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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 (IAS) and IARs from various parts of the world including several IAS/IARs from European universities together with several IAS/IARs 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.
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 enzymes that elongate the synthesized DNA are stimulated by the 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 Mieyama 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 Gama warehouse. 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 unwanted daughter.

Doctors need to be very sociable. They need to work with a lot of people, 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 for 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 when 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 1st 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 US by ship, on the Hikawa Marr, 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 preparing the double helix by DNA helicase. Two complementary single-stranded DNA are formed, which will become templates for DNA replication. One of the two DNA strands is replicated continuously (leading strand), but the other strand is replicated discontinuously (lagging strand). In the case of DNA polymerase, the new synthesized DNA strand is DNA strand in the new direction only (from 3’ to 5’). In the process of lagging chain production, whose overall direction of elongation from 3’ to 5’. Okazaki fragments are produced here in the direction opposite to that of full progression and are later connected to form a complete long strand.
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. Contrastly, 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 35. 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-rearing?

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 9:00 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.

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 junior 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 the specific region as a primer and amplify gaps, are widely used now.

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.

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 treated 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.
Research of Egyptian Pyramids with Cosmic ray Imaging

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 Khafre 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 Khafre Pyramid.

INTRODUCTION

Pyramids are gigantic stone architectures, 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, 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, if any anomalies are found, they placed horizontally on the pyramid inside the three chamber to measure cosmic rays to validate imaging of the upper chamber.

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 means 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, 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 limestone. 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 limiting 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-micrometrical 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.

Scampy Pyramid

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 Khafre 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 3m². 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. 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 directional distribution 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.

Measuring the Khafre Pyramid

We have been measuring the Khafre 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 sigma, strongly suggesting one or several unknown inside behind the north face. We are measuring from additional positions in the Descending Corridor to clearly identify the shape and positions suggested by the anomaly and also analyzing the data collected from the Queen's Chamber.

Future Prospects

Cosmic ray imaging is a very powerful technology for not only archeology as shown above 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.

References

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

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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 San Andrés in the Zapotitán Valley located c. 45km from Ilopango Volcano, however, provides new insights and hypotheses regarding human responses to its catastrophic eruption.

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 hazards as they are unpredictable, sudden, and often have catastrophic effects. In this sense, archaeological data on the gigantic eruption of Ilopango permit a deeper discussion of the impact of natural disasters on human societies. At the same time, I highlight the importance of interregional and social networks to mitigate or overcome the damage of natural disasters. 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 mentions 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 Maya realm, because San Andrés is considered to have been a satellite center of the Copán dynasty.

Concluding Remarks

Generally, defining direct connections between sudden environmental change and cultural practices is complicated by a number of factors. However, volcanoes produce like ash that 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.

Acknowledgments

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References

Enhanced plant photosynthesis and growth through manipulation of stomatal apertures

Yin WANG

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 control the amount of atmospheric CO₂ taking up CO₂ while losing water vapor through the stomata (3).

Overexpression of H⁺-ATPase in guard cells promoted light-induced stomatal opening and enhances the photosynthetic rate

Using the Guard Cell-PK (GCP) promoter, we successfully overexpressed H⁺-ATPase (an isoform of the blue-light receptor phototropin) in Arabidopsis (a typical isomer of the plasma membrane H⁺-ATPase, AKT1, and AKT2 isoforms of plasma membrane H⁺-ATPase) in guard cells, and thereby obtained homo lines with high expression levels. Then, physiological studies on abiotic stress plants with the overexpressed components were performed. Via isolation of the epidermis of 5- to 6-week-old mature leaves, stomatal apertures were examined by microscopy. The results showed that the stomatal apertures of the plants with overexpressed AHAA2 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 AHAA2 opened more quickly than WT stomata over a period of 30 minutes of illumination. In contrast, the overexpression of PHO2, AKT1 and KAT1 had no effect on stomatal opening under light conditions. These results indicated that H⁺-ATPase, not phototropin or K⁺-channel, 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).

Then, the stomatal conductance (reflection of the stomatal gas-exchange abilities of intact leaves and photosynthetic activity (photosynthetic rate) of intact leaves of the plants with overexpressed AHAA2 were examined in detail by a gas-exchange system. As expected, the stomatal conductance and photosynthetic rates were significantly higher in the plants with overexpressed AHAA2 than in the WT plants (Figure 2). To determine whether this higher photosynthetic rate of the plants with overexpressed AHAA2 was due to the increased stomatal opening, we examined the response curves between the CO₂ assimilation rate and the leaf intercellular CO₂ concentration using a gas-exchange system under summer 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 AHAA2. These results indicate that the increased stomatal opening in the plants with overexpressed AHAA2 contributed to the increased photosynthetic rate (3).

Overexpression of H⁺-ATPase in guard cells enhances plant productivity

Growing under conditions of sufficient light (~150 µmol photon-m⁻² s⁻¹), the plants with overexpressed AHAA2 exhibited superiority in plant growth. They showed a higher number of larger and increased numbers of rosette leaves with an average of 45–65% greater fresh and dry weights than those of 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, silique, and flowers, of the plants with overexpressed AHAA2 were ~36–41% greater than those of the WT plants under the same growth conditions. The number of silique per plant with overexpressed AHAA2 was much greater than for the WT plants, although the dry weights of individual silique from the plants with overexpressed AHAA2 were comparable to those from the WT plant (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 AHAA2 was obtained under laboratory conditions with proper light, water, temperature, and CO₂ 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 AHAA2 were grown under various unfavorable conditions including low light, short daylight hours, and high CO₂, and the stomatal apertures and plant growth were subsequently examined. The results showed that the stomatal apertures of the plants with overexpressed AHAA2 were still larger than those of the WT plants under all the growing conditions. However, since under low light and high CO₂ conditions stomatal limitation did not constrain 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 AHAA2 grow better and larger than the WT plants.

Meanwhile, the stress resistance of the plants with overexpressed AHAA2 to drought and high temperatures (considered as two major abiotic stresses) and pathogens (considered as the major biotic stress) were examined. It is notable that the plants with overexpressed AHAA2 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.
Content Reuse for Text and Multimedia Documents

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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 slides by copying existing slides or reuse contents of existing slides rather than starting from scratch. Investigating content reuse in electronic documents may involve 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 content. For example, reused text may exist in academic papers, dissertations, etc. People may plagiarize other 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 content, e.g., [3, 4], they can be easily fooled by minor modifications (Figures 1), such as reorganizing sentences, replacing words with synonyms, etc. Consequently, reused content with modifications are often missed by these methods, and hence the quality of detection is not satisfactory. To solve 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.

Besides improving the recall 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 these modules: (1) slide element search, (2) slide management, and (3) slide auto-generation. For slide element search, we propose a new solution 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 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 disk 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 to 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.

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. Then we select elements using the slide element search module, and arrange 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 interface that can easily be used in a company with common a slide composition tool such as Microsoft PowerPoint.

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

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 reuse material from the other. The gray square on the left indicates a summary. The green circle on the right indicates multiple versions of the same presentation.

Figure 4. Example slides generated by the slide auto-generation system.
IAR Core Faculty Committee

The IAR Core Faculty Committee is composed of the Institute Director, Deputy Directors, Full-Time Faculty Members, and member of the clerical staff, who promote the Institute’s activities, and make proposals to the IAR Committee.

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Nagoya University Graduate School of Law, PhD thesis, pp. 171. (2011)

“Children’s rights after marital resolution in Uzbekistan”, Nargiza Amirova, Kyushu University Journal, Comparative Law and, pp. 46-60 (2012)


“Diversity of employment and the image of worker”, WADA, Hojime, Book: Miseion of the democratic Law and worker, Mitaka-ventures, pp. 87-90 (2016)


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Affiliates: Vice President of Nagoya University, Professor of Graduate School of Science
Research Interests: High Energy Astrophysics

Hideyo KUNISHITA
Steering Committee

Affiliates: Vice President of Nagoya University, Professor of Graduate School of Engineering
Research Interests: Superconductor Device, Integrated Circuit, Detector System

Fujiwara OGUISHI
Steering Committee

Affiliates: Professor of the Graduate School of Engineering
Research Interests: Material Science

Tetsuya TOYAMA
Steering Committee

Affiliates: Professor of the Graduate School of Medicine
Research Interests: Neurochemistry, Glycobiology

Kazunori ISHII
IAR Faculty

Affiliates: Professor of the Graduate School of Science
Research Interests: Developmental Neuroscience

IPGRIE: IAR People | IAR Steering Committee

IAR People | IAR Steering Committee

IAR People | IAR Faculty

March 2017  IAR LETTER  March 2017

18  IAR LETTER  March 2017  17
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.

**MAJOR WORKS**

- "Local variance on the L2 0 00 gauge interaction mechanism and the \( \nu \) in the theory of gravitational collapse and black hole formation" Shinya Matsuzaki, Kazuo Furuichi, Hirohisa Hamada, Koichi Yamawaki, Physical Review, D 88, no. 11, 115009-119510 (2013).
Yuya MIZUNO  
Young Leaders Cultivation Program Faculty  
(YLC)

Research Interests: Nonlinear dispersive equations, Long-time dynamics

Affiliation: Designated Assistant Professor at Nagoya IAR and Graduate School of Science

Satoshi KURONAGI  
Young Leaders Cultivation Program Faculty  
(YLC)

Research Interests: Cosmology and Gravitational Wave

Affiliation: Designated Assistant Professor at Nagoya IAR and Graduate School of Letters

Akira ICHIKAWA  
Young Leaders Cultivation Program Faculty  
(YLC)

Research Interests: Political Science. Political Philosophy.

Affiliation: Designated Assistant Professor at Nagoya IAR and Graduate School of Law

Yoohiko UMEKAWA  
Young Leaders Cultivation Program Faculty  
(YLC)

Research Interests: Nonlinear dispersive equations, Long-time dynamics

Affiliation: Designated Assistant Professor at Nagoya IAR and Graduate School of Science

Takaaki MATSUMOTO  
Young Leaders Cultivation Program Faculty  
(YLC)

Research Interests: Mathematical Physics

Affiliation: Designated Assistant Professor at Nagoya IAR and Graduate School of Mathematics

Cyrus Tristan ROY  
Young Leaders Cultivation Program Faculty  
(YLC)

Research Interests: Number theory, Dispersive equations, Long-time dynamics

Affiliation: Designated Assistant Professor at Nagoya IAR and Graduate School of Science
Masa
KANO NAKATA
Young Leaders Cultivation Program Faculty (YLC)

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

MAJOR WORKS


Takahiro
HACHIYA
Young Leaders Cultivation Program Faculty (YLC)

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

MAJOR WORKS

Mio
HORIE
Young Leaders Cultivation Program Faculty (YLC)

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

MAJOR WORKS

Masa
TAKUCHI
Young Leaders Cultivation Program Faculty (YLC)

Affiliation: Designated Assistant Professor at Nagoya IAR and Graduate School of Bioagricultural Sciences
Research Institute: Microbe-plant interactions

MAJOR WORKS


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Chun LI
Young Leaders Cultivation Program Faculty (YLC)

Affiliation: Designated Assistant Professor at Nagoya IAR and Graduate School of Bioagricultural Sciences
Research Institute: Molecular Genetics, Molecular Biology

MAJOR WORKS

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Tomohiro
AHE
Young Leaders Cultivation Program Faculty (YLC)

Affiliation: Designated Assistant Professor at Nagoya IAR and Kobayashi Branch Institute
Research Institute: elementary particle physics

MAJOR WORKS

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Shingo
KOHAYAHO
Young Leaders Cultivation Program Faculty (YLC)

Affiliation: Designated Assistant Professor at Nagoya IAR and Graduate School of Bioagricultural Sciences
Research Institute: Condensed matter physics (theory)

MAJOR WORKS

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Masa
TAKUCHI
Young Leaders Cultivation Program Faculty (YLC)

Affiliation: Designated Assistant Professor at Nagoya IAR and Graduate School of Bioagricultural Sciences
Research Institute: Microbe-plant interactions

MAJOR WORKS

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Takahiro
HORIE
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Research Institute: Anthropology, Area Studies

MAJOR WORKS

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Mio
HORIE
Young Leaders Cultivation Program Faculty (YLC)

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

MAJOR WORKS
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 lectures are selected from international researchers of the highest caliber and all lectures are open to the general public.

On November 16, 2016, the Nagoya University Lecture was held at the Toyoda Auditorium, organized by the Institute for Advanced Research of Nagoya University and Churchストリム有限公司.

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

Professor Miyamoto is known for studying the Japanese word “Higi,” 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.

Shinichiro Tanokura, a professor at Tokyo 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. Tanokura, 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!”.

According to Prof. Teranishi, a well-known saying “There is no wealth, but life” by John Ruskin in the light of Prof. Teranishi`s research may definitely be interpreted as “There is no wealth, but life and environment!”.

At the end of the lecture Prof. Miyamoto shared his motto with young researchers: “The unique purpose of science is to ease the burdens of humanity’s existence” – a truth that we all need to remember.

IAR Lecture

The IAR lectures are the most important academic lectures at the Institute. They target University researchers and senior 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 held 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-chiao Huang from National Taiwan University and research members gave several lectures. Those lectures were: “The history of collaborative research and professor Huang” by Professor Takeshi Ando (Chiba University), “The methods of exchange of history of thoughts in East Asia and problems – East Asia Confucianism – Present time” by Associate Professor Tomoharu Kawajiri (Arts & Philosophy University), “Western musics of Japan and the spirit of Confucianism” by Professor Yasuyuki Ono (Nagoya University of International and Informatics), “The media transmission of wisdom and the history of thoughts” by Professor Masayoshi Takimoto (National Taiwan University) and a keynote lecture “The views of East Asian Confucianism and the problems of its methodology” by Professor Chun-chiao Huang (National Taiwan University).

Ryooji Noyori Academy Salon


IAR Symposium

We organized IAR symposiums starting from 2016. The symposiums aim at connecting the international research, and invited experts and cutting-edge research at Nagoya University to all its members. We set three different fields, humanities 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 20, 2016. Six 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-Noel Robert (Professor of Philosophy of Japanese Civilization, Collège de France) were selected for this fellowship. While they were visiting Nagoya University, they discussed collaborative research with the PI in Nagoya University. Also, they contributed to the education of young researchers by giving advice and lectures.

“Plant AEC transporters: from detoxification to hormone transport” by Prof. Jean-Noel Robert gave a lecture “La hormigas (ant) comme module language” by Prof. Enrico Martinoia in East Asia and problems – East Asia Confucianism – Present time.

New IAR academy member

The IAR Academy is comprised 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, Tetsunori Otsuki, University Professor at Nagoya University became a member of the Academy. For more information on Professor Otsuki, please see ‘SPECIAL INTERVIEW’ on page 3-6.
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”.

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 IA-IAR, 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.

**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 IA-IAR, and Carsten Dose, managing director of FRIAS. Nagoya IAR’s activities were introduced by Hisanori Shinohara, director of Nagoya IAR.

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

**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).

**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 Horita (Hokkaido University), “Biological clocks and 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 of Neuronal Oscillations” by Kazuhiko Kume (Nagoya City 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 Ohta (Kobe University) and “Time, Guilt, Irrevocability and Forgiveness” by Sara Pihlström (University of Helsinki).

FRIDAY, MARCH 11—Panel Discussion

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 Hitoshi Miyauchi, 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 Brusseur’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 Akitsui 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.