visitor research institute in Japan.



TOKYO ELECTRON House of Creativity



Seiryō Auditorium

## Seiryō Campus

Seiryō Hall has had a facelift. In addition to extensive renovation work, a 280-seat auditorium has been added to the building's east wing. The cafeteria and bookstore have also been refurbished. The recessed glass surface on the outer wall of the auditorium is designed to attract sunlight and offer a sense of greenery.



# University Facts & Figures



Faculties	10
Graduate Schools	16
Research Institutes	6
International students	1,663

Students **17,865**

## Subway stops



Tohoku University's 5 main campuses in Sendai City are built on 2,896,574m<sup>2</sup> of land.

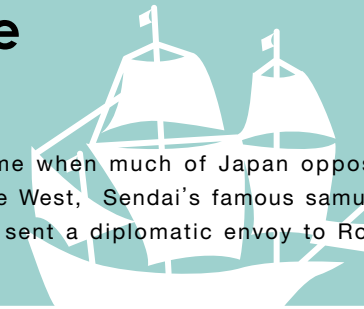
- Aobadori Ichibancho Station
- Kawauchi Station
- Aobayama Station

## SENDAI → TOKYO

**1 hr 36 mins** by bullet train



## To Rome



In 1613, at a time when much of Japan opposed relations with the West, Sendai's famous samurai, Date Masamune sent a diplomatic envoy to Rome to meet the Pope.

## Libraries

**20**

The main library houses:

- the largest collection of books and materials belonging to writer Natsume Soseki, one of the most influential writers of the Meiji period.
- woodblock prints by artist Utagawa Hiroshige.

## Great East Japan Earthquake



On March 11, 2011 a magnitude 9.0 earthquake occurred off the coast of Sendai, triggering mega-tsunamis and a nuclear accident. Since the disaster, Tohoku University has initiated 108+ reconstruction projects to support recovery in the region.

City		Dose of Radiation(uSv/h)	Date of measurement
Sendai		0.041	Dec. 16, 2015
Tokyo		0.032	Nov. 9, 2015
Paris		0.057	Oct. 29, 2015
London		0.092	Nov. 9, 2015
Beijing		0.055	Sep. 30, 2015
Seoul		0.117	Nov. 10, 2015
New York		0.094	May 31, 2011

## Seasons

Summer is hot / Winter is cold



August **28.1°C**



January **1.5°C**

## Cafés

**13**



## Public Gardens

**2**



## Convenience stores

**8**



## Museums & exhibition rooms

**7**



## Sports clubs & Culture clubs

**77**



## Observatories

**8**



## Occasionally spotted on campus



bears



raccoons



pheasants



foxes



goshawks

## City of Trees

Sendai is known as the City of Trees for its numerous parks



Cherry blossom



Zelkova



Ginkgo



Persimmon

## Festivals in Sendai

Aobamatsuri  
Tanabata  
Jazz Festival  
Starlight Pageant







## Tohoku University's Alumni Association

Joining the Tohoku University Alumni Association, the best way to stay in touch with events on campus. The Alumni Association hosts four main events each year – Kansai, Kanto, Kyushu area and Premium members' social gatherings. In addition to these, there are regional events run by local alumni organizations, as well as regular campus activities that all alumni are welcome to attend!

Homecoming Day is the largest alumni event on the annual calendar, with concerts and stalls throughout the day. It's a chance for alumni to revisit the campus, meet with former teachers, friends and current students.

### Registering your alumni branch with the Alumni Association

If you are an alumnus of Tohoku University and have an alumni branch in your city or country, you can register your branch with the Shuyukai Alumni Association at no cost. Once registered with us we will post your contact information on our website, so that other alumni can be made aware of your activities.

Contact: [alumni@grp.tohoku.ac.jp](mailto:alumni@grp.tohoku.ac.jp)



NEW YORK

**New York Alumni Branch Founded**

In February last year, a group of alumni from Tohoku University held a social gathering in the Big Apple. Their numbers have gradually been increasing since officially registering as the New York branch of the Tohoku University Alumni Association. They welcome anyone with a connection to Tohoku University to attend future events. For more information contact Tsukasa Kawai: [kawai.tsukasa\\_j01@joyobank.co.jp](mailto:kawai.tsukasa_j01@joyobank.co.jp)

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# Welcome to Sendai, the City of Trees

Tohoku University's five main campuses are spread across the cosmopolitan city of Sendai, the cultural, political and economic center of Japan's north east (Tohoku) region.

Located some 300 kilometers - and a short 90-minute bullet train ride - from Japan's capital, Tokyo, Sendai is a city of fascinating contradictions.

It's a big, sophisticated metropolis with museums and music halls, trendy shops and cafes, and a home team in every major professional sport. But it also has a small city charm, easy friendliness and magnificent nature as far as the eye can see. In fact, for its Zelkova-lined streets and rivers that flow downtown, Sendai has the well-deserved nickname of Mori no Miyako, or the City of Trees. Through four distinct seasons, the city enjoys a temperate climate, with especially beautiful autumn colors and snow-covered landscapes in the winter.

A day trip away from Sendai are many of the region's other famous landmarks, such as Matsushima Bay, dotted with small islands, pine trees and oyster farms. Known as one of Japan's three most scenic locations, Matsushima has inspired poetry by the most famous poet of the Edo period, Matsuo Basho.

For the more athletic, nearby Mt. Zao is a popular ski and hot springs resort. It is also the best place to view the region's famous Snow Monsters in winter.

Sendai is home to a million people - many of whom are students and academics. Anchored by Tohoku University, the city boasts some of the top research facilities and institutes in the world. With a vibrant and energetic population, the city celebrates many colourful events throughout the year, while retaining many old traditions. The Aoba Street Festival, the Sendai Tanabata Festival, the Jozenji Streetjazz Festival and the winter Starlight Pageant are just examples of annual events that consistently draw visitors and participants from all over the country and across the globe.

Come join us in Sendai!



© Sendai Tourism, Convention and International Association





# Tohoku University at a Glance

Tohoku University's five main campuses are spread across the cosmopolitan city of Sendai - the capital of Miyagi Prefecture and largest city in the Tohoku region.

## Seiryō / Kawauchi / Aobayama Campus

- Hospital

Museums / Memorials

Arts & Performance


Stations


Gardens & Trees


Libraries


Eateries


Conference & Event Venues


Schools / Faculties
- 






















- Tohoku University Hospital

Sendai City Museum

Tohoku University Museum

Miyagi Prefecture Art Museum

Automobile Museum

Cyber Science Center Exhibition

Sendai Castle

Nishizawa Memorial Room

Quantum Way

Tohoku University Centennial Hall

Aobayama Station

Kawauchi Station

Kokusai Center Station

Botanical Gardens

Herb Garden

Kita-Aobayama Park

Tohoku University Main Library

Kita Aobayama Library

Engineering Library

Cafe and bookstore 'Boook'

Bee ARENA Cafe

Cafeteria

Mozart Klee's Cafe

Seattle's Best Coffee

Cafeteria Komorebi Cafe

Keyaki Dining

Aosis

Bush Clover Cafe

Espace ubel

Cafe

Cafe Aoba Dining

Shikisai

Qatar Friendship Fund Hall

Multimedia Research Hall

Sendai International Center

Center Hall














Science Administration Center







# Katahira Campus

Eateries	 Restaurant Alley - Iroha Yokocho	University Facilities	 Tohoku University Archives
	Sindra Indian Restaurant		Tohoku University Administration
	Ban Thai Lanna		Honda Memorial Room
	Cafe Mozart Atelier		Lu Xun Lecture Hall
	Kazunori Ikeda Patisserie	Conference	 Sakura Hall
	Sakura Kitchen		Katahira Kitamon Commons
Sightseeing	 Ryokusuian Tea House		TOKYO ELECTRON House of Creativity
	 Yanagimachi Shrine	Accommodation	 Katahira Hall
	Anagura Shrine		University House
	 Zuihoden	Parks	 Academic City Memorial Park
	 Otamayabashi Bridge		Katahira Park
	 Main Gate		Komegafukuro Walkway
Shopping Stores	 Meiji Foreign Goods		Hyojogawara Baseball Field
Station	 Aoba-dori Ichibancho Station	ATMs	 Post office





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