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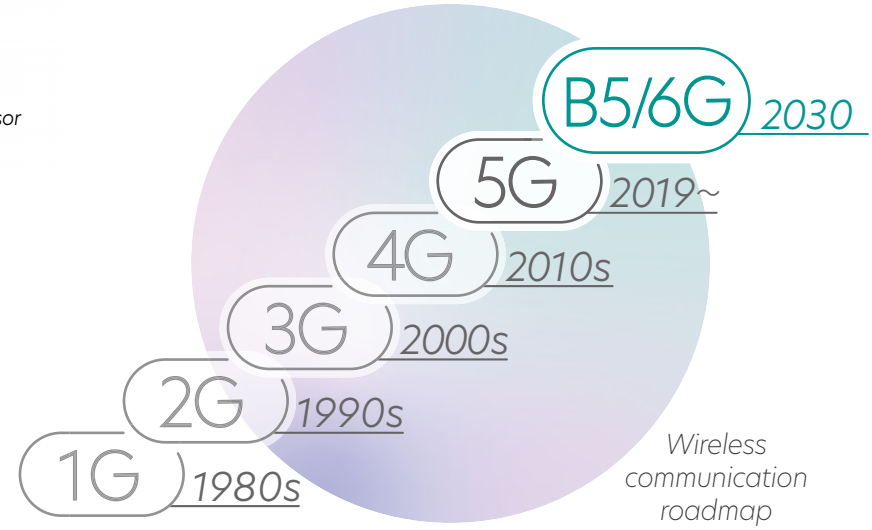
東京大学生産技術研究所

Institute of Industrial Science, The University of Tokyo

Looking beyond 6G

Associate Professor Sugiura learns from past scientific giants and aims to develop concepts for wireless communications 20 years from now

Associate Professor Shinya Sugiura



Wireless communication roadmap

Since South Korea and the United States became the first countries to commercially launch fifth generation (5G) mobile wireless networks in 2019, researchers have been engaged in a fierce competition to develop viable technologies for 6G networks. Shinya Sugiura, Associate Professor of the Institute of Industrial Science at the University of Tokyo (UTokyo-IIS), says his mission is to formulate concepts – backed up with mathematical formulae and simulations – for element technologies for mobile communication that he hopes will prove revolutionary in the decades ahead.

Associate Professor Shinya Sugiura learned the importance of publishing academic papers in the early 2000s when he began conducting researching into wireless networks for intelligent transportation systems (ITS) at a leading international automaker's research institute. This was reinforced after the company dispatched him to Britain's University of Southampton for a doctoral program.

"I'd like to produce academic achievements, because I believe scholars are evaluated by papers they write," Sugiura said in explaining his research stance. "It is difficult to talk about myself in an objective way, but I believe the sheer number of papers I had produced was a decisive factor when UTokyo hired me." Sugiura joined the UTokyo IIS in 2018 after a five-year stint at the Tokyo University of Agriculture and Technology.

Sugiura is unwavering as he conducts wireless research with the aim of providing an impetus for future wireless technologies. Currently, both the academic and business worlds are looking for promising technologies for development as part of new 6G networks, which are expected to have a performance level at least 10 times higher than 5G networks by around 2030.

"My mission is to produce ideas and preferably obtain patents for them so that they can be used for the 6G and beyond," Sugiura said. Asked about what kind of a world we can expect in a couple of decades, he cited complete autonomous driving as an example. "Further advancement in wireless technologies is essential if the world wants to see the fruition of autonomous driving technologies – meaning a world without accidents and with a smooth flow of traffic," he said. "It is probably impossible to have flawless autonomous driving unless vehicles are connected to a wireless network that allow the exchange of data about their position, speed and destination with other cars without delays."

Further information

Sugiura Laboratory
http://sgurlab.iis.u-tokyo.ac.jp/en/index.html

Learning from past scientific giants essential

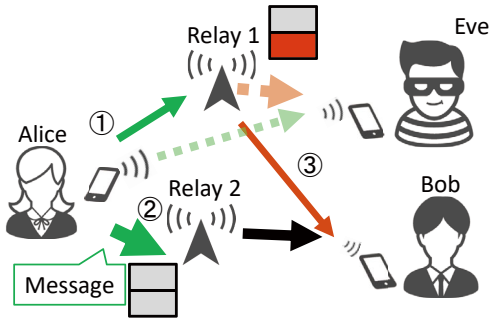
Sugiura places importance on learning from past scientists, who made breakthroughs in research into wireless communication, and then thinking about how to translate their concepts into reality.

"I can find ideas for wireless communications in past work because the mathematical foundations are unchanged – this is a very interesting part of my research," Sugiura said. "Such ideas were not used in practical applications due to technological limitations, but it is now possible due to advances in relevant technologies. Learning about past work in detail is also essential, because it allows us to think of ways to solve problems we encounter, while developing concepts to realize theories that have been proposed in the past."

For example, Sugiura is working on the theory of physical layer security, which can be traced back to the 1970s in the United States, to make it applicable in the real world. The pioneering work was done by Aaron Wyner, an American information theorist at Bell Laboratories, but it has never been put to practical use.

In Wyner's model, "Alice" is connected to "Bob" over a noisy channel that is eavesdropped by "Eve." Communication between Alice and Bob can be made secure if the channel capacity is greater than that between Alice and Eve. Physical layer security has gained much attention in recent years because it can provide a model for passive wiretapping in wireless communications.

By studying Wyner's model in depth, Sugiura came up with a way of controlling the transmission environment via channel-aware adoptive coding and signaling through relay nodes. But that's where his work stops. He leaves it to others to conduct demonstrations to find out whether his concept is viable in the real world.

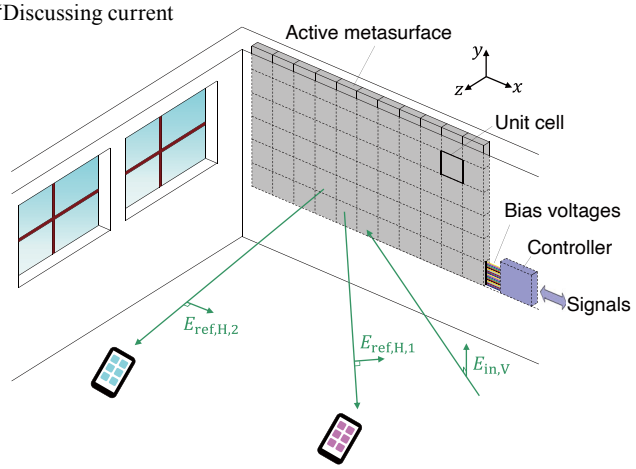


Physical layer security with cooperative relaying

Gathering information from peers essential

In addition to reading past papers, Sugiura gathers information from his peers, including his colleagues at Southampton, who are now spread around the world. "Discussing current topics with them is a very important aspect of information gathering," Sugiura said.

It was through this network that he learned about Intelligent Reflecting Surface (IRS), which enables the control of a wireless propagation environment, before the technology came under the spotlight as a promising technology for boosting the spectrum and energy efficiency of future wireless communication systems. The concept, a candidate to be included in 6G wireless networks, is to design to create a Smart Radio Environment with the help of "intelligent" radio-reflecting boards and replace the current wireless communication system, whose environment cannot be changed. Sugiura also came up with a way of applying IRS to physical layer security.



Intelligent reflecting surface enhanced wireless network

After collecting information with the goal of solving security or other issues involved in wireless communication, Sugiura spends time trying to come up with ideas. He often gets inspired while taking a walk or soaking in the bath. Then he discusses the idea with his fellow researchers and students, while writing down mathematical formulas on a white board – again and again. If it succeeds in formulating a theory, the Sugiura Lab conducts simulations to verify the theory and publishes an academic article.

So far, the Sugiura Lab has produced 90 articles, attended 36 international conferences and filed 22 patent applications. Members of the lab have received 13 prizes. In December 2021, Sugiura's achievements in theorizing a method to efficiently use a large number of transmit antennas with much less energy earned him the prestigious Japan Society for the Promotion of Science Prize.

"I will be happy if the technologies I developed or helped develop are adopted in 6G or 7G systems," Sugiura said. "But I am not the type of person who is suited for being involved in the process of deciding which technologies will be adopted in the next generation of systems, because it is a very political process. My goal may seem like a small one, but I aim to produce research results that will have major spillover effects in the future and to write papers that will be cited in other research that produce revolutionary results."

Reference

IEEE Transactions on Vehicular Technology (2021), DOI: 10.1109/TVT.2021.3055237

Unlocking na

Professor
Yoshitaka Umeno

```
*# Read SETDAT end ###
Read config file = CONFIG
Species (1st line) = Zr
potential (2nd line) =  Dipole Potencial arg (2nd line) =
objects = 1
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 Dipole potential file = pot/Dipole_YSZ.pot
 # of species = 3 , # of pairs = 6
DIOPLE potential initialization done.
urrent Working Directory = /home/umeno/MD_MYCODE/mdspas
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Simulation of crack propagation in rubber

Professor Umeno looks into how materials deform and fracture in nano- and microworld with simple computer programs he devises

Fracture mechanics researchers around the world are competing to unravel how cracks propagate in materials such as metals and ceramics to help the industrial sector design more robust and functional materials. Professor Yoshitaka Umeno of UTokyo-IIS is taking a unique approach to examine mechanical behaviors of materials such as deformations and cracks at nano and micro levels – phenomena which are difficult to grasp even with the use of state-of-the-art microscopes – through modeling and simulation.

Professor Yoshitaka Umeno became interested in science as a boy, influenced by his engineer father, who bought him a personal computer at the dawn of the computer age. So, it was natural for him to pursue engineering a quarter-century ago at Kyoto University with the aim of becoming involved in the manufacturing sector.

A professor at the university's graduate school who was exploring fractures at the atomic level prodded Umeno to set out on a journey to an uncharted tiny world by using computer simulations. This journey's initial stage, however, was marked by difficulties – such as Umeno being mocked.

He recalls being ridiculed by some of his peers, who told him using simulations to observe such a tiny world was no use in fracture mechanics – a typical reaction by people when they encounter a groundbreaking idea. But Umeno's research is now getting attention amid rapid advances in nanoscience and nanotechnology over the last few decades as he explores the mystery-shrouded nano- and microworld. Umeno, who now belongs to UTokyo-IIS's Center for Research on Innovative Simulation Software, joined the university as an associate professor in 2006.

"Dramatic improvements in computer performance made it possible to conduct simulations using simplified mathematical models to identify how a string of atoms ruptures and causes a material to fracture," Umeno said. "It can be done much more easily than with actual experiments requiring flawless tiny test pieces on which a load is applied repeatedly." With simulations, conditions can be changed to pinpoint a certain mechanism, Umeno added.

For example, in 2021, a team comprising Umeno and other Japanese scientists succeeded in identifying for the first time in the world the origin of a phenomenon known as velocity jump, which occurs when rubber materials under stress rapidly break. The mechanism of velocity jump has been a mystery for years despite its importance in designing durable rubber materials.

"It was challenging for me to conduct simulations on rubber, which is a soft material (materials that are easily deformed by thermal fluctuations and external forces)," Umeno said, explaining that he had focused his research on hard matter such as metals and ceramics. "It proved that my approach in using simulations is effective in examining soft matter as well." He plans to continue conducting researching into soft matter such as biodegradable plastics.

noworld mysteries?

Generating an idea for a simplified mathematical model

Umeno's job is to write computer programs from scratch for the simplified mathematical models that are used for conducting simulations. "What I am doing is very rudimentary -- like craftwork done by primary schoolchildren as a summer vacation assignment," he said with a smile. "But it has to be simple to pinpoint any forces that are at play."

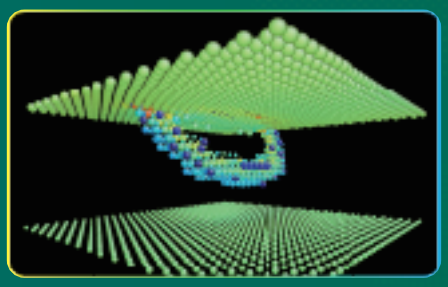
Deciding which mathematical formulas should be used in modeling is often a daunting challenge. Umeno says that ideas often come to him while he is driving, skiing, playing the piano or doing something other than his job.

He is responsible for many attention-getting research results. For example, Umeno used atomic model simulations, or a molecular dynamics study, to examine hard but brittle silicon, a material that is used for semiconductors. He found phenomena such as cleavage (a tendency of crystalline materials to split along a definite crystallographic structural plane) and slips (sliding displacement along a plane of one part of crystal relative to the rest of crystal).

A 2019 study by his lab offered new insights into reactions occurring in solid-oxide fuel cells (an electrochemical conversion device that produces electricity directly from oxidizing a fuel) with atomic-scale models. This could pave the way for improving their performance and durability.

Furthermore, in April 2021, Umeno's lab adopted a new research topic: "Nano-Micro Mechanophysics," which involves multiscale modeling and simulation to pursue the essence of material strength and properties, such as electrical conductivity and magnetism.

Umeno made it clear, however, that his job is to unravel mysteries involving how materials behave at the atomic level, not to think about industrial applications. "If we understand mechanisms, researchers in the private sector can use the knowhow to improve their products, a task where they excel," he said. "My mission is simply to conduct basic research to understand hitherto unknown mechanisms of how materials behave."



Simulation of crystal slip in silicon carbide

Aiming to develop new multiscale simulation method for fatigue

Umeno is now focusing on developing a new multiscale simulation method to elucidate fatigue mechanisms at nano- and micrometer scales of materials. Fatigue is a phenomenon that occurs when materials are subject to repeated stresses or loading, which could lead to crack initiation and propagation and ultimately fracture.

"The old example of metal fatigue causing an accident is the doomed Japan Airlines jet that crashed in 1985," he said. "Fatigue accounts for 90 percent of problems in industrial products, but we don't know how cracks begin at the nano- and microscale level."

This project is being pursued under the initiative of a JST-CREST program for the "nanomechanics" research area. Utilizing machine learning, the new method combines deductive (bottom-up) and inductive (top-down) multiscale approaches, which enable performing multiscale simulations that overcome the drawbacks of both conventional schemes.

"My ultimate goal is to make a multiscale simulation in a real sense from the nanometer scale to the visible scale because conventional multiscale simulation does not offer a coherent picture of how each scale is linked to the others," Umeno said. "That's the ultimate goal for any researcher in material science, I believe, but it will take a long time to achieve it."

Asked what he finds most rewarding, Umeno said it is when one of his programs is shown to be workable. He is now conducting simulations where it is difficult to learn about mechanical behaviors of materials with actual experiments. His ultimate aim is to revolutionize the process by reversing it, or by first conducting simulations to establish a hypothesis and verifying it through experiments.

Further information

Umeno Laboratory
http://www.cmsm.iis.u-tokyo.ac.jp/en/index.html

Continental UTokyo-IIS Global

Encouraging aspiring IIS students to excel in the world

In autumn 2021, UTokyo-IIS and Continental Japan announced the four winners of the first Continental UTokyo-IIS Global Engineering Fellowship. The grant is provided by Continental Japan to IIS graduate students who hope to make the world a better place to live through their research.
To mark the occasion of the inaugural fellowship, IIS invited the recipients to take part in a discussion on October 28, 2021, to talk about their research and their aspirations for future projects that can contribute to the betterment of our planet.

Yuki Sekimori
Maki Laboratory
(2nd year in master's program)

Takumi Bannai
Yamazaki Laboratory
(1st year in master's program)

Akira Fuji
Imai Laboratory
(1st year in master's program)

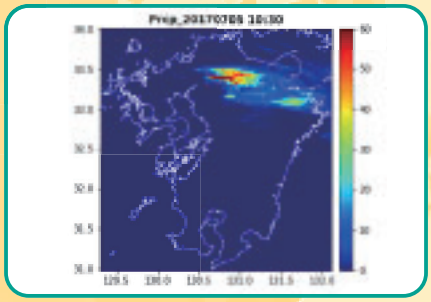
Wang Hongyi
Kawazoe Laboratory
(2nd year in master's program)

Could you tell us about your research?

Sekimori I am conducting research aimed at developing an information system for operating multiple marine robots. Specifically, I use acoustic waves for communicating with and positioning robots. The system is expected to be applicable in a wide range of areas, such as exploring natural resources and managing offshore wind turbines.

AUV (Autonomous Underwater Vehicle)

Bannai My research topic is the development of algorithms to estimate global precipitation levels by applying machine learning to satellite remote sensing data. I would like to use my research to help countries with insufficient radar capability to carry out countermeasures against flooding and global warming.



Precipitation (mm/h) from Radar-AMeDAS in Kyushu, Japan.

Fuji I am currently taking a year off school and have just begun taking an internship at an architectural office in Rotterdam in the Netherlands. When I applied for this fellowship, I wrote "exploring sustainability in architecture" as my theme. But during my internship I'd like to think about what I'd like to research for my master's program.

Why did you decide to apply for the fellowship?

Sekimori Japan is connected to the world via the sea, whose development requires international cooperation. I applied for the fellowship because I'd like to contribute to the betterment of the world by using marine robots.

Bannai My lab teacher prodded me to apply. I thought applying for the fellowship would give me a chance to review the international experience I gained by studying in Canada and Singapore, in addition to how research at my lab can be expanded globally.

Fuji As I was preparing for the internship, I learned about the fellowship. I applied because I thought it would give me more opportunity to think about how I can develop my research plan.

What were the advantages of applying?

Fuji In the final interview, professors from different fields gave me valuable feedback. Many of them asked pointed questions to which I had not given much thought. I realized that I needed to think more deeply about my research theme.

Bannai After I won the fellowship, I became more aware of the need to proactively conduct research that would benefit the world. Previously, when I conducted research into algorithms, I tended to look only at fine details and forget about how my research related to the world.

Engineering Fellowship

Sekimori I became firmly determined to conduct research into technologies that Japan can proudly introduce to the world. Such technologies include those relating to preserving the environment and bringing harmony between industry and nature/the environment.

This fellowship was created this year to give a boost to aspiring IIS students after the Covid-19 pandemic deprived many students of their chance to study abroad. Did you have any difficulties in continuing your studies during the pandemic?

Fuji It was very difficult. I started preparing for an overseas internship in March 2021, when the pandemic was raging. Initially, I didn't quite know how to look for an internship abroad. I sought advice from UTokyo graduates who had previously done internships abroad. One of my friends was also looking for an internship abroad. We tried to encourage each other. I finally managed to find an internship in Rotterdam.

Sekimori I am grateful that IIS and Continental Japan set up this fellowship immediately after many students became unable to study abroad due to the Covid-19 pandemic.

Although there were some restrictions imposed on our visits to the campus, UTokyo still gave us the opportunity to conduct research at IIS and at an offshore experiment facility in Hiratsuka, Kanagawa Prefecture.

Bannai I did not know about this fellowship, but I thought it was an interesting project that only an institution like the University of Tokyo could take on.
Even before the pandemic, we held online meetings. That's because our project participants are in various locations, such as Kyoto and South Korea. I was able to work at home because I could access my lab's computer server from home. So, the pandemic didn't affect me very much.

Could you tell us about your future aspirations?

Bannai I don't believe I can complete all of my research during the master's program. I'd like to continue it one way or another after finishing the program. By cooperating with experts in other countries, I'd like to make my algorithms usable so that I can help solve environmental problems.

Fuji I came to the Netherlands to look for a specific research theme, so it is difficult to answer that question. But since I specialize in architectural design, I would like to study cityscapes and building renovation in Europe.

Internship destination workplace

Sekimori I'd like to make field robots to take over dangerous and monotonous tasks that are now performed by humans. I'd like to advance to a doctoral program, and after that I'd like to base myself in Japan and help raise Japanese technology to a top-class, world level and revitalize the country's industry.
Entrepreneurship is another option that I can pursue.

Learning Architecture in Switzerland!

Department of Architecture, Graduate School of Engineering,
The University of TokyoYoshiyuki Kawazoe Laboratory M2 Wang Hongyi

From September 2021, through the world-wide exchange program, I came to ETH Zurich for architecture master program.
My courses are focused on architecture and landscape. On the course 'Serendipity: Water resourced', we did research about the tap water drunk in Zurich and present it through video works. We also dived into a cave, shooting, and recording everything interested.
It was fun and good way to learn connection between urban infrastructure and nature!

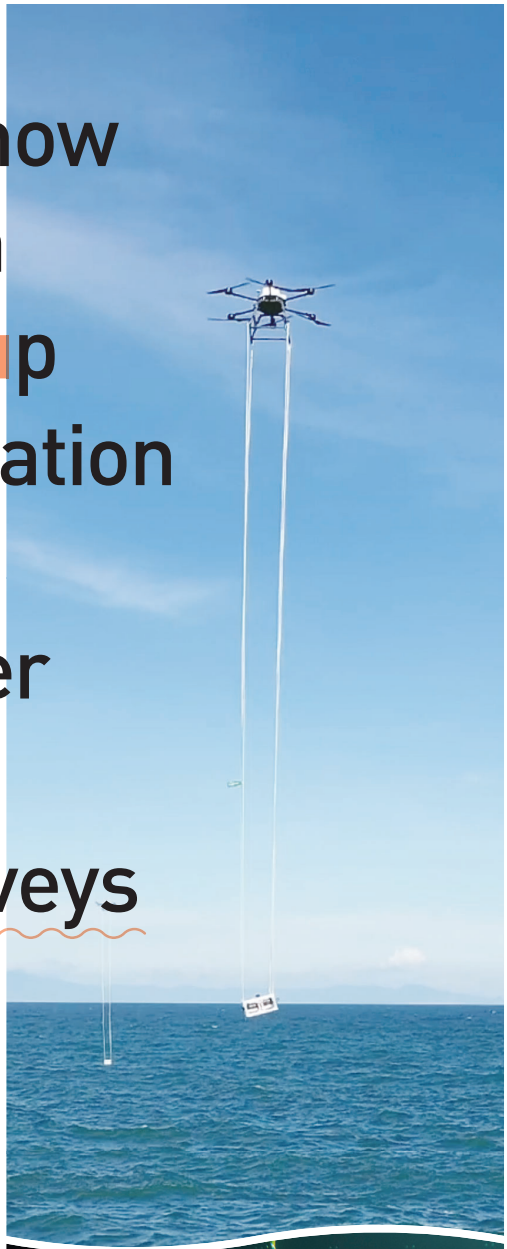
Recording the sounds from water resource

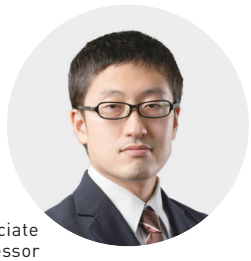
Comments from Continental

Chigusa Kawanami, Director Human Relations, Continental Automotive Corporation

We are very pleased to receive many applications to the new Continental UTokyo-IIS Global Engineering Fellowship. Congratulations to the four winners of 2021!!
The corona pandemic is changing our lives, and we see this as an opportunity for shaping everyday life, driving innovation, and solving social issues through technology. Let your ideas shape the future!

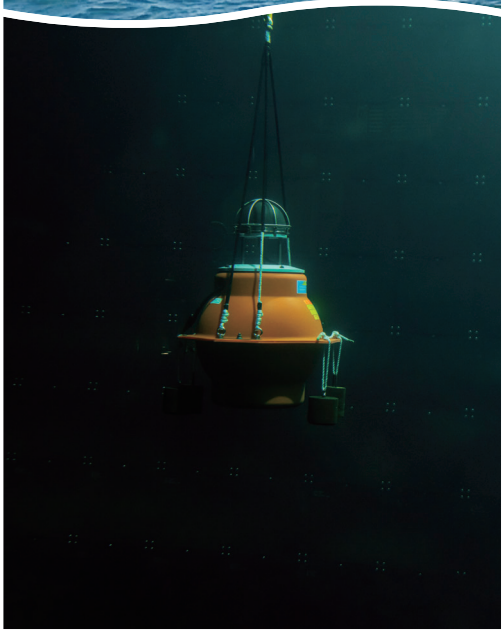
Drones show promise in speeding up communication with underwater robots for ocean surveys





Associate Professor Yusuke Yokota

Researchers from UTokyo-IIS find that drones may be the next generation of communication bases to monitor the ocean and seafloor because of their high-speed positioning, stability, and efficiency.



① UAV as a new sea-surface platform
② Acoustic station that measures the centimeter-level seafloor movement

Tokyo, Japan – To conduct ocean surveys, sensors mounted on underwater robotic devices are typically used in communication with sea-surface base stations. Researchers from Japan have found a promising way to optimize this underwater communication.

In a study published this month in *Remote Sensing,* researchers from UTokyo-IIS revealed that unmanned aerial vehicles (UAVs), commonly referred to as drones, show promise as communication bases with robotic devices known as autonomous underwater vehicles (AUVs) for ocean surveys.

AUVs are commonly used for underwater survey missions and monitoring the seafloor because they can obtain detailed seafloor images and information. Sea-surface base stations are a necessary partner to the AUVs to obtain absolute positions and real-time data because ocean water weakens the transmitted radio wave signals. However, these base stations have low mobility and drift with sea disturbances. Thus, to optimize this underwater communication, researchers at UTokyo-IIS aimed to address these limitations with devices that would be more efficient, fast, and stable.

"Because sea-surface vehicles cannot efficiently achieve high-speed observations, we examined whether UAVs could be used as a base station for underwater communication with an AUV," explains lead author Yusuke Yokota. "UAVs can travel at 50 km/h or more and they are not affected by ocean currents or other perturbations, making them ideal candidates for this application."

To do this, the researchers first observed whether the UAV could land on a sea surface and lift off to return to its base. They then studied the underwater communication using two UAVs (with one imitating an AUV) to find out the distance stability between the hovering and underwater devices. Finally, the researchers examined the sea-surface sway of a UAV used as a buoy.

"The results are very exciting," says Takumi Matsuda, second author of the study. "The application of UAVs will reduce the cost of many ocean observation operations."

In addition to the distance stability between the hovering and underwater devices, the UAV was functional as a measurement buoy under wind speeds of 5–10 m/s and wave height of ~1 m.

"Our results suggest that because of their robust hovering control, stability against sea-surface sway, and operation speed, UAVs may be a suitable communication platform with AUVs in ocean surveys up to a distance of approximately 1 km from the shore," says Yokota. "However, further research is necessary before we can carry out more complicated work with them."

Reference

Yusuke Yokota , Takumi Matsuda
"Underwater communication using UAVs to realize high-speed AUV deployment"
Remote Sensing **(2021), DOI: 10.3390/rs13204173**

Measles: activation of two different innate immune responses spotted

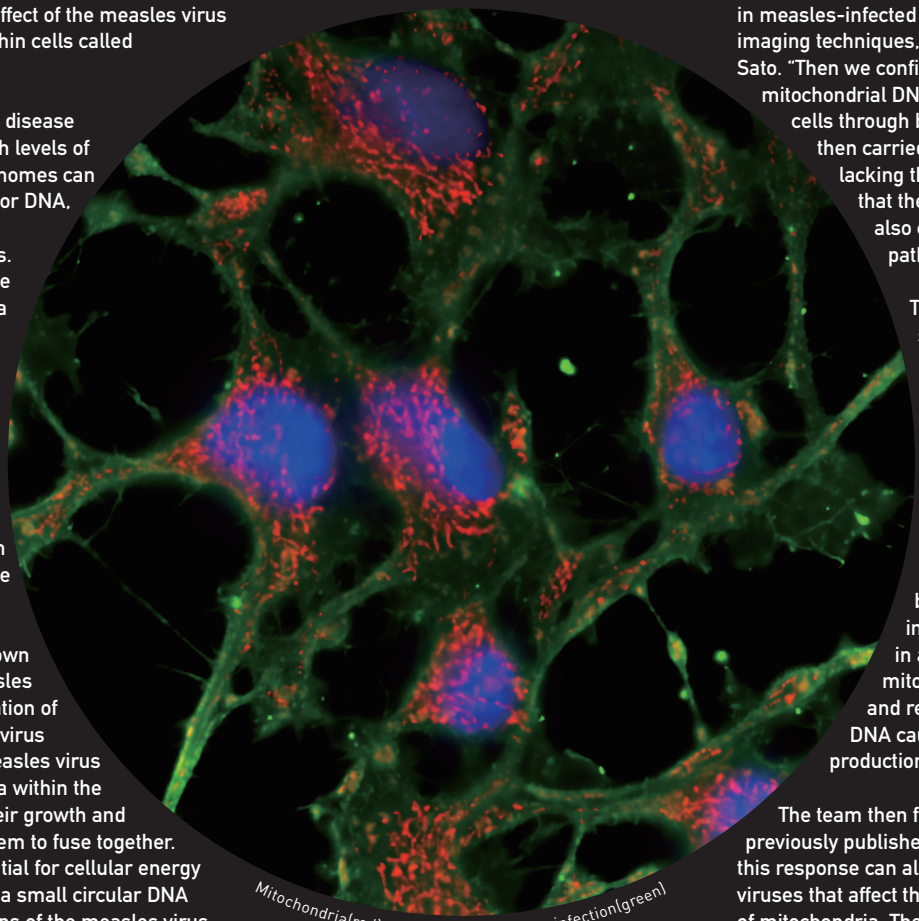
Researchers from UTokyo-IIS describe a novel feature of the immune response to certain viruses such as measles.

Project Associate Professor Hiroki Sato

Researchers from UTokyo-IIS have found that infection with the measles virus activates not one but two different branches of the innate immune system. This is because of the effect of the measles virus on small structures within cells called mitochondria.

Measles is a significant disease worldwide, causing high levels of child mortality. Viral genomes can be made of either RNA or DNA, and the host immune response to each differs. RNA viruses such as the measles virus activate a molecule called RIG-I, whereas DNA viruses activate a different molecule called cGAS. These molecules then trigger a cascade of activation of other molecules such as interferon, leading to an immune response to the virus.

The team have now shown that infection with measles virus leads to the activation of both the RNA and DNA virus immune responses. Measles virus affects the mitochondria within the cell, interfering with their growth and division and causing them to fuse together. Mitochondria are essential for cellular energy production and contain a small circular DNA molecule, and the actions of the measles virus cause this mitochondrial DNA to be released into the cell. This release of DNA into the cytoplasm of the cell, where usually no DNA is found, triggers the cGAS immune response just as a DNA virus would. This response occurs after the immune response to RNA viruses caused by the measles virus itself.



Mitochondria(red), nuclei(blue) and virus infection(green)

"We first showed mitochondrial abnormalities in measles-infected cultured cells using imaging techniques," says lead author Hiroki Sato. "Then we confirmed the presence of mitochondrial DNA in the cytosol of infected cells through biochemical analysis, and then carried out experiments on mice lacking the cGAS protein to show that the immune response was also caused by the cGAS pathway."

This is the first time that single and negative strand RNA viruses have been shown to activate the cGAS pathway. "We suggest that there are two steps to measles infection," says senior author Chieko Kai. "In the first, early phase, viral RNA replication is detected by the RNA-sensing immune response, and then in a second, later phase, mitochondrial downregulation and release of mitochondrial DNA cause prolonged interferon production."

The team then found evidence in previously published datasets to suggest that this response can also be triggered by other viruses that affect the growth and development of mitochondria. They therefore suggest that this is an important host mechanism for a full immune response to such viruses. Increased understanding of how the body works to combat an infection such as measles may help to eradicate this disease for good.

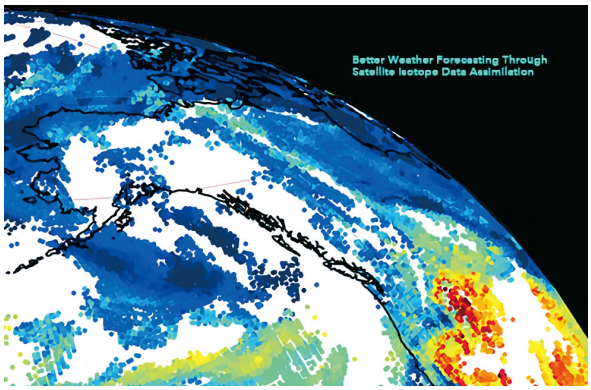
Reference

Hiroki Sato, Miho Hoshi, Fusako Ikeda, Tomoko Fujiyuki, Misako Yoneda and Chieko Kai
"Downregulation of mitochondrial biogenesis by virus infection triggers antiviral responses by cyclic GMP-AMP synthase"
PLOS Pathogens **(2021), DOI: 10.1371/journal.ppat.1009841**

Further information

http://www.kailab.iis.u-tokyo.ac.jp/cn3/topen.html

Better Weather Forecasting Through Satellite Isotope Data Assimilation

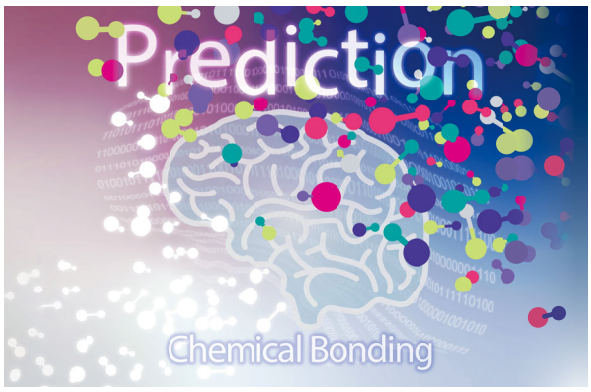


The actual satellite water vapor isotope data was assimilated into a general circulation model to determine if the inclusion of these data could improve prediction accuracy both globally and locally. Overall, the accuracy of the forecast has improved by a few percent. This effect is particularly pronounced for variables closely related to water vapor isotope fractionation, such as temperature and specific humidity, and a research team led by Kei Yoshimura more clearly modeled the local pressure pattern in Japan in 2013.

Scientific Reports (2021), DOI: 10.1038/s41598-021-97476-0

Further information https://www.iis.u-tokyo.ac.jp/en/news/3652/

Bonding's next top model – Projecting bond properties with machine learning

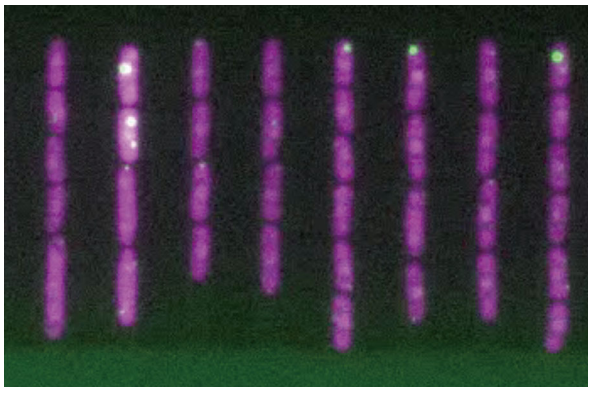


A research team led by Teruyasu Mizoguchi have developed a machine learning-based model to predict the characteristics of bonded systems. Using the density of states of the individual component reactants, they have achieved accurate predictions of the binding energy, bond length, number of covalent electrons, and Fermi energy. The broadly applicable model is expected to make a significant contribution to the development of materials such as catalysts and nanowires.

Applied Physics Express (2021), DOI: 10.35848/1882-0786/ac083b

Further information https://www.iis.u-tokyo.ac.jp/en/news/3607/

Computer-assisted Biology: Decoding Noisy Data to Predict Cell Growth



A research team led by Tetsuya J. Kobayashi used artificial intelligence to obtain a more objective understanding of cell growth and division without preconceived assumptions. Using deep-learning neural networks, they were able to more accurately model the complex processes that affect cell size over time. This work may lead to advances in microbiology and industrial production of microorganisms.

Physical Review Research (2021), DOI: 10.1103/PhysRevResearch.3.033032

Further information https://www.iis.u-tokyo.ac.jp/en/news/3597/

UTokyo-IIS

Professor Toru H. Okabe, Director General

Message from the Director General / Scope

The Covid-19 pandemic has transformed our lives, making us realize the limits of science and technology against formidable viruses. At the same time, through remote work and online lectures, we have become more aware of the importance and the future potential of digital transformation (DX). Many issues cannot be solved by technology alone. However, engineering is expected to play an increasingly important role in meeting the challenges of modern society, which has become ever more complicated and diversified.

The Institute of Industrial Science (IIS) at the University of Tokyo is the largest university-affiliated research institute in Japan. With a commitment to pursuing academic truth, the UTokyo-IIS carries out a wide range of educational and research activities, such as cross-disciplinary research that transcends academic boundaries — which is a traditional feature of the UTokyo-IIS — as well as practical industry–academic collaboration, international collaboration, and hands-on research aimed at social implementation.
In 2019, we celebrated our 70th anniversary. During the past 70 years, there have been significant research accomplishments and we have succeeded in producing many outstanding members of society.

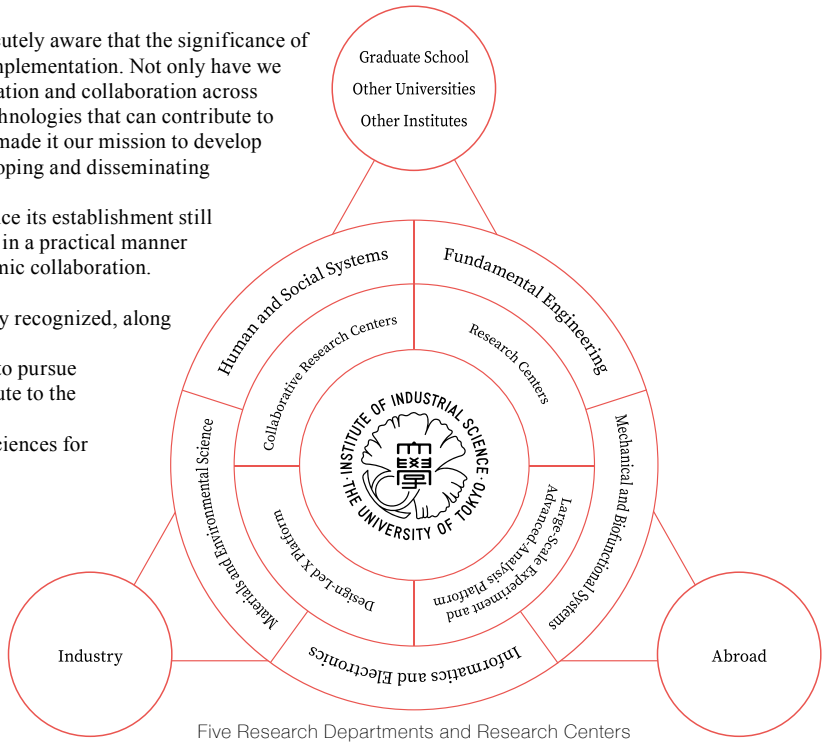
The UTokyo-IIS is a comprehensive engineering research institute that covers almost all fields of engineering, consisting of five research divisions. It has approximately 120 laboratories overseen by professors, associate professors, and lecturers. More than 1,200 personnel, comprising approximately 250 faculty members, 150 support members, and 800 graduate students and postdocs participate in educational and research activities that are responsible for producing excellent research outcomes and fostering outstanding talent.

Furthermore, there are 3 affiliated research centers that span multiple research departments, 7 internal centers, 2 collaborative research centers, and an international collaborative research center that pursues international joint research. In addition to promoting original research in specialized fields, each laboratory systematically engages in interdisciplinary or international activities by using organizations such as the cross-disciplinary research centers.In 2017, the Chiba Experiment Station was relocated from its original site in Nishi-Chiba to the Kashiwa Campus, and since 2020, the facility is operating as a Large-scale Experiment and Advanced-analysis Platform (LEAP). In addition, a completely new facility called the “Design-Led X Platform,” the first of its kind, has also begun operations in 2017.

Since the foundation of the UTokyo-IIS, we have been acutely aware that the significance of academic research in engineering lies in its real-world implementation. Not only have we created new academic fields through enhanced specialization and collaboration across disciplines, but we have also developed and deployed technologies that can contribute to solving problems in the real world. In addition, we have made it our mission to develop individuals who will shoulder the responsibility of developing and disseminating technology in the industrial world.
The spirit and the sense of mission of the UTokyo-IIS since its establishment still live on, and we tackle various engineering-related issues in a practical manner as a pioneering organization advocating industry–academic collaboration.

Such achievements and such a proactive stance are widely recognized, along with the name *SEIKEN (short name for IIS in Japanese)*.
We seek to create a new “*SEIKEN* style” as we continue to pursue academic truth as a university research institute, contribute to the creation of new value through innovation, and aim for a multidisciplinary approach integrating humanities and sciences for implementation in the real world.

Although the UTokyo-IIS is the largest university research institute in Japan, it maintains a strong sense of unity as an organization. Using its agility and comprehensive capabilities, the UTokyo-IIS will continue to fulfill its role as one of the world’s top research institutes in the field of engineering. We believe that we will continue to make great contributions to society through research and education.



Five Research Departments and Research Centers

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