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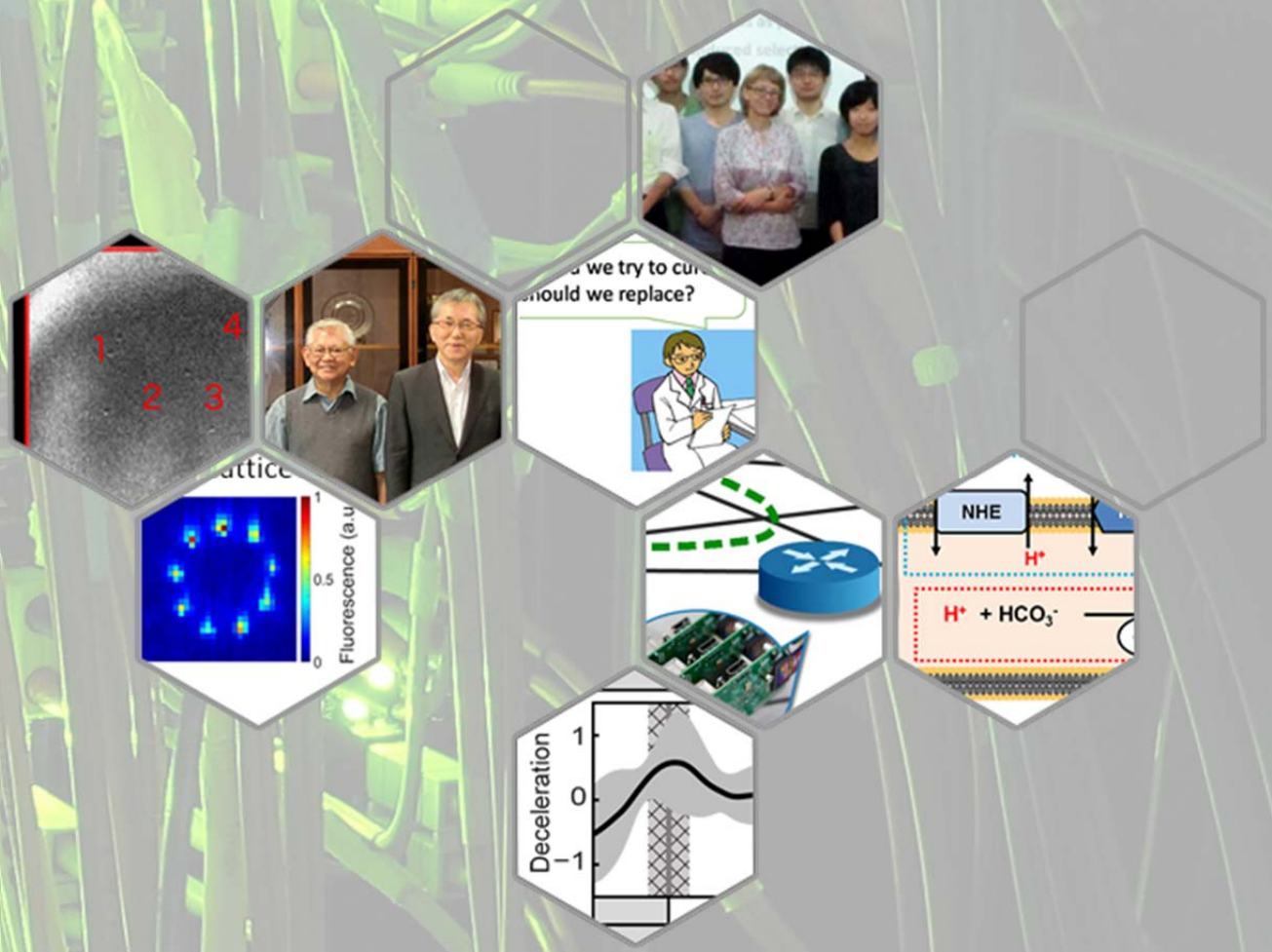
UEC e-Bulletin

Updates on research, innovation, and events at UEC:
Unique and Exciting Campus in Tokyo

Vol.11, September 2016



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Feature

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News and Events

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Medical optical imaging: Innovative near infrared bioluminescent probes for deep tissue imaging

Shojiro Maki
Assistant Professor
Department of Engineering Science, Graduate School of Informatics and Engineering

Medical treatment of diseases: Transition from cure to replacement

Advances in medical research have changed society through the ages. For example, the discovery and mass production of antibiotics revolutionized the treatment of tuberculosis and other diseases so-called incurable diseases. But what does the future hold in medical research and technology? Scientific reports indicate that advances in iPS research and related regenerative medicine will change our approach to treatment of intractable diseases such as ALS, and other global challenges including cancer, Ebola, SARS, and infectious diseases such as avian influenza.

"In the 21st century medical treatment will change from medical cure to medical replacement," says Shojiro Maki. "Regenerative medicine will enable the replacement of organs with congenital abnormalities. For example, type I diabetes will be cured by combining order-made personalized medicine with regenerative medicine. I want to contribute to this future by developing high precision 'optical in-vivo imaging technology' using for visualization of deep parts of the body far from the skin."

Optical in-vivo imaging technology

Conventional in-vivo optical imaging employs optical probes made of natural firefly bioluminescence with wavelengths of about 560 nm. The major problem with such probes is that this wavelength of light is mostly absorbed by biological materials (in particular blood) and does not reach the outside of the body where is could be detected with CCD cameras.

To overcome these shortcomings, Maki and colleagues used synthetic organic chemistry to produce firefly bioluminescence substances artificially, and importantly, they extended the wavelength to about 675 nm with their luciferin analogue called AlaLumine-HCL (Tokeoni). This wavelength yielded a major improvement of the in vivo transmission of 675 nm light, enabling the measurement of cancer cells metastasized to the lungs in mice, which was not possible with conventional light probes.

"Our 675 nm probes are a major advance in medical research," says Maki. "This material is AkaLumine (Wako Pure Chemical Industries, Ltd.) and is commercially available from Tokeoni (Sigma-Aldrich Co. LLC.). See Fig.1.

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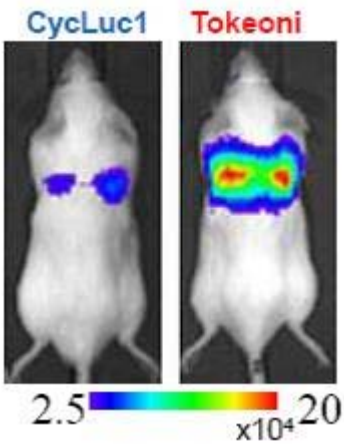

Fig. 1: Tokeoni is brighter than Cycluc 1.

Future in vivo imaging technology

Maki and colleagues want to use this 675 nm imaging technology for basic research on regenerative medicine. "For example, we could create a new human liver using iPS technology," explains Maki. "The nurture it in the body of a pig, and when it is of the appropriate size, return it to a human. I envisage demand for this type of medical transplantation." Maki adds that realization of this technology would enable liver and heart transplantation to be performed in Japan without having to go overseas, and personalized medicine would reduce the amount immunosuppressive drugs used.

To achieve these goals it is necessary to develop high precision in-vivo imaging technology. Specifically, it is necessary to use high luminescent long wavelength light-emitting substrate and an appropriate optical enzyme (luciferase) both specially designed for the organs of pigs.

"We have already produced promising near infrared luciferin analogues," says Maki. "And patents for the appropriate light-emitting enzymes have been filed by collaborators at RIKEN (Japanese Patent Application No. 2016-165053). But the problem we have now is that the sensitivity of the existing equipment to long wavelengths is low, and the pigs cannot enter the measuring chamber."

Currently, we are planning a kick off meeting to launch a new 'pig optical imaging project' in collaboration with experts with in depth knowledge of conducting experiments with pigs, (Shizuoka Prefecture, small and medium-sized livestock research center) and staff at a measurement instruments company (Berthold Japan Ltd).

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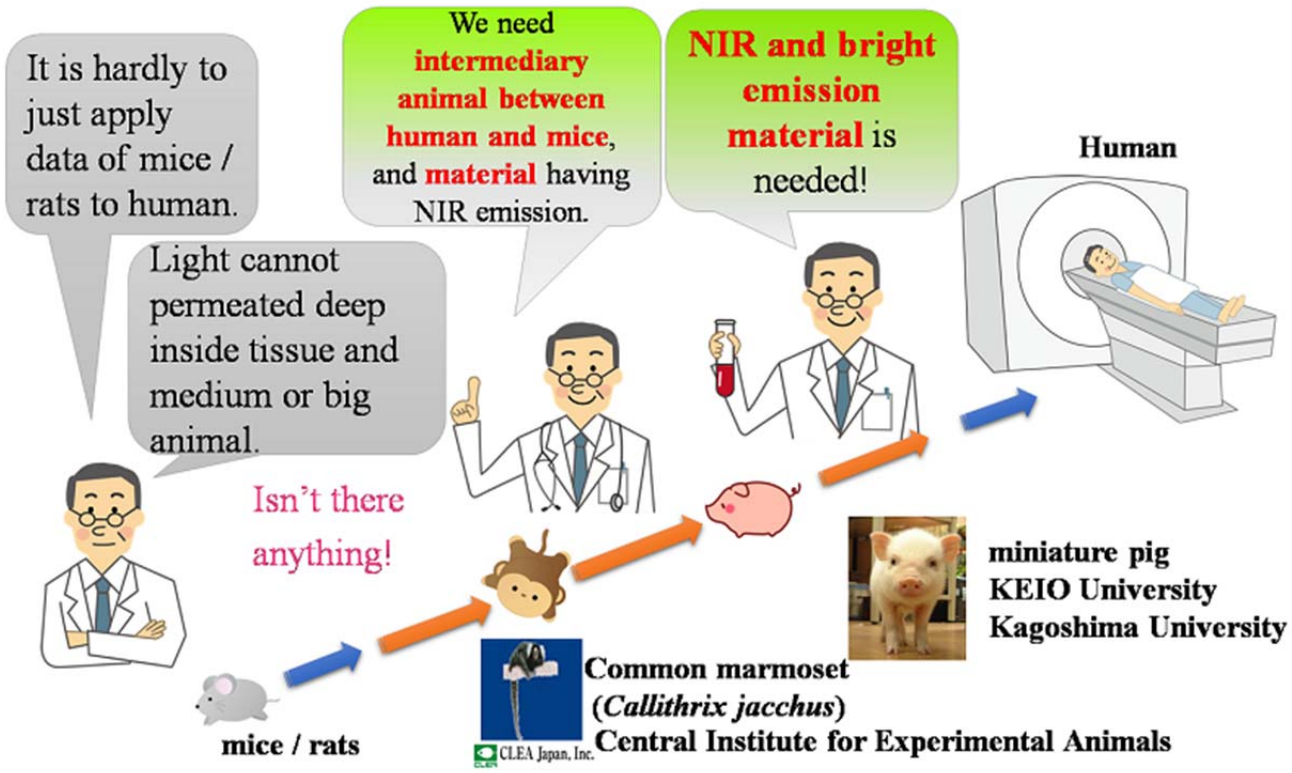
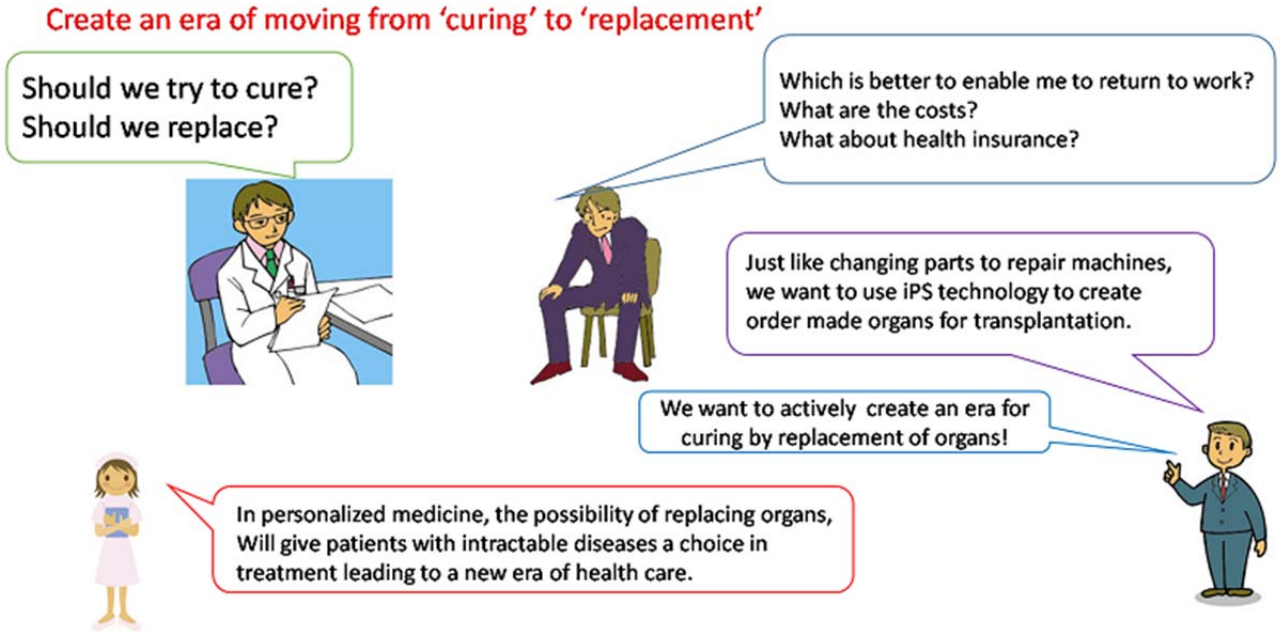


Future of medicine



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   Authors and affiliations
   Takahiro Kuchimaru, Shun Mitsumata, Tetsuya Kadonosono & Shinae Kizaka-Kondoh: School of Life Science and Technology, Tokyo Institute of Technology, 4259, Nagatsuta, Midori-ku, Yokohama 226-8501, Japan.
   Satoshi Iwano, Masahiro Kiyama, Haruki Niwa & Shojiro Maki: Graduate School of Informatics and Engineering, The University of Electro-Communications, 1-5-1 Chofugaoka, Chofu, Tokyo 182-8585, Japan.
2. **"Multicolor bioluminescence obtained using firefly luciferin"**, *Current Topics in Medicinal Chemistry*, 16 (24), 2648-2655, DOI: 10.2174/1568026616666160413135055, http://benthamscience.com/journals/current-topics-in-medicinal-chemistry/volume/16/issue/24/,
   Masahiro Kiyama, Ryohei Saito, Satoshi Iwano, Rika Obata, Haruki Niwa and Shojiro A Maki: The University of Electro-Communications.
3. **"Development of simple firefly luciferin analogs emitting blue, green, red, and near-infrared biological window light"**, *Tetrahedron*, **69**, 3847-3856, DOI: 10.1016/j.tet.2013.03.050, http://www.sciencedirect.com/science/article/pii/S0040402013004134,
   Satoshi Iwano, Rika Obata, Chihiro Miura, Masahiro Kiyama, Kazutoshi Hama, Mitsuhiro Nakamura, Yoshiharu Amano, Satoshi Kojima, Takashi Hirano, Shojiro Maki, Haruki Niwa: The University of Electro-Communications.

Further information

Shojiro MAKI Laboratory
http://www.uec.ac.jp/eng/research/introduction/opal-ring/0000470.html

Associate Professor: Shojiro Maki (Doctor of Science from Keio University 1994/03)
Current research areas: chemical biology, bio imaging, imaging probe
Current research subjects: innovation of in vivo imaging technology
Personal website: http://www.firefly.pc.uec.ac.jp/members.html

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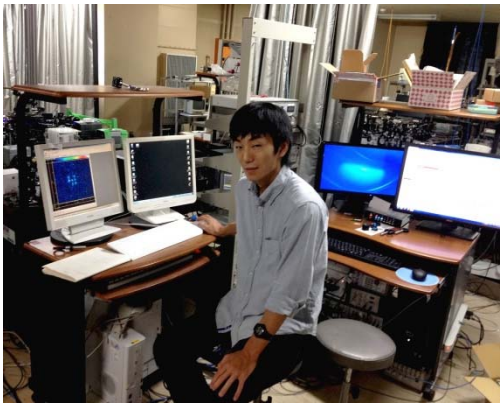
Quantum computing: Trapping single atoms in a uniform fashion

Single neutral atoms trapped individually in optical microtraps are incredibly useful tools for studying quantum physics, as the atoms then exist in complete isolation from the environment. Arrays of optical microtraps containing single atoms could enable quantum logic devices, quantum information processing, and quantum simulation.

While single atom trapping has already been achieved, there are still many challenges to overcome. One such challenge is making sure each trap holds no more than one atom at a time, and also keeping it there so it won't escape. This requires uniform optical microtraps, which have yet been fully realised.

Now, Ken'ichi Nakagawa and co-workers at the University of Electro-Communications, Tokyo, Japan, together with scientists across Japan and China, have successfully demonstrated an optimization method for ensuring the creation of uniform holographic microtrap arrays to capture single rubidium (^{87}Rb) atoms.



TAMURA Hikaru, a Ph.D. student in the lab of Prof. Nakagawa, measured the diffracted light intensity with a specialized camera, and monitored the in-trap fluorescence from the Rb atoms.

The team generated holograms for red light-tuned microtraps arrays in various shapes including square, honeycomb and ring formations (see image). They combined each hologram with two phase patterns, including a grating pattern which allowed the researchers to separate out the traps from non-diffracted light. A spatial light modulator tuned the trap light to the calculated hologram pattern and ensured uniformity of depth across the microtraps.

Nakagawa's team measured the diffracted light intensity with a specialized camera, and monitored the in-trap fluorescence from the Rb atoms; these two 'feedback' methods allowed them to optimize the traps and ensure uniformity. They could also verify the presence of a single atom in each trap more precisely.

Reference

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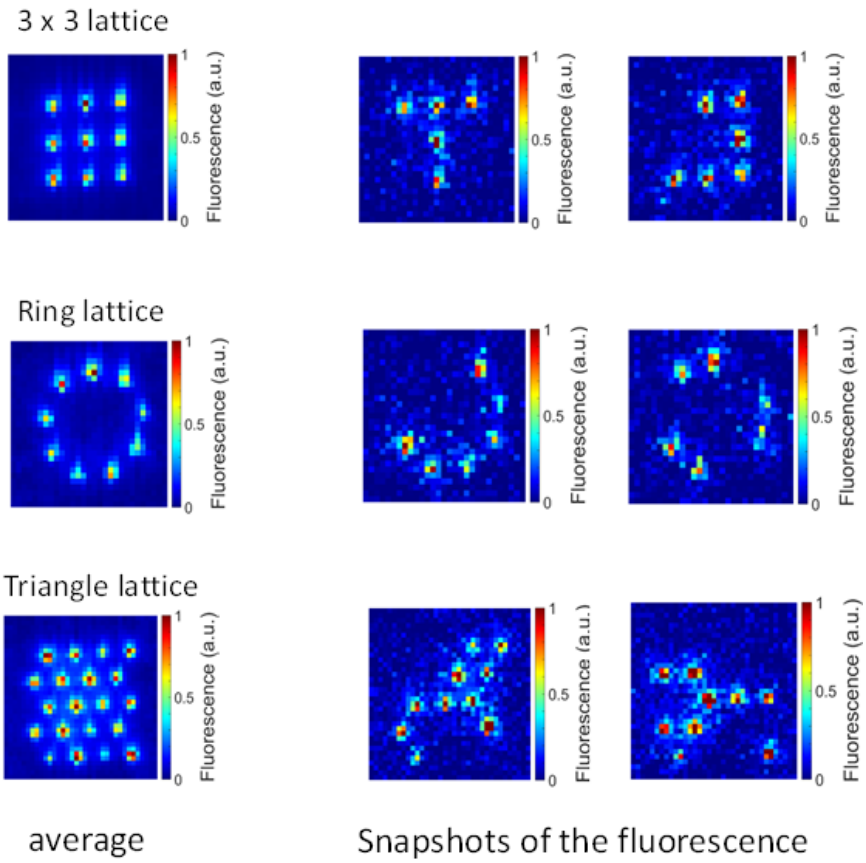

Researchers at the University of Electro-Communications in Tokyo have successfully developed a method for creating uniform, shaped optical microarrays for trapping single atoms. The technique may pave the way for new quantum computing applications.

Professor: Ken'ichi NAKAGAWA (Doctor of Science from the University of Tokyo 1989/03)
Current research areas: Atomic/Molecular/Quantum electronics
Current research subjects: Laser Cooling of Atoms and Atom Optics
Personal website: http://www.ils.uec.ac.jp/~naka_lab/index_e.html

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Physiology: Cell pH regulation revealed

Most physiological processes are pH-sensitive, and pH within individual cells in skeletal muscles (pH_i) must be carefully regulated to maintain normal cellular functioning. During intensive exercise, and also in certain diseases, levels of a cationic form of hydrogen (H^+) rise rapidly within cells, causing pH_i levels to plummet and become more acidic. There are three membrane transporters known to be involved in regulating pH_i, but their precise individual roles are unclear.

Yutaka Kano and co-workers at the University of Electro-Communications, Tokyo, together with scientists across Japan and the US, conducted experiments using *in vivo* bioimaging models to verify the roles of these transporters in pH_i regulation.

The team tested the effects of an injection of H^+ into single muscle fibers in rats. They blocked each transporter involved in pH_i regulation - namely, lactate/H^+ cotransporter (MCT), Na^+/ H^+ exchange transporter (NHE) and Na^+ / HCO_3 cotransporter (NBC) - one at a time and then all together. They compared their results with a control group with normal transporter functioning.

Their results showed that two stages exist in pH_i recovery; an initial rapid stage followed by a second, more gradual recovery stage. Kano's team discovered that the three transporters were not involved in the rapid stage. While individual transporter inhibition did not impact on pH_i recovery, blocking all three transporters prevented the second stage (gradual recovery) from occurring.

The study also revealed that the pH of surrounding fibers changed following H^+ injection, suggesting that they take up excess H^+ to alleviate stress in affected cells.

Reference

1. Tanaka, Y., Inagaki, T., Poole, D.C., & Kano, Y. pH buffering of single rat skeletal muscle fibers in the in vivo environment. *American Journal of Physiology* **310** (2016)

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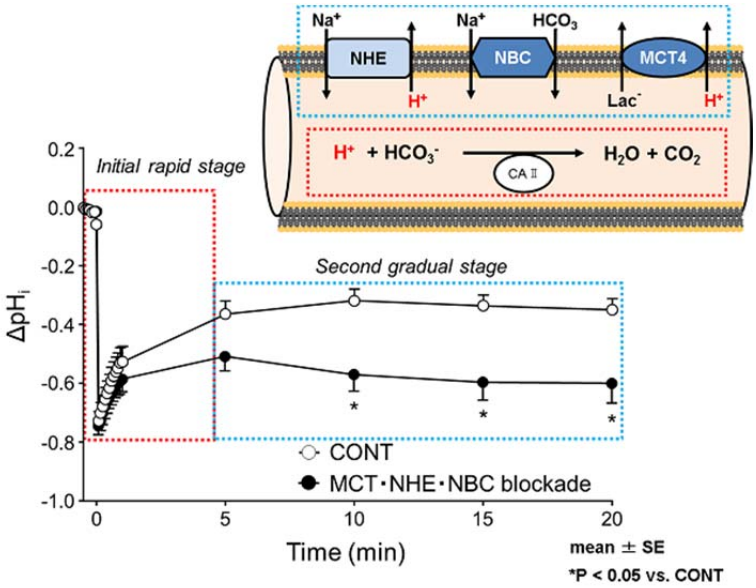

Upper panel: There are three transporters contributing to pHi maintenance in muscle cell.
Lower panel: Two stages exist in pHi recovery after injection of low pH solution.

Postdoctoral fellow: Yoshinori Tanaka, (Ph. D. from University of Electro-Communications 2016/06)
Current research areas: Cell biology / Bioimaging
Current research subjects: Regulation of intracellular pH on muscle cell
Personal website: http://www.ecc.es.uec.ac.jp/index.html

Professor: Yutaka Kano, (Ph. D. from University of Tsukuba 1997/03)
Current research areas: Physiology / Bioimaging
Current research subjects: in vivo bioimaging on muscle cell
Personal website: http://www.ecc.es.uec.ac.jp/index.html

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Neurology: A closer look at walking control

Humans and animals tune their walking rhythms in response to their environment. If walking is disturbed in some way, the brain's neurons respond by altering the walking rhythm to maintain stability. Studying the physiological and neurological processes behind rhythm control can help scientists understand how we walk steadily and may inform future treatments for those with walking difficulties.

Previous research examined reactions to disturbance by pulling on the swing leg during the walking cycle. This, however, had no significant effect on the stance leg. Therefore, Tetsuro Funato at the University of Electro-Communications, Tokyo, Japan, together with scientists across Japan, decided to examine the reactions of people walking on a moving treadmill that randomly changed speed.

The team aimed to estimate the 'phase response curve', or PRC, for humans under a complete, but disturbed, walking cycle. Analysis of the PRC can reveal the behaviour of neurons and associated rhythm changes during a cycle. The researchers also assessed two methods of estimating the PRC; the conventional 'impulse method' and the newer 'weighted spike-triggered average' (WSTA) method.

Their results demonstrated that changing floor velocities affected human walking rhythm by lengthening the touch-down phase of the leading foot. The participants also extended the mid-single support phase, where only the stance leg is in contact with the floor. The researchers discovered these rhythm changes through clear, stable waveform patterns in the PRC estimated using the WSTA method. The WSTA method picked up smaller perturbations than the impulse method, and as such may prove more valuable for such investigations in future.

Reference

1. Funato, T., Yamamoto, Y., Aoi, S., Imai, T., Aoyagi, T., Tomita, N., & Tsuchiya, K. Evaluation of the phase-dependent rhythm control of human walking using phase response curves. *PLOS Computational Biology* **12** (5) (2016)

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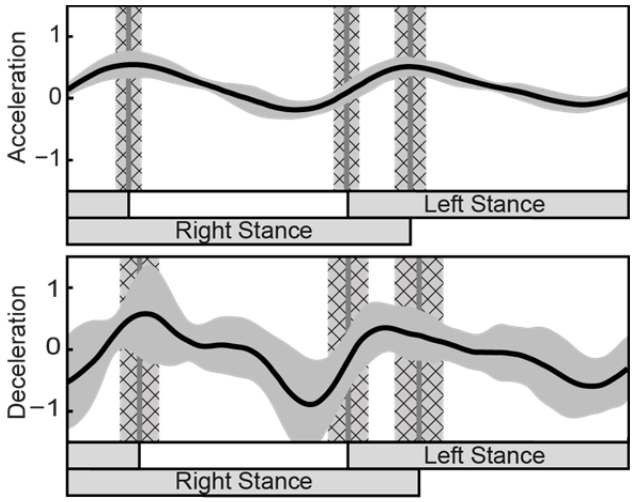

phase response curve of human walking

Associate Professor: FUNATO Tetsuro (Ph.D from Tokyo Institute of Technology 2008/03)
Current research areas: Intelligent mechanics/ Mechanical systems
Current research subjects: Evaluation of biological rhythm control for system designing using the environmental dynamics.
Personal website: http://www.uec.ac.jp/eng/research/introduction/opal-ring/0006402.html

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Space physics: Confirming the structure and shape of polar cap patches

Large-scale patches of enhanced electron density (plasma) are often found in the polar ionosphere - about 80 to 1000 kilometers above the Earth's surface. These 'polar cap patches' can last for hours, cover huge areas and travel quickly, and their presence can disrupt satellite communication links.

Scientists have recently begun collecting high definition, two-dimensional images of the patches using 'all-sky airglow imagers' (ASI). These specialized instruments can image emissions from excited atomic oxygen, allowing for the capture of plasma patches in greater detail.

Keisuke Hosokawa at the University of Electro-Communications in Tokyo and co-workers across Japan analyzed ASI images of ten different patches that occurred during a four-hour period over Longyearbyen in Norway in December 2013. Their observations prove for the first time that the patches exhibit specific structural qualities, as previously predicted by computer simulations[1].

For example, the images allowed the team to visualize the gradients between the leading and trailing edges of the patches as they moved from day-side to night-side across the poles. The leading edge gradient was between two and three times steeper and more stable than the trailing edge.

Hosokawa's team then verified the presence of 'finger-like' structures on the trailing edge of each patch. They believe these fingers result from plasma restructuring due to disturbances moving through the plasma and mixing it. This activity makes the trailing edge more gradual in gradient and influences the shape and size of the whole patch.

Understanding patch instability, structure and shape may enable better predictions of space weather impacts on satellite communication links.

Reference

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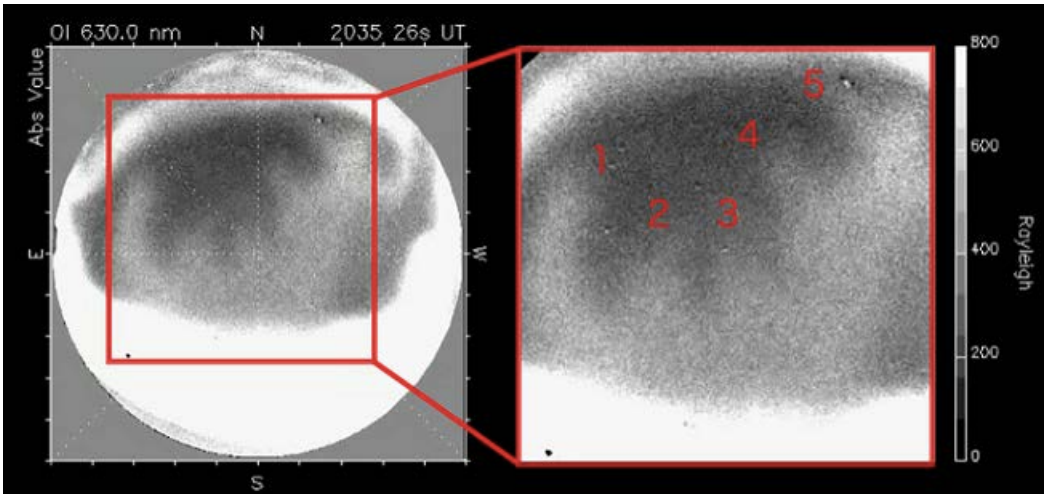

Images captured using all-sky airglow imagers have enabled researchers in Japan to verify the shape and structure of polar cap patches in the ionosphere. These patches can disrupt satellite communication links, and it is hoped that understanding their structure will aid space weather predictions.

Associate Professor: Keisuke HOSOKAWA (Ph.D in Science from Kyoto University 2003/03)
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Current research subjects: Dynamics of the ionospheric plasma, Aurora and airglow, and GPS navigation system
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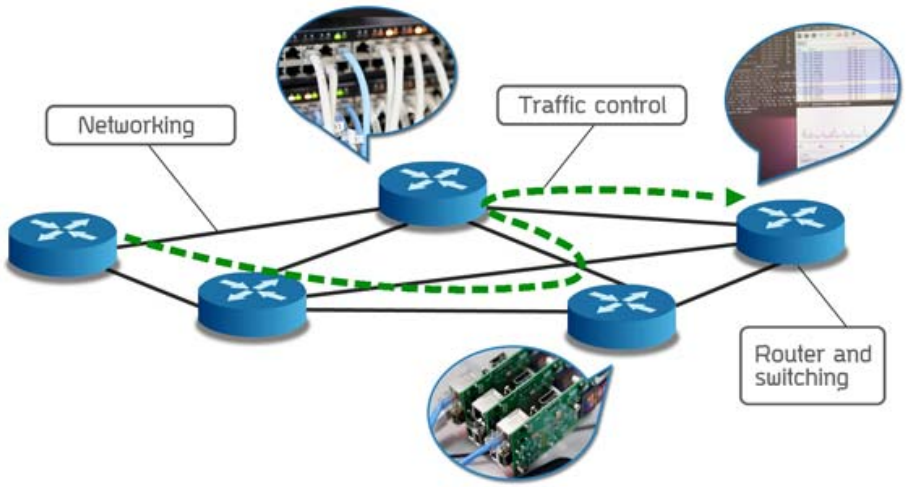
Designing high performance network communications

Professor Eiji Oki
Department of Communication Engineering and Informatics

"Research in my group covers optical and IP networks, and other such communications system technology for applications such as large bandwidth high definition television," says Eiji Oki. "Our ultimate aim is to devise cost-effective, high speed, and high quality networking technologies."

One of the many research themes being pursued by researchers at the Oki Lab is the development of reliable and robust networking technology to mitigate network failures that would have adverse effects on businesses as well as society in general.

In a recent paper, Oki and coworkers reported on their approach to reduce energy consumption in communications networks that implement over capacity to prevent failure during unpredictable peak hours traffic--the so-called 'traffic matrix' [1]. Their solution to save power in communications networks where large volumes of traffic cannot be predicted accurately is a "green and robust optimization scheme that is based on hose model with bound of link traffic (HLT)." Notably, HLT does not require precise information about traffic, instead it is defined in terms of the "total volume of traffic outgoing and incoming at each node and the total traffic at each link". This research is expected to improve the power efficiency and robustness of communications networks.



Research on networking communications at the Oki Lab., UEC, Tokyo.

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Further information

Eiji Oki Laboratory

https://oki.ice.uec.ac.jp/english/index_e.shtml

Professor: Eiji OKI (Ph. D. from Keio University 1999/02)
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Current research subjects: Optical IP networking technologies
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Design and analysis of information and stochastic systems

Professor Tsutomu Kawabata
Department of Communication Engineering and Informatics, Graduate School of Informatics and Engineering.

"My research activities are dedicated to information theory in order to establish a mathematical basis for digital communications with priority on engineering feasibility of related technologies," says Tsutomu Kawabata. "The applications of this research is not restricted to electrical engineering but include the so-called BLAST method used for the search of DNA bases in the Human Genome Project in the 1990s."

Current projects being undertaken by Kawabata and colleagues include:

1. The design and analysis of lossy and lossless data compressions [1,2]. The lossy data compression is used to find the rate distorton function, that is, trades-offs between compression rates and distortion.
2. Applications of information theory to mobile communications for wireless LAN channel [3] and multiuser-user detection problem for a sparsely spread CDMA system [4].

The focus of the research being undertaken in collaboration with Neji Yuossef [3] is to statistically characterize capacity outage events in multi-antenna systems to "improve the performance and spectral efficiency of mobile radio links".

"UEC, Tokyo has a long history of research on information theory in Japan," explains Kawabata. "My laboratory is an excellent environment to study advanced information communication technologies based on the information theory."

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[1] M.M. Rashid and T. Kawabata, Analysis of zero-redundancy estimator with a finite window for Markovian source, *IEICE Trans. Fundamentals of Electronics, Communications, and Computer Sciences*, vol.E88-A, no.10, 2819-2825, Oct.2005.
[2] J. Takeuchi, T. Kawabata, and A. Barron, Properties of Jeffereys Mixture for Markov Sources, *IEEE Trans. Info. Theory*, vol. 59, no.1, 438-457, Jan. 2013.
[3] R. Hicheri, G. Rafiq, T. Kawabata, M. Pätzold, and N Youssef, On the Statistical Properties of Capacity Outage Intervals in OSTBC-MIMO Rayleigh Fading Channels, *IEEE Trans. on Wireless Communications*, vol.15, 3547-3559, May 2016.
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Further information

Tsutomu KAWABATA Laboratory

http://www.uec.ac.jp/eng/research/introduction/opal-ring/0000343.html

Open discussion between faculty and students of the Kawabata Lab., UEC Tokyo.

Professor: Tsutom KAWABATA (Ph. D from The University of Tokyo 1993/10)
Current research areas: Information theory, Source coding, Data compressions
Current research subjects: Asymptotic multi-dimensional quantization, Information theory for singular probability measures, Design and analysis of data compression algorithms, Applications of statistics and information theory
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Letter from Alumni

Ihsen Aziz Ouedraogo
Social ICT Business Division, ICT Policy and Strategy Research Group, Mitsubishi Research Institute, Inc.

I enrolled at University of Electro-Communications, Tokyo (UEC) in October 2010 after being granted a scholarship by the Japanese Government. Before coming to Japan I worked for several years in the Network Management Center of a mobile network operator in Burkina Faso, my home country. I did my undergraduate studies in Senegal and Benin, and majored in electrical engineering with the option of telecommunication and networks.

At UEC I joined Professor Eiji Oki's lab that specialized in advanced networking technologies, and received my master's degree and PhD in March 2013 and June 2016, respectively. During my 6 years in the Oki lab I conducted research related to IP routing (fast reroute), IP networks/traffic optimization and green communications. My PhD thesis introduced optimization models for robust and power efficient networks. The work in the thesis, which is the result of several years of training and collaboration with Prof. Oki, was accepted for publication in the IEEE Journal on Selected Areas in Communications in 2016, and presented at the IEEE CQR 2016 conference. During my master's course and PhD combined, I also co-authored five papers that were published with IEICE, IET Networks and IEEE journals.

I enjoyed the international and friendly environment in the Oki lab that had students from many countries (Japan, Bangladesh, Sri-Lanka, Indonesia, Laos, Senegal, Cameroun, Burkina Faso, Vietnam, Thailand, China etc.), which makes the lab very special in UEC. I also really appreciate the support provided by the university to foreign students through the organization of wide ranging activities and the Japanese language classes. This significantly helped me to integrate in Japan.

IEEE GreenCom Conference 2013, Beijing, China (session chair)

During my doctoral research I had the desire to pursue an activity that would not only leverage my research experience but also allow me to proactively contribute and have a direct impact on society using some of my other skills. In April 2016, two months before graduating, I joined Mitsubishi Research Institute, which is the consulting company of Mitsubishi group in Japan. In my section we carry out research related to information and communication technology (ICT) policy and strategy, while advising and providing services to the government and businesses. It is challenging to work in a Japanese environment but a good opportunity to grow.

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This new step in my life was made possible thanks to the advice and mentoring from my advisor Prof. Oki and the support from all of my Japanese language teachers at UEC.
I am very grateful for being able to study at UEC, Tokyo.

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Oscar H. Ibarra, an eminent academic from UC Santa Barbara, visits UEC, Tokyo

Oscar H. Ibarra is Professor Emeritus and Research Professor at the Department of Computer, University of California-Santa Barbara, USA. Professor Ibarra met Professors Wataru Mitsuhashi (Member of the Board of Directors (Research Strategy)) and Kazushi Nakano (Member of the Board of Directors (Education Strategy)) to share his insights on establishing international collaborations programs with universities in the USA.

Later, Professor Ibarra gave a seminar entitled, "On the complexity of Parikh membership problems" hosted Shinnosuke Seki, Assistant Professor, Graduate School of Informatics and Engineering, UEC.

Professor Ibarra has had an illustrious research career in areas including design and analysis of algorithms, molecular computing, and membrane computing. He received his bachelor's degree in electrical engineering from the University of the Philippines, and master's and doctorate in electrical engineering from UC Berkeley. His excellence in research is underscored by the numerous international honors and awards including Fellow of the American Association for the Advancement of Science; inclusion in the Thomson ISI database of 230 Highly Cited Researchers in Computer Science, 2003; and in July 2015, during the 40th anniversary of the Journal of Foundations of Computer Science, he was named the most prolific author in its 40-year history.

This visit was an excellent opportunity for students to learn more about Professor Ibarra's research and for UEC to strengthen ties with distinguished researchers from UC Santa Barbara.

Oscar H. Ibarra (center), Wataru Mitsuhashi (left) Shinnosuke Seki (2nd from left), Kazushi Nakano (2nd from right) and Adarsh Sandhu.

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Related information on research by Shinnosuke Seki, Assistant Professor Graduate School of Informatics and Engineering.

UEC media release
6 July 2016
University of Electro-communications research: Mathematical model gives insights into cotranscriptional folding of RNA
http://www.uec.ac.jp/eng/news/announcement/2016/20160706-4.html

UEC NEWS
28 Jan 2016
RNA origami for building biomolecular factories within living cells
Caltech scientist Cody Geary delivers lecture on RNA origami to UEC students and faculty
http://www.ru.uec.ac.jp/topics/news/rna-origami.html

UEC e-Bulletin
December 2015 Issue, Topics
Cotranscriptional folding: Computational modelling of self-assembly of RNA origami for universal computation
http://www.ru.uec.ac.jp/e-bulletin/topics/2015/cotranscriptional-folding.html

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Dorota Gryko from the Institute of Organic Chemistry Polish Academy of Sciences, gives a seminar at UEC, Tokyo.

Professor Dorota Gryko gave a seminar at UEC, Tokyo, entitled, "Porphyrins as photocatalysts for visible-light induced selective functionalizations of aldehydes", hosted by Masumi Taki, Associate Professor at the Department of Engineering Science.

Professor Gryko is a green-organic chemist undertaking research on projects that include engineering of photocatalysts to achieve environmentally-friendly chemical reactions with no waste or pollutants.

The interdisciplinary nature of the seminar attracted students and faculty members from many departments at UEC. The talk was followed by more informal discussions about current research and collaboration in the future.

Summary of the seminar

Our life depends on porphyrinoids and these tetrapyrroles are referred as pigments of life. They are responsible for oxygen transport (heam), electron transport (cytochrome c), and photosynthesis (chlorophyll a) - the most crucial processes for human being. Without the chlorophylls and bilins life as we know would not exist on our planet. This green pigment is, in the first, instance responsible for transforming light energy into the chemical reactivity with the ultimate production of starch (photosynthesis). In the energy shortage era, we should follow nature and take an advantage Pigments of life from the unlimited source of energy.

Although photocatalysis has been already applied in few industrial applications (photooxygenation of citronellol for the synthesis of rose oxide, artemisinin, photocatalytically induced radical polymerization), these represent a small fish in the big ocean of science. In this line photoredox catalysis has recently emerged as powerful tool for the formation of C-C bonds mainly catalyzed by ruthenium and iridium complexes. But, they are both very expensive and undesirable by pharmaceutical industry. On the other hand organic dyes exhibit considerable advantages and in fact they have been shown to act as photoredox catalysts with eosin Y being the most widely studied.

References

M. Giedyk, K. Goliszewska, K. ó Proinsias, D. Gryko, Cobalt(I)-catalysed CH-alkylation of terminal olefins, and beyond, *Chem. Comm*. (2016).
M. Giedyk, K. Goliszewska, D. Gryko, Vitamin B12 catalysed reactions, Chem. Soc. Rev., (2015).

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Professor Dorota Gryko giving her seminar at UEC.

Group photograph with the participants of the seminar.

Related information on research by Masumi Taki, Associate Professor, Department of Engineering Science.

Websites

Lab: http://tkl.pc.uec.ac.jp/index-english.html

UEC site: http://www.uec.ac.jp/eng/research/introduction/opal-ring/0006100.html

Media coverage

June 2016 Issue of *UEC e-Bulletin*

Masumi Taki edits special issue of Current Topics in Medicinal Chemistry

Editing and publication of a special edition of the journal Current Topics in Medicinal Chemistry (CTMC).

http://www.ru.uec.ac.jp/e-bulletin/news/2016/masumi-taki-edits-special-issue-of-current-topics-in-medicinal-chemistry.html

June 2014 Issue *UEC e-Bulletin*

Research highlights

Pharmacophores: The future of drug discovery

http://www.ru.uec.ac.jp/e-bulletin/research-highlights/2014/the-future-of-drug-discovery.html

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UEC Press Release

4 February 2016

http://www.uec.ac.jp/eng/news/announcement/2015/20160205-2.html

Color-changing probes shed light on protein sensing

A novel fluorescent probe library is developed by a research team including scientists from the University of Electro-Communications, Tokyo. The findings are published in the journal *Analytical Chemistry*.

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The University of Electro-Communications (UEC) in Tokyo

is a small, luminous university at the forefront of applied sciences, engineering, and technology research. Its roots go back to the Technical Institute for Wireless Commutations, which was established in 1918 by the Wireless Association to train so-called wireless engineers in maritime communications in response to the Titanic disaster in 1912. In 1949, the UEC was established as a national university by the Japanese Ministry of Education, and moved in 1957 from Meguro to its current Chofu campus Tokyo.

With approximately 4,000 students and 350 faculty, UEC is regarded as a small university, but with particular expertise in wireless communications, laser science, robotics, informatics, and material science, to name just a few areas of research.

The UEC was selected for the Ministry of Education, Culture, Sports, Science and Technology (MEXT) Program for Promoting the Enhancement of Research Universities as a result of its strengths in three main areas: optics and photonics research, where we are number one for the number of joint publications with foreign researchers; wireless communications, which reflects our roots; and materials-based research, particularly on fuel cells.

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