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Cover
Based on an *ukiyoé* print depicting a *hanami* (appreciation of cherry blossoms) scene. The kimono patterns and scenery behind the seated beauty reflect the Africa theme of this issue. Can you find the grasscutter from pages 8–11? (Trais/Fujiwara)

Kyoto *into* Africa

Kyoto University researchers have spent over a half-century on the African continent developing a tangled web of relationships. Until now, these have mainly been points of contact among individual researchers or projects, but in 2016, the Interdisciplinary Unit for African Studies ('Africa Unit') was established to organize these into an international network, with Kyoto University at its center. We asked the unit's Chair, Masayoshi Shigeta, and his colleagues about how the unit got its start, as well as future hopes for it to become an international hub for Africa research and education.

Professor Masayoshi Shigeta
Director, Center for African Area Studies
Deputy Executive Vice-President for International Affairs
Kyoto University

Backstage at the lab

Masayoshi Shigeta, Africa Unit chair

Kyoto University and Africa

Africa-related research at Kyoto University is jointly led by the Graduate School of Asian and African Area Studies (ASAFAS) and the Center for African Area Studies (CAAS), as well as the Primate Research Institute, Wildlife Research Center, Laboratory of Physical Anthropology, and department of Human Evolution Studies. Main faculty members span the humanities to the natural sciences, including Motoji Matsuda of the Faculty of Letters, Naoto Ishikawa from Human and Environmental Studies, Hirohiko Ishikawa from the Disaster Prevention Research Institute, and Shinya Funakawa of Global Environmental Studies.

However, according to Shigeta, until recently no one was officially responsible for interdepartmental coordination among existing researchers and research projects. Because many worked in isolation all over the continent, it was possible that they were missing opportunities to obtain large-scale research grants. The Africa Unit was therefore established as a hub for connecting ongoing efforts.

The first step that Kyoto University took was the Africa Anthropoid Academic Investigation (1961–1967), led by Kinji Imanishi, the father of Japanese primatology. As Shigeta says, "There is no mistake that research in Africa at Kyoto University started with primates." Similarly, CAAS was established in 1986 by primatologist Junichiro Itani, with the objective of better understanding Africa through study the ecology of flora and fauna beyond primates, as well as the social and cultural aspects of African peoples, which led to studies covering a broad range of fields.

In the 1980s, as area studies programs got started around the world, it was rare to see natural scientists in an institute such as CAAS. Shigeta explains, "Area studies here is distinctive, similar to how various disciplines, such as agriculture, were deeply involved in Southeast Asian area studies, even before the conception of interdisciplinary studies. African area studies enjoys heavy involvement from the natural sciences, ranging from primate and animal research, together with agriculture."

CAAS attracted a wide range of researchers as Japan's first such center for African area studies. However, to meet the need for a graduate program to help train future researchers, CAAS partnered with the Center for Southeast Asian Studies in 1998 to establish ASAFAS, which subsequently reorganized itself as CAAS in its current form.

Kinji Imanishi (center) and Jinichiro Itani (right)

A new unit and a potential base

Kyoto University has several "units" that are comprised of interdisciplinary

Africa Unit kickoff meeting

research and education projects, but until recently there was no such organization connecting the over 60 Africa-related educators and scholars. Thus the faculty members from ten departments, including Shigeta's ASAFAS, formed a unit to act as a hub connecting Kyoto University to African society.

One major objective of this unit is to connect stakeholders in Africa organically, sharing information accumulated throughout the university, making related efforts more effective. Additionally, by connecting Africa-related researchers in an alumni-like network, the unit hopes to become the university's gateway for research in Africa.

As of May 2016 there were 74 African students representing 53 countries at Kyoto University, and many more alumni who have since returned. Numerous other students and researchers have also travelled to the continent, but despite this multitude of ties, there was no unified organization until the recent formation of the Kyoto University African Alumni Association, established at the same time as the Africa Unit, and creating a platform for students and researchers past, present, and future to exchange information spanning borders and fields of study.

A physical base of operations for the new Africa Unit remains to be determined. Kyoto University has satellite offices in Europe and Asia, acting as gateways for multiple fields of study. A similar physical presence on the African continent may help to increase relations with Africa from research, education, and international relations' standpoints. Shigeta is enthusiastic, saying, "With the establishment of the unit, I want to keep the momentum going in the tradition of interdisciplinary area studies at Kyoto University."

Bringing the world to Africa

Some Africa Unit researchers have fields of expertise lying outside of Africa. One example is Makoto Kimura of the Graduate School of Engineering, who is unusual figure in Africa Unit, as his field of study is civil engineering, focused on basic

Backstage at the lab


Makoto Kimura

research into buildings and structures through geotechnical and foundation engineering. If plans were made to construct a subway in an African city, he would likely be called upon.

Currently, however, Africa has no need for Kimura's expertise in this area. Nonetheless, he has already travelled there almost 80 times, his first contact dating back to the 1980s. He started bicycling the world as a student, and after submitting his Master's thesis he left to cross the Sahara by bicycle in January 1984. At that time he did not have much interest in Africa itself. However, beginning in 1993 and spanning a period of over 20 years, Kimura came to be intricately involved with the continent.

After the Sahara crossing and then becoming an assistant professor at the Graduate School of Engineering, he received an invitation to come to Kenya from colleague Hiroji Nakagawa, who was involved in establishing Jomo Kenyatta University of Agriculture and Technology (JKUAT), which the Japanese government had been supporting since the 1970s. Kimura had just finished his PhD thesis when he was offered a lecturer position at JKUAT, and he spent two months of every year in Kenya until 1998, helping to improve the curricula as a lecturer in civil engineering.


A memento from the Sahara

Japanese government support for establishing JKUAT grew out of a desire to aid Kenyan agriculture — its largest economic sector — but in Kimura's view as a civil engineer, improving agricultural production must be preceded by transportation upgrades. A lack of roads makes going to school, hospitals, and normal life difficult. Kimura saw such improvements to quality of as necessarily tied to solving the problem of poverty. Based on Nakagawa's experience in Kenya, Kimura helped adapt an easy, Japanese road maintenance technique using sandbags. This became a program of the non-profit organization Community Road Empowerment, and is now used in other developing countries worldwide.

Kimura has high hopes for the future of the Africa Unit, saying, "Although there are many researchers focusing on Africa at Kyoto University, my specialty is not Africa itself, but more generally improvements to infrastructure within local communities, which is intimately linked to NPO activities. For both students and researchers in the Engineering Department, there are many challenges to tackle in Africa. The establishment of the Africa Unit will enable interdisciplinary exchange of information, and lead to new ideas. I also want to network with colleagues in agriculture and cultural anthropology. With this in mind, I would like to further Kyoto University's reputation worldwide as an institution for expanding knowledge."

African researchers at Kyoto University

The Africa Unit is an important presence not only for researchers heading to Africa from Kyoto, but also for scholars and exchange students coming to Japan from the continent. Masahiro Kihara of the Graduate School of Medicine approaches epidemiology from a social science point of view. He takes in researchers from all over the world, many of whom are from Africa, to help solve problems in developing countries. Currently, he employs two scientists from the Democratic Republic of the Congo and from Swaziland, who


Road improvement using Kimura's method

are conducting research related to HIV/AIDS.

For Patou Musumari, who came to Kyoto University from the DRC in 2009, Japan was not the country he originally had in mind to pursue his research interests. "The people of Congo think of Europe first as a center of research. I found out about Japan through a scholarship program at the embassy. Until then, the only 'Kyoto' I knew about was the Kyoto Protocol (3rd Conference of Parties of the UNFCCC)." Musumari obtained a degree with support from Kihara, and continues to be productive in the field of social epidemiology.

The other African in the Kihara lab, Bekumusa Lukuhele ('Becky'), came to Japan from Swaziland in 2010. He obtained his Master's degree after one year at Kyoto University, and then completed his PhD in the Inter-Graduate School Program for Sustainable Development and Survivable Societies. He had studied nursing in Swaziland, and had national-level experience in public health. Becky had first came to Japan through a program of the Japan International Cooperation Agency (JICA), and eventually elected to study public health in Kyoto using social marketing. "Before coming to Japan, I was considering Colombia University in New York. I had a Fulbright scholarship as well, but Kyoto University's novel research methods ultimately proved to be more attractive when considering future prospects."

However, Becky also struggled linguistically during his Master's studies, as many of the lectures were held in Japanese. He was surprised by the lack of English knowledge at Kyoto University, as he was able to use English during his stay in Osaka with the JICA program, where he had initially thought, "How advanced! Everyone can speak English." He didn't imagine how different it was going to be in Kyoto.

Further, even if he wanted to connect with other Africans, there was no such network at the time. "I was the very first student from Swaziland that came to Kyoto University. There aren't very many Swazis in Japan either, although this changed with the ABE Initiative (a human resources development program for industry, run by the Japanese government)."

Based on the experiences of these two Africans, and the lack of opportunities for networking, the role of the Africa Unit will be extremely important for future exchange students.

Oussouby Sacko, born in Mali, is the head of the Faculty of Humanities at Kyoto Seika University and obtained his degree at the Faculty of Engineering at Kyoto University. At a kickoff ceremony for the Africa Unit, he addressed the audience representing African Kyoto University graduates, saying, "As an exchange student, it was difficult to make connections that transcended national origins and departments. A network like the Africa Unit is extremely welcome in order to strengthen the connections between African researchers in Japan, as well as between Japan and Africa."

The Africa Unit got off to a good start, hosting the Inaugural African Women Exchange Student Meeting and the African Primatological Consortium Conference shortly after its establishment. With this, the unit has given Africa-related research at Kyoto University an opportunity to leap forward, heralding the arrival of new researchers and the birth of new ideas.

Patou Musumari of the DRC

'Becky' Lukuhele of Swaziland

The genetics of wildlife breeding and conservation

Dr Miho Murayama
Professor, Wildlife Research Center

How can we objectively evaluate the factors that regulate monkey behavior?

This has been the guiding question of Miho Murayama's research career. Now at the Wildlife Research Center of Kyoto University, she actively uses genetics to characterize wildlife ecology, investigating genes that affect animal personality traits, and those useful for identifying kinship. Her work has far-reaching applications for breeding and conservation of animals in the wild.

Please tell us about your wildlife genetics research.

DNA provides a rich source of information concerning animal behavior and ecology. In my lab we extract DNA from animal blood, hair, droppings, and other samples. These data are stored in a database containing detailed information on other biological characteristics, which we then use to discover specific DNA variations, or 'polymorphic markers,' that help identify individual animals and their kinship. We focus on markers associated with or underlying animal behavior and personality traits, which we can use to promote wildlife breeding and conservation.

What attracted you to wildlife research?

In my early days as an undergrad, I scarcely imagined becoming a scientist. I was surprised to learn that many of my classmates were considering becoming researchers, which led me to think deeply about what I really wanted to do. I had visited Arashiyama Monkey Park in Iwatayama many times, where I had observed monkeys acting and behaving like humans, sometimes suddenly start to fight or chase each other. I had no clue why they behaved like that, and I began to wonder if there might be a tangible basis for their actions.

Male Japanese monkeys have a dominance hierarchy. As my work advanced to the doctoral stage, I found that low-ranking males produce a considerable number of offspring, which is not necessarily the case for higher-ranking monkeys. This raised further questions, such

Miho Murayama in her lab

as: what factors other than social dominance influence reproductive success? This inspired me to study monkey social behavior, the factors that determine monkey personality traits, and to do my dissertation on genetic paternity analyses of Japanese macaques.

However, you then applied for a research post at the Shirakawa Institute of Animal Genetics, Japan Livestock Technology Association, where you worked on beef quality…

I really wanted to continue work on primates as a postdoc, but I couldn't get a job as a monkey researcher. Working with wild monkeys is quite different from that with domesticated cattle. At first, I was at a loss as to how to make headway with this new career.

But I gradually found myself being drawn into this new subject. My research involved determining the genetic basis of high-value, marbled beef. I discovered that the ability to produce such meat is determined by an interaction between multiple genes together with environmental factors.

Animal behavior genetics became my life's work. It is mediated not by one, but by multiple genes, in combination with significant environmental influence. I began to feel that the methodology of marbled beef genetics may be similar to behavioral genetics.

What projects have you engaged in since leaving the institute?

Humans and other mammals display unique personality traits, which we understand to be influenced by their genes and their environment. These traits are mediated by genes that regulate neural and hormonal transmissions, and can strongly influence an individual's health. This led to the idea of conducting genetic studies of wildlife to identify their personalities, which I surmised would be useful for predicting health status and mate choice, both important factors for successful breeding and conservation.

Our studies include wild animals, such as elephants, dolphins, zebras, and birds of prey, as well as domesticated animals, such as dogs, cats, horses, and chickens. The work is ongoing, and I hope that our findings will assist in selecting and training animals, such as to serve as police or guide dogs. In addition to personality trait research, I assist with surveys of genetic diversity of endangered species such as the golden eagle, and in a domestication project of a large rodent in Ghana.

A grasscutter being raised at the University of Ghana

Tackling a food shortage in Ghana through animal breeding

The Ghanaian domestication project is a grassroots cooperation initiative sponsored by the Japan International Cooperation Agency (JICA).

Yes, it takes place in the northern part of the Republic of Ghana, West Africa, which is facing a severe food shortage. Due to a reduction in the supply of animal protein, the physical development of children is being greatly delayed in comparison with the south. The harsh, dry climate in the region is not suitable for raising cows and pigs. As an alternative, our project seeks to domesticate and breed 'grasscutters' (*Thryonomys swinderianus*), a rodent species indigenous to the area.

The logo for the JICA-based "Enhancing Livelihoods in Ghana through Improvement in Native Livestock Production" project (© Natsuno Kiyohara)

How do grasscutters taste?

They are about the size of cats and their meat, which is low in fat, has a flavor resembling pork. It is a delicacy among Ghanaians. Typically they capture them wild, but this can lead to an ecological imbalance, and a risk of zoonotic (animal-to-human) infection, which is why we are promoting grasscutter domestication for food purposes.

What role does genetics play in this project?

We are searching for grasscutter gene markers and implementing genome-wide sequencing of genetic variants, which should lead us to genes for docile live-stocking and will aid selective breeding. We are also investigating wild grasscutter diet and health, for which we are analyzing their digestive bacterial flora, pathogenic bacteria, and parasites.

We chose three farmers in each village in the study area, and gave them farm-raised grasscutters and cages. We trained the farmers in breeding, and the project started out well. Several farms produced live pups, and their success encouraged us. But then they reported that the animals suddenly stopped bearing litters. So it might take more time before they can achieve stable production.

What is the farmers' response to the idea of grasscutter rearing and breeding?

They are taking care of the grasscutters very well. The cages are placed in the best spots in their backyards. They also breed chickens and goats, which are mostly unconfined. Keeping animals in a cage is a new idea for them, so some time is needed to get used to this new method of rearing animals.

Could this project possibly develop into a profitable business?

Many European countries are worried about an increase in illegal imports of 'bushmeat' (meat from wild animals) from Africa, because of infection risks and negative environmental impact. Bushmeat is consumed among African immigrants living in Europe, and legally permitting import of a controlled supply could allow a potentially large market to expand. Consequently we are planning to produce canned grasscutter meat products, but many hurdles remain before this plan can be realized. We hope that this will eventually promote safe distribution of food.

An international network for protecting endangered species

Your proposal entitled "International Coordination for Endangered Animal Conservation Based on New Post-Genomic Techniques" has been funded this year by the University's SPIRITS program. What is this project about?

This project promotes genomic analysis of

endangered species for conservation purposes. Specifically, we will gather detailed data on genetic similarities and differences between closely related species and habitat-specific genetic diversities of endangered animals. In Japan, for example, efforts are being made to aid reproductive pairing between crested ibises reintroduced from China. We needed detailed genetic information to determine whether these two similar-looking birds actually belong to the same species. We will collect geo-referenced data, such as biological samples, so that we can gain a better understanding of the genetic specificity and diversity of such species facing peril.

Many overseas organizations and institutions have been promoting genetic research for environmental conservation purposes. The San Diego Zoo in California, for example, maintains a bank of over 40 years-worth of frozen cell cultures collected from almost all of the zoo's animals. Scientists there are using stored cell samples from the northern white rhino to create induced pluripotent stem cells, in an attempt to save this critically endangered species from extinction.

What contributions will your project make in addition to saving endangered species?

If we can understand the genes that underlie stress response, pathogenesis, and fertility, such knowledge will help in achieving stable production of many generations of offspring from zoo animals. We would no longer need to capture wild animals and bring them into captivity. We do not know for certain how such genetic information could be applied to human needs. But for example, wild animals with powerful legs for running or jumping have abilities that are far superior to those of domesticated animals or humans. If we could uncover the genetic mechanisms underlying those abilities, we might possibly be able to apply such knowledge to a better understanding of human physiology.

Do international partnerships play a role in advancing your research?

Yes, international cooperation plays a critical role, for example, in determining the migration ranges of birds, because birds do not recognize national boundaries. I have learned a great deal from research organizations overseas. Many zoos in Europe and the United States have research departments, where staff have ready access to biological samples from the park's animals. In addition, their scientific output can be fed back to the zoo's animal rearing and management strategies. Many zoos also actively exhibit the achievements of their research programs. Inspired by such activities, our Wildlife Research Center has launched a program to coordinate scientific cooperation and networking between many zoos and aquaria in Japan, including the Kyoto City Zoo. The cooperation between researchers, veterinarians, and keepers is mutually beneficial, and should yield scientific findings that promote research projects across the globe.

Kyoto University President Yamagiwa (far right), greeting researchers from the University of Ghana; Drs Yamagiwa and Murayama (far left) are wearing T-shirts bearing the Ghana Grasscutter Project logo

What does Kyoto University's research potential mean to you?

Diversity is a hallmark of Kyoto University, where people from different parts of Japan and many other countries come together to study and conduct research. Diversity in personal preferences, frames of reference, and backgrounds can widen research perspectives. When I attended first-year elective courses at Kyoto University, I met and studied with students from other departments. I still maintain contact and hold interdisciplinary learning sessions with many of them. Access to new ideas and different ways of thinking can help us to think outside of the box.

The Wildlife Research Center that I belong to has been designated as a joint-use organization for research and education. The center hosts visiting researchers from many colleges and universities, providing them with circumstances for mutual intellectual stimulation and learning, and giving the University's scientists rich opportunities to expand their research potential.

Smiling baby monkeys and the roots of laughter

When human and chimp infants are dozing, they sometimes show facial movements that resemble smiles. These facial expressions — called spontaneous smiles — are considered the evolutionary origin of real smiles and laughter.

Researchers at Kyoto University's Primate Research Institute show that this not only happens to higher-order primates like humans and chimpanzees, but also in newborn Japanese macaques, which are more distant relatives in the evolutionary tree.

"About a decade ago we found that chimp infants also display spontaneous smiles," says study author Masaki Tomonaga. "Since we see the same behavior in more distant relatives, we can infer that the origin of smiles goes back at least 30 million years, when old world monkeys and our direct ancestors diverged."

Lead author Fumito Kawakami caught macaque infants smiling when they were receiving routine health checkups. "These checkups can take quite long, so the infants tend to nap in between," says Kawakami. "We took this opportunity to empirically examine the behavior."

In total they observed 58 spontaneous smiles from seven macaque infants, all of which showed spontaneous smiles at least once. "Spontaneous macaque smiles are more like short, lop-sided spasms compared to those of human infants. There were two significant similarities; they both happened between irregular REM sleep, and they show more lop-sided smiles compared to symmetrical, full smiles," says Kawakami. "A major difference, though, is that the smiles were much shorter."

Some researchers have argued that infants' spontaneous smiles exist to make parents feel that their children are adorable and to enhance parent-child communication. On the other hand, this study suggests that spontaneous smiles don't express feelings of pleasure in chimpanzees and Japanese monkeys; rather, the smiles are more similar to submissive signals (grimaces) rather than smiles (play faces). The team interpreted that spontaneous smiles facilitate the development of cheek muscles, enabling humans, chimpanzees, and Japanese monkeys to produce smiles, laughs, and grimaces.

So is smiling special to monkeys and primates? Tomonaga says he won't rule out the possibility.

"There are case reports about mice laughing when they get tickled and dogs displaying facial expressions of pleasure. It may be the case that many mammal infants display spontaneous smiles, in which case smiling would have an older evolutionary origin. Who knows?" he says with a smile. ■

Homosexual termite regicide

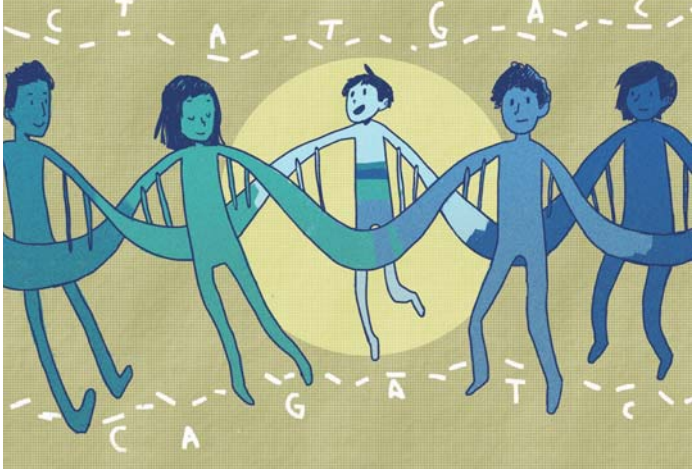
Termites not only raid people's homes, but also the humble abodes of other happy termite couples.

In new research, Kyoto University scientists have found that male Japanese termites form homosexual couples when no females are around — and when the chance arises, they take over a heterosexual couple's nest and kill the male so that one of them can mate with the now spouseless female. The research team's observations support a theory that homosexual couplings in invertebrates have evolutionary advantages.

The evolutionary paradox of homosexuality has long puzzled biologists. Recent research suggests that there are benefits associated with homosexuality, at least for mammals and birds. As for invertebrates like insects, experts have considered that homosexual behavior results from an inopportune misrecognition of males as females. But lead scientist Nobuaki Mizumoto and colleagues discovered that male termites aren't so unobservant; they behaved differently toward males and females, and when coupling with males, they didn't act as though they were mistaking them for females.

"Japanese termites usually make nests in monogamous, heterosexual pairs," says Mizumoto. "In theory, misrecognizing a female for a male in a monogamous mating system should incur considerable costs for reproduction. There had to be some sort of benefit if this were a common behavior."

In the study, published in *Animal Behaviour*, the researchers report that homosexual male termites built nests together, just as with heterosexual couples. "Male termites aren't able to survive on their own, but those that make nests with another male survived for much longer," continues Mizumoto. "This was especially beneficial in situations when searching for females raises the risk of being



Is it your second cousin? Cotton swabs may tell you

The precision of DNA testing portrayed on mystery television shows could soon become reality. With a new technique developed at Kyoto University, a simple swab sample can accurately confirm relatedness between two individuals as distant as second cousins. With more DNA datasets at hand, the method could be utilized to identify disaster victims in mass floods and tornadoes that destroy entire communities.

"Up till now, the accuracy of verifying pairwise blood relations between parents and children were 95 percent and siblings around 72 percent. With slightly more distant relatives like aunts and uncles it goes down to five percent. As for cousins and second cousins, it was practically impossible," says study author Keiji Tamaki. "This new technique brings all of this to nearly 100 percent."

All it takes is a dab inside the cheek with a cotton swab. From these samples they compare 170 thousand single nucleotide polymorphisms (SNP), which are locations where the genetic code varies minutely from person to person. Instead of simply comparing how each individual SNP matches, they also examine how many consecutive matches there are.

"Our inspiration for the project came from tsunami victims in the 2011 Great East Japan earthquake," says Chie Morimoto, who led the study. "Many tsunami victims passed away, and over 70 of them have yet to be identified even though five years have passed."

DNA collected from personal belongings left at home — for example, toothbrushes the person used to use — are reliable material for personal identification. Tsunamis, however, wipe away entire communities, leaving forensic scientists with no direct clues. In such instances, testing for blood relations is the only beacon of hope; but this also had its limitations, because it can only confirm blood relationships between first-degree relatives like children or siblings.

For the time being the team only has enough information for the Japanese population, but with sufficient data the method could be applied anywhere in the world.

"The DNA from the Great East Japan tsunami victims have been subjected to a prolonged period of time, so we won't be able to apply this method immediately to these people," says Morimoto. "At the moment we're making improvements so that we can utilize DNA from degraded samples like these." ■

preyed upon. It's clear that male-male pairing is a strategy for survival."

The team found that once workers from the heterosexual couple's colony began digging tunnels to patrol, a male-male pair would travel back through the tunnel to invade and attempt to kill the heterosexual couple's nest. From genetic analyses of subsequent offspring, the scientists found that only one of the invading males had been able to mate with the female.

"Pairing with another male isn't the best option, but it gives mateless termites a chance to survive until they find a female, if that happens at all," says Mizumoto. "To understand this behavior further, it will be important to consider the effects of other factors such as predators." ■

Drinking green tea to prevent artery explosion

Japan's favorite beverage might be offering more than just a relaxing tea break.

According to new research, green tea could prevent a deadly condition in the body's main artery. A Kyoto University team has found that abdominal aortic aneurysm — a condition in which the main artery becomes overstretched and bloated — developed less frequently in rats that drank green tea polyphenol, a major component of green tea.

Without treatment, abdominal aortic aneurysms eventually rupture and lead to death 50% of the time.

Cutting edge

"Abdominal aortic aneurysms often go unnoticed because there are no symptoms until they burst," says Kenji Minakata, an author of the study. "If a patient is lucky and bloating is found before rupture, it needs to be treated surgically, such as by transplanting an artificial blood vessel or inserting a stent graft. At the moment there are no pharmacological treatments."

Recent research has pointed to a host of health benefits from drinking green tea, including the prevention of cancer, cardiovascular disease, inflammation, and oxidation.

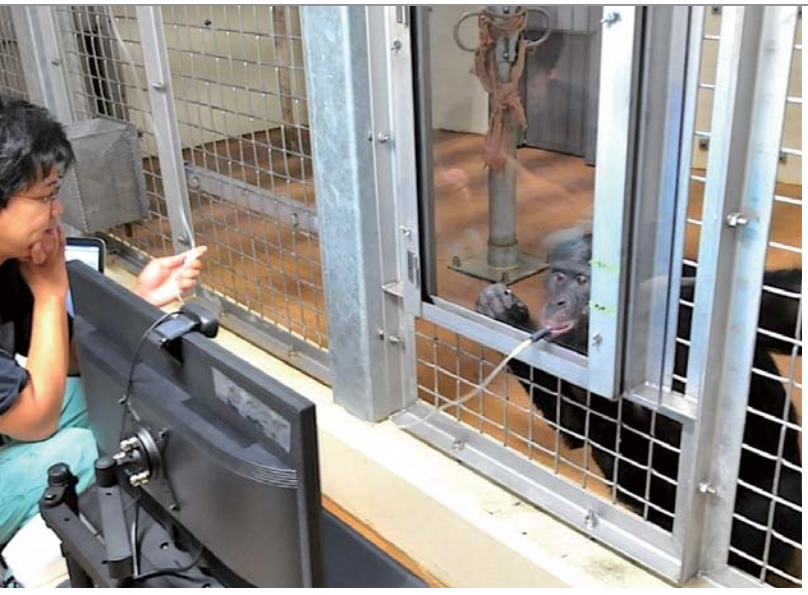
"The type of polyphenol found in green tea has recently been shown to regenerate elastin, an essential protein that gives the artery its stretchy, yet study, texture," explains lead author Shuji Setozaki. "Considering that abdominal arterial aneurysms are caused by inflammation and the degradation of elastin components in the arterial wall, we thought drinking green tea may show promise for treatment."

In the study, the team treated rats with enzymes that induce abdominal aortic aneurysm, and found that the condition developed less in rats that drank green tea polyphenol. They also saw less inflammation and more elastin production, protecting the artery from rupture.

"Japanese people have the longest lifespan in the world, and studies show that 80% of the population drink green tea on a daily basis," says co-author Hidetoshi Masumoto. "We believe daily intake of green tea should be considered as a new preventative strategy for abdominal aortic aneurysm; the focus of future studies will be to investigate optimal doses."

Damage from the 2016 Kumamoto earthquake could hasten Mt Aso's eruption, volcanologists warn. In a paper published in *Science*, Kyoto University researchers and colleagues report on new faults in the vicinity of Mt Aso's magma chamber and volcanic cones, which they say could alter spatial and mechanical properties of the Aso volcano.

Mt Aso is one of the largest active volcanoes in the world. The 16 April 2016 Kumamoto earthquake, study authors say, was a rare opportunity to study



Great apes can "read minds"

A quirky video with ninja swords and ape costumes isn't just for the amusement of people on reddit.

A new study shows that great apes watching such a video can process false beliefs, which is the notion that someone's understanding of a situation may not be congruent with reality. The paper, published in *Science*, challenges the view that the ability to understand unobservable mental states is unique to humans.

In the video, a human and a person dressed in an ape suit are engaged in a hide and seek-like scenario. An eye-tracker on a TV monitor follows an observing apes' gaze, recording where the ape anticipates the action will occur next.

The video was adapted from a typical false-belief test that indicates whether someone can understand that another's actions are not driven by reality, but by beliefs about reality, even when those beliefs are false.

"Say there are two friends — Sally and Bob — and Sally puts her pen into her pencil case," explains Fumihiro Kano of Kyoto University. "She looks away for a moment, and Bob, in the meantime, puts the pen in his pocket. Sally would think the pen is still in her pencil case. This is an example of a false belief.

"Human infants only start understanding the concept of false beliefs after they're about four years old," continues Kano. "Despite their excellent social cognitive skills, great apes consistently failed the false-belief test in previous studies that required them to physically retrieve an object."

The videos and eye-trackers used for this study, on the other hand, were simplified from a version of the test used previously for human infants and great apes; with this design the great apes need only to sit, stare at the screen, and be passive spectators of test videos.

The team, led by Kano and Christopher Krupenye at Duke University, showed this video to chimpanzees, bonobos, and orangutans at Kyoto University's Kumamoto Sanctuary in Japan (pictured) and the Max-Planck Institute in Leipzig, Germany.

"The apes performed very well, even when compared to human infants and adults," notes Kano. "The results indicate that the great apes can predict how the human in the video will make the wrong choice. This shows that apes understand reality-incongruent beliefs, at least when the test subject only needs to watch the video."

"These findings suggest that this essential human skill — to recognize others' beliefs — may be at least as old as humans' last common ancestor with the other apes, which lived 13 to 18 million years ago," elaborates Krupenye.

"This certainly puts to question the notion that the human psyche is unique and superior to other animals," adds Satoshi Hirata, senior author of the study. "With similar eye-tracking techniques we'd like to start testing great apes' imagination and ability to predict things that will happen further in the future."

how faults form in the vicinity of volcanoes.

"Our survey group went to the epicenter area one day after the event and continued field work for the past half year after the earthquake," says Aiming Lin of Kyoto University, who led the study. Drone footage (pictured) was used to document surface ruptures.

The Kumamoto earthquake enabled the researchers to do a before-and-after comparison of fault distribution in the area. Field investigations, seismic data, and analysis of high-resolution Google earth images show that the earthquake produced new faults and surface ruptures.

Some of these cut into the Aso caldera but terminated there.

"Magma is fluid so it absorbs stress. That's why the damage — the surface ruptures — shouldn't travel any further," says Lin. "Large earthquakes often accompany or precede volcanic eruptions. The presence of magma does have an association with the distribution of active faults. But whether volcanoes affect the formation of new faults following an earthquake has remained unclear due to a lack of case studies.

"Our findings show that propagation of ruptures from this earthquake terminated in Aso caldera because of the presence of magma beneath the Aso volcanic cluster."

The newly formed co-seismic ruptures under Aso caldera are potential new channels for magma venting, thus changing the physical dynamics of Aso volcano, such as where pressure is concentrated. These then influence factors like the nucleation of interpolate earthquakes, seismicity patterns, source rupture processes, strong ground motion and recurrence behavior of fault segments. The study results, the authors write, could play an important role in reassessing the volcanic hazard around Aso.

And Mt Aso actually did erupt 8 October 2016, after the research team had submitted the paper.

"We were amazed that Aso erupted after 36 years of dormancy, as we had just documented in this paper how the new faults changed the spatial and mechanical dynamics of the volcano," says Lin.

Mt Aso could erupt much sooner, scientists warn

Aging bonobos in the wild could use reading glasses too

As people age, they often find that it's more difficult to see things up close. Reading a newspaper suddenly requires a good pair of reading glasses or bifocals. Now, researchers reporting in the Cell Press journal *Current Biology* find that the same goes for bonobos, one of human's closest primate relatives along with chimpanzees, even though they obviously don't read.

This long-sightedness in bonobos is most evident as older animals engage in grooming their peers, the researchers say. The older they get, the longer they stretch their arms from the rest of their bodies as they groom.

"We found that wild bonobos showed the symptoms of long-sightedness around 40 years old," says Heungjin Ryu of the Primate Research Institute of Kyoto University. "We were surprised that the pattern found in bonobos is strikingly similar to the pattern of modern humans. This suggests that senescence of the eyes has not changed much from the Pan-Homo common ancestor, even though the longevity of modern humans is far longer than that of chimpanzees and bonobos."

Ryu says that researchers had already noticed this trend of bonobos needing longer distances for grooming before. There had also been anecdotal reports in chimpanzees. It's just that no one paid much attention to it.

"One day, I was with another researcher and observed the oldest male bonobo Ten (TN) grooming Jeudi (JD)," Ryu recalls. "TN had to stretch his arm to groom JD, and only when he found something on JD's body would he come close to remove it using his mouth. It was funny to see how he groomed."

While it might have looked amusing, the researchers began to appreciate that this long-sightedness, caused by a decline in the refractive power of the crystalline lens with age, might also have serious consequences for the survival and social lives of those older animals.

To learn more, the researchers used digital photographs to measure the grooming distance of 14 wild bonobos of various

ages, ranging from 11 to 45 years old. They also examined how grooming distance varied in relation to age and sex in bonobos and compared it with the nearest focus distance in humans.

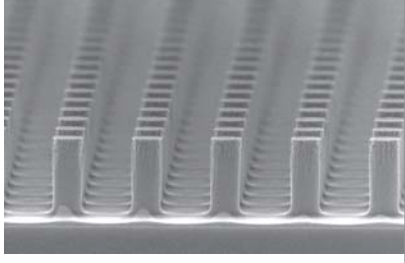
The measurements showed that the grooming distance increased exponentially with age. In one case, an old video of one of the bonobos, named Ki, enabled them to show that his eyesight had worsened over time.

"The results we found were very surprising even for us," Ryu says. "When I started to collect data, I did not expect that age could be such a strong predictor of long-sightedness."

Ryu says that long-sightedness might hinder the social lives of older individuals, explaining why older individuals aren't favored when it comes to selecting grooming partners. People who grow long-sighted with age also have particular trouble seeing in the dark, he adds. That could be a big challenge for the bonobos, living as they do in the shade of the rainforest canopy.

As for us humans, the findings in our bonobo relatives suggest that long-sightedness isn't a consequence of the modern lives we lead and all that time spent reading or staring at a screen. Rather, it's a natural process of aging rooted deep in our past. Ryu says that they plan to continue studying aspects of aging in bonobos to learn more about them and us. ■

A big nano boost for solar cells



Solar cells convert light into electricity. While the sun is one source of light, the burning of natural resources like oil and natural gas can also be harnessed.

However, solar cells do not convert all light to power equally, which has inspired a joint industry-academia effort to develop a potentially game-changing solution.

"Current solar cells are not good at converting visible light to electrical power. The best efficiency is only around 20%," explains Kyoto University's Takashi Asano, who uses optical technologies to improve energy production.

Higher temperatures emit light at shorter wavelengths, which is why the flame of a gas burner will shift from red to blue as the heat increases. The higher heat offers more energy, making short wavelengths an important target in the design of solar cells.

"The problem," continues Asano, "is that heat dissipates light of all wavelengths, but a solar cell will only work in a narrow range.

"To solve this, we built a new nano-sized semiconductor that narrows the wavelength bandwidth to concentrate the energy."

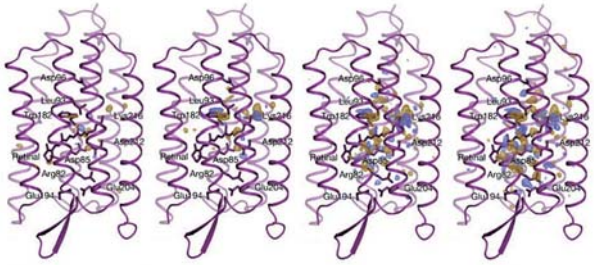
Previously, Asano and colleagues of the Susumu Noda lab had taken a different approach. "Our first device worked at high wavelengths, but to narrow output for visible light required a new strategy, which is why we shifted to intrinsic silicon in this current collaboration with Osaka Gas," says Asano.

To emit visible wavelengths, a temperature of 1000˚C was needed, but conveniently silicon has a melting temperature of over 1400˚C. The scientists etched silicon plates to have a large number of identical and equidistantly-spaced rods (pictured in an electron micrograph), the height, radii, and spacing of which was optimized for the target bandwidth.

According to Asano, "the cylinders determined the emissivity," describing the wavelengths emitted by the heated device.

Using this material, the team has shown in *Science Advances* that their nanoscale semiconductor raises the energy conversion rate of solar cells to at least 40%.

"Our technology has two important benefits," adds lab head Noda. "First is energy efficiency: we can convert heat into electricity much more efficiently than before. Secondly is design. We can now create much smaller and more robust transducers, which will be beneficial in a wide range of applications." ■



Proteins at the movies

Proteins twist and contort as they go about their work. And now scientists have found a way to film these nuanced movements, as reported in the journal *Science*.

In research conducted at SACLA, Japan's XFEL (X-ray free electron laser) facility, membrane protein folding has been captured for the first time in 3D and at a single-atom level.

Membrane proteins are popular drug targets, as they are exposed to the environment surrounding the cell. Capturing their movements in video, the authors say, is potentially a revolutionary step forward in drug development.

Lead author Eriko Nango of Kyoto University explains that, whereas conventional X-ray crystallography only captures static protein structures, SACLA has enabled the team to observe minute changes in protein structures during transformation.

"With XFEL, we can get diffraction images of protein structures using crystals that are merely a few micrometers in size. SACLA's laser pulses are extremely short, lasting less than 10 femtoseconds, exposing the protein crystals to minimal radiation damage," says Nango.

The technique enabled the team to observe proteins before deformation from radiation, and also take 'snapshots' in time increments shorter than previously possible, later assembling these into time-lapse movies.

Nango elaborates, "It's like being able to add extra pages to a flip book animation, so that you don't lose track of very fine, detailed movements."

In the study, the team observed *bacteriorhodopsin*, a membrane protein of microorganisms that live in hyper-salty conditions.

"Bacteriorhodopsin releases hydrogen ions — essentially protons — outside the cell in response to light," says corresponding author So Iwata of Kyoto University. "The movement

The sea roils and life returns

The tsunami of 2011 is well remembered in Japan. Some towns have recovered, while others struggle to return to a life that once was. The same is true for ecosystems. In a study in *PLOS ONE*, Japanese researchers report how the sea life in different coastal regions of Japan struck by the tsunami have flourished or faltered.

"We watched in real time an ecosystem recover from a large natural disaster," said Reiji Masuda, who directs the Maizuru Fisheries Research Station at Kyoto University and led the study. "We could observe how species recovered and whether any invading species could thrive."

Even though, like the rest of the country, the authors were still in mourning in 2011, they also recognized the uniqueness of the opportunity and set up four research stations in Eastern Japan within two months of the tsunami. They then continued to collect data for the next five years.

"We found a very logical progression. First, small fish with short lifespans thrived, but gradually larger fish with longer lifespans began to recover, stabilizing the populations of the small fish. Also, body lengths got longer over the years, suggesting that the environment was supporting healthy recovery."

The smaller fish recovered first because of their short reproductive cycle and the absence of predators. Another reason for their recovery, hypothesizes Masuda, was the new abundance of food.

"Many small fish survive off nutrients and sediments. The tsunami brought in a rich buffet from the land, and this could feed the fish."

Interestingly, the authors of the study did find a brief period of invasion. Species typically associated with southern climates were found in the stations until the later years of observation, when cold-water species began to stabilize and likely begin to prey on the aliens. Indeed, invasion was greatest at the stations located in areas that suffered from the greatest destruction.

While Masuda's interest is primarily in marine life, he sees a bigger purpose for the research. "Japan suffers from many natural disasters, including tsunami and earthquakes. As marine biologists, we want to know how sea life recovers. But we hope our findings will help Japan prepare for disasters on land or sea." ■

of these protons is always one-way. How it's pumped out of the cell, but not back in, has puzzled scientists for fifty years."

The team designed a device to shine lasers in the range of visible light, in order to capture bacteriorhodopsin's reactions immediately after light exposure.

In 13 images taken between one nanosecond and one millisecond after irradiation, the researchers found that bacteriorhodopsin goes through four transformations before returning to its default form. As the protein reshapes, amino acid residues in its vicinity move toward the inside of the cell, being replaced by water molecules that pass protons to amino acid residues in the cell's exterior.

"Membrane transport proteins are everywhere in biology," continues Iwata. "This new experimental method is a game-changer for research in the life sciences, because we can now investigate protein structures, including their motion, in much greater detail." ■

Safety in darkness

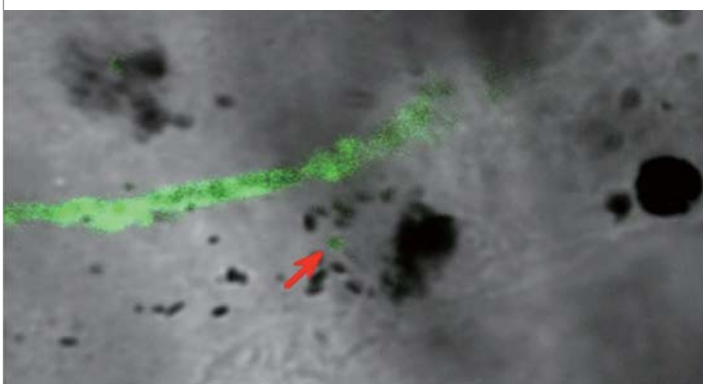
With a little help from chickens and video cameras, scientists have captured live the moment when skin gets darker. In a study appearing in *Scientific Reports*, a Japanese team has filmed and demystified the process by which melanin — molecules that give skin its color — are carried to the epidermis.

"Our study settles a long-standing debate about how melanin is transported from *melanocytes*, cells where it is synthesized, to *keratinocytes*, cells which it protects in the actual body," says Ryosuke Tadokoro of Kyoto University's Graduate School of Science, who led the study.

Melanin pigments protect the skin from DNA damage by surrounding — and thus guarding — the nuclei of keratinocytes.

"The melanin production process has been extensively studied, but since it needs to travel somehow, it's also crucial to understand the transport process in order to develop effective dermatological treatments," explains Kyoto University's Yoshiko Takahashi, senior author of the study.

"In our experiments, we mimicked in 3D how cells are actually organized. We also used chicken tissue, which is similar to ours in terms of how melanocytes are distributed throughout the skin."



Using a new in-house fluorescence imaging technique, the team found that melanocyte membranes form 'blisters', which become vehicles for carrying *melanosomes*. Once the cargo is loaded, these structures pinch off, migrate (pictured), and are 'eaten' by keratinocytes. The melanosomes then enter the cells and surround their nuclei, protecting them from damage.

"Controlling skin pigmentation is crucial for protecting our skin from UV damage," continues Takahashi, pointing out that vesicle formation and the proteins necessary for it are analogous to how cancer cells spread to different parts of the body.

"This finding, while just a first step, could have significant implications in cosmetic contexts and in studies of depigmentation syndromes and skin cancer." ■

WINDOW to ASEAN

Kyoto University ASEAN Center

Reflecting and responding to major contemporary issues in the ASEAN region, Kyoto University has advanced a wide range of projects over the years, developing diverse programs for students and researchers. The University's ASEAN Center promotes research, education, and international collaboration to develop the region's potential through integration of academic networks and the cultivation of human relationships based on a sense of connectedness. The center acts as an open window to bring students and researchers together from across the broad spectrum of ASEAN.

Kyoto-ASEAN Forum 2016
In September 2016, the first "Kyoto-ASEAN Forum: WINDOW to ASEAN" was held in Kuala Lumpur, Malaysia to explore new horizons in collaboration. Bringing together more than 250 students, researchers, government officials, and news media representatives from Japan and ASEAN, the forum served to connect academia and society, with benefits for the global community. Y B Khairy Jamaluddin, Minister for Youth and Sports in Malaysia, highlighted mutual cooperation for innovation in his remarks, saying, "We can learn from Japan about creating better fabrics and better biomechanics analysis because only innovation can make us better at something."

Southeast Asia Network Forum
In addition to its work region-wide, the Center is strengthening country-wide networking through its annual support for the Southeast Asia Network Forum in Indonesia, Malaysia, Myanmar, and Thailand held in collaboration with the Center for Southeast Asian Studies at Kyoto University. This forum contributes to growing the University's alumni networks in ASEAN, and advancing academic cooperation as well as cultivation of talented and ambitious students and researchers.

H E Aung San Suu Kyi receives honorary doctorate
A culmination of historical ties between Kyoto University and Myanmar came in November 2016, when H E Aung San Suu Kyi, Myanmar's state counselor and foreign minister visited Kyoto to receive an honorary doctorate in recognition of her outstanding achievements in promoting freedom and democracy in Myanmar and around the globe. After a ceremony, Daw Aung San Suu Kyi participated in an open dialogue with students, eight coming from faculties and graduate schools related to international politics or involved in exchange with Myanmar. Daw Aung San Suu Kyi answered their questions carefully, and the crowd of around 150 were treated to an inspiring discussion in a friendly and relaxed atmosphere.

A lasting legacy and its horizons from Kyoto to ASEAN
A global ethic based on humans and society can be observed in the spread of networks between Kyoto and ASEAN. The late Professor Tetsuro Watsuji (1889–1960) left a legacy of philosophy for exploring the horizons of networking: the ethical concept of "betweenness (*aidagara*)", the space which people occupy, and in which the various crossroads of relational interconnections are established (*Stanford Encyclopedia of Philosophy*). Even in this global and industrialized era, Kyoto University's history with ASEAN reminds us of lasting, shared values of *betweeness* and *connectedness* among individuals and across the ages.

Spanning the “Hexagon”

Kyoto University European Center, Heidelberg Office

The Heidelberg Office’s activities are tightly interwoven with the HeKKSaGOn network, a German-Japanese university consortium between Heidelberg University, Kyoto University, Karlsruhe Institute of Technology, Tohoku University (in Sendai), the University of Göttingen, and Osaka University. Established in 2010, the name comes from the initials of the six universities’ cities.

From its outset, HeKKSaGOn has promoted research, education, and innovation in science, technology, industry, and culture, working through exchanges of researchers and students, and organizing seminars, workshops and summer schools. A conference for presidents and rector is held every 18 months, alternating between Germany and Japan. By talking face to face, the leaders can move quickly to manage effectively. For example, a student workshop was held for the first time at the 5th conference in September 2016, following on a suggestion for student participation by President Juichi Yamagiwa during the 4th conference.

HeKKSaGOn’s core collaborations revolve around nine research areas, jointly hosting seminars and collaborating on papers in a wide range of fields such as Life and Natural Science, Social Science and Humanities, Disaster Risk and Response, and Robotics. Reflecting a philosophy rooted in highly advanced research, HeKKSaGOn’s mission statement affirms, “It is the responsibility of the scientifically and technologically advanced nations to find solutions not only for their own countries but on a global scope.” These nine research foci also gather at the leaders’ conference to reaffirm their missions.

The Heidelberg Office also supports academic and student exchange among HeKKSaGOn members, acting as a liaison between Japanese representatives and German counterparts. The office now strives to expand its horizons beyond HeKKSaGOn and into the rest of Europe, Asia, and Africa.

Hoya on the menu: exploring evolution with ascidians

FY2015 Kyoto University President's Award recipient

Kana Waki (3rd Year, Doctoral Program, Graduate School of Science)

Ms Waki draws for a hobby, and her pictures adorn the covers of research meeting minutes and the lab door. "I take care to depict their forms accurately."

Sea-dwelling ascidians (*hoya*) are considered a delicacy, loved by many for their unusual, addictive flavor.

"The edible species of ascidian is the 'sea pineapple' (*Halocynthia roretzi*), which lives in the coastal waters of Japan and Korea. For my research I also use the 'vase tunicate' (*Ciona intestinalis*), which lives in oceans across the globe. It may be unfamiliar to many, but it is a model organism for study.

"I had never even heard of the sea pineapple before coming here," smiles Ms Waki, her eyes turning into crescents.

Ms Waki's research began with a simple question: how did the human body evolve and take on the form it has today? —But then why are ascidians, which look nothing like us, used to study evolution?

"Their larvae are like tadpoles, and their body structure is extremely close to that of humans." Soft-bodied ascidians, which belong to the same chordata phylum as us, are actually close relatives to vertebrates.

For a fertilized egg to divide and form many and varied cells, its genes need to work in the right place at the right time.

"The reason I focus on ascidians is that we know their entire cell lineage, that is, which cells differentiate into which tissues."

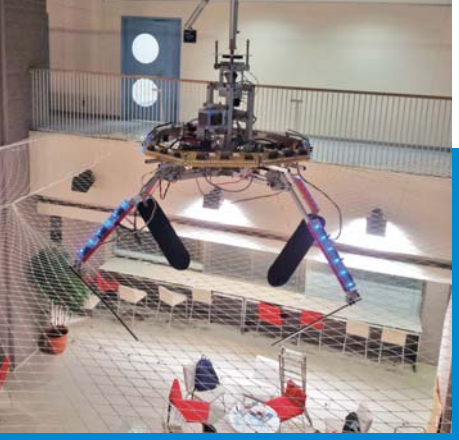
Ms Waki focuses on sensory neurons. Vertebrates and invertebrates typically have different neuron differentiation mechanisms, but ascidian larvae appear to have both: vertebrate types on the dorsal side and ventrally, invertebrate types. Investigating the genetic pathways, she has found that, although the sensory neurons on both sides were differentiated by the same gene, the mechanisms differed.

Her experiments have revealed the process by which vertebrates obtained a new mechanism for sensory neurons based on the neurons of invertebrates, a discovery that is "packed with clues explaining how living creatures evolved from their ancestors."

"It has been tough at times, but I'm glad I persevered," she says, her smile returning.

Inspired by a love for living creatures, she says, "Next I want to study another species and compare its genetic pathways to hoya. The higher the organism's order, the more genes there are, increasing the difficulty. But I really savor the challenge."

Adult vase tunicates (right) are bred for research. Larvae (left) adhering to petri dishes are transported to the Kyoto University Maizuru Fisheries Research Station or the University of Tokyo's Misaki Marine Biological Station, and raised in the sea for one to two months. Once grown, they are shipped to researchers nationwide. "We receive a delivery of new ascidians every week."



The giant "UFO Catcher" claw suspended in the atrium. It covers an area of around 10-by-20 meters.

A round, plastic card acts as a key for the workshop door. Club members built their own auto-lock system with 3D-printed parts, reflecting a club policy of self-reliance. Each spare key cost about 20 yen. "We used plastic because we couldn't afford to make metal keys for all of our members."

"Making robots means giving shape to your ideas. That moment when the image in your head takes shape and starts to move just feels wonderful."

The Yoshida dormitory annex workshop, which Shinji Minato is showing us, is strewn with aluminum scraps, gears, and other bits one assumes will become part of a robot.

Emulating Kyoto University's spirit of academic freedom, the Mechatronics Creators' policy is "to be free." Some club members may spend an entire year creating a single large robot, while others may make multiple small ones.

"We deliberately don't take part in NHK's Robocon[1], which most robot enthusiasts follow closely. It takes nearly a year to make a robot that'll win a contest. Rather than competing, we prefer valuing creativity and giving form to our ideas."

In the absence of a competition objective, many unique robots have been brought to life by the club. In particular a giant, 1.5-meter long crane-game claw, which was on demonstration at the November Festival, brought passersby to a halt. The sight of the moving crane suspended from the ceiling of the Yoshida-South Academic Center Building elicited exclamations of surprise.

"Making robots is something we do for our own enjoyment, but it is even better when we can share our ideas and make other people think, isn't this fun?"

Mr Minato's dream is to help popularize robots in society. "I dream of an era in which there is a humanoid robot in every home. I'd like to design one myself."

In the present, most robots in use in society are industrial. In recent years, however, robots that blend in with our lives and can communicate with humans — such as RoBoHoN[2] and Pepper[3] — have emerged.

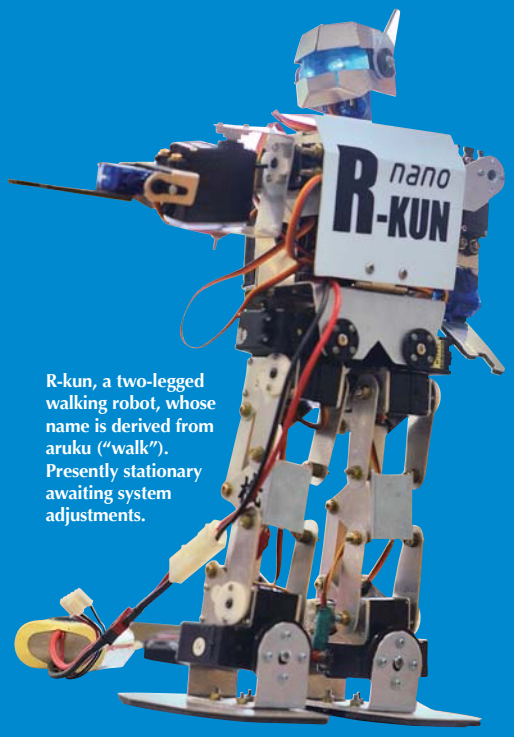
"Their appearance has made it easier to imagine a future in which robots will be part of our daily lives. It is exciting to realize that the dream I envisage is getting closer."

The clear, bright eyes of the polite Mr Minato make us also yearn for this future.

1 NHK Student RoboCon: a robotics contest organized by national broadcaster NHK and NHK Enterprises. Contestants build robots according to an assigned theme and compete on the basis of their technological skills and originality.

2 RoBoHoN: a small humanoid robot that can walk on two legs, developed by Sharp Corporation in collaboration with robot creator Tomotaka Takahashi (Kyoto University graduate).

3 Pepper: a commercially available humanoid robot that speaks and perceives emotions, developed jointly by Aldebaran Robotics SAS (now SoftBank Robotics Europe) and mobile operator SoftBank Corp.



R-kun, a two-legged walking robot, whose name is derived from aruku ("walk"). Presently stationary awaiting system adjustments.

Shinji Minato (3rd Year, Undergraduate School of Engineering Science, Faculty of Engineering)

Creator's dream: a robot in every home
Kyoto University Mechatronics Creators

Global outreach

Office of Global Communications

With a focus on relaying the university's research output to domestic and international audiences, the university's Office of Global Communications got started in October 2015. Visit us at Public Relations in the historic Clock Tower building, or reach us via <comms@mail2.adm.kyoto-u.ac.jp> or @KyotoU_News or facebook.com/Kyoto.Univ.E

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A Fund to help us grow

Since its founding in 1897, Kyoto University has been committed to a spirit of openness and academic freedom that pervades all levels of academic life, from freshman courses to research in world-leading laboratories.

Protecting and promoting this freedom, and encouraging students to reach even further, is the highest goal of the institution.

The Kyoto University Fund provides an avenue for university stakeholders — from members of the local community to businesses and corporate sponsors — to support these students, their efforts, and their learning and study environment. In addition to a main, central fund, special-purpose funds are targeted toward particular activities and fields of research.

One example is the SPEC (Student Projects for Enhancing Creativity) fund, in which student r&d projects selected through a contest received development funding.

Making dreams a reality for students and researchers throughout the institution: this is what the Fund makes possible.

For details on types and levels of support, as well as payment methods, please see the website below. Your generous support of the university is most greatly appreciated.

Kyoto University Fund

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Artwork by Kyoto University students, combined with artistic scenes as glimpsed by researchers.

もどかしくて、届かなくて、
圧倒的に足りなくて、ほんの少し寂しくて、
それでも舌を、喉を、指を、目を耳を君を使うのは、
不自由の愛しさがここにあるから。

So frustrating, not getting through
So overwhelmingly inadequate
Just a little sad and lonely
And yet my tongue, my throat, my fingers,
My eyes, my ears, yearning for you
Because of the crippling affection
I have for you

Creators' Club "Meisho-Mitei"
Kozakana (pen name)
(2nd Year, Faculty of Integrated Human Studies)

I find words so difficult to use. Telepathy would be so much easier. As science progresses, perhaps words will gradually disappear. However, I think that novels and poetry will live on, which is likely due to our affection for words.

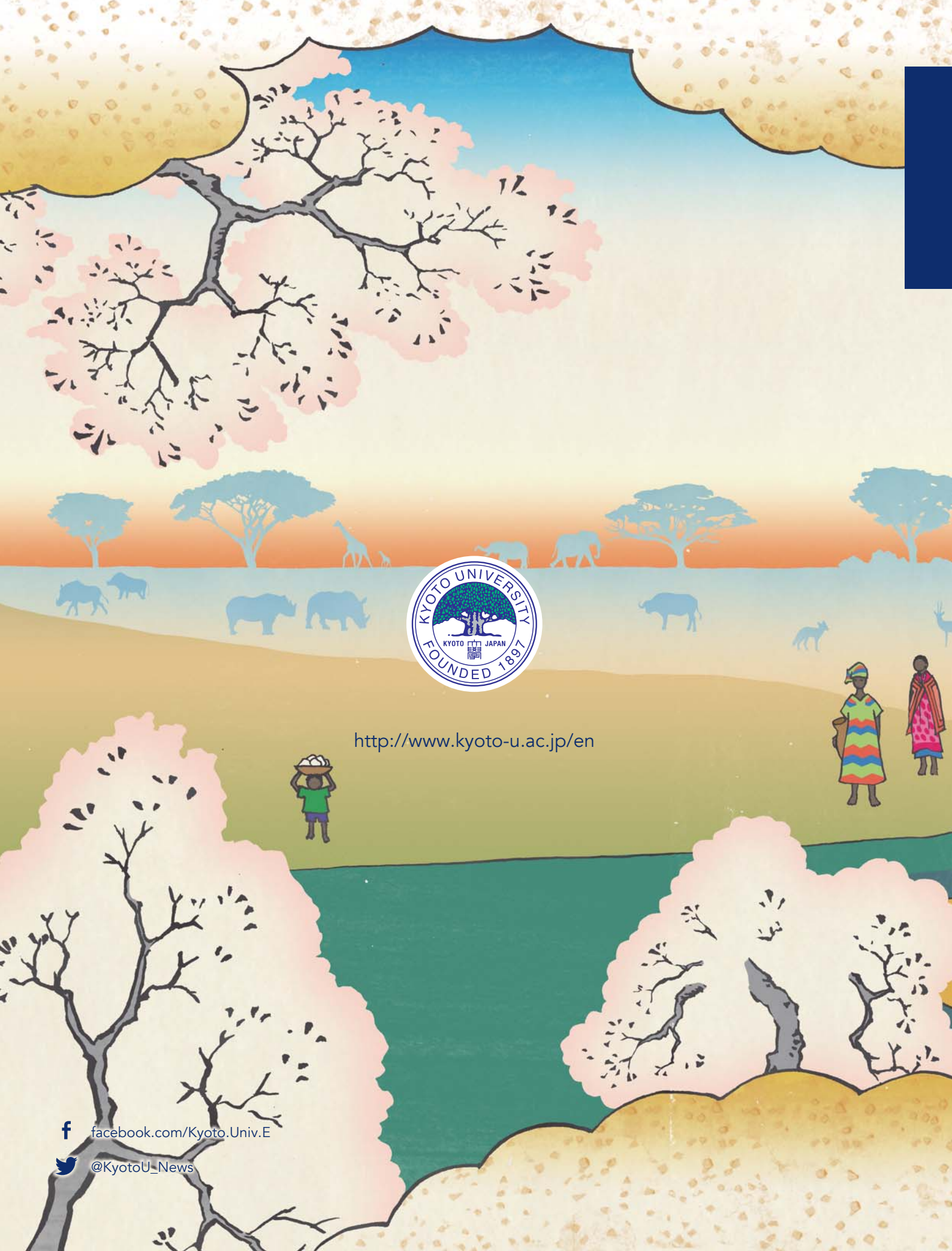
Art Club
Kohei Kurata
(1st Year, Master's Program, Graduate School of Agriculture)

When I have something important to tell someone, I meet and talk directly or over the phone. Telephone calls, letters, or (like in the picture) media that show the figure of the communicator — or traces of them — are special in any age.

Eifukai Japanese Music Club

Title: *Samushiro* Music: Ariwara Koto Lyrics: Unknown

The heart of a woman, waiting in futility for a man who has left her, is depicted in contrast to a vibrant autumnal scene. The festive mood may sound out of place, but perhaps it is precisely this kind of atmosphere that accentuates the loneliness of the solitary figure.



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