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INSTITUTE FOR ADVANCED RESEARCH
LETTER
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Special Interview

My Life & Okazaki Fragments
—— Tsuneko Okazaki

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For Further progress of the Institute

The Institute for Advanced Research (IAR) of Nagoya University was established in 2002 to promote academic studies, and is independent of the schools and departments at the University, as stipulated in the University Academic Charter. The fundamental objective of this institute is to foster and produce academic achievements at a prominent and internationally significant level. Such achievements are indispensable for the University not only to be widely recognized as a seat of learning but also to cultivate "courageous intellectuals." All members of the University should strive for an unsurpassed level of creative academic research. IAR has been and will be a center for assembling and coordinating various fields of state-of-the-art academic research in Nagoya University.

Internationally, IAR is a member of the Steering Committee of the University-Based Institutes for Advanced Study (UBIAS) and has some leading international exchange activities in research and education. In this context, we are planning to host a Nagoya University IAR international workshop on university education, where more than ten Institutes for Advanced Study (IASs) and IARs from various parts of the world including several IAS/IARs from European universities together with several IAS/IAR from Southeast Asian Universities in November this year. In this workshop, "The East and West" IAS/IAR will get together here in Nagoya for the first time to discuss a common theme in university education related to IAS/IAR and to strengthen mutual ties. I sincerely hope that all participants in the workshop at the Nagoya University IAR will enjoy discussing such a cross-disciplinary theme and exchanging ideas of mutual interest in the forum.

During the past seven years, the IAR has also been coordinating an important University program, the so-called Young Leaders Cultivation (YLC) Tenure-track Program, which has played a crucial role in cultivating and supporting talented young researchers in various fields. The program has contributed greatly to converting the outcomes of excellent studies done by IAR researchers in individual departments into common property of all members of the University. This year, we have newly hired eight brilliant young researchers in various fields as YLC Designated Assistant Professors. Readers may find this issue' s Special Interview and Research Highlights interesting, and the interview is with Professor Tsuneko Okazaki, professor emeritus at Nagoya University, who was honored as a Person of Cultural Merit in 2015 and known for the discovery of "Okazaki Fragments" with her late husband, Professor Reiji Okazaki.

February 2017
Director of Institute for Advanced Research

Director
Hisanori SHINOHARA

15
March 2017

INSTITUTE FOR ADVANCED RESEARCH

LETTER

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Cover Photo :
Great Pyramid of Giza.
(Kunihiro Morishima, from Research Highlights, pp. 7-8.)

Special Interview

Tsuneko OKAZAKI

Dr. Tsuneko Okazaki is a molecular biologist renowned for her discovery of the Okazaki fragments with her husband Dr. Reiji Okazaki. Even after the early death of Dr. Reiji Okazaki in 1975, she continued their research and clarified the mechanisms of discontinuous DNA replication. She graduated from Nagoya University in 1956 and received a PhD in Science from the same university in 1963. She was awarded a Fulbright travel grant and studied in the USA from 1960 to 1963; she studied as a fellow in 1960-1961 at Washington University, School of Pharmacology (supervised by Dr. Jack L. Strominger) and from 1961-1963 at Stanford University, School of Medicine (supervised by Dr. Arthur Kornberg). She worked at the Graduate School of Science at Nagoya University as an assistant- (1965-1976), associate- (1976-1983) and full professor (1983-1997). She was also a full professor (1997-2002) and a visiting professor (2002-2008) of the Institute for Comprehensive Medical Science at Fujita Health University, and served as a director of the Japan Society for Promotion of Science, Stockholm Office (2004-2007) and president and CEO of Chromo Research Inc. (2008-2014). In 2016, she became a University Professor at Nagoya University and a member of the IAR Academy. She has won numerous awards such as the L'Oréal-UNESCO Awards for Women in Science (2000), the Medal with Purple Ribbon (2000), the Order of the Sacred Treasure, Gold Rays withNeck Ribbon (2008) and the Person of Cultural Merit (2015).

My Life & Okazaki Fragments

—— Could you please explain what Okazaki fragments are?

OKAZAKI: DNA has a double helix structure. In replication of DNA, the double strands of the DNA helix are unwound to produce a new strand complementary to each strand. Conventionally, it was believed that there were two different enzymes, one elongating the strand from the 5' to 3' direction and another elongating the strand from the 3' to 5' direction. However, in fact, there was only one enzyme that elongates the strand from the 5' to 3' direction. So we attempted to explain how two strands were oriented in the double helix with only one enzyme. This is referred to as discontinuous replication.

We formulated a hypothesis that the reverse strand running in the opposite direction is synthesized in a series of short DNA fragments. What we did was to clarify the mechanism of how the synthesis of the strand proceeds involving various reactions such as binding the short DNA fragments together. Okazaki fragments are those short strands of DNA that are discontinuously synthesized in the reserve direction.

When we first started this research, we knew nothing at all about the strands, including their length. We took the strategy of labeling of the end of the fragments being elongated with short intervals and monitoring the shift of the labeled ends to see on which side they would be found. At first, the labels were found in the short fragments in a concentrated manner; however, the labels shifted to the longer fragments after being left for a while. We therefore assumed that the fragments were formed in a discontinuous manner although we had to take various steps before the assumption was proved.

We knew that DNA polymerase cannot start synthesis of DNA de novo but needs already existing, so-called primer termini, to start synthesis. We analyzed the primer termini used for the synthesis to see how the synthesis of these short fragments was started repeatedly. As the result, we found that these primers were short RNA primers. The RNA was broken down and the gaps thus produced were filled up with DNA and short DNA chains were bound together with an enzyme named ligase. It was proved that short fragments were accumulated with involvement of various reactions of the enzymes and the suppression of the enzymes. This finally clarified the discontinuous replication.

—— What motivated you to be interested in natural science?

OKAZAKI: I was born in Moriyama ward of Nagoya city. I grew up during the war. My father was a doctor; he lost his hospital in the war, and worked as a director of a hospital in Gamagori city. I was a junior high school student then and used to visit there, where I spent my summer holidays swimming in the sea or looking into a microscope. My father showed me the process of bacterial cells dying due to penicillin used for treatment. I naturally became interested in organisms and bioscience.

—— What was your reason for choosing biology in university?

OKAZAKI: My father planned to make all his children medical doctors. So by not choosing to enter the medical department I was an unworthy daughter.

Doctors need to be very sociable. They need to work with a lot of staff, and most of all, doctors should interact effectively with many patients. Because I was not a very sociable person, I thought I was not suited to being a doctor. So, instead of entering the medical department, I chose biology, since that was what I was most interested in.

—— In those days, there were only a few female researchers. How did you dare to become a female researcher?

OKAZAKI: At the time, female students in the department of biology where I was studying had difficulties finding a job. Other than being a researcher, teaching at a high school was the only choice of employment open to us. Today it is an era of bioscience and women are in gainful employment. But the situation was completely different then.

—— You met your husband, Dr. Reiji Okazaki, when you were a university student.

OKAZAKI: When I was in my senior year of university, I met Reiji who was working as a researcher then. We got married in the spring in which I advanced to the graduate school. We started our joint research in the same laboratory. Reiji was the type of scientist who thought of nothing else but his research, and as I recall we were totally absorbed in the research in those days.

Besides research, Reiji was very fond of sumo wrestling, and because we had no TV set, we used to go to an udon noodle shop where a TV set was installed to watch sumo broadcasts. There were no other entertainments actually.

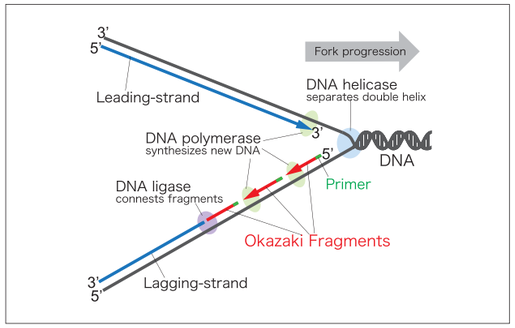
—— What was the research environment like?

OKAZAKI: Japan was still very poor in those days, and the research environment was incomparably poorer than it is today. The laboratory was a wooden building and there was a leak in the roof caused by the Ise Bay Typhoon, which damaged all our laboratory samples. We were short of research funds so we often bought reagents with money from our own pockets.

—— Then the two of you went to America...

OKAZAKI: In 1960, Reiji and I went to the U.S. by ship, on the Hikawa Maru, and studied in Washington University and Stanford University as recipients of the Fulbright travel expense scholarship. In Stanford University, we studied DNA polymerase in the laboratory of Professor Arthur Kornberg who won the Nobel Prize.

In 1963, Reiji was called back by Nagoya University and we returned to Japan. Reiji became an assistant professor while I returned to the doctoral course and obtained a Ph.D. After that, I became an assistant in Reiji's laboratory and started to work on the research with him.



OKAZAKI FRAGMENTS
Okazaki fragments are short DNA fragments that are temporarily produced during DNA replication at the lagging-strand. DNA replication is started by separating the double helix by DNA helicase. Two complementary single-stranded DNA are formed, which will become templates for DNA synthesis. One of the single DNA strands is replicated continuously (leading-strand), but this is not possible for the other strand (lagging-strand). It is because DNA polymerase, the enzyme synthesizing new DNA, extends DNA strands in one direction only (from 5' to 3'). In the process of lagging-chain production, whose overall direction of elongation is from 3' to 5' Okazaki fragments are produced first in the direction opposite to that of fork progression and are later connected to form a complete long strand.

—— Were working conditions for women in the U.S. very different from those in Japan in those days?

OKAZAKI: A woman was not recognized as a full-fledged researcher in Japan back then. A woman researcher was not even given a post. That was the atmosphere of the time. Contrarily, in the States, I was recognized as full-fledged researcher. I appreciated that very much.

In Japan, it was the matter of course that women stayed at home raising their children. After I came back to Japan, I had my first child at the age of 30, and my second child at the age of 40. Unlike today, there was no framework for parenting support, such as nurseries to look after children. I had to make these arrangements on my own. I even took part in a citizen's campaign demanding improvement of nurseries.

—— How did you balance your research activities and child-raising?

OKAZAKI: It was very hard. I sent my children to a nursery but they came home at 3:00 or 4:00 in the afternoon. After that time, I hired a part-time baby-sitter to look after them. But even this arrangement was limited to 5:00 at the latest. Then, I had to go and pick them up, so I took them to the laboratory, put them in a big cardboard box and made them play there.

It was even harder after they went to elementary school, because they came home earlier.
A person who used to work at my father's hospital lived in my neighborhood and she looked after my children after school. I owe her a great deal.

With respect to research, we started working on "discontinuous replication" from around 1964. We discovered the Okazaki fragments and published our results in 1967.

—— Your husband passed away in 1975.

OKAZAKI: He was in Hiroshima in the year World War II ended. About two years prior to his death, he showed bleeding on his skin and we knew that he suffered from leukemia. No treatment was available for leukemia back then. In 1975, he was called to an academic meeting in Canada, and died shortly after returning to Japan.

His death meant that the laboratory lost its boss and our children lost their father. People suggested that I should give up the research because of the children. At such time, my respected professor Kornberg in America sent me a letter, saying "never give up the research; the world is waiting for the outcome of your research at Nagoya." This letter encouraged me very much. My son was in the 6th grade of elementary school and my daughter was two and a half years old then. I asked the neighbor who had been baby-sitting my children to continue to look after them. I really owe her so much.

—— What sort of research did you do after your husband's death?

OKAZAKI: I continued the research that I had been doing with Reiji. I had competent joint researchers. The biggest mystery was the primer RNA - how is it that short fragments are formed repeatedly? So we worked on isolating the primer and determining its structure.

—— What is the significance of the research on Okazaki fragments and discontinuous replication?

OKAZAKI: We discovered the truth - the concept of a primer, the role of the short sequence of bases to trigger DNA replication. Using this, methods such as PCR, to design a base sequence of a specific region as a primer and amplify gaps, are widely used now.

—— Who had the most influence on you?

OKAZAKI: There were many people who helped me and encouraged me. When Reiji passed away, I might have quit the research if it had not been for Professor Kornberg's letter encouraging me to continue with it. I also received encouragement from researchers all over the world.

—— Do you have any advice to younger women researchers or other working women about the balance between career and home?

OKAZAKI: I think there must be very hard times, but the most important thing is not to quit in any case. Difficult times or tough times are limited to a short while. Once you have gone through such times, children grow up. In the case of a researcher, if you quit, your post is likely to be filled by someone else, making it difficult for you to return to it. Today, supportive measures are taken by universities. Making use of these advantages, it is important to manage to get through hard times by taking holidays or decreasing working hours.

—— What do you think is important now, to give more opportunities for women?

OKAZAKI: I think it is desirable that a system should be available for women to return to work after leaving temporarily or to decrease their working hours for child-birth and child rearing. The support of nurseries is also important.

On top of that, another important factor is whether the family and surrounding people understand the situation and are willing to provide support. Criticism from parents or sisters or brothers is often very harsh. Many people together could change the public mind-set that says "keeping house and raising children is women's work."

My daughter lives in Sweden now. Men in Sweden know how to raise a child and do housework. They are good cooks too. The social environment is such that it is a common practice for men to do all kinds of housework and child-rearing, as much as women do, and boys are brought up in that way. So in Japan too, it is important to prepare boys to be able to do household chores and raise children as a matter of course.

—— About student scholarship

OKAZAKI: Once I personally provided financial aid for a graduate student who could not get a scholarship. The current Japanese scholarship program is provided mainly in the form of student loans that force students to accumulate large amounts of debt when they graduate. Scholarships that do not need to be paid back should be awarded to competent young students. This is extremely important in terms of cultivation of human resources, and this style of scholarship is provided in many countries.

—— How do you think university students and graduate school students should prepare when aiming to be a researcher? What is your advice for them?

OKAZAKI: An important thing is that the starting point of a research project is to have a question asked initially by the researcher himself/herself, who then attempts to clarify it. It is not something that you can be told by someone else to do.

First, the researcher should think about what he/she wants to seek, and discuss it thoroughly. Some people avoid discussion to keep some matters secret, but it is important to engage in a lot of discussion with people around you.

—— What is the mechanism of living organisms or mysteries of nature for you?

OKAZAKI: The mechanism of nature is extremely ingenious, always exceeding what I have imagined. There are so many things we do not know yet. When we were doing the early research, we simply studied the naked DNA, while now researchers are studying a chromosome as a packaged structure containing composite information to see how things are inherited. What researchers are studying now is much more advanced.

Interview with Prof. Okazaki was done by Nagoya-IAR faculties and C. Tsuboi (Chunichi Shimbun Co., Ltd). This interview article was written by C. Tsuboi and translated to English under the responsibility of Nagoya IAR.

Research of Egyptian Pyramids with Cosmic ray Imaging

Installation of nuclear emulsion detectors inside the Bent Pyramid at the Dahshur necropolis in Egypt. Aluminum plates, which fix nuclear emulsions, were placed horizontally on the ground inside the lower chamber to measure cosmic rays to validate imaging of the upper chamber.

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Egyptian pyramids built more than 4500 years ago still hold various mysteries. To take transmission images inside gigantic objects like a pyramid, we are developing Cosmic ray imaging technology with nuclear emulsions that can detect radiation emissions such as muons with very high accuracy. We have been measuring the Bent Pyramid at the Dahshur necropolis and the Khufu Pyramid at Giza in Egypt since 2015. We validated our methodology by performing the first imaging of the chamber inside the Bent Pyramid and found an anomaly behind the north entrance of the Khufu Pyramid.

INTRODUCTION

Pyramids are gigantic stone architecture, which were built by ancient Egyptians more than 4500 years ago. There are a lot of mysteries; "Who did build them?" "Why and how built?" These are still unknown. In order to solve the mysteries of Pyramids, various research missions with advanced non-destructive technologies were conducted in past 50 years; radar scan, micro-gravity meter, robot and so on. However, these technologies have not enough searching ability of depth, which can search up to several meters from these devices. Thus, if there are any hidden structures deeply inside Pyramid, it could not be found. And also, since they have not enough accurate imaging resolutions, its positions and shapes can't be clearly revealed if any anomalies are found.

Cosmic ray Imaging

X-ray imaging is a non-destructive imaging technology for viewing the human body or industrial materials with accurate imaging resolution. However, X-rays are not able to penetrate a pyramid because its penetration length is an order of meters in matter. Imaging using muons contained in cosmic rays can realize visualization deeply inside gigantic objects like pyramids. Cosmic rays are fundamental particles or nucleus, which are produced and accelerated by high energy astronomical phenomena in the universe like, for example, a supernova explosion. Interaction between cosmic rays and atoms in the atmosphere produce secondary particles including muons that have various energy levels. Muons have high penetration power in matter due to their physical properties, which depends on their energy; for instance, high energy muons are able to penetrate more than 1 km thick limestones. Through this property, if a hidden space inside a pyramid is present and muons pass through the space, then more muons are able to penetrate the pyramid than without the space. To take transmission images, directional sensitive detectors are needed because Cosmic ray muons are hitting the ground from every direction. Directional distribution of Cosmic ray muons measured by a detector shows an absorption effect while passing through matter and this can be converted into the density length, which is defined as the product of density and length along the pass, in each direction from the detector. Thus, the inner structure of a pyramid can be reconstructed.

Nuclear Emulsion

A nuclear emulsion is a photographic film used for detecting three-dimensional trajectories of radiation with sub-micrometric spatial resolution thanks to very small silver bromide crystals, which work as a sensor of radiation [1, 2, 3]. It is thin, lightweight, and works without an electric power supply. These properties are suitable for Cosmic ray imaging. Therefore, we are developing advanced nuclear emulsions and its analyzing technologies for Cosmic ray imaging.

Scanpyramids

We are applying Cosmic ray imaging with nuclear emulsion technologies to the measurement of pyramids through participation in an international scientific research project called "ScanPyramids," which was organized mainly by Egypt's Ministry of Antiquities and started in October 2015. So far in this project, the Bent Pyramid at Dahshur and Khufu Pyramid at Giza have been measured.

Measuring the Bent Pyramid

We measured the Bent Pyramid to validate our methodology from December 2015 to January 2016. Nuclear emulsions were produced in our laboratory at Nagoya University and sent to Cairo, Egypt. They were installed inside the lower chamber in the Bent Pyramid (Fig. 1 (a), (b)), with the installation area covering 3m^2. The emulsions were collected and developed after 40 days in Cairo, and then analyzed at Nagoya University by a high speed automated scanning system called HTS. Through these measurements, we took Cosmic ray muon images and compared them with a simulation (Fig. 1 (c), (d)). These images show that red means a large number of Cosmic ray muons and blue a small number in the two-dimensional angular space that shows the detected direction of Cosmic ray muons. The dashed circle in each image shows the direction of the upper chamber. Through this analysis, we validated our methodology by imaging the upper chamber from the lower chamber. This is the first validation of imaging of a chamber inside a pyramid of 100 m-thick limestone.

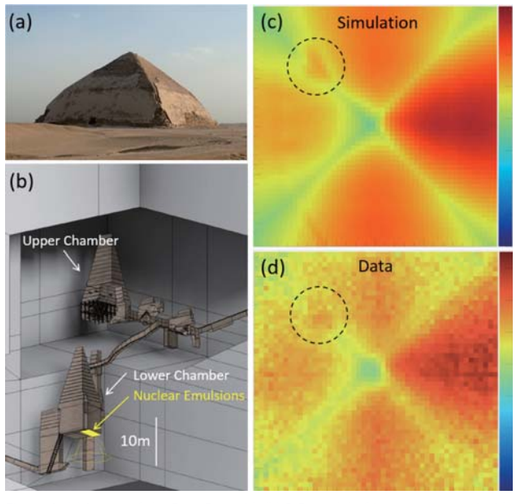

Figure 1. (a) Image of the Bent Pyramid, (b) 3-D model of inner structures inside the Bent Pyramid, (c) Cosmic ray image by simulation, (d) Cosmic ray image from measurement data.

Measuring the Khufu Pyramid

We have been measuring the Khufu Pyramid since 2016. Nuclear emulsions were installed in the Descending Corridor extending from the main entrance and the Queen's Chamber (Fig. 2). We released our results from data from the Descending Corridor in 67 days (Fig. 3). It showed that there is a clear difference from the center to north side when comparing data versus simulation. This difference is over five sigmas, strongly suggesting one or several unknown voids behind the north face. We are measuring from additional positions in the Descending Corridor to clearly identify the shape and positons suggested by the anomaly and also analyzing the data collected from the Queen's Chamber.

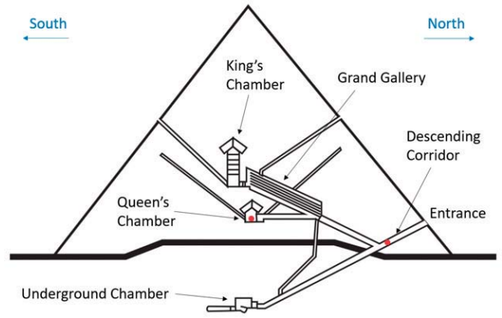

Figure 2. North-south cross-section of the Khufu Pyramid. The two red points show the installation locations of the nuclear emulsions.

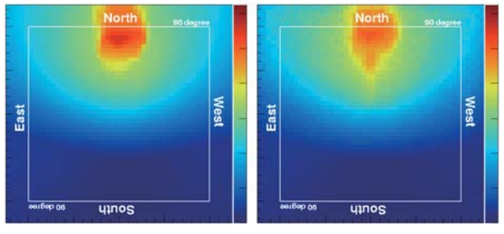

Figure 3. Cosmic ray images of the north face of the Khufu Pyramid from the Descending Corridor by (a) simulation, and from (b) measurement data.

Future Prospects

Cosmic ray imaging is a very powerful technology for not only archaeology as shown but also a wide variety of research fields: science, engineering, industry, infrastructure inspections, and more. In the near future, we plan to apply nuclear emulsion technology to various applications and realize Cosmic ray tomography, which is three-dimensional visualization from many two-dimensional images inside a gigantic object.

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The Effects on Ancient Maya Society of the Catastrophic Holocene-epoch Eruption of Ilopango

Acrópolis, SanAndrés, El Salvador.

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There is no doubt that natural disasters have brought sudden environmental and cultural changes, and have impacted current and past human societies. Archaeology provides excellent evidence on these topics. However, scholars have far too often simply emphasized natural disasters as dramatic and fatal events, while human responses to and resilience in the face of natural disasters have been underestimated. Using the case study of the San Andrés site located in the southeastern Maya area, I highlight that we need to conduct careful case-by-case examinations of the effects of disasters.

INTRODUCTION

Natural disasters are an important concern for the modern world due to the huge loss of life they cause. Although most natural disaster studies are still dominated by natural scientists, social scientists have recently entered this arena to better understand the human response to hazardous events and sudden environmental change. Archaeology is especially recognized as one of the key disciplines in the advancement of disaster studies, since archaeological research can trace past human responses and the correlation of disasters with cultural change from a long-term perspective.

Ironically, archaeologists often benefit from volcanic disasters because the eruptive products of the eruption—such as pyroclastic flow, ash-fall tephra, etc.—can preserve the artifacts of ancient daily lives in excellent condition. In addition, the widespread emitted volcanic ash is often useful in accurately dating finds. On the other hand, volcanoes are especially dangerous hazards as they are unpredictable, sudden, and often have catastrophic effects on current and past human societies. Scholars have often emphasized that volcanic eruptions are critical events for human societies. However, we can also observe long-term human activities in volcanic areas. The purpose of our study is to better understand the correlation between volcanic activity and human response, as well as the resultant cultural and social shifts, based on archaeological investigation of the southeastern Maya area, specifically the Zapotitán Valley in El Salvador.

Geological Setting and Eruption of Ilopango Volcano

The Zapotitán Valley, located in central El Salvador, has experienced numerous explosive events over the past two millennia. One of these volcanic events was the eruption of Ilopango Volcano. Although the dating and effects are still under discussion (1), this eruption occurred in the 5th—6th centuries AD, and is well known as the most catastrophic New World eruption during the Holocene (2). For several decades, many scholars have argued that the Ilopango eruption resulted in serious sudden environmental changes and social problems in bordering regions, including the Zapotitán Valley, with many sites being abandoned for at least half a century or even a few centuries. Recent archaeological investigation of SanAndrés in the Zapotitán Valley located c. 45km from Ilopango Volcano, however, provides new insights and hypotheses regarding human responses to its catastrophic eruption.

Volcanic Disaster and Construction of Monumental Architecture

Based on archaeological evidence at SanAndrés, I hypothesize that the construction of monumental architecture was the motivating force behind the recovery process from the catastrophic natural events. Our team excavated the platform of Structure-5, the largest monumental architecture at the site, which consists of a 13m-tall pyramid on top of a 7m-tall platform, approximately 90m from north to south by 80m from east to west. In general, Maya monumental architecture consists of a superimposed series of constructions. Excavations revealed at least three construction phases of the platform of Structure-5, the first of which is masonry architecture, which was constructed on top of volcanic ash layers of approx. 40cm thick spewed out in the eruption of Ilopango Volcano. This masonry architecture was covered by adobe construction. Previously, it was considered that this earthen architecture was constructed several decades or centuries after the catastrophic eruption. However, the masonry architecture between the volcanic Ilopango ash and the adobe architecture indicates that ancient people returned to the Zapotitán Valley more rapidly than previously thought.

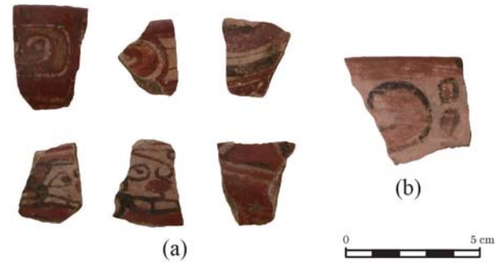
Masonry architecture constructed after the eruption of Ilopango Volcano.

Volcanoes are an important element in Maya cosmological concepts. Monumental architecture usually represented a “sacred mountain” and was an important symbol of community identity. Therefore, I consider that the collaborative actions in constructing monumental architecture might have reinforced not only elite power but also the social relationships between community members, in this case the victims of the eruption, and motivated people during the post-eruption recovery process.

Social Networks as a Mitigation Strategy

Networks are highly important socioeconomically in studies of ancient societies. At the same time, I highlight the importance of interregional and social networks to mitigate or overcome the damage of natural disasters. Establishing and maintaining broader social networks contributes to mitigating impacts over time and building resilient societies.

In the case of San Andrés, the masonry architecture mentione above is key evidence in identifying support for the affected society from other regions. Generally, in the southeastern Maya region (present-day El Salvador) both monumental and household architecture consisted of earthen materials like adobe brick and mud plaster. Therefore, the masonry architecture that was constructed after the eruption should be regarded as significantly different, because people needed new concepts, techniques, and labor organization for these construction activities. Furthermore, ceramic types also dramatically changed after the eruption. I hypothesize that these data indicate reconstruction support from another social group. One candidate is Quelepa, located about 130km east of San Andrés, a settlement demonstrating similar architectural components. Another possibility is Copán, one of the most powerful dynasties in the Classic Mayan realm, because San Andrés is considered to have been a satellite center of the Copán dynasty.



Ceramic sherds related to Copán (a: Copador Polychrome) and Quelepa (b: Quelepa Polychrome).

Concluding Remarks

Generally, defining direct connections between sudden environmental change and cultural practices is complicated by a number of factors. However, volcanic products like thick ash fall are easily identified in archaeological sites. In this sense, archaeological data on the gigantic eruption of Ilopango permit a deeper discussion of the impact of natural disasters on human societies. Although the hypothesis mentioned previously still needs to be verified, constructions of monumental architecture and social networks in ancient Maya societies could have had special roles and probably played these roles in response to natural disasters.

Acknowledgements

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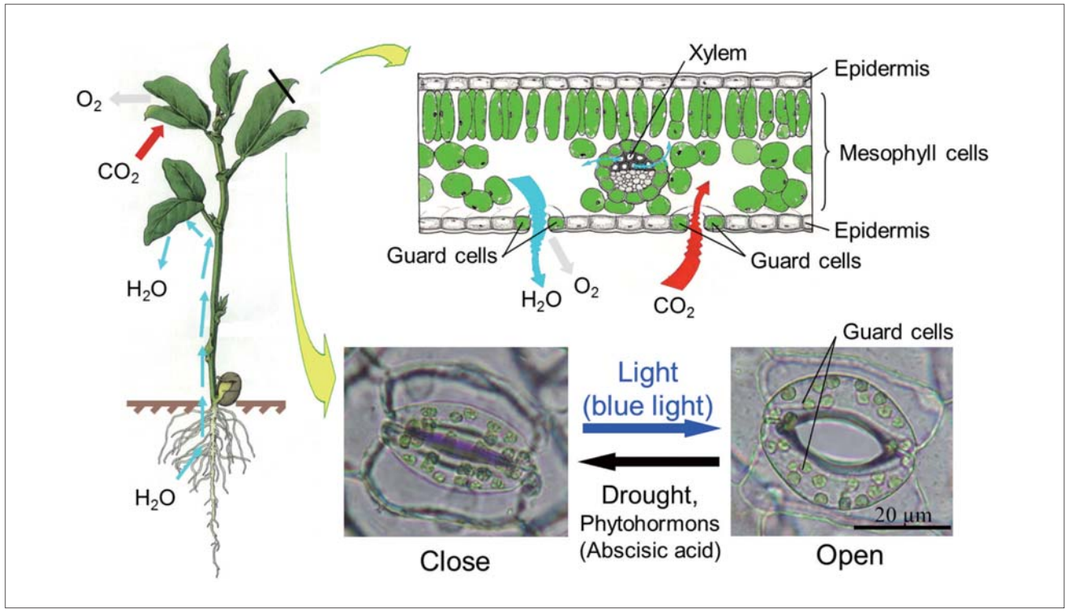
Enhanced plant photosynthesis and growth through manipulation of stomatal apertures



Each stoma (pl. stomata) is controlled by a pair of special cells, named guard cells. Stomata regulate gas exchange between the plant and the atmosphere.

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Stomata are microscopic pores surrounded by two guard cells and play an important role in the uptake of carbon dioxide (CO_2) for photosynthesis. Here, we showed that overexpression the amount of plasma membrane H^+-ATPase in guard cells had a significant effect on light-induced stomatal openings, and therefore enhanced photosynthesis activity and plant growth. Application of this strategy in crops and fuel plants is expected to contribute greatly to the promotion of plant production and a sustainable low-carbon society.

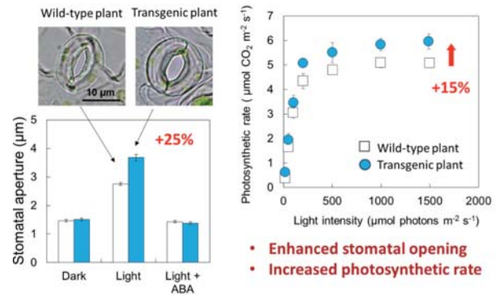
INTRODUCTION

Photosynthesis is a fundamental process that has a close relationship with two critical worldwide problems: global climate change and food shortage. How to improve the efficiency of photosynthesis of land plants to promote carbon dioxide (CO_2) absorption and increase crop growth is a hot topic for biologists. Leaves are the primary involved in plant photosynthesis. As the leaf surface is virtually impermeable to air and water, key microscopic pores—known as stomata—provide the major pathways for the diffusion of CO_2, O_2, and water vapor between the ambient atmosphere and the interior of the leaf. This facilitation of gas exchange by stomatal openings is one of the most essential processes in plant photosynthesis and transpiration.

Stomata are microscopic pores found on the surface of the leaves, petioles, stem, and other aerial parts of a plant. Each stoma is bound by two specialized cells in the epidermis, called "guard cells," which regulate and control the size of the stomatal aperture (see Figure 1). Light is one of the principal factors that stimulates stomatal opening, and various mechanisms underlie stomatal opening in response to light. Recent studies on *Arabidopsis thaliana* (a typical model plant) have revealed that the signaling pathway of light induces stomatal opening involving at least three key components—photoreceptors (phototropins), the plasma membrane H^+-ATPase, and inward-rectifying K^+ channels (K^+in channels) (1). Therefore, it is expected that the overexpression of those three components in *Arabidopsis* guard cells could induce stomatal opening to increase photosynthesis and plant growth. However, no previous studies have determined stomatal effects on plant growth by manipulating stomatal apertures via gene regulation in guard cells, perhaps because of the difficulty of balancing the counteracting effects of taking up CO_2 while losing water vapor through the stomata (2).

Overexpression of H^+-ATPase in Guard Cells Promotes Light-Induced Stomatal Opening and Enhances the Photosynthetic Rate

Using the Guard Cell 1 (GC1) promoter, we successfully overexpressed PHOT2 (an isoform of the blue-light receptor phototropin), AHA2 (a typical isoform of the plasma membrane H^+-ATPase), AKT1 and KAT1 (isoforms of plasma membrane K^+in channels) in guard cells, and thereby obtained homo lines with high expression levels. Then, physiological studies on *Arabidopsis* plants with the overexpressed components were performed. Via isolation of the epidermis of 3- to 4-week-old mature leaves, stomatal apertures were examined by microscope. The results showed that the stomatal apertures of a plant with overexpressed AHA2 opened wider than those of wild-type (WT) plants exposed to light illumination for 2.5 hours, but these stomata closed in darkness just as those in the WT plants (Figure 2). It also demonstrated that the stomata of the plants with overexpressed AHA2 opened more quickly than WT stomata over a period of 30 minutes of illumination. In contrast, the overexpression of PHOT2, AKT1 and KAT1 had no effect on stomatal opening under light conditions. These results indicated that H^+-ATPase, not phototropins or K^+in channels, is the limiting factor in light-induced stomatal opening, and that increasing the amount of H^+-ATPase in guard cells increases the magnitude and speed of stomatal opening (3).



Transgenic plant (plant with overexpressed AHA2) showed larger stomatal apertures and a higher photosynthetic rate than wild-type plants

Then, the stomatal conductance (reflection of the stomatal gas-exchange ability of intact leaves) and photosynthetic activity (photosynthetic rate) of intact leaves of the plants with overexpressed AHA2 were examined in detail by a gas-exchange system. As expected, the stomatal conductance and photosynthetic rate were significantly higher in the plants with overexpressed AHA2 than in the WT plants (Figure 2). To determine whether the higher photosynthetic rate of the plants with overexpressed AHA2 was due to the increased stomatal opening, we examined the response curve between the CO_2 assimilation rate and the leaf intercellular CO_2 concentration using a gas-exchange system under saturated light conditions. The two curves were almost coincident with each other, indicating that both the Rubisco carboxylation capacity and the electron transport capacity were similar in the WT and transgenic plants, but only the stomatal conductance was greater in the plants with overexpressed AHA2. These results indicate that the enhanced stomatal opening in the plants with overexpressed AHA2 contributed to the increased photosynthetic rate (3).

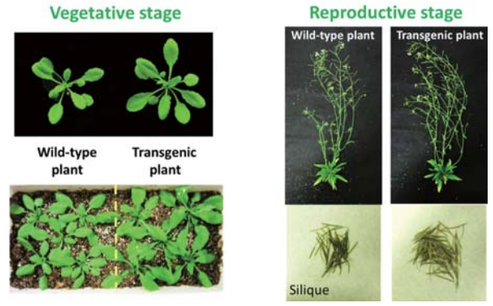
Overexpression of H^+-ATPase in Guard Cells Enhances Plant Productivity

Grown under conditions of sufficient light (about 200 μmol photon m-2 s-1), the plants with overexpressed AHA2 exhibited superiority in plant growth. They produced larger and increased numbers of rosette leaves with approx. 42–63% greater fresh and dry weights than the WT plants in the vegetative stage (25 days old). Moreover, the dry weights of the total flowering stems in the reproductive stage (45 days old), including seeds, siliques, and flowers, of the plants with overexpressed AHA2 were approx. 36–41% greater than those of the WT plants under the same growth conditions. The number of siliques per plant with overexpressed AHA2 was much greater than for the WT plants, although the dry weights of individual siliques from the plants with overexpressed AHA2 were comparable to those from the WT plants (3). more the intention of the husbands, who typically had a larger ideal family size than their wives.

Environmental response of plants with overexpressed H^+-ATPase in guard cells

It should be mentioned that the increment of plant growth in the plants with overexpressed AHA2 was obtained under laboratory conditions with proper light, water, temperature, and CO_2 concentration. However, in the field, the environmental factors are not always optimal for plant growth, and even worse, certain abiotic and biotic stresses may occur. To investigate these factors, the plants with overexpressed AHA2 were grown under various unfavorable conditions including low light, short daylight hours, and high CO_2, and the stomatal apertures and plant growth were subsequently examined. The results showed that the stomatal apertures of the plants with overexpressed AHA2 were still larger than those of the WT plants under all the growing conditions. However, since under low light and high CO_2 conditions stomatal limitation did not constitute a key limitation to photosynthesis, the superiority in growth was negated under those two conditions. Only under the short-daylight-hours condition did the plants with overexpressed AHA2 grow better and larger than the WT plants.

Meanwhile, the stress resistance of the plants with overexpressed AHA2 to drought and high temperature (considered as two major abiotic stresses) and pathogens (considered as the major biotic stress) were examined. It is notable that the plants with overexpressed AHA2 showed normal stress resistance, equivalent to the WT plants, under all the abiotic and biotic stresses. These results provide important additional information of how stomatal aperture manipulation biotechnology can be used to promote stomatal opening and enhance plant growth in the field.



The transgenic plant (plant with overexpressed AHA2) exhibited greater plant growth in both the vegetative stage and the reproductive stage than the wild-type plant

Acknowledgements

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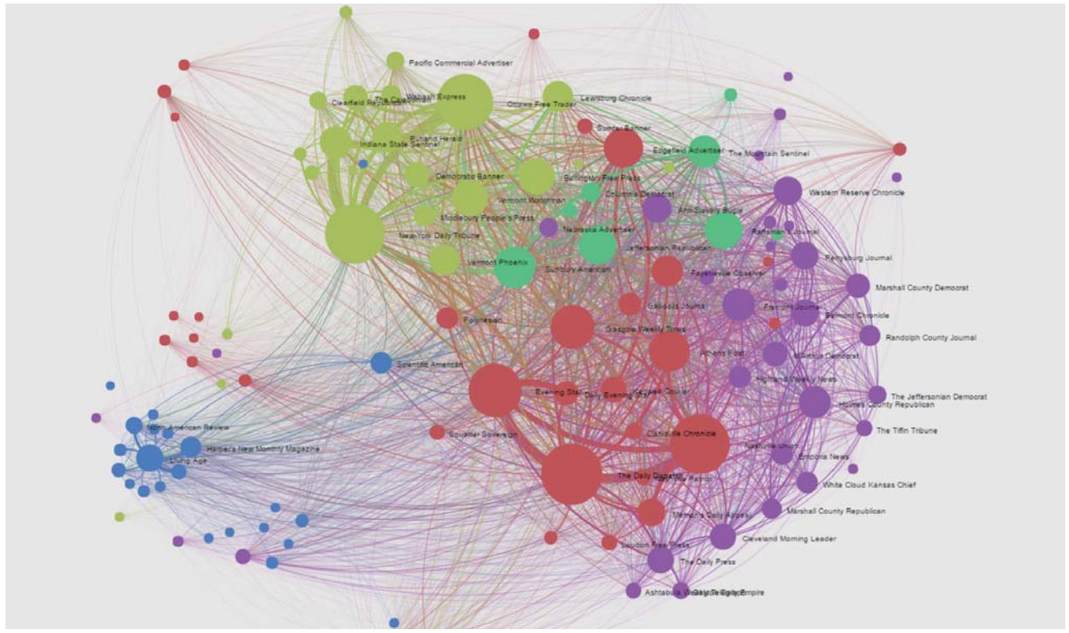
Content Reuse for Text and Multimedia Documents



A network showing text reuse among pre-Civil-War newspapers from the Library of U.S. Congress's Chronicling America newspaper archive [1].

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Content reuse is a common practice in an era when electronic documents prevail. For example, when composing presentation slides, people often create new files by reusing the materials in existing slides instead of starting from scratch. Investigating content reuse in electronic documents may assist in a wide range of applications, including plagiarism detection, near-duplicate Web page removal, text summary generation and presentation slide composition. This study covers two tasks: content reuse detection in text documents and content reuse for presentation slide composition. We addressed several important technical issues and proposed effective methods with high efficiency. On the basis of the proposed methods, prototype systems with user-friendly interfaces were developed for practical use.

INTRODUCTION

One of the main issues accompanying the growing popularity of electronic documents is the existence of reused contents. For example, reused text may exist in academic papers, dissertations, etc. People may plagiarize others' work by copying text segments from various sources and making a few modifications to avoid detection. Another example is that when composing presentation slides, 97% of people compose presentation slides by reusing existing materials rather than starting from scratch [2]. One of the primary reasons for such reuse is to repurpose the contents of existing slides for different audiences, events, formats, etc. In this study, we looked at content reuse for two common types of documents: text and multimedia, and focused on the following two tasks: (1) content reuse detection in text documents, and (2) content reuse for presentation slide composition.

Content reuse detection in text documents

Although there have been many existing solutions to the detection of reused contents, e.g., [3, 4], they can be easily fooled by minor modifications (Figure 1), such as reorganizing sentences, replacing words with synonyms, etc. Consequently, reused contents with modifications are often missed by these methods, and hence the quality of detection is not satisfactory.

Seeing the limitations of prior solutions, we propose a new approach by detecting similar text segments. Our method is not only insusceptible to word order or sentence structure, but is also tolerant of a small number of differences. Hence text reuse can be detected in spite of minor modifications. We evaluated our method for the purpose of plagiarism detection. The experiment results show that our method detects more than 90% of plagiarism in benchmark datasets, significantly outperforming existing methods, which detect up to 70% of plagiarism. In addition, our method is able to detect templates and boilerplates, which are commonly used in newspapers and Web pages.

...Now, then, if we are interested in the problem of democracy, we have two courses open it of finding out why it is that the laws we already have are not enforced, and are PRACTICAL difficulties which confront the Negro choice in many parts of the South. The point I wish to make is that legally the Negro is the political equality of the white man as well. The doctrine laid down in the Fifteenth is neither for some both white and colored to poorer category of white man, nor for the women of now expired by limitation. Let me then lay down this general: Nowhere in the South today is neither for the factories and shops, nor for the well within the principle laid down by the Fifteenth Amendment the Negro cut off LEGALLY, as a Negro, from the ballot...

...Legally, today, any Negro who can meet the comparatively slight requirements as to education, or property, or both, can cast his ballot on a basis of equality with the white man. I have emphasized the word legally, for I know the PRACTICAL difficulties which confront the Negro votes in many parts of the South. The point I wish to make is that legally the Negro is essentially the political equal of the white man; but that practically, in the enforcement of the law, the legislative ideal is still pegged out far beyond the actual performance. Now, the, if we are interested in the problem of democracy, we have two courses open to us. We may think the laws are unjust to the Negro, and incidentally to the 'poor white' man as well. If we do, we have a perfect...

Figure 1. Text reuse (left, in yellow) by copying from another document (right) and making minor modifications (in red).

Besides improving the result quality, we also developed efficient indexing and optimization techniques to speed up our method for the purpose of handling large volumes of text data. The experimental evaluation shows that our method equipped with these techniques is up to 12 times faster than alternative solutions.

Content reuse for presentation slide composition

We designed a platform to help users compose slides by reusing existing materials. The platform consists of three modules: (1) slide element search, (2) slide management, and (3) slide auto-generation.

For slide element search, due to the existence of different types of elements in presentation slides, e.g., textual elements such as titles and sentences, and graphical elements such as images, charts, and diagrams, we develop a series of techniques to handle the variety of presentation slide elements. For textual elements, users can input keywords or sentences to search, like when using a Web search engine. For graphical elements, users can select an image on their disks or drag a rectangle area in a slide as a query (Figure 2). Then the module efficiently searches in their presentation files and shows relevant materials. It also supports the feature of approximate search so that users do not have to remember the materials exactly.

Slide management is a module with which users can manage their presentation files in terms of their relationships, e.g., multiple versions, summaries, etc. The files are visualized in a network (Figure 3). Two files are connected if common materials are identified. Users can easily find out which files reuse materials from others and which elements are reused. In addition, users can drill down the reused elements to see their timelines, i.e., which file they originate from and in which files their content has been reused and when.

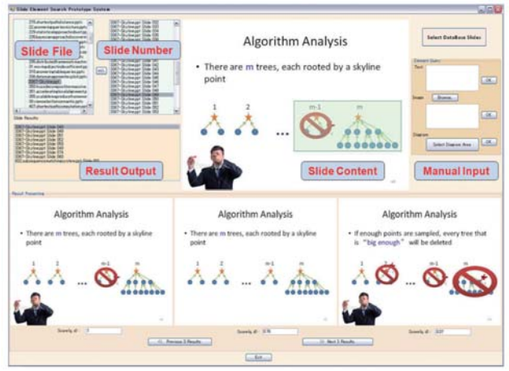

Figure 2. The user interface of the slide element search module. The green rectangle contains the query diagram. The results are shown at the bottom.

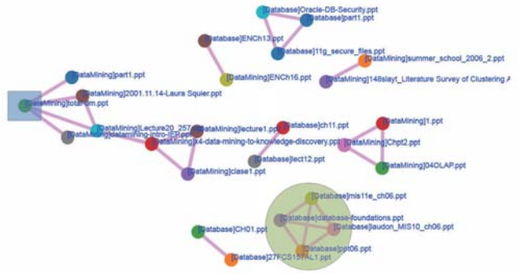

Figure 3. Two files are connected if one file reuses material from the other. The grey square on the left indicates a summary. The green circle on the right indicates multiple versions of the same presentation.

The slide auto-generation module saves users from making slides page by page. First, the users specify the titles for each slide. They may input a title by the keyboard or choose from a range of common titles, such as "related work," "experiments," or "conclusions" for academic presentations. They then select elements using the slide element search module, and assign these elements to the pages. Finally, they adjust the slide layouts, e.g., the positions of the text and images. Presentation slides are automatically generated after these steps. A set of example slides generated by this module is shown in Figure 4.

On the basis of the above modules, we design prototype systems with user-friendly interfaces that can easily be used in a company with common a slide composition tool such as Microsoft PowerPoint.

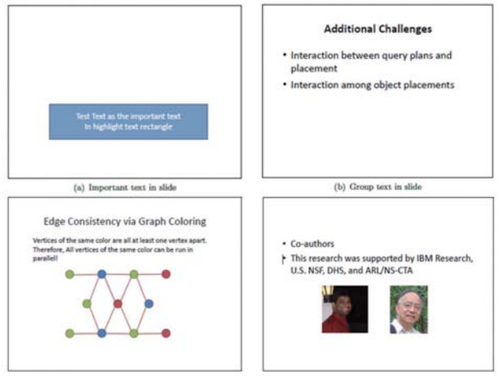

Figure 4. Example slides generated by the slide auto-generation system.

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MAJOR WORKS

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MAJOR WORKS

"Cosmic Background Anisotropies in Cold Dark Matter Cosmology", Naoshi Sugiyama, *Astrophysical Journal Supplement*, vol.100, pp. 281-305 (1995)
"The physics of microwave background anisotropies", Wayne, Hu, Naoshi Sugiyama, Joseph Silk, *Nature*, vol. 386, Issue 6620, pp. 37-43 (1997)

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MAJOR WORKS

"On the meaning of work and the future of employment", WADA, Hajime, Hougaku-seminar, Nr. 731, pp. 27-32 (2015)
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MAJOR WORKS

"Side-chain modification of cytokinins control shoot growth in Arabidopsis", Kiba T, Takei K, Kojima M and Sakakibara H, *Developmental Cell*, vol. 27, pp. 452-461 (2013)
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MAJOR WORKS

"Mediation in Family Dispute Resolution: opportunities for transforming divorce procedure in Uzbekistan", Nargiza Amirova, Nagoya University Graduate School of Law, PhD thesis, pp. 171. (2011)
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MAJOR WORKS

"Deletion of a histidine-rich loop of AtMTP1, a vacuolar Zn^{2+} /H^{+} antiporter of *Arabidopsis thaliana*, stimulates the transport activity", Kawachi, M., Kobae, Y., Miura, T., Maeshima M., *Journal of Biological Chemistry*, vol. 283, pp. 8374-8383 (2008)
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MAJOR WORKS

"The integrated Sachs-Wolfe effect and the Rees-Sciama effect", Atsushi J. Nishizawa, *PTEP*, vol. 6, PTEP 6B101 (2014)
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MAJOR WORKS

"The quiescent intracluster medium in the core of the Perseus cluster", Hitomi Collaboration;, *Nature*, vol. 535, pp. 117-121 (2016)
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"Rapid Variability of the Iron Fluorescence Line from the Seyfert 1 Galaxy NGC6814", Kunieda et al., *Nature*, vol. 345, pp. 786-788 (1990)

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MAJOR WORKS

"Cryogenic ferromagnetic patterns with controlled magnetization for superconducting phase-shift elements," S. Taniguchi, H. Ito, K. Ishikawa, H. Akaike, and A. Fujimaki, *Japanese Journal of Applied Physics*, vol. 54 , art. 043101 (2015)
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MAJOR WORKS

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MAJOR WORKS

"A complex hyperbolic structure of the moduli space of curves of genus three", Shigeyuki Kondo, *J.Reine Angew. Math.*, vol. 525, pp. 219-232 (2000)
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MAJOR WORKS

"TAG-1–assisted progenitor elongation streamlines nuclear migration to optimize subapical crowding", Okamoto, M., Namba, T., Shinoda, T., Kondo, T., Watanabe, T., Inoue, Y., Takeuchi, K., Enomoto, Y., Ota, K., Oda, K., Wada, Y., Sagou, K., Saito, K., Sakakibara, A., Kawaguchi, A., Nakajima, K., Adachi, T., Fujimori, T., Ueda, M. Hayashi, S., Kaibuchi, K., Miyata, T., *Nature Neuroscience*, vol. 16, pp. 1556-1566 (2013)
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MAJOR WORKS

"Bilingual Graffiti from the Ptolemaic Quarry at Akoris and Zawiat al-Sultan", Y. Suto and R. Takahashi, *P. Schubert (ed.) Actes du 26e congrès international de papyrologie, Genéve, 16-21 août 2010, Genéve*, vol. 1, pp. 729-738 (2012)
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MAJOR WORKS

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"O-linked-N-acetylglucosamine on extracellular protein domains mediates epithelial cell-matrix interactions.", Sakaidani Y et al., *Nat Commun*, vol. 2, pp. 583 (2011)
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MAJOR WORKS

"Mutation in triangulated categories and rigid Cohen-Macaulay modules", O. Iyama, Y. Yoshino, *Invent. Math*, vol. 172 pp.117-168 (2008)
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Research Interests : Chronobiology, Circadian clock, KaiC ATPase, Plant Physiology

MAJOR WORKS

"Expression of a gene cluster kaiABC as a circadian feedback process in cyanobacteria", Ishiura M, Kutsuna S, Aoki S, Iwasaki H, Andersson, CA, Tanabe A, Golden SS, Johnson CH, Kondo T, *Science*, vol. 281, pp. 1519-1523 (1998)
"Reconstitution of Circadian Oscillation of Cyanobacterial KaiC Phosphorylation in vitro", Nakajima M, Imai K, Ito H, Nishiwaki T, Murayama Y, Iwasaki H, Oyama T, Kondo T. *Science*, vol. 308, pp. 414-415 (2005)

Yasuo
FUKUI
IAR Faculty

Affiliation : Professor of the Graduate School of Science
Research Interests : Radio astronomy

MAJOR WORKS

"A Detailed Study of the Molecular and Atomic Gas toward theγ-Ray Supernova Remnant RX J1713.7-3946: Spatial TeVγ-Ray and Interstellar Medium Gas Correspondence", Fukui, Y., 15 colleagues, *Astrophys. J*, vol. 746, pp. 82-99 (2012)
"Molecular Loops in the Galactic Center : Evidence for Magnetic Flotation", Fukui, Y., 13 colleagues, *Science*, vol. 314, pp.106-109 (2006)

Takaho
ANDO
IAR Faculty

Affiliation : Visiting Professor at Nagoya University / Professor at Chubu University
Research Interests : History of Social Thought

MAJOR WORKS

"Establishment of French liberalism" (in Japanese), Nagoya University Press, (2007)
"France 's modern thought" (in Japanese) *Annual Report of the Society for the History of Social Thought*, vol. 37, pp.33-53 (2013)

IAR Tenure-Track Faculty

The Institute selects and supports young researchers who are expected to lead the research of the University in the next generation as the Tenure-track Faculty.

Bisei
OHKAWARA
Tenure Track Faculty
(YLC-t)

Affiliation : Associate Professor at Nagoya IAR and Graduate School of Medicine
Research Interests : Neuromuscular junction

MAJOR WORKS

"R-spondin 2 promotes acetylcholine receptor clustering at the neuromuscular junction via Lgr5.", Nakashima H*, Ohkawara B*, et al., *Scientific Report*, vol. 6, pp. 28512 (2016)
"LRP4 third β-propeller domain mutations cause novel congenital myasthenia by compromising agrin-mediated MuSK signaling in a position-specific manner", Ohkawara B, Cabrera-Serrano M, Nakata T, Milone M, Asai N, Ito K, Ito M, Masuda A, Ito Y, Engel AG, Ohno K., *Hum Mol Genet*, vol. 23, pp. 1856-1868 (2014)
"Requirement of prorenin receptor and vacuolar H+-ATPase-mediated acidification for Wnt signaling", Cruciat CM*, Ohkawara B*, Acebron SP, Karaulanov E, Reinhard C, Ingelfinger D, Boutros M, Niehrs C, *Science*, vol. 327, pp. 459-63 (2010) *:equal contribution

YLC Program Faculty

YLC Faculty members are promising young researchers recruited under the Nagoya University Young Leaders Cultivation Program (YLC Program).

Kazuma
SAKAMOTO
Young Leaders
Cultivation Program
Faculty
(YLC)

Affiliation : Designated Assistant Professor at Nagoya IAR and Graduate School of Medicine
Research Interests : Neuroscience, Biochemistry

MAJOR WORKS

"Mechanisms of axon regeneration and its inhibition: roles of sulfated glycans", Kadomatsu K, Sakamoto K., *Arch Biochem Biophys*., vol. 15, pp. 36-41 (2014)

Shinya
MATSUZAKI
Young Leaders
Cultivation Program
Faculty
(YLC)

Affiliation : Designated Assistant Professor at Nagoya IAR and Graduate School of Science
Research Interests : Research on Origin of Mass

MAJOR WORKS

"Is 125 GeV techni-dilaton found at LHC?", S.Matsuzaki and K.Yamawaki, *Physics Letters*, *B 719*, pp. 378-382 (2013)
"Holographic techni-dilaton at 125 GeV", Shinya Matsuzaki, Koichi Yamawaki, *Physical Review*, D 86, pp. 115004-115015 (2012)
"Implications of Holographic QCD in ChPT with Hidden Local Symmetry", Masayasu Harada, Shinya Matsuzaki, Koichi Yamawaki, *Physical Review* , D 74, pp. 076004-076009(2006)

Yasuyoshi
YONEZAWA
Young Leaders
Cultivation Program
Faculty
(YLC)

Affiliation : Designated Assistant Professor at Nagoya IAR and Graduate School of Mathematics
Research Interests : Representation theory and topology

MAJOR WORKS

"Quantum (sl_n, \wedge V_n) link invariant and matrix factorizations.", Yasuyoshi Yonezawa, *Nagoya Math. J*, vol. 204, pp. 69-123 (2011)
"Link invariant and G_2 web space", Sakamoto, Takuro;Yonezawa, Yasuyoshi, *Hiroshima Math. J.*, vol. 47 (2017)
"sl(n) web categories", Marco Mackaay and Yasuyoshi Yonezawa, arXiv:13066242, (2013)

Alisher
UMIRDINOV
Young Leaders
Cultivation Program
Faculty
(YLC)

Affiliation : Designated Assistant Professor at Nagoya IAR and Graduate School of Law
Research Interests : Investment Arbitration, Tax Sovereignty, Competition Law and Policy, Energy Law and Policy

MAJOR WORKS

"Competition Law of Uzbekistan in Transition-current situation and challenges", with Shuya Hayashi in *International Enforcement of Antimonopoly Law*, Nihonhyoronsha, pp. 259-302 (2012)
"Investment Treaty Arbitration and Protection of Host State's Discretion Power in Tax Disputes", *Japanese Yearbook of International Economic Law*, vol. 22, pp. 191-215 (2013)

Yuko
URAKAWA
Young Leaders
Cultivation Program
Faculty
(YLC)

Affiliation : Designated Assistant Professor at Nagoya IAR and Graduate School of Science
Research Interests : Cosmology, High energy physics, Gravity

MAJOR WORKS

"Loops in inflationary correlation functions", Takahiro Tanaka, Yuko Urakawa, *Classical and Quantum gravity. J*, vol. 30, art. 233001 (2013)
"Consistency relations and conservation of ζ in holographic inflation", Jaume Garriga, Yuko Urakawa, *Journal of Cosmology and Astrophysics*, vol. 10, pp. 30 (2016)
"Modular invariant inflation", Tatsuo Kobayashi, Daisuke Nitta, Yuko Urakawa, *Journal of Cosmology and Astrophysics*, vol. 8, pp. 14 (2016)

Chuan
XIAO
Young Leaders
Cultivation Program
Faculty
(YLC)

Affiliation : Designated Assistant Professor at Nagoya IAR and Graduate School of Information Science
Research Interests : Databases

MAJOR WORKS

"An Efficient Algorithm for Similarity Join with Edit Distance Constraints", Chuan Xiao, Wei Wang, and Xuemin Lin, *Proceedings of the VLDB Endowment*, vol. 1, pp. 933-944 (2008)
"Efficient Similarity Joins for Near Duplicate Detection", Chuan Xiao, Wei Wang, Xuemin Lin, et al., *ACM Transactions on Database Systems*, vol. 36, pp. 15:1-15:41 (2011)
"Efficient Error-tolerant Query Autocopletion", Chuan Xiao, Jianbin Qin, Wei Wang, et al., *Proceedings of the VLDB Endowment*, vol. 6, pp. 373-384 (2013)

Yin
WANG
Young Leaders
Cultivation Program
Faculty
(YLC)

Affiliation : Designated Assistant Professor at Nagoya IAR and Institute of Transformative Bio-Molecules (ITbM)
Research Interests : Plant physiology, Plant ecophysiology

MAJOR WORKS

"Stomatal Regulation on CO_2 Uptake", Yin Wang, Toshinori Kinoshita, 光合成研究, vol. 25(3), pp. 194-201 (2015)
"Oryza sativa H^+-ATPase (OSA) is involved in the regulation of dumbbell-shaped guard cells of rice", Yosuke Toda, Yin Wang, Yuya Kawai, et al., *Plant and Cell Physiology*, vol. 57, pp. 1220-1230 (2016)
"Improvement of Arabidopsis biomass and cold-, drought-, and salinity-stress tolerance by modified circadian clock-associated PSEUDO-RESPONSE REGULATORs", Nakamichi, Takao, Kudo, Takato, Wang, et al., *Plant and Cell Physiology*, vol. 57, pp. 1085-1097 (2016)

Itaru KUSHIMA

Young Leaders Cultivation Program Faculty (YLC)

Affiliation : Designated Assistant Professor at Nagoya IAR and Graduate School of Medicine
Research Interests : Psychiatric genetics

MAJOR WORKS

"Single-neuron and genetic correlates of autistic behavior in macaque.", Yoshida K, Go Y, Kushima I, et al., *Sci Adv.*, vol. 2, pp. e1600558 (2016)
"High-resolution copy number variation analysis of schizophrenia in Japan", Kushima I, Aleksic B, et al., *Mol Psychiatry* (2016)
"White matter microstructure between the pre-SMA and the cingulum bundle is related to response conflict in healthy subjects.", Yamamoto M, Kushima I, et al., *Brain Behav.*, vol. 5, pp. e00375 (2015)

Yuya MIZUNO

Young Leaders Cultivation Program Faculty (YLC)

Affiliation : Designated Assistant Professor at Nagoya IAR and Graduate School of Mathematics
Research Interests : Representation theory of algebras

MAJOR WORKS

"Classifying tau-tilting modules over preprojective algebras of Dynkin type", Yuya Mizuno, *Mathematische Zeitschrift*, vol. 277 (3), pp. 665-690 (2014)
"A Gabriel-type theorem for cluster tilting", Yuya Mizuno, *Proceedings London Mathematical Society*, vol. 108 (4), pp. 836-868 (2014)
"APR tilting modules and graded quivers with potential", Yuya Mizuno, *International Mathematics Research Notices*, vol. 2014 (3), pp. 817-841 (2014)

Fusa MIYAKE

Young Leaders Cultivation Program Faculty (YLC)

Affiliation : Designated Assistant Professor at Nagoya IAR and Institute for Space-Earth Environmental Research
Research Interests : Cosmogenic nuclides, solar activity

MAJOR WORKS

"A signature of cosmic-ray increase in AD 774–775 from tree rings in Japan", F. Miyake, K. Nagaya, K. Masuda, T. Nakamura, *Nature*, vol. 486, pp. 240-242 (2012)
"Another rapid event in the carbon-14 content of tree rings", F. Miyake, K. Masuda, T. Nakamura, *Nat. Commun.*, vol. 1748, pp. doi:10.1038/ncomms27 (2013)
"Cosmic ray event of A.D. 774–775 shown in quasi-annual 10Be data from the Antarctic Dome Fuji ice core", F. Miyake, et al., *Geophys. Res. Lett.*, vol. 42, pp. 84-89 (2015)

Kunihiro MORISHIMA

Young Leaders Cultivation Program Faculty (YLC)

Affiliation : Designated Assistant Professor at Nagoya IAR and Institute of Material and Systems for Sustainability
Research Interests : Fundamental particle physics. Astrophysics. Radiation detectors.

MAJOR WORKS

"Development of a new automatic nuclear emulsion scanning system, S-UTS, with continuous 3D tomographic image read-out", *Journal of Instrumentation*, vol. 5, P04011 (2010)"First demonstration of cosmic ray muon radiography of reactor cores with nuclear emulsions based on an automated high-speed scanning technology", *RADIATION DETECTORS AND THEIR USES Proceedings of the 26th Workshop on Radiation Detectors and Their Uses in KEK*, pp. 27-36 (2012)

Sayuri YOSHIDA

Young Leaders Cultivation Program Faculty (YLC)

Affiliation : Designated Assistant Professor at Nagoya IAR and Graduate School of Letters
Research Interests : Anthropology. Ethnology. African Studies

MAJOR WORKS

"Struggle against Social Discrimination: Petitions by the Manjo in the Kafa and Sheka zones, Southwest Ethiopia", YOSHIDA Sayuri, *Nilo-Ethiopian Studies*, No.18, pp. 1-19 (2013)
"The life and Collection of Friedrich Julius Bieber: An Archival Study of Kafa at the Beginning of the 20th Century", YOSHIDA Sayuri, *Nilo-Ethiopian Studies*, No.21, pp. 29-39 (2016)
"*The Reality of Discrimination: Ethnography of the Kafa and the Manjo in Ethiopia*" (Shumpusha, 2014, in Japanese).

Simon DALGLEISH

Young Leaders Cultivation Program Faculty (YLC)

Affiliation : Designated Assistant Professor at Nagoya IAR and Research Center for Materials Science
Research Interests : Organic electronics and optoelectronics, Near-infrared dyes, Low bandgap semiconductors, Electrochemistry, Organic synthesis

MAJOR WORKS

"Utilizing Photocurrent Transients for Dithiolene-Based Photodetection: Stepwise Improvements at Communications Relevant Wavelengths", *Journal of the American Chemical Society*, vol. 134, pp. 12742-12750 (2012)
"Electrodeposition as a Superior Route to a Thin Film Molecular Semiconductor", *Chemical Science*, pp. 316-320 (2011)

Cyrus Tristan ROY

Young Leaders Cultivation Program Faculty (YLC)

Affiliation : Designated Assistant Professor at Nagoya IAR and Graduate School of Mathematics
Research Interests : Nonlinear dispersive equations, Long-time dynamics

MAJOR WORKS

"On control of Sobolev norms for some semilinear wave equations with localized data", T. Roy, *J. Funct. Anal.*, vol. 265, pp.2724–2752 (2013)
"Global existence of smooth solutions of a 3D log-log energy-supercritical wave equation", T. Roy, *Anal. PDE*, vol. 2, pp. 261–280 (2009)

Takuya MATSUMOTO

Young Leaders Cultivation Program Faculty (YLC)

Affiliation : Designated Assistant Professor at Nagoya IAR and Graduate School of Mathematics
Research Interests : Mathematical Physics

MAJOR WORKS

"A Quantum Affine Algebra for the Deformed Hubbard Chain", Niklas Beisert, Wellington Galleas, Takuya Matsumo, *J. Phys.*A, vol. 45, no. 36, 365206 (2012)
"Representations of centrally extended Lie superalgebra psl(212)", Takuya Matsumoto and Alexander Molev, *Journal of Mathematical Physics*, no.55 pp. 91704 (2014)
"Lunin-Maldacena backgrounds from the classical Yang-Baxter equation ? towards the gravity/CYBE correspondence --- ", Takuya Matsumoto and Kentaroh Yoshida, *Journal of High Energy Physics*, no. 6 pp. 135 (2014)

Akira ICHIKAWA

Young Leaders Cultivation Program Faculty (YLC)

Affiliation : Designated Assistant Professor at Nagoya IAR and Graduate School of Letters
Research Interests : Mesoamerican Archaeology

MAJOR WORKS

"Reconsideración de la Cronologia del valle de Zapotitán, Sureste Maya: Análisis tefrocronológicos y cerámicos", Ichikawa, Akira y Hiroaki Yagi, *America Antigua*, no.19, pp. 1-33 (2016)
"Prehispanic Salt Production on the Pacific Coast of Southeastern Mesoamerica: A Case Study of Nueva Esperanza, El Salvador", Ichikawa, Akira, Masayo Minami, and Hiroaki Yagi, *Journal of Japanese Archaeology*, no.40 (2015)
"*Atrás de las Grandes Ciudades de Mesoamérica: Una Perspectiva de la Periferia -El Caso de la zona arqueológica de Chalchuapa, El Salvador-*" , Ichikawa, Akira, Keisuisya, Japan (2017)

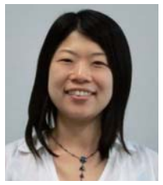
Yoshiko UMEKAWA

Young Leaders Cultivation Program Faculty (YLC)

Affiliation : Designated Assistant Professor at Nagoya IAR and Graduate School of Law
Research Interests : Political Science. Political Philosophy.

MAJOR WORKS

"Charles Taylor and Hungarian Incident, 1956-1957 (1)(2)" Yoshiko UMEKAWA, *The Nagoya journal of law and politics*, vol. 257, pp. 109-136 (2014) and vol. 259, pp. 113-132, (2014)
"Charles Taylor as a New Left, 1956-1960 (1)(2)", Yoshiko UMEKAWA, *The Nagoya journal of law and politics*, vol. 261, pp. 47-73, (2015), and vol. 262, pp. 177-210 (2015)
"Charles Taylor's theory of political participation and government investment fund: Canadian politics and NDP (1961-1971)", Yoshiko UMEKAWA, *The Nagoya Journal of Law and Politics*, vol. 264, pp. 85-115 (2015)



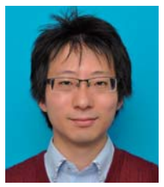
Sachiko KUROYANAGI

Young Leaders Cultivation Program Faculty (YLC)

Affiliation : Designated Assistant Professor at Nagoya IAR and Graduate School of Science
Research Interests : Cosmology and Gravitational Waves

MAJOR WORKS

"Implications of the B-mode Polarization Measurement for Direct Detection of Inflationary Gravitational Waves", S. Kuroyanagi, S. Tsujikawa, T. Chiba, N. Sugiyama, *Physical Review D*, vol. 90, 063513 (2014)
"Reheating signature in the gravitational wave spectrum from self-ordering scalar fields", S. Kuroyanagi, T. Hiramatsu, J. Yokoyama, *Journal of Cosmology and Astroparticle Physics*, vol. 02, 023 (2016)
"Anisotropies in the gravitational wave background as a probe of the cosmic string network", S. Kuroyanagi, K. Takahashi, N. Yonemaru, H. Kumamoto, *Physical Review D*, vol. 95, 043531 (2017)



Hidetoshi SANO

Young Leaders Cultivation Program Faculty (YLC)

Affiliation : Designated Assistant Professor at Nagoya IAR and Graduate School of Science
Research Interests : Radio Astronomy, High-Energy Astrophysics

MAJOR WORKS

"A detailed study of non-thermal X-ray properties and interstellar gas toward the γ-ray supernova remnant RX J1713.7–3946" Sano, H., Tanaka, T., Torii, K. et al., *The Astrophysical Journal*, vol. 799, pp. 175-184 (2015)
"Non-thermal X-rays and interstellar gas toward the γ-ray supernova remnant RX J1713.7-3946: Evidence for X-ray enhancement around CO and HI clumps", Sano, H., Tanaka, T., Torii, K. et al., *The Astrophysical Journal*, vol. 778, pp. 59-77 (2013)
"*Shock-Cloud Interaction in RX J1713.7–3946; Evidence for Cosmic-Ray Acceleration in the Young VHE γ-ray Supernova Remnant*", Sano, H., Springer Japan (2016)

Mana KANO-NAKATA

Young Leaders Cultivation Program Faculty (YLC)

Affiliation : Designated Assistant Professor at Nagoya IAR and Graduate School of Bioagricutural Sciences
Research Interests : Crop Production Science

MAJOR WORKS

"Root plasticity as the key root trait for adaptation to various intensities of drought stress water stresses in rice" Kano, M., Inukai, Y., Kitano, H. and Yamauchi, *Plant Soil.*, vol. 342, pp. 117-128 (2011)
"Functional roles of the plasticity of root system development in biomass production and water uptake under rainfed lowland conditions in rice: evaluation by utilization of IR64 introgression lines", Kano-Nakata, M et al., *Field Crops Res.*, vol. 144, pp. 288-296 (2013)
"Root plasticity for maintenance of productivity under abiotic stressed soil environments in rice: Progress and prospects", Suralta, R.R., Kano-Nakata, M. et al., *Field Crops Res.*, In Press (2016)

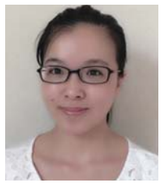
Takahiro HORIBE

Young Leaders Cultivation Program Faculty (YLC)

Affiliation : Designated Assistant Professor at Nagoya IAR and Graduate School of Engineering
Research Interests : Organic Chemistry, Development of Catalysts

MAJOR WORKS

"Stable And Versatile Gold(III) Catalysts by Oxidative Addition of a Strained Carbon-Carbon Bond", Chung-Yeh Wu*, Takahiro Horibe* , Christian B. Jacobsen, F. Dean Toste, *Nature*, vol. 517, pp. 449-454 (2015)
"Chiral Magnesium(II) Binaphtholates as Cooperative Brønsted/Lewis Acid-Base Catalysts for the Highly Enantioselective Addition of Phosphorus Nucleophiles to α,β-Unsaturated Esters and Ketones", M. Hatano, T. Horibe, K. Ishihara, *Angew. Chem. Int. Ed.*, vol.52, pp. 4549 (2013)
"Chiral Lithium(I) Binaphtholate Salts for the Enantioselective Direct Mannich Type Reaction with a Change of Syn/Anti and Absolute Stereochemistry", M. Hatano, T. Horibe, K. Ishihara, *J. Am. Chem. Soc.*, vol. 152, pp. 56 (2010)



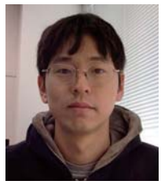
Chun LI

Young Leaders Cultivation Program Faculty (YLC)

Affiliation : Designated Assistant Professor at Nagoya IAR and Graduate School of Science
Research Interests : Molecular Genetics, Molecular Biology

MAJOR WORKS

"The growth factor SVH-1 regulates axon regeneration in C. elegans via the JNK MAPK cascade", Chun Li, Naoki Hisamoto, Paola Nix, Shuka Kanao, Tomoaki Mizuno, Michael Bastiani and Kunihiro Matsumoto, Nature Neuroscience, vol. 15, pp. 551-557 (2012)
"Axon regeneration is regulated by Ets–C/EBP transcription complexes generated by activation of the cAMP/Ca2+ signaling pathways", Chun Li, Naoki Hisamoto and Kunihiro Matsumoto, PLOS Genetics, vol. 11, art. e1005603 (2015)



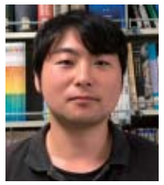
Tomohiro ABE

Young Leaders Cultivation Program Faculty (YLC)

Affiliation : Designated Assistant Professor at Nagoya IAR and Kobayashi-Maskawa Institute
Research Interests : elementary particle physics

MAJOR WORKS

"Lepton-Specific Two Higgs Doublet Model as a Solution of Muon g–2 Anomaly", Tomohiro Abe, Ryosuke Sato, Kei Yagyu., *Journal of High Energy Physics*, vol. 1507, pp. 64 (2015)
"Gauge invariant Barr-Zee type contributions to fermionic EDMs in the two-Higgs doublet models", Tomohiro Abe, Junji Hisano, Teppei Kitahara, Kohsa, *Journal of High Energy Physics*, vol.1401, pp. 106 (2014)
"LHC Higgs Signatures from Extended Electroweak Gauge Symmetry", Tomohiro Abe, Ning Chen, Hong-Jian He., *Journal of High Energy Physics*, vol. 1301, pp. 82 (2013)



Shingo KOBAYASHI

Young Leaders Cultivation Program Faculty (YLC)

Affiliation : Designated Assistant Professor at Nagoya IAR and Graduate School of Engineering
Research Interests : Condensed matter physics (theory)

MAJOR WORKS

"Abe homotopy classification of topological excitations under the topological influence of vortices", Shingo Kobayashi, et al., *Nuclear Physics B*, vol. 856, pp. 577 (2012)
"Topological Blount's theorem of odd parity superconductors", Shingo Kobayashi, et al., *Physical Review B*, vol.90, pp. 24516 (2014)
"Topological superconductivity in Dirac semimetals", Shingo Kobayashi and Masatoshi Sato, *Physical Review Letter*, vol. 115, pp. 187001 (2015)

Masaru TAKEUCHI

Young Leaders Cultivation Program Faculty (YLC)

Affiliation : Designated Assistant Professor at Nagoya IAR and Graduate School of Engineering
Research Interests : Micro-nano manipulation

MAJOR WORKS

"Shape-controlled high cell-density microcapsules by electrodeposition", Z. Liu, M. Takeuchi, M. Nakajima et al., *Acta Biomaterialia*, vol. 37, pp. 93-100 (2016)
"On-chip Self-assembly of Cell Embedded Microstructures to Vascular-like Microtubes", T. Yue, M. Nakajima, M. Takeuchi et al., *Lab on a Chip*, vol. 14, pp. 1151-1161 (2014)
"Reconfigurable Microfluidic Pump Enabled by Opto-electrical-thermal Transduction", M. Takeuchi, M. Hagiwara, G. Haulot, CM. Ho, *Applied Physics Letters*, vol. 103, pp. 174101 (2013)

Takushi HACHIYA

Young Leaders Cultivation Program Faculty (YLC)

Affiliation : Designated Assistant Professor at Nagoya IAR and Graduate school of Bioagricultural Sciences
Research Interests : Anthropology, Area Studies

MAJOR WORKS

"Interactions between nitrate and ammonium in their uptake, allocation, assimilation, and signaling in plants", Hachiya, T. and Sakakibara, H., *Journal of Experimental Botany*, doi.org/10.1093/jxb/ (2016)
"Arabidopsis Root-Type Ferredoxin:NADP(H) Oxidoreductase 2 is Involved in Detoxification of Nitrite in Roots", Hachiya, T., Ueda, N., Kitagawa, M., et al., *Plant and Cell Physiology*, vol. 57, pp. 2440-2450 (2016)
"Nitrate Addition Alleviates Ammonium Toxicity Without Lessening Ammonium Accumulation, Organic Acid Depletion and Inorganic Cation Depletion in Arabidopsis thaliana Shoots", Hachiya, T., Watanabe, C.K., Fujimoto, M., et al., *Plant and Cell Physiology*, vol. 53, pp. 577-591 (2012)

Mio HORIE

Young Leaders Cultivation Program Faculty (YLC)

Affiliation : Designated Assistant Professor at Nagoya IAR and Graduate School of Letters
Research Interests : Anthropology, Area Studies

MAJOR WORKS

"Inter-ethnic Marriage Migration among Lahu Women in Yunnan: Focusing on Changing Marriage Practices among Women?s Sending Society", Mio Horie.,*Southeast Asian Studies*, vol. 52(1), pp. 52-81 (2014)
"Chained Wife Shortage and Women's Cross-border Marriage Migration: The Case Study of Lahu Women on China-Myanmar Border", Mio Horie, *Research Report of the Institute for Culture of Travel*, vol. 26, pp. 43-56 (2016)
"Book Review: Jianxiong Ma, The Lahu Minority in Southwest China; A Response to Ethnic Marginalization on the Frontier", Mio Horie, *Southeast Asian Studies*, vol. 2(3), pp. 629-633(2013)

Masatsugu TOYOTA

Young Leaders Cultivation Program Faculty (YLC)

Affiliation : Designated Assistant Professor at Nagoya IAR and Graduate School of Bioagricultural Sciences
Research Interests : Plant Physiology, Biophysics

MAJOR WORKS

"Salt stress-induced Ca2+ waves are associated with rapid, long-distance root-to-shoot signaling in plants", Choi WG, Toyota M, Kim SH, Hilleary R, Gilroy S,*Proceedings of the National Academy of Sciences of the United States of America*, vol. 111, pp. 6497-6502 (2014)
"Amyloplast displacement is necessary for gravisensing in Arabidopsis shoots as revealed by a centrifuge microscope", Toyota M, Ikeda N, Sawai-Toyota S, Kato T, Gilroy , *Plant Journal*, vol. 76, pp. 648-660(2013)
"Analyses of a gravistimulation-specific Ca2+ signature in Arabidopsis using parabolic flights", Toyota M, Furuichi T, Sokabe M, Tatsumi H, *Plant Physiology*, vol. 163, pp. 543-554(2013)

INFORMATION | Activity & News

The Nagoya University Lecture 2016

The Nagoya University Lecture is an annual event which is the most important academic lecture at the University, and is hosted by the President. The lecturers are selected from international researchers of the highest caliber and all lectures are open to the general public.

On November 19, 2016, the Nagoya University Lecture was held at the Toyoda Auditorium, organized by the Institute for Advanced Research of Nagoya University and Chunichi Shinbun Co., Ltd.

This year, the Lectureship was awarded to Kenichi Miyamoto, Osaka City University professor emeritus and Shiga University professor emeritus who is an internationally recognized pioneer in the field of environmental economics.

Professor Miyamoto is known for coining the Japanese word "kōgai," which is literally translated as "public harm" and refers to environmental pollution. His lecture gained a lot of public attention and attracted more than 500 people.

Shunichi Teranishi, a professor at Teikyo University and emeritus professor at Hitotsubashi University also joined the lecture and gave a speech on the history of environmental pollution after World War II, the increase of pollution and environmental problems in Asia, particularly emphasizing the role of Professor Miyamoto in the development of research in this field and introducing a new definition – so-called "Miyamoto economic thought". According to Prof. Teranishi, a well-known saying "There is no wealth, but life" by John Ruskin in the light of Prof. Miyamoto`s research may definitely be interpreted as "There is no wealth, but life and environment!".

Professor Miyamoto`s lecture was devoted to sustainable society with historical lessons learnt after WWII. In the lecture, he pursued the issue of pollution as a price paid for Japan's period of rapid economic growth starting in the 1960s, and explained the issues of pollution he has studied and examined in the field for over half a century. Professor Miyamoto also mentioned his work to find solutions to issues such as Japan's "four big pollution diseases," including so-called "Yokkaichi asthma" caused by sulfur dioxide pollution, as well as his views on the approaches to these issues - from the standpoint of respect for basic human rights and the independence of local governments.

It was an excellent opportunity for the public to find out more about environmental problems and the possible ways for their solution from the most experienced and outstanding researcher, who presented his lecture in a very comprehensible and easy to understand manner.

The questionnaires collected after Prof. Miyamoto's lecture reflected the great interest and concern the majority of participants had regarding environmental issues. Most people, expressing their deep gratitude to the lecturer, confirmed the belief that environmental problems are among those that need immediate solution.

At the end of the lecture Prof. Miyamoto shared his motto with young researchers: - "The unique purpose of science is to ease the hardships of humankind's existence" – a truth that we all need to remember.

Prof. Teranishi (right) at the Lectureship award ceremony

IAR Lecture

The IAR lectures are the most important academic lectures at the Institute. They target University researchers and cover research of extraordinary excellence from within and outside the University. They are open to the general public. The 9th IAR Lecture on the Problems in Exchange of History of Thoughts in East Asia was held on December 16, 2016 at the Noyori Conference Hall. Nagoya-IAR has had a joint research project with several Universities in Asia for a number of years. At the lecture, a leader of this joint research project Professor Chun-chieh Huang from National Taiwan University and research members gave lectures. Those lectures were: : "The history of collaborative research and professor Huang" by Professor Takaho Ando (Chubu University), "The methods of exchange of history of thoughts in East Asia and problems – East Asia •Confucianism •Present time" by Associate Professor Fumihiko Kawajiri (Aichi Prefectural University), "Western musicians of Japan and the spirit of Confucianism" by Professor Jianying Ou (Niigata University of International and Information Studies), "The media transmission of wisdom and the history of thoughts" by Professor Masashi Tsujimoto (National Taiwan University) and a keynote lecture "The vision of East Asian Confucianism and the problems of its methodology" by Professor Chun-chien HUANG (National Taiwan University).

Prof. Huang at the IAR Lecture

Ryoji Noyori Academy Salon

Since January 2013, University Prof. Ryoji Noyori, a 2001 Nobel Laureate in Chemistry, has contributed numerous articles to "Kamitsubute" in the Japanese daily newspaper Chunichi Shimbun. Based on these articles, he holds regular academic discussions with students. In 2016, four (the 19th to 22th) Ryoji Noyori Academy salons were held. Prof. Noyori and students from different academic fields discussed various topics. The topics were "Supercomputers and the Future" (19th), "Civilization to Be Developed on One's Culture" (20th), "Multiplication Can Create New Value" (21th) and "Only-one and Number-one" (22th).

The 22th Ryoji Noyori Academy Salon

IAR Symposium

We organized IAR symposiums starting from 2016. The symposiums aim at communicating the established, novel and cutting-edge research at Nagoya University to all its members. We set three different fields, human and social science, natural science and engineering, and medicine and biology. The first IAR symposium "Creation and Inheritance of Knowledge in Humanities and Sociology" was held on June 29, 2016. Six assistant/associate professors and six full professors who were chosen as the representatives of the Graduate School of Letters, Graduate School of Education and Human Development, Graduate School of Law, Graduate School of Economics, Graduate School of International Development and Graduate School of Languages and Cultures presented their research results, and about 100 people attended the symposium.

Foreign PI Fellowship Program

The Foreign Principal Investigator (PI) Fellowship program is a program inviting excellent researchers from foreign countries with outstanding research achievements for three to four months' fellowship, to promote the University's academic research. In the academic year 2016, Prof. Enrico Martinoia (Professor of the Institute Plant Biology, Zurich University) and Prof. Jean-Noël Robert (Professor of Philology of Japanese Civilization, Collège de France) were selected for this fellowship. While they were visiting Nagoya University, they discussed collaborative research with PIs in Nagoya University. Also, they contributed to the education of young researchers by giving advice and lectures. Professor Martinoia gave a lecture "Plant ABC transporters: from detoxification to hormone transport" and Prof. Jean-Noël Robert gave a lecture "La hieroglossie japonaise comme modele langagier".

Prof. Enrico Martinoia

Prof. Jean-Noël Robert

2016 Young Leaders Cultivation Program

The Young Leaders Cultivation (YLC) Program, through which Nagoya University regularly and systematically recruits and trains young faculty members, is a strategic program based on the premise that it is important to secure an appropriate quantity and quality of young faculty members, in order to sustain the development of outstanding education and research in the future. In the academic year 2016, Tomohiro Abe (Kobayashi Maskawa Institute), Shingo Kobayashi (Grad. Sch. of Engineering), Masaru Takeuchi (Grad. Sch. of Engineering), Takushi Hachiya (Grad. Sch. of Bioagricultural Sciences), Mio Horie (Grad. Sch. of Letters) and Msatsugu Toyota (Grad. Sch. of Bioagricultural Sciences) were newly employed as designated assistant professors of the YLC program.

IAR Freshmen Lecture Series

Targeting freshmen of the University, this lecture series includes lectures delivered by members of the Academy, IAR Faculty members, IAR Fellows, and researchers of Nagoya University. It is aimed at communicating the fun of academic research. In the academic year 2016, the following 14 lectures were given:

1. **"Power of molecules. Encouragement of interdisciplinary research"**
   Prof. Kenichiro Itami (Director of ITbM)
2. **"Science starts from seeing"**
   Prof. Sumio Iijima (Meijo University/Distinguished Invited Professor of Nagoya University)
3. **"Creating enzymes: The boundary of chemistry and biology"**
   Prof. Yoshito Watanabe (Grad. Sch. of Science/Vice President)
4. **"The dark universe"**
   Prof. Naoshi Sugiyama (Grad. Sch. of Science/Deputy Director of IAR Nagoya)
5. **"Children in Islam: Different cultures seen from education"**
   Prof. Mina Hattori (Grad. Sch. of Education and Human Development)
6. **"What is social justice?"**
   Prof. Hajime Wada (Grad. Sch. of Law, Deputy Director of IAR Nagoya)
7. **"How to use contemporary economics"**
   Prof. Jiro Nemoto (Grad. Sch. of Economics)
8. **"Fascination with an introduction to the history of thought"**
   Prof. Takaho Ando (Chuo University/Sixth Director of IAR Nagoya)
9. **"Searching for the mystery of languages"**
   Prof. Ken Machida (Grad. Sch. of Letters)
10. **"Bench & bed"**
    Prof. Takashi Takahashi (Grad. Sch. of Medicine)
11. **"Genome breeding to solve the food crisis"**
    Prof. Makoto Matsuoka (Grad. Sch. of Bioagricultural Sciences)
12. **"Development of a terahertz-wave source and application for a non-destructive inspection"**
    Prof. Kodo Kawase (Grad. Sch. of Engineering)
13. **"Close-up to the essence of brain information processing"**
    Prof. Ikue Mori (Grad. Sch. of Sciences)
14. **"The laws of science and development"**
    Prof. Toshihide Maskawa (Director of the Kobayashi Maskawa Institute, 2008 Nobel Laureate in Physics)

New IAR academy member

The IAR Academy is composed of the scholars that the University is most proud of, who provide advice and suggestions concerning the academic advancement activities of the University. They also communicate the essence of academic research to young scholars and graduate students through their outstanding research. In 2016, Tsuneko Okazaki, a University Professor at Nagoya University became a member of IAR Academy. For more information on Professor Okazaki, please see 'SPECIAL INTERVIEW' on page 3-6.

Awards

Dr. Sumio Iijima (Director of Nagoya IAR)
won the Japan Royal Medal with a Purple Ribbon from the Japanese Government in 2016 April. He also won the 2016 Fellow of Royal Society of Chemistry (FRSC) Awasd.

Dr. Hitoshi Sakakibara (Deputy Director of Naoya IAR)
won the IPGSA Distinguished Research Award from the International Plant Growth Substances Association in 2016 June. He also won the Highly Cited Researchers 2016 from the Clarivate Analytics in 2016 November.

Dr. Hidetoshi Sano (YLC Assistant Professor of Nagoya IAR)
won the 32th Inoue Research Award for Young Scientists in 2014 February.

Dr. Itaru Kushima (YLC Assistant Professor of Nagoya IAR)
won the 10th Academic Award from the Japanese Society of Schizophrenia Research in 2016 February. He also won the 5th JSBP Young Investigator Program Encourtagement Awards from Japanese Society of Biological Psychiatry in 2016 September

Dr. Yoshiko Umekawa (YLC Assistant Professor of Nagoya IAR)
won the Excellent Paper Award from the Japanese Association for Canadian Studies in 2016 September.

1st Intercontinental Academia, Nagoya-workshop

The 1st Intercontinental Academia under the theme of "TIME" consists of a São Paulo workshop (first phase) and a Nagoya workshop (second phase). The second phase was held from March 7 to 21, 2016 at Nagoya University.

Thirteen young researchers that had been selected based on recommendations from their respective Advanced Research Institutes all over the world and over 30 senior researchers from different fields attended the Nagoya workshop. Continuing on from the first phase, they discussed the theme of "TIME" from a multidisciplinary approach and made a plan for a joint project to create a Massive Open Online Course (MOOC) on knowledge of "TIME".

MONDAY, MARCH 7—*Opening Ceremony*

The Nagoya-workshop was opened by welcome remarks from Seiichi Matsuo, president of Nagoya University. Academic research at Nagoya University was introduced by Hideo Kunieda, trustee and vice president of Nagoya University. There were welcome remarks by Martin Grossmann, former director of IEA-UPS, and Carsten Dose, managing director of FRIAS. Nagoya IAR's activities were introduced by Hisanori Shinohara, director of Nagoya IAR.

After lunch with Nagoya University's Nobel laureates, participants went on a campus tour visiting "Nobel Road". In the afternoon, master classes with Nobel laureates were held. Toshihide Maskawa, winner of the 2008 Nobel Prize in Physics and director of Kobayashi-Maskawa Institute for the Origin of Particles and the Universe (KMI) at Nagoya University, and Ryoji Noyori, winner of the 2001 Nobel Prize in Chemistry and Honorary Director of Nagoya IAR gave lectures.

In the evening session, the premiere of "A Documentary on ICA São Paolo Workshop" was held and participants' research achievement about 'TIME' were introduced. A keynote speech titled "Higher Education and Academic Research" was given by Michinari Hamaguchi, president of JST.

The first day of the Nagoya workshop ended with a welcome reception and participants enjoyed a traditional Japanese dinner and pleasant conversation.

TUESDAY, MARCH 8—*Biology Workshop*

On the second day of the Nagoya workshop, the biology workshop was held. Opening remarks were made by chronobiologist Takao Kondo, designated professor of Nagoya University. Four distinguished chronobiologists were invited and gave lectures about TIME in biology. The titles of the talks and names of lecturers were: "Life without clocks" by Ken-ichi Honma (Hokkaido University), "Bugs' time: chronobiology in invertebrates" by Hideharu Numata (Kyoto University), "Bioaesthetic art projects related to time: 'Biogenic Timestamp', and 'Memorial Service for Artificial Cells" by Hideo Iwasaki (Waseda University), "Time in the brain: synchronization and dissociation" by Kazuhiko Kume (Nagoya City University).

WEDNESDAY, MARCH 9—*Physics Workshop*

On the third day, the physics workshop was held. Opening remarks and an overview talk were given by astrophysicist Naoshi Sugiyama, deputy director of Nagoya IAR. Four lectures about TIME in physics were given by a planetary scientist, an atomic scientist, a theoretical physicist and an astrophysicist. The titles of the talks and the names of lecturers were: "How Long 'was' a Day on Earth?" by Takanori Sasaki (Kyoto University), "Precision Metrology with Optical Lattice Clocks" by Masao Takamoto (RIKEN), "Emergence of Spacetime in String Theory" by Tadashi Takayanagi (Kyoto University) "Time in Relativity (Relativity for Humanity People)" by Naoshi Sugiyama (Nagoya University).

THURSDAY, MARCH 10—*Humanities/Social Sciences Workshop*

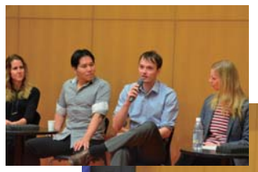
On the fourth day, the humanities/social sciences workshop was held. There were opening remarks by economist Takaho Ando, former director of Nagoya IAR. The workshop consisted of two parts.

Part I, Time in Humanities and Social Sciences: "Articulating Time in the Hellenistic World" by Yoshiyuki Suto (Nagoya University), "Approach to Time in Ancient Greek Philosophy" by Yasuhira Kanayama (Nagoya University), "Time institutionalized and its transformation" by Takehiro Ohya (Keio University) and "Time, Guilt, Irrevocability and Forgiveness" by Sami Pihlström (University of Helsinki).

Part II, Oriental Time: "Notion of 'Time' in Traditional Chinese Culture and its Significance in the 21st Century" by Chun-chieh Huang (National Taiwan University), "Daoism, Zen, Time Awareness, and the Reality of Time" by Kirill O. Thompson (National Taiwan University).

FRIDAY, MARCH 11—*Panel Discussionhop*

On the fifth day, there were panel discussions on “Interdisciplinary: Benefits and Challenges of Intercontinental Academia” by young scientist participants and on “The Future of UBIAS” by the senior committee. Also, there was keynote speech “The Development of Institutes for Advanced Study and their Role in the Contemporary University“ by Peter Goddard, former director of the Institute for Advanced Study. After discussion, participants visited the Yagoto Koushoji Temple and experienced Zen Meditation ‘Zazen’ and had a banquet dinner.



SATURDAY, MARCH 12—*Exploring the City*

For the weekend free-choice activity, a study tour of Nagoya city was provided. Participants visited the Toyota Commemorative Museum of Industry and Technology and Tokugawa Art Museum.

SUNDAY, MARCH 13—*Traveling Day*

Participants moved from Nagoya to Tokyo to attend the Waseda Workshop.

MONDAY, MARCH 14—*Waseda Workshop*

The Waseda workshop in search of interdisciplinary dialogue was held by the Waseda Institute for Advanced Study (WIAS). The workshop was opened by opening remarks by Hideaki Miyajima, director of WIAS. There was a keynote lecture by chronobiologist Till Roenneberg (Ludwig-Maximilians University) followed by a WIAS Lectures on TIME from an Interdisciplinary Perspective, “Circadian Clock System in Peripheral Tissues of Mice” by Yu Tahara (Waseda University), “Truth and Time in Brouwer’s Intuitionism” by Ryota Akiyoshi (Waseda University), “History of Time and Calendar in Japan” by Masashi Abe (Waseda University).

TUESDAY, MARCH 15—*Arts Workshop*

The arts workshop was opened by remarks by Takaho Ando (Chubu University and Nagoya University) and Martin Grossmann (University of São Paulo) and followed by the lectures, “Time and Space in Sculpture” by Satoru Kitago (Tokyo University of the Arts), “Time and Space of Works of Art in Comparison with Gei-do” by Akitoshi Edagawa (Tokyo University of the Arts. In the afternoon, Japanese Tea Ceremony (cha-do) was held at CALE Hall Tearoom.

WED～THU, MARCH 16～17

Closed workshops were held among young researcher participants. They discussed and consolidated the MOOC’s scripts.

FRIDAY, MARCH 18—*Final Presentation*

There was a final presentation by young researcher participants at Sakata-Hirata Hall. They presented their plan for making a MOOC on the knowledge of “TIME”. The MOOC will consist of four parts 1) Introduction: Aspects of Time, 2) Is the Present Special? 3) Is Time Different for Humans and Non-Humans? 4) How Do We Value Time? and will be filmed at the Ubatuba Marine Institute in Brazil. After the presentation, a final meeting with the UBIAS Intercontinental Academia Senior Committee was held. It was decided that the cost for making the MOOC will be provided by Nagoya University and the University of São Paulo.