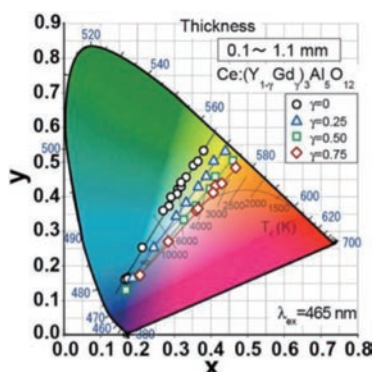
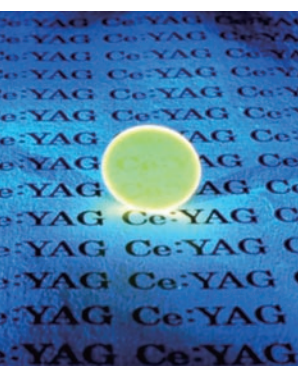


Cutting-Edge Research in Kyoto University

Kyoto University is known for the quality and diversity of its research. Each issue of Research Activities can only highlight a small selection of those endeavors, but we hope to convey an impression of the university's rich academic milieu.

MAT-SCI Luminescent Ceramics Benefit a New LED Lamp!

Plate-shaped phosphors enable high-power and efficient solid-state lighting.



ceramic plate has better thermal conductivity and high luminous efficiency. The paper of these results published in 2011 has been top-ranked both in the most-cited and most-downloaded articles among all the papers in Optical Materials journal since September 2013 to present.

The Light Emitting Diode (LED) lamp is now widely replacing conventional incandescent lamps and fluorescent tubes, because it efficiently converts input electric-power into white light with no ultraviolet nor infrared light. Also LEDs are free from mercury and thus regarded as an environmental-friendly lighting device. In the LED lamp a blue LED is usually a key device combined with some powder phosphors doped with rare-earth ions, which absorb blue light and emit visible light with lower-energy. We have developed ceramic-plate phosphors with transparency for this combination to produce a white spectrum for illumination. Compared with the powder-form, the

Setsuhisa Tanabe, PhD

Professor, Graduate School of Human and Environmental Studies

www.talab.h.kyoto-u.ac.jp/



RESOURCE-ENG New Method to Extract Shale Gas

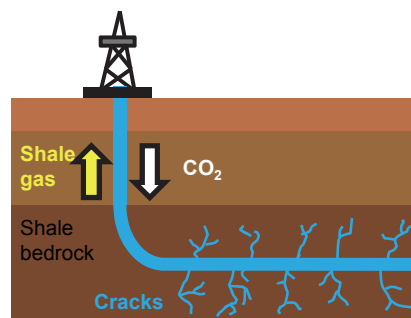
Fracturing with carbon dioxide instead of water.

We have proposed a new method to extract shale gas (flammable methane gas) trapped in shale bedrock around 3,000 meters deep. Conventional methods to extract shale gas involve making cracks by injecting water into hard shale bedrock. In the new method, carbon dioxide (CO₂) is used instead of water. At great depths where shale gas is extracted, CO₂ becomes very slick, being in a so-called supercritical state. Since we found in our laboratory experiments that supercritical CO₂ can make finer cracks extending in a larger area, we expect CO₂ to produce more shale gas than

water. In arid regions such as deserts, this method offers greater advantages. Working in collaboration with Japan Oil, Gas and Metals National Corporation (JOGMEC), we aim to use this method in an actual shale gas field.

Tsuyoshi Ishida, PhD (left) *Professor, Graduate School of Engineering*

Youqing Chen, PhD (right) *Assistant Professor, Graduate School of Energy Science*
geo.kumst.kyoto-u.ac.jp/lab/member/Ishida_t/English.htm



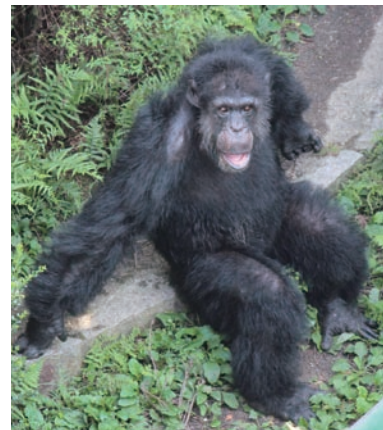
MOL-BIO What a big difference!

Humans and chimpanzees descended from the same ape six million years ago.

Humans walk fully upright, but chimpanzees do not. Humans can make an iPad, but chimpanzees cannot. Chimpanzees have a gripping power strong enough to crush an apple, but humans do not. One may suppose that these differences originate from a significant difference in the genetic information between the two species. Recent genome sequencing projects, however, have revealed that 98% of human DNA is identical to that of chimpanzees. It is now widely thought that this difference of 2% alone may not be enough to explain the big differences between these two species. Our research group focuses, as one clue, on chromosome structure. Chimpanzees, and also gorillas, maintain a lot of accessory structures at the tips of their chromosomes, which humans have lost during the last six million years. Loss of chromosomal parts may therefore be related to gaining new lifestyles.

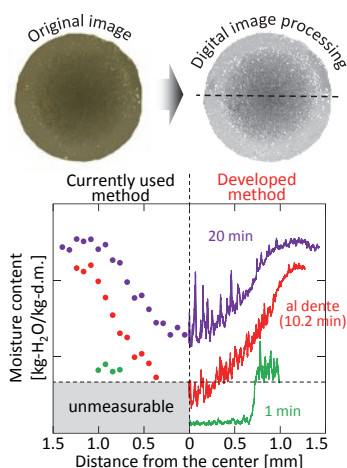
Akihiko Koga, PhD Professor, Primate Research Institute

www.pri.kyoto-u.ac.jp/index.html



FOOD-ENG How Does Water Migrate in Spaghetti?

Measurement of precise moisture profile in spaghetti.



We have developed a new method to measure the moisture profile in spaghetti or other pasta during the rehydration process. Using a digital camera and an image processing technique, it is possible to observe an increase in sample color brightness with increasing moisture content. Our method enables us to measure lower moisture content at a higher spatial resolution than currently used methods. The moisture profiles that we have obtained suggest that factors such as penetration of water into small holes and cracks on the surface of the pasta, water diffusion in the pasta, and structural relaxation of the protein matrix play important roles in the rehydration mechanism. The data also suggest that starch granule gelatinization prevents water migration into the interior portion of the pasta.

Shuji Adachi, PhD

Professor, Graduate School of Agriculture

www.bioeng.kais.kyoto-u.ac.jp/



LIT English Past and Present

History of English from the Fifth Century to the Present Day.

The word *lord*, though monosyllabic today, goes back to the compound *hlaf-weard* in Old English, which meant the 'keeper of bread': *hlaf* corresponds to *loaf* in present-day English and *weard* is 'keeper'. Likewise, *sad* in the past had a different meaning: 'satisfied'. This is the type of research I conduct, while reading early English, which is often extant on parchments. It is quite time-consuming to read medieval manuscripts, as the text has a tendency to fade due to the passage of time. However, I can appreciate that it was time-consuming for medieval scribes to transcribe them as well. It is certainly an art; I enjoy discovering the roots of English through these manuscripts.



Yoko Iyeiri, PhD

Professor, Graduate School of Letters

homepage3.nifty.com/ieyrei/

Polychronicon, Tokyo, Senshu University Library, MS 1, fol.15r
© Senshu University Library



HST The Kitchen: A Historical Record

Reconstructing history from the kitchen, where nature, mankind, and society converg.



History of the Kitchen in Modern Germany (2012)

The kitchen is a vital anchor for the global food system. Farmers produce crops and livestock, fishermen catch seafood, wholesalers buy them, retailers sell them, and we buy, cook, and eat them. In order to aid digestion, the food we eat is often cut, boiled, grilled, and masticated. The kitchen can be viewed as a “branch office” of the digestive system. In addition, the kitchen is not only an individual component, but also one that exists in a social and national context.

To illustrate one example, in National Socialist Germany, Adolf Hitler ordered German housewives to sort and preserve garbage from their kitchens to raise pigs in conditions specified by the National Socialists. The purpose was to achieve “self-sufficiency”. Inevitably, the Third Reich reconstructed a military state as a large number of German civilians as well as soldiers suffered from hunger due to the Allied Powers’ blockade during the First World War. However, housewives complained about this policy, as the specifications were extremely detailed and time-consuming. Their obligation was to cook for their families using food produced in Germany. In 1934, the Ministry of Food and Agriculture and the National Socialist Women’s League began a campaign to protect food from hostile factors such as coldness, frost, heat, insects, and bacteria, representing the “enemy” to the ideal of

self-sufficiency. It was called *Kampf dem Verderb*, meaning “Struggle against Waste”, and by implication, corruption, as *Verderb* refers to both waste and corruption. Notably, the name applies to both the natural phenomenon and the housewives themselves. During the Second World War, civilians were once again confronted by a food shortage. They came up with various ideas to cook. In a cookbook titled *Let’s cook!* (1944), the author notes: “German housewives should be a machine” — highlighting just one way in which Hitler tried to control food consumption through the kitchen in Germany.

In my book, *History of the Kitchen in Modern Germany: Environmental History of ‘Eating’* (2012), I state that the kitchen is a space where nature and politics intersect in ways that are dynamic and complex. In the kitchen, one can often find water, fire, people, some plant and animal products, and considerably more bacteria. Politicians, academics, bureaucrats, and the food industries are capable of controlling people’s lives through their kitchens, for example, for the purpose of recruiting soldiers, or for developing new markets. During the course of my research in Germany, I collected many cookbooks from secondhand bookstores and libraries, which were written by economists, doctors, feminists, bureaucrats and private corporations. Cookbooks show us what the writers or publishers intend. In a cookbook published by Siemens, for example, a famous cookery writer explained how to cook using products such as an electric oven. Also, cookbooks tell us how others cook in their own kitchens; it is possible to imagine how people interpret the cookbook’s recipe compared to the original.

My research does not focus on food itself. Instead, I examine the function of food in an ecological, social, and political context. The kitchen is one of the hottest battlefields pitting humans against nature, women versus men, and families versus the government or corporations. By familiarizing ourselves with the history of the kitchen, we may be able to understand how people lived in the past more vividly: How did they cook? What did they eat? With whom did they cook and eat? These questions have not yet been fully addressed by historians. From the viewpoint of such a basic human condition, we may perhaps try to seek a world without hunger.

Tatsushi Fujihara, PhD Associate Professor, Institute for Research in Humanities

www.zinbun.kyoto-u.ac.jp/~fujihara/



LAUREATES was published

Award-Winning Scholars at Kyoto University 1949-2013

This brochure aims to introduce Kyoto University researchers who have been awarded major international accolades since 1949, the year that Professor Hideki Yukawa received the Nobel Prize, to 2013, providing profiles of the individual researchers, as well as their award-winning research.

WEB repository.kulib.kyoto-u.ac.jp/dspace/handle/2433/189403?locale=en



PHILOS In Search of the Nature of Time

Presentism and Enigmas of Temporality.

My research interest can be summarized in just three words: what is time? This simple question leads us to a deep philosophical labyrinth because time matters for temporal beings like us in many respects. I have been tackling various issues, ranging from the phenomenological question of how we experience time to the metaphysical one of whether and how time passes. There are also serious tensions between our common sense and contemporary physics. While we ordinarily believe that the notion of simultaneity is absolute, the special theory of relativity would indicate otherwise.



The possibility of time travel seems to deny our freedom, both in the past and the future. In discussing these problems, I adopt the presentist thesis that everything is present. Presentism can shed some light on the nature of time.

Takeshi Sakon

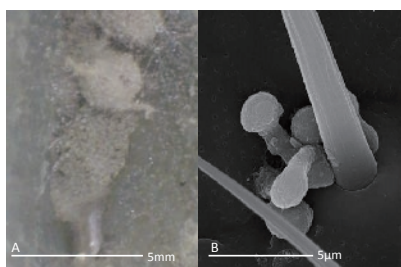
Assistant for Faculty Development and Foreign Language, Graduate School of Letters
fptconference.web.fc2.com/A_Frontier_of_Philosophy_of_Time/FPT_Top.html



Taken by Takeshi Inoue

INSECT PATHOL Cost-saving Disease Resistance

Behavioral resistance in insects against pathogenic infection.



A: Termite infected by an entomopathogenic fungus.
 B: Fungal hyphae invading the termite cuticle

Social insects use their sociality for survival. They have well-developed social behaviors to fight pathogenic infections. Such hygiene behaviors are observed in all insects including solitary insects. However, these behaviors may work more effectively in social insects. Instead of paying the high cost of producing antimicrobial compounds, termites clear out pathogens from their nestmates' cuticles and dispose of them through alimentary tracts. This hygiene behavior is referred to as grooming behavior. Observations of pathogen dynamics on host cuticles have revealed that behavioral resistance is one of the most effective means of fighting back pathogenic infection. To get the best results — which means the lowest cost with the highest protective effect — there should be some correlative links

between pathogen perception, behavioral resistance, and the immune system in insects. Since the stage of perception should set off the whole protection process, the aim of the present study is to find links between perception and behavioral resistance or the immune system by focusing on termites and entomopathogenic fungi.

Aya Yanagawa, PhD

Assistant Professor, Research Institute of Sustainable Humanosphere



PHYS Ultimate Control of Material Properties

Ultraintense terahertz pulse boosts electron density 1,000-fold.

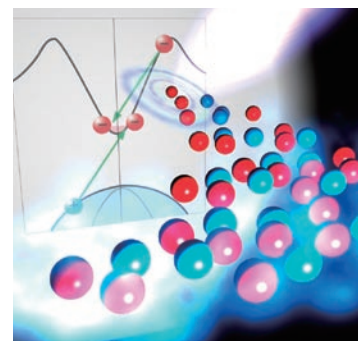
Spectroscopic and material sciences in the terahertz frequency region are being developed through advances in laser technology. Here, I succeeded in developing the world's strongest terahertz radiation pulse source. This pulse is the first ever with electric field strength of over 1 MV/cm and is strong enough to control an electrical property of material. In fact, by shining this terahertz light on a semiconductor for an incredibly short period of time — around a trillionth of a second — I successfully increased the density of free electrons, a key parameter in determining the semiconductor's electrical conductivity, by a factor of roughly 1,000. This result opens a door to control functions of solids, chemical molecules, and biomaterials with a terahertz pulse.



From the Editor Dr. Hirori received the German Innovation Award "Gottfried Wagnere Prize 2014" for his work on the generation of ultra-intense terahertz radiation sources and nonlinear spectroscopy.

Hideki Hirori, PhD Associate Professor, Institute for Integrated Cell-Material Sciences

www.tanaka.icems.kyoto-u.ac.jp/



STEM CELL Regenerative medicine for ALS using human iPS cells

Transplanted glial cells improve the disease environment in spinal cords of ALS mice.

There is currently no effective cure for amyotrophic lateral sclerosis (ALS), which is characterized by a loss of motor neurons. Diseased glial cells are thought to accelerate motor neuron degeneration. My colleagues and I have found that transplanted healthy glial cells derived from human induced pluripotent stem cells (iPSCs) can protect motor neurons in spinal cords and prolong the lifespan of ALS mice. Despite the hurdles ahead for human trials, all possible avenues provided

by iPSC technology should be considered and tested to combat this pervasive disease.

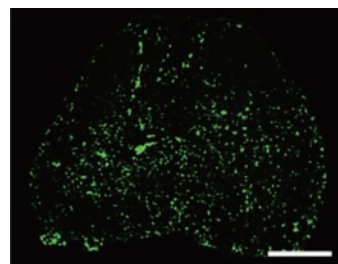


Haruhisa Inoue, PhD

Professor, Center for iPS Cell Research and Application
www.cira.kyoto-u.ac.jp/e/research/inoue_summary.html



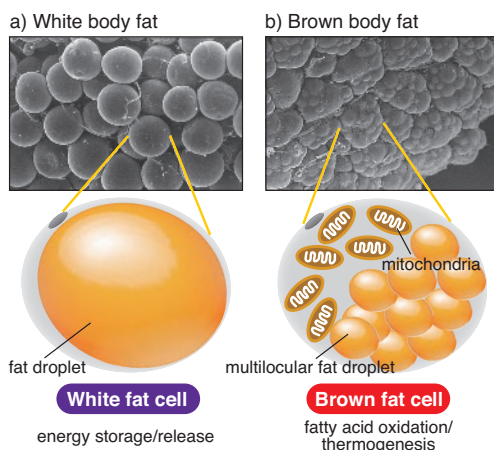
Schema of spinal cord transplantation



Transplanted cells expressing green fluorescent protein in spinal cords of ALS mice (Kondo *et al.*, "Focal Transplantation of Human iPSC-Derived Glial-Rich Neural Progenitors Improves Lifespan of ALS Mice," *Stem Cell Reports*, 3, 242-249 (2014), <http://dx.doi.org/10.1016/j.stemcr.2014.05.017>)

FOOD-SCI Combating the middle-age spread

Activation and regeneration of brown fat by food components.



Scanning electron microscope images and inner structures of (a) white and (b) brown body fat. Lipids in unilocular lipid droplets exist as one large globule as opposed to multiple small globules in multilocular droplets. Photograph Source: Professor Emeritus Hajime Sugihara, Saga University.

The question of why we gain weight is far from straightforward. Obesity — defined as an excess accumulation of white body fat — is becoming an increasingly urgent issue. The primary function of white body fat is to store lipids converted from food-derived sugar and fat. Brown body fat, on the other hand, uses stored lipids to generate heat. Recently, brown body fat loss and depression have been shown to lead to middle-aged spread known as *chunen butori* in Japanese. My aim is to help improve the prevention of obesity-related diseases using food components. By elucidating the differentiation mechanism and physiological roles of brown body fat, my study aims to promote the development of novel therapies for obesity-related common diseases.



Teruo Kawada, PhD

Professor, Graduate School of Agriculture
www.foodfunc.kais.kyoto-u.ac.jp/index.html

The Center for Southeast Asian Studies

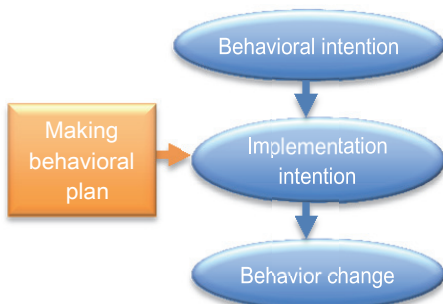


AS I majored in Southeast Asian studies at Kyoto University, for me, this Center for Southeast Asian Studies building is one of the most familiar features of the campus. The century-old brick building formerly belonged to the Kyoto Textile Company, but is currently used as a library.

In my first year of postgraduate study, many lectures and seminars used to be given on the second floor of the East building next to this building. At that time, as I couldn't understand what was discussed in class, or what "area studies" actually was, I sat facing

Using Communication to Ease Traffic Jams

Requesting a behavioral plan has a strong effect on actual behavior.



A Social Psychological Theory of Behavior Change Process
[T. Gärling, S. Fujii, *Scand. J. Psychol.*, 43(1), 1-8 (2002)]

The basis of my study is to apply psychological approaches to account for social issues such as traffic congestion. Traffic congestion is a type of phenomenon generally recognized as a social dilemma, with conflicts between public and the private interests. Figure 1 shows the social psychological theory of the process of behavioral change. This theory is applied to Mobility Management, a soft measure to promote voluntary changes of individual travel behavior through communication such as asking to make a behavioral plan. Mobility Management for inhabitant reduced car use by around 19% and increased transportation use by approximately 32%*.

*H.Suzuki, A. Taniguchi, S. Fujii, *Journal of JSCE*, 62(4), 574-585 (2006).

Ayu Miyakawa, PhD

Assistant Professor, Graduate School of Engineering
trans.kuciv.kyoto-u.ac.jp/tba/member/miyakawa



Grassroots Research for Peacekeeping in Africa

Land rehabilitation and conflict prevention in Sahel, Africa.

Land degradation is causing a decline in crop and livestock production as well as exacerbating conflicts over land resources in Sahel, West Africa. Since 2000, I have been continuing to conduct research on these issues. To avoid the risk of land degradation and prevent food shortages, local people carry trash from their homesteads and add it to degraded land

as manure. I describe these trials experienced by the local community. I constructed 50 m x 50 m fenced plots with the cooperation of local people and scattered urban organic trash onto the degraded land. This experiment revealed that urban trash input is a useful tool for plant recovery. I have a plan to apply this method for conflict prevention between farmers and herders.



From the Editor Based on this research, Dr. Oyama received the Daido Life Foundation Incentive Award for Area Studies 2014.

Shuichi Oyama, PhD

Associate Professor, Graduate School of Asian and African Area Studies, The Center for African Area Studies
www.africa.kyoto-u.ac.jp/eng/enmember/oyama.html

the window overlooking the courtyard and the library, and indulged in sketching these two chimneys, as well as my professors and classmates. I asked myself if it was the right choice to attend graduate school. However, I didn't want to give up the benefit of being able to stay in the lovely city of Kyoto for as long as five years, with the good justification of being a graduate student of the prestigious university. This is the only building I sketched while I was a student at Kyoto University, as I had much time to daydream in the East building.

Kiyoko Yamaguchi, PhD

After obtaining a PhD in Southeast Asian Area Studies from Kyoto University in 2005, Yamaguchi taught at the History Department of The Chinese University of Hong Kong from 2006 to 2014. Her architectural drawing was selected for The Royal Watercolour Society 2014 Competition.

