Hokkaido University Times

Hokkaido University's E-Newsletter

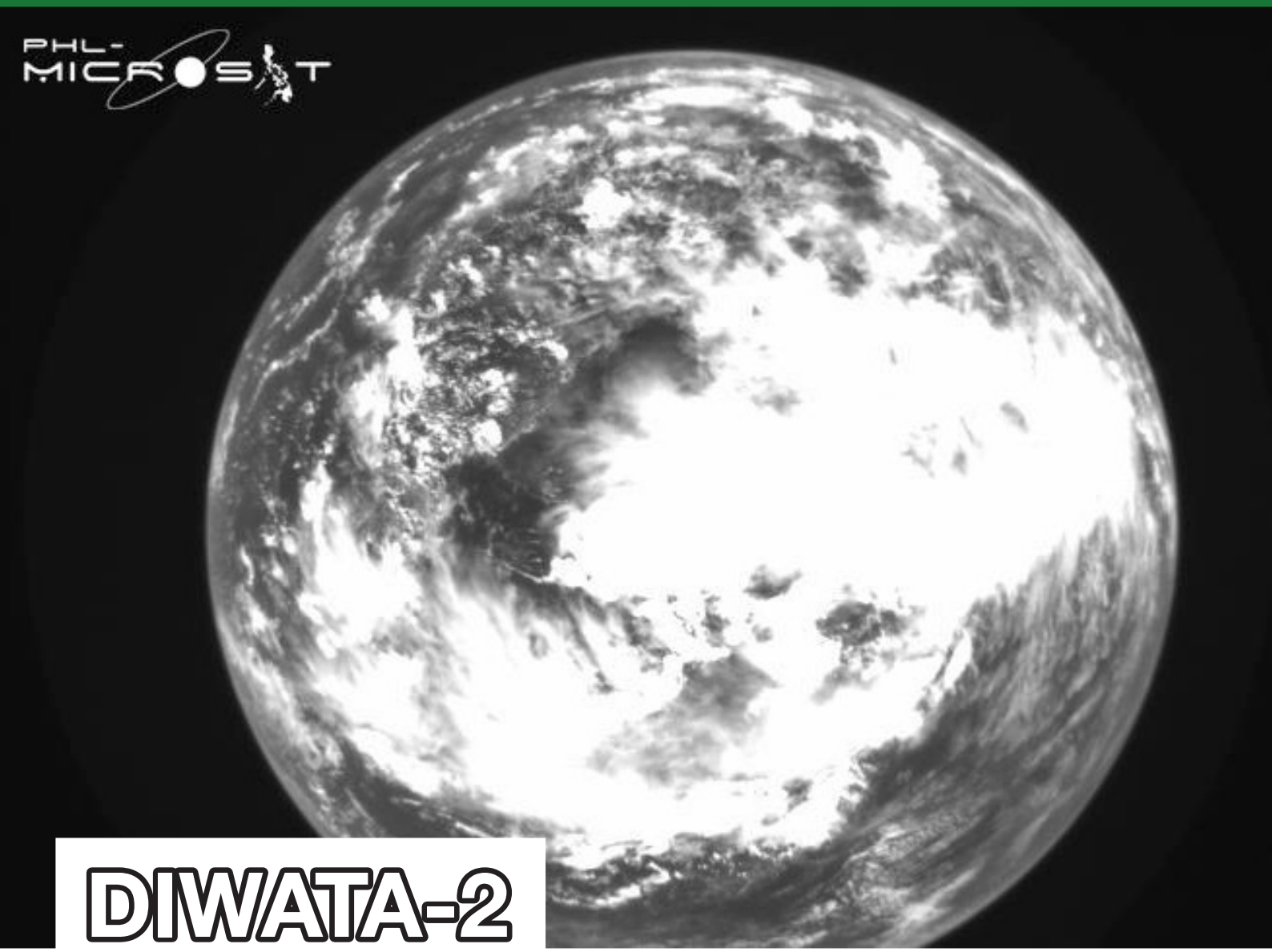
HokudaiSnowFes
1st place

HokudaiSnowFes
runner-up

Contents

Cover images:
1st place and runner-up entries for this season's Snow Sculpture Contest. Congratulations to @amyta.b and "Team Phlippines" respectively. We hope everyone can participate in our next #HokudaiSnowFes!

March 2019 | Issue 9



DIWATA-2 Successfully Captures First Images

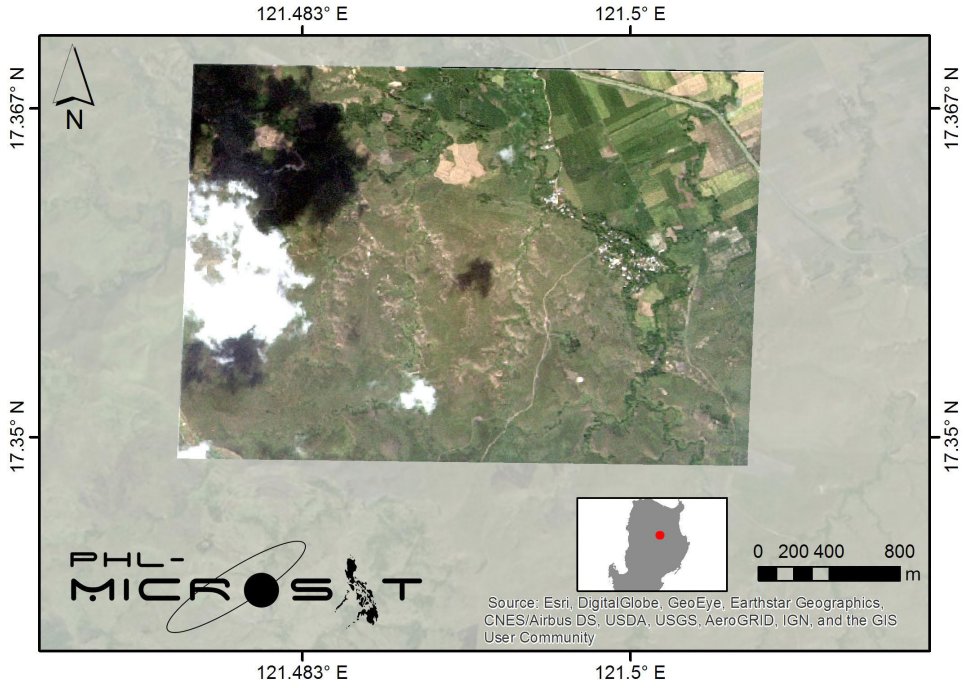
January 23 | University News

Philippine microsatellite DIWATA-2 has successfully captured initial images. Launched last autumn, it is the second microsatellite designed and developed under a collaborative project between Hokkaido University, Tohoku University, the Advanced Science and Technology Institute (DOST-ASTI), and the University of the Philippines-Diliman (UPD).

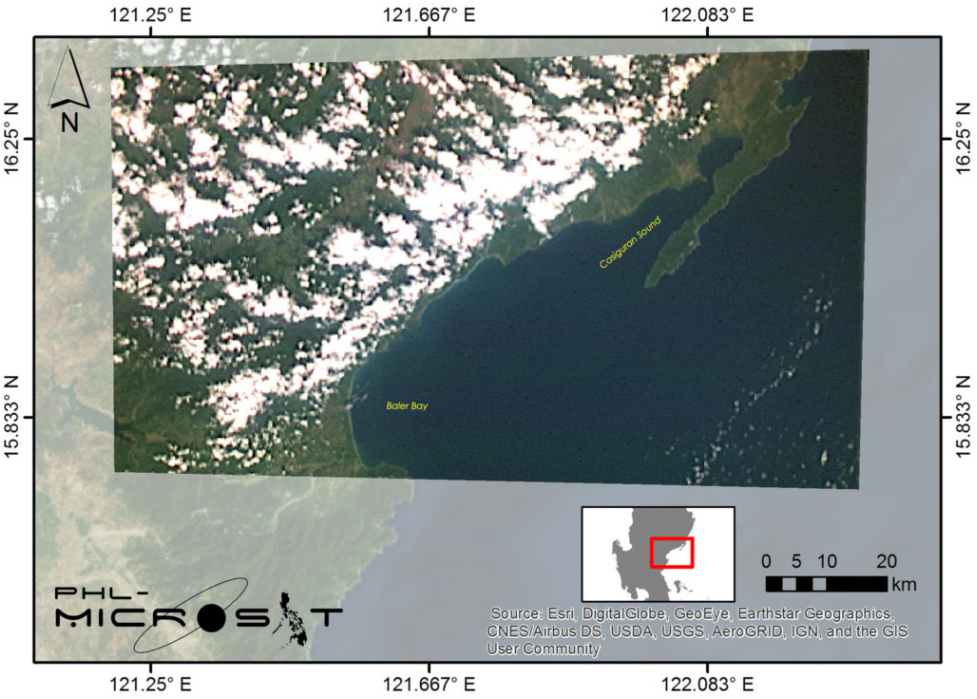
Microsatellites have attracted worldwide attention due to several advantages they have over traditional satellites, including their cost-efficiency, making their development and operation affordable for smaller countries.

The microsatellite DIWATA-2 was launched by H-IIA rocket from Japan's Tanegashima Space Center on October 29th, 2018. Featuring improved operation features and technology of its predecessor, the DIWATA-1, the handling of the DIWATA-2 has been extremely smooth, with the satellite being able to send high-quality images back to Earth.

DIWATA-2 carries 5 types of optical payloads, including a spectral camera capable of sensing 590 spectral bands; the highest in the world. In



This photo was taken on November 14th, 2018 above the Province of Kalinga, Philippines using a high precision telescope (HPT) equipped on the DIWATA-2. The ground resolution for this telescope reaches 5 meters.



This photo was taken over the area near Casiguran, Philippines, on November 15th, 2018, utilizing the DIWATA-2's Spaceborne Multispectral Imager (SMI).

addition to these cameras, the satellite has a target pointing capability which allows a constant observation of a specific location from its attitude control, and also can increase the observation frequency accordingly.

DIWATA-2 was developed as part of the PHL-Microsat Program, a Philippine government program that aims to build, launch, and utilize two Earth observation microsatellites to make effective use of disaster monitoring, and natural resource management. The program is managed and operated by the Philippine Council for Industry, Energy, and Emerging Technology Research and Development (PCIEERD), but was made possible through close collaboration between Hokkaido University and Tohoku University in Japan, DOST-ASTI, and UPD. As part of the program, both Hokkaido University and Tohoku University admitted Filipino researchers and students as graduate students to help them develop the skills needed to develop, create, operate, and analyze a satellite program from scratch.

The control, operation, and acquisition of satellite data of both DIWATA-1 and DIWATA-2 are currently being handled by the Philippine Earth Data Resource Observation Center (PEDRO), which is managed by the DOST-ASTI. Cameras onboard the DIWATA-1 can detect outbreaks of blight in banana groves — a major cause of economic damage in the country — from space. This was the first time in the world satellite technology has been successfully used for this purpose, one of many prominent results.

Together with Tohoku University, the Hokkaido University team that worked on the development of DIWATA-1 and DIWATA-2 have successfully created and launched 4 microsatellites in total. In addition, they are making progress toward the establishment of the "Asian Micro-satellite Consortium", proposed to be an international network made up of 9 member countries and 16 institutions. Together, the group aims to create, launch, and operate a network of microsatellites capable of relaying real-time information on natural disasters around the globe.

Prof. Balitskaya & Naomi Takeshima (Coordinator of HUAP Office)

HU Partner Prof. Irina V. Balitskaya receives her HUAP Certificate

March 1 | Ambassador and Partner News

Prof. Balitskaya, appointed an HU Partner on November 1st, 2018, received her HUAP Certificate during her visit to Hokkaido University on February 26th. She came as a representative of Sakhalin State University in Yuzhno-Sakhalinsk, Russia, one of our counterparts for the RJE3 Program.

During her visit, she attended the RJE3 program's Summary Symposium, where representatives from each counterpart university discussed upcoming curricula, operations, and management of the program as a whole.

The students who had studied with the RJE3 program also gave presentations regarding the topics they studied. Afterwards, the participants (students, professors, administrators, and others concerned about the project) exchanged their ideas on how to improve and expand the RJE3 program.

We believe that our new HUAPs, Prof. Balitskaya, Prof. Ikkonikova, and Dr. Korsunov, will play a huge roll in expanding and strengthening the HU community in Russia, the RJE3 program, and more.

Indonesia Alumni Association Get-together

March 20 | Alumni News

"The Indonesia Alumni Association Meeting of Hokkaido University 2019" was held successfully in Palangka Raya, Central Kalimantan, Indonesia on March 8th and 9th, 2019. On behalf of the President of the University of Palangka Raya (UPR), UPR Vice President and HU alumnus Prof. Dr. Sulmin Gumiri warmly welcome all attendees and expressed his hope that collaborations between HU and UPR would continue to be improved and developed.

The 1st day of the meeting was attended by more than 150 (UPR) students from various study programs and academic levels and nearly 50 Indonesian HU alumni. Presentations related to HU for Indonesian students and alumni were delivered by Prof. So Kawanobe (HU), Prof. Dr. Hanny Wijaya (HU Ambassador, IPB), and Dr. Maria Stefanie (HU Assistant Professor), with Dr. Hendrik Segah (HU Partner, UPR) acting as moderator.

On the 2nd day, HU alumni were invited to visit some interesting landmarks around Palangka Raya, including an excursion along the Sebangau River by boat to see a unique black water ecosystem originating from the soil. In this area there are around 50,000 hectares of UPR peatland laboratories that have been developed and established in collaboration with HU since 1993.

SPOTLIGHT ON RESEARCH

Octopus skin, from light to dark, from smooth to bumpy

March 1 | Research News

Octopuses are fascinating creatures. They can change the shape of their body, squeeze through seemingly impossible spaces, and are often subjects of fascination in stories and mythologies worldwide. This wonder has recently captured the interests of Hokkaido University students studying fisheries science at the Hakodate Campus.

Around four years ago, Associate Professor John Bower, who at that time had been researching squids, received a wave of requests from students interested in studying octopuses. According to Dr. Bower, up until that point nobody at the Faculty of Fisheries Sciences had done extensive work on octopuses, whereas squid, a Hakodate delicacy, was commonly studied.

The community studying octopuses at the university has since grown. Dr. Bower, now the leading supervisor and authority in octopus research at Hokkaido University, manages a number of undergraduate and graduate students on their projects studying octopus behavior. Most of their research has focused on one species in particular, the giant Pacific octopus, which is known in Japan as "*mizu-dako*."

The giant Pacific octopus can live up

Associate Professor John Bower, Faculty of Fisheries Sciences

to 5 years and is the largest known octopus species, reaching a maximum size of around 70 kg. In Japan, it is caught mainly in Hokkaido and is the target of Hokkaido's largest octopus fishery, making it a fitting specimen for Dr. Bower and his students.

Dr. Bower and his students conduct their research at the Usujiri Fisheries Station, which is located near the mouth of Funka Bay about a 1 hour drive from Hakodate. Since the station is near octopus fishing grounds and the water quality is excellent, it is an ideal place to conduct live experiments on octopuses and other marine wildlife.

Dr. Bower has studied many aspects of the behavior and ecology of cephalopods, but recently he has been particularly interested in the tactics and reasons behind why octopuses change the appearance of their skin.

Octopuses can change the color and texture of their skin within 200 milliseconds (about the time it takes to blink your eyes!). This rapid adaptive coloration is used in a wide range of situations. Although primarily for camouflage, by changing the color and texture of their skin and body patterns, octopuses are able to escape predators and even possibly attract mates.

"In some squid species," Dr. Bower explained, "the color of their body can be used to attract mates and ward off rivals—sometimes both at the same time. So, a male squid can show an aggressive silver pattern one side of his body to repel approaching males while at the same time showing the female a darker (brownish) courtship pattern on his other side. There is little evidence that octopuses can also do this, but this is one kind of behavior we want to explore."

The possibility that octopuses and other cephalopods use their skin to communicate is something which Dr. Bower finds especially fascinating. With this in mind, he and one of his students have just started a project exploring how light affects octopuses and their skin, a challenge since octopuses can see well in the dark, have no blind spots, and seem to be able to sense light without sending signals to their brains.

"Octopuses have pigment cells, reflectors cells, muscles..." he began. "They all work together to change the color, reflection, and texture of their skin. Their skin can change from very smooth to *papillae*, bumpy and spiky. No other animal is able to morph their skin three-dimensionally like this."

In addition, Dr. Bower is working on documenting the research done on the giant Pacific octopus as well as the techniques used at cephalopod fisheries in Hokkaido. This work has been in exceptional demand since, even though the distribution of the species extends from Japan all the way to the U.S. and Canada, most of the information is only available in Japanese.

When not undertaking research on octopuses, he also teaches courses on fisheries science and goes on a number of expeditions on the *Oshoro-Maru*, one of the university's training ships. On these cruises, he shows students how to catch and dissect cephalopods and conduct oceanographic sampling. "I want to encourage anyone out there interested in fisheries science to get out in the field — study nature, not just books!" he smiled.


A Giant Pacific octopus. Photo by Robin Rigby.

Self-growing materials that strengthen in response to force

A strategy inspired by the process responsible for muscle growth could lead to the development of stronger, longer-lasting materials.

February 1 | Research News

Hokkaido University researchers have developed a strategy to fabricate materials that become stronger in response to mechanical stress — mimicking skeletal muscle growth. Their findings, published in the journal Science, could pave the way for long-lasting materials that can adapt and strengthen based on surrounding conditions.

The strategy was inspired by the process that makes human skeletal muscles become stronger. As a result of strength training at the gym, for example, muscle fibres break down, encouraging the formation of new, stronger fibres. For this to happen, the muscles must be supplied with amino acids, the building blocks of proteins, which join together and form muscle fibres.

Hokkaido University's Jian Ping Gong specializes in polymer science. Her research team developed a strategy employing "double-network hydrogels" that emulates the building process of skeletal muscles.

Double-network hydrogels are a soft, yet tough material formed of about 85 weight percent water and two types of polymer networks: one rigid and brittle, and the other soft and stretchable.

The team placed a double-network hydrogel inside a solution containing molecules, called monomers, which can be joined to form larger compounds called polymers. This solution emulates the role of circulating blood carrying amino acids to skeletal muscles.

Applying tensile force (stretching) to the hydrogel causes some of its rigid and brittle polymer chains to break. This leads to the generation of a chemical species called "mechanoradicals" at the ends of the broken polymer chains. These mechanoradicals can trigger the joining up of the monomer absorbed into the hydrogel from the surrounding solution into a polymer network, strengthening the material.

With successive stretching, more breaking down and building up occurs, similar to what happens with skeletal muscles undergoing strength training. Through this process, the hydrogel's strength and stiffness improved 1.5 and 23 times respectively, and the weight of the polymers increased by 86%. The team was further able to tailor the material's response to mechanical force by using a specific monomer that altered the gel's reaction to heat; heated at high temperatures, the gel's surface became more water-resistant.

The researchers say their work could help with the development of self-growing gel materials for applications as flexible exosuits for patients with skeletal injuries; these suits would potentially become stronger and more functional the more they are used. Professor Gong explained "Since many types of DN gels have similar mechanical features, this process could be applied to a wide range of gels, expanding the range of potential applications."

Engineering a cancer-fighting virus

An engineered virus kills cancer cells more effectively than another virus currently used in treatments, according to Hokkaido University researchers.

January 29 | Research News

Hokkaido University researchers have engineered a virus that selectively targets and kills cancer cells. The virus, called dl355, has an even stronger anticancer effect than another engineered virus currently used in clinical practice, according to a study published in the journal *Oncology Reports*.

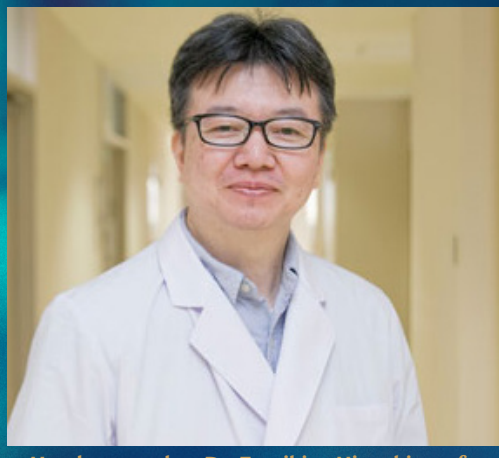
Molecular oncologist Fumihiro Higashino and colleagues deleted a gene involved in viral replication, called E4orf6, from a type of adenovirus. The team previously discovered that E4orf6 stabilizes a type of mRNA called ARE-mRNAs in the infected cells enabling viral replication. ARE-mRNAs are known to be stable in stressed cells and cancer cells, but rapidly degrade in normal cells.

In laboratory tests, they found that their modified adenovirus, called dl355, replicated and increased its number significantly more in cancer cells than it did in normal cells. Higashino explains "The E4orf6-lacking virus relies on the stable ARE-mRNAs in cancer cells for its replication."

Some viruses can be used to treat cancers, as they replicate within the cells until they burst and die. The researchers infected several types of cultured cancer cells with 100 dl355 virus particles per cell and found that nearly all the cancer cells died within seven days. In contrast, most normal cells infected with the virus did not die, even after seven days. Several cancer cell lines managed to survive low doses of dl355, but all cancer cells were killed by the virus as the dose was increased. Tumour growth was also significantly suppressed when dl355 was administered to human tumour cells grown in mice.

Finally, the team compared the anticancer effects of dl355 with another anticancer adenovirus currently used in clinical practice, called dl1520. dl355 replication was higher in all cancer cell lines tested, including cervical and lung cancer cells, and was better at killing all but one type of cancer cell, compared to dl1520. Both viruses only killed very few normal cells.

The findings suggest that dl355 has potential to be an effective anticancer treatment, the team concludes. They suggest enhancing the stabilization of ARE-mRNAs in cancer cells could even further strengthen its effect, but Professor Higashino notes that further research is required. "While we think dl355 has the potential to be an effective treatment method in dealing with many types of cancers, much more research needs to be done. When we think of a timeline, at least five more years of further research may be required, possible more, on top of clinical trials," Professor Higashino noted.



Head researcher Dr. Fumihiro Higashino of Hokkaido University's Graduate School of Dental Medicine.

2019 Undergraduate and Graduate School Commencement

Sapporo Campus

Undergraduate

Date: Monday, March 25th 2019
Time: 10:00am to 11:00am
Venue: Gymnasium I

- Graduating students should arrive at the venue by 9:15am.
- Doors open at 9:00am.
- Parking is not available on campus. Please use public transportation.
- Indoor shoes are not necessary.
- A stream of the commencement ceremony will be available online. The broadcast will start from 10:00am.
- Limited seating is available for families.

Graduate

Date: Monday, March 25th 2019
Time: 11:15am to 12:10pm
Venue: Gymnasium II

- Graduating students should arrive at the venue by 10:30am.
- Doors open at 10:15am.
- Parking is not available on campus. Please use public transportation.
- Indoor shoes are not necessary.
- Limited seating is available for families.

Hakodate Campus

Undergraduate and Graduate

Date: Tuesday, March 26th 2019
Time: 10:00am
Venue: Four Points by Sheraton Hakodate 3F "Camellia"

- Graduating students should bring their Student ID and arrive at the venue by 9:50am.
- Doors open at 9:30am.
- Seating is available for families.

The Hokkaido University Times is produced by the Public Relations Division, Hokkaido University

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