



Outstanding Professors 2009 - 2010

Yamaguchi University

Map and Location



- ①Yoshida Campus (Faculties of Humanities, Education, Economics, Science and Agriculture)
- ②Kogushi Campus (Faculty of Medicine and Health Sciences), ③ Tokiwa Campus (Faculty of Engineering)

Transportation access to Yamaguchi

From Tokyo	Shinkansen	Tokyo~Shin-Yamaguchi: 4 hrs. 30 min.
	Airplane	Tokyo Int'l Airport(Haneda) ~ Yamaguchi Ube Airport: 1 hr. 30 min
From Osaka	Shinkansen	Shin-Osaka~Shin-Yamaguchi: 2 hrs.
From Fukuoka	Shinkansen	Hakata~Shin-Yamaguchi: approx. 40 min.

Preface by the President

With the advent of globalization of our society in general and the internationalization of our universities in particular, a progressive institution is not only evaluated by the information that it received but also by the quantity and quality of information it transmits or disseminates.

Faculty members of a university represent a major human resource that a university possesses. It is also the facade of a university that can be reflected with pride. Every university has its fair share of the so-called “star professors”. These “cream of the crop” professors are recognized for their outstanding performances in their respective fields.

In this publications, we selected some of our faculty members to highlight their profiles and academic achievements. This will serve as a tribute to their efforts and ingenuities for their contributions to the advancement of science and technology as well as in social sciences that directly or indirectly influences not only our daily life and our community but also human kind as a whole.

In the following pages, we can reap information pertaining to a recognizable level of scientific, academic or societal achievements of these outstanding faculty members. However, our faculty members with outstanding achievements are by no means limited to those who are listed in this publication. As time passes by, we will introduce more distinguished faculty members in the future. By spot-lighting the achievements of our outstanding professors, we hope that other faculty members as well as students will be presented with examples of what it takes to be recognized professionally and academically. In this context, we also hope that our other faculty members and students will be inspired to aim for higher objectives after perusing through this publication.



A handwritten signature in black ink that reads "T. Marumoto". The signature is stylized and written in a cursive-like font.

Takuya Marumoto, Ph. D.
President,
Yamaguchi University, Japan

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Research Activities

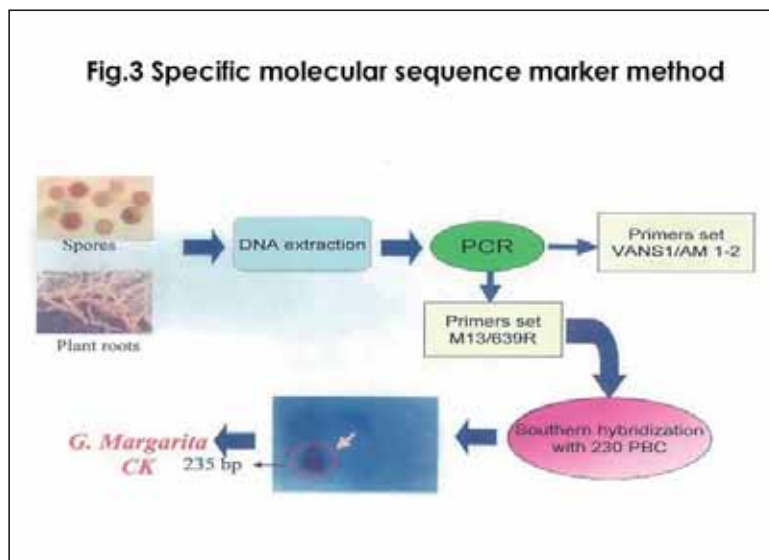
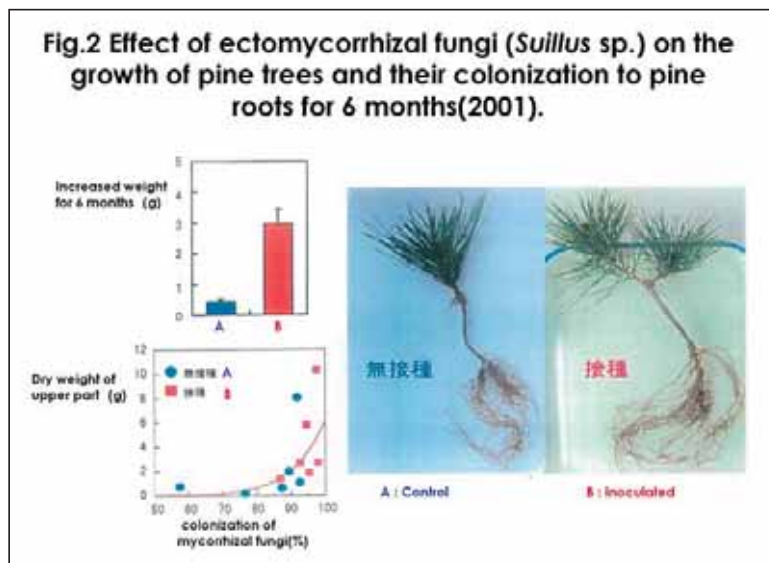
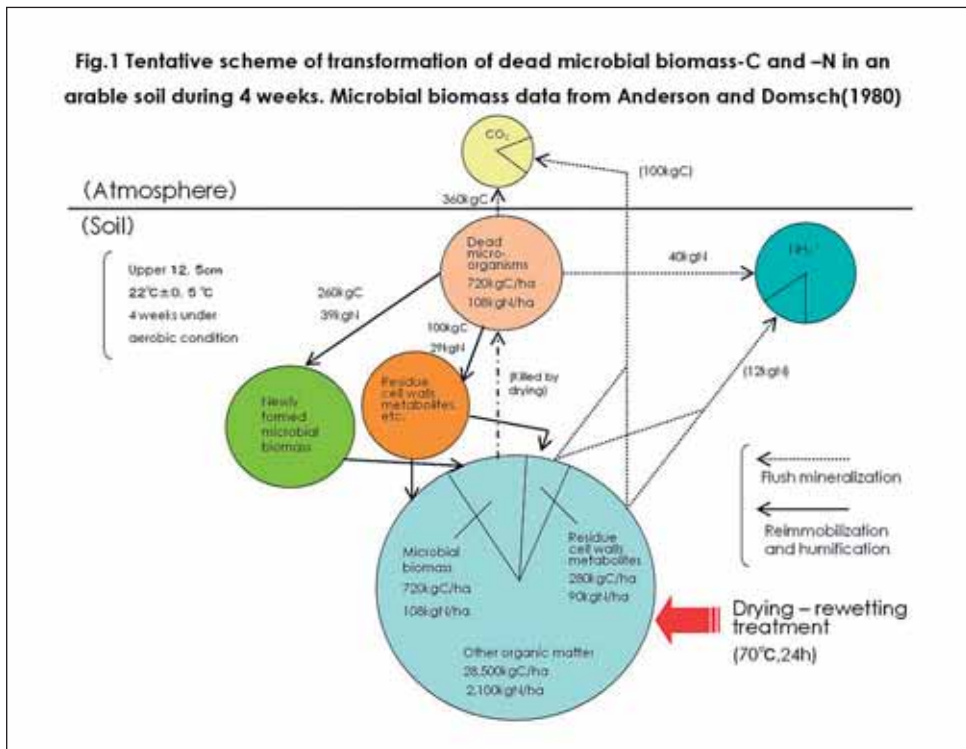
Revealing Nutrient Supply Function of Soil Microorganisms and Developing Environmental Restoration Techniques for Growth of Vegetation in Barren Areas

Dr. Marumoto's research focused mainly in two areas: I. Nutrient supply function of soil microorganisms, especially in the nitrogen supply, and II. Environmental restoration of barren ground slopes through the use of the symbiotic phenomenon between microorganisms and plants to promote rapid growth of vegetation on land slopes.

In the early 1970s, Dr. Marumoto started on the analysis of the role of soil microorganisms in the soil nutrient supply function for crops, which is an extremely important factor in food production. Using paired label ^{14}C and ^{15}C microorganism biomass, he revealed for the first time that bacterial cells (microorganism biomass) and the metabolic products of such microorganisms serve as the main source of nutrient nitrogen supply from the soil to crops. Furthermore, he also clarified the speed of the metabolic turnover of microorganism biomass nitrogen accompanying environmental changes during the period of crop growth, the possible amount of nutrient supply, and the possible nutrient supply mechanism. The discovery of these factors led to an efficient fertilizer management method for sustainable development of agricultural land and making a major contribution to the establishment of farming methods that promote environmental conservation.

In the early 1990s, large-scale land development, such as dams and road construction projects, led to the formation of barren ground slopes that became a problem during rainy season due to mud slide. Thus, to prevent the mud slide, environmental restoration and methods to promote the growth of vegetation were urgently needed. Dr. Marumoto formulated a new material for this purpose by mixing plant seeds, fertilizer and plant material to non-woven fabric sheets that composed mainly of water-repellent synthetic fiber, and also adding to it microorganisms (mycorrhiza fungi) which live symbiotically with plant roots by supplying nutrients and water to the plants. Using this new soil erosion prevention method, growth of vegetation on barren areas could be achieved rapidly. The effectiveness of this new method to prevent soil erosion and quickly establishing stable environmental restoration with the rapid growth of vegetation proved to be very successful in the field when tested in Japan and in other foreign countries. Dr. Marumoto discovered the high efficacy of his method with the inoculation of mycorrhiza fungi (*Gigaspora margarita*) in the affected areas using equipment for the large-scale cultivation of solid form ectotrophic mycorrhiza fungi.

With the development of mycorrhiza fungi inoculation techniques and subsequent gene analysis of the microorganism, he made clear for the first time the feasibility of implementing his research in the field. His research contributed greatly to the use of ecological systems in soil science and also to the development of techniques to promote the growth of vegetation in barren areas, which can be extrapolated in the future to the greening of the desert.





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Research Activities

Dr. Yukawa is an authority in the studies of folk culture in Japan. Presently, his research focuses on cultural changes in village life of inhabitants in mountainous communities and the changes of folk customs.

His studies on the change of mountain village life focused on the transformation of traditional values held by the mountain village people. Life in a mountain village can be divided in two parts; mountain life and village life. Although the mountain and the village were of a different nature, they coexisted to form a unique culture as expressed in the form of folklores. This gives rise to characteristics of folklore culture depicting the mountain village life. In recent years, however, Dr. Yukawa had observed that both the mountain life and the aforementioned village life have undergone a complete transformation and lost their traditional characteristic. The most remarkable and important change in both the mountain and village worlds occurred in the people's way of thinking : their original way of thinking that consisted of "borrowing" the products of nature (or adapting oneself to nature) was replaced by a desire to maintain their life through possession and management. That is to say, their sense of values had drastically changed.

Dr. Yukawa's work on change of folk customs focused on the interpretation of regional variation. Generally, Japanese folklorists have attempted to understand the regional variation in folk customs from two main viewpoints. One is to explain the changes in folk customs in term of chronological and differences in historical timing. The other is to pick out the variety and the regional uniqueness of folk customs in Japan by regarding them as local manifestation. In addition to these viewpoints, Dr. Yukawa advocated a novel viewpoint that place emphasis on the meaning of the regional variation in folk customs, as it relate to the formation of individual regional societies. His studies also contributed to the preservation and conservation of Japanese traditional mountain folklore culture.



A traditional mountain village,
Itsuki-mura, Kumamoto Pref.



A mountain village community that disappeared due to the
construction of the Kawabegawa Dam, *Itsuki-mura*, Kumamoto Pref.



The Kagura (sacred dance) performed by the mountain village people,
Iwakuni-shi, Yamaguchi Pref.

Message

The study of Japanese folklore was established in the 1930's. Thereafter, Japanese folklorists have investigated traditional customs and worked to reconstruct their history. But, at present, it is becoming important to understand the meaning of folk customs in our daily life. Join us in the new research into folklore to see the changes in contemporary Japan.



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Research Activities

Dr. Koketsu is a prolific writer, having authored and published more than 26 books. He is an authority on the association and interaction between the military establishment and the democratic institution in a country. To maintain the political democracy of a country, Dr. Koketsu put forward the collaborative co-operation theory between the political entity and the military brass as outline in the concept of civilian control. He advocated a harmonious balance of power among the political and military parties as well as with entities with power that be.

His research started with his dissertation entitled “The psychological structure of Nazism –how did Hitler capture the political power”. He then moved on to do research on a related subject entitled, “Japanese Style Fascism and the background of all-out war”, resulting in the publication of the book entitled “A Study on all-out war” (Soryokusen Taisei Kennkyu). Although this research was conducted to investigate the process and background of all-out war, his later interest was extended to a study on “the persons who were responsible for this all-out war”.

In 1996, he published a non-fiction book entitled “Nihon Kaigun no Shusen Kosaku” (Maneuver by Japanese Navy during final stage of the war.), which turned out to be a best seller, having sold more than 50,000 copies. His two books entitled “Kinndai Seigun Kannkei” (Civil-Military Relations in Modern Japan) and “Bunmin tosei” (Civilian Control) published in 2005 present theoretical discussion on civil-military relations, as well as discussing the problems of current Japanese defense system from the point of view of civil-military relations.

In parallel with these writings, he also visited, Beijing, Shanghai, Korea, Taiwan, Malaysia, and Singapore to reconfirm his historical perception from the field survey where much destruction were carried out by the Japanese regime immediately before and during the second world war.

Besides these research works on current Japanese and Asian history, he became interested in armament problems. His publications are based on analysis of contemporary legal documents, policy speeches and government white papers. They include the following titles: “Shin Guideline Anpo Taisei” (The New Guideline of Japan –US Security Treaty) (1998), “Shuhen Jitai Ho” (The Law of Military Emergency) (2000), “Yuji Sei Towa Nanika” (What is Meant by Military Contingency) (2002), “Yuji Sei Ni Damasareruna” (Do Not be Fooled by the Military Contingency plan) (2002), and “Yuji Tai Sei Ron”(The Theory of Military Contingency) (2004).



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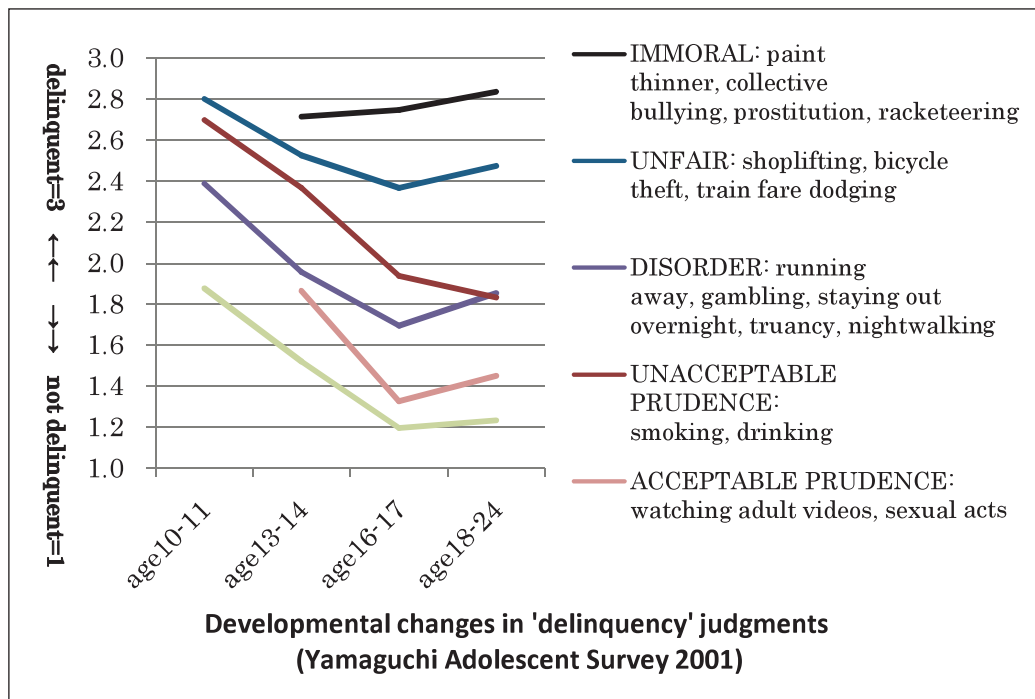
Research Activities

Dr. Takahashi is a social scientist whose research interest focused on adolescent behavior with respect to the norms and the moral value of the contemporary society. He has conducted research on *The national surveys of sexual behavior of Japanese youth*, *Surveys of adolescent morality in Yamaguchi prefecture* and *Glocalization of Japanese pop culture in Taiwan*. He proposed and analyzed the process of adolescent socialization by using a metaphor of the immune system, which protects organisms from infection with layered defenses of increasing specificity. The rationale and background of his research can be traced to the following social issue; adolescents in modern societies often show moral rebellion, skepticism and scoffing to the established norms. This phenomenon is called adolescent relativism. Although it has been one of the most favorite themes of the modern literature, movie and animation, social scientists have not paid enough attention to describe or analyze it. Unfortunately, adolescent relativism has been misunderstood as a failure to integrate the norms, or as transitional disorder in a normal hierarchical social structure.

These misconceptions may have its roots in the ontological metaphors of morality in socialization theory. Morality was substantialized as ‘treasures in one’s own bag’, ‘commandments to be carved on a blank slate’, or ‘iron cages to capture wild animals’. Based on these metaphors, socialization has been considered as an accumulative process to internalize norms of a given society.

However, adolescent socialization is accompanied by linguistic, interactive, and reflective process. Although adolescents tend to judge certain delinquencies less punitively as they get older, a certain pattern in the disobedient process can be observed (see Figure). Viewing from the strongest and most stable judgments of ‘true (IMMORAL) delinquency’, adolescent socialization can be described as a process of increasing reflexivity. Once moral strictness is relaxed, the classifications of badness and its variations are usually modified to allow for more realistic solutions to problems.

Adolescent relativism implies their advanced competence at testing, specifying and grading some types of badness in the real world. The naïve dualism (good/bad) of childhood is gradually replaced by a more complex concept of badness with a highly graded grayscale.



Message

Youth and youth culture in modern society have been colonized by moral enterprisers, such as politicians, mass media and educators. Although they always seem to seriously discuss youth problems, their observations sometimes contain exaggeration and distortion based on some stereotype images of “dangerous youth.”

To start a scientific research on youth and youth culture, we need to avoid these prejudices and deliberately criticize its root metaphor. Aristotle once said, “The greatest thing in style is to have a command of metaphor and a good metaphor implies an intuitive perception of the similarity in dissimilar”. As in social sciences, reconstruction of the root metaphor generates alternative approach, a new set of data, and new knowledge.

Cross-cultural research is very good for reflecting the root metaphors embedded in one’s own culture. So we always welcome cross-cultural research projects concerning youth and youth culture.



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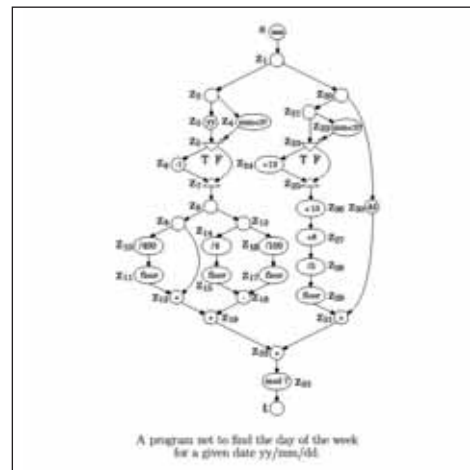
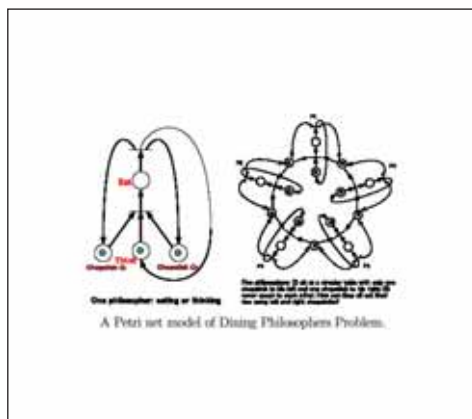
Research Activities

Dr. Ge's main research focused on modeling, analysis of programs and workflow based on Petri net and its variety nets. The net theory is an indispensable key concept in the analysis and design of discrete distributed systems. Its representative modeling tool is Petri net, which was proposed by C.A. Petri in 1962.

Program net, a variety of Petri net, is used to model programs for parallel computer, such as data-flow computer. Modeled by program nets, the characteristics of programs in the computer can be revealed qualitatively and quantitatively. Dr. Ge's research includes the analysis of properties of programs, such as terminacy, deadness, token self-cleaniness, computation determinacy and parallelism. He made an important contribution to parallelism analysis by proposing the concept of *Parallel Degree (PARAdeg)*, that is considered as a standard to quantitatively evaluate parallelism residing in program nets and to estimate the necessary processors to execute the programs. He also developed methods for measuring *PARAdeg* to find the related optimal or quasi-optimal schedules. These fruits of his research have become indispensable in the construction of the multiple-processor systems.

A workflow is a flow of work carried out by different people placed in series and or in parallel position. This is usually modeled by a Petri net. Dynamic change is an important notion that deals on how to change the current flow of works to a new and efficient one. Dr. Ge's research group has introduced an important concept, called, *Change Time* to evaluate the effectiveness of dynamic changes. Many algorithms have been designed and applied to several types of dynamic changes. These works contributed to the development of business society, especially to electronic business of today's information society.

Besides program nets and workflow nets, he has also applied the Petri net to modeling and analyzing biosystem and designing public-key cryptography system.



Message

“Net” includes Graph, Petri Net and their variations. Net theory is an essential knowledge of information science. Won't it be wonderful to create a system that comprehensively features a combination of man, machine and network? It would also be interesting to know if such a system can work normally and if a quick response to a request is available from the system. Most of these problems can be resolved by applying net theory as well as its analytical techniques and simulation tools. Invention of computer has provided humans with a new civilization and the Internet has brought us affluence and made living in our society attractive. With such rapid progress in computer technology, net theory will play an ever more important role in more complicated system designing and is increasingly gaining attention in information science. Isn't it joyful to work to develop and advance the net theory?



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Research Activities

Her main monograph focuses on the pioneering British journalist, Pierce Egan (1774-1849) and how he developed sport as a distinctive area in journalism. Her research highlighted how sports journalism was shaped by the prevailing political culture of the Regency period in England. Particularly, she observed how early radicals of the late eighteenth and early nineteenth century raised the idea of ‘British Liberty’, through the defence of popular sports and through the assertion of ‘what the people is’ and ‘what the rights of the people are’. During that time the origin of a sporting press become evident, which attracted a readership that was identified across the social spectrum. Thus, it was argued

that the ideas of the early radicals and the birth of the study of sport in the twentieth century shared historical continuities. This argument was presented in papers by her entitled, “Political Analysis of the Historical Development of Sports Writing in Britain from the Early Radicals to the New Left”, as well as in “Sport, Politics and Business”. In addition to these studies on the history of British sport, her publications also include “The Body and Grass-roots Fascism during World War II: ‘the topos’ of the Emperor in a personal-body-mechanism in Japan.”, and the study of a national graveyard in Dublin and Boxing history: “Radicals and Sport: ‘Bully’s Acre’, John Egan and Pierce Egan’s *Boxiana*.”.



Message

The history of sport in pre-Victorian Britain provides an interesting perspective of contemporary sporting activities as well as of such activities in the modern era. Interestingly, previous work on Pierce Egan was undertaken by a Canadian historical-sociologist and a New Zealander. This highlights how foreign academics can shed light on their subjects, and provide an insight into historical peculiarities, which indigenous academics generally missed out. This also applied to my work. Following my research into the history of British sport, I felt that there was a need for a comparative study with Japanese culture. Previous work generally argued that there was resistance to the dominant culture in Japan, and the making of the Japanese nation state was a blend of this traditional Japanese cultural traditions as well as the influence of Western modernization.

Recent works on history of the ‘body’, ‘bodily culture’ and ‘sporting culture’ have revealed both hidden political ‘truths’ and identified ‘what we are’, which the other disciples of history such as political history have not been able to illustrate. In this sense, the history of sport can provide a lens into this process. In addition, it can also highlight cultural prejudices that extend beyond the realm of nationality or ethnicity and allowing a more comprehensive understanding of our society.



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Research Activities

Prof. Chen's research focuses on Environmental Management for Sustainable Development (SD). His research introduces an ideal method of multi-level environmental governance system for sustainable development. The integration of environmental issues into other policy areas known as environmental policy integration (EPI) is widely recognized as a key for SD. It is also the biggest challenge facing the environmental preservation community, requiring not only a new approach to policy-making but also changes in policies and their implementation. However, the cross-cutting nature of EPI does not easily fit into traditional hierarchical governance based on (nation-) state authority, sectoral differentiation, and 'command and control' type instruments. It is therefore not surprising that measures to promote EPI frequently rely on new modes of governance, such as voluntary, procedural, information, learning and market-based instruments.

Prof. Chen had presented proposals that can galvanize efforts to achieve and improve EPI at local/regional, national and global levels of governance, and also within the private sector. He also recognized that measures at different levels may affect each other, thereby improving or weakening EPI and SD. Indeed, the interlinkages between these different modes of governance and layers are emerging as a central challenge in the area of EPI. His research results have contributed greatly to a rapidly growing body of literature that analyze and discuss the different EPI approaches and measures.

Message

Environmental issue continues to grow on a global scale, transcending national and regional interests. Reducing greenhouse gas emissions, including CO₂, has specifically emerged as one of the most urgent issues. It is very important to highlight and to propose new values that address global environmental issues. By way of education and research, we will overcome the difficulties that we are facing now. We should stay ahead of time by being at the forefront in the area of the environmental protection, conservation and sustainability.



Joint environmental research field work with Guizhou University to help the minority race in Guizhou, China



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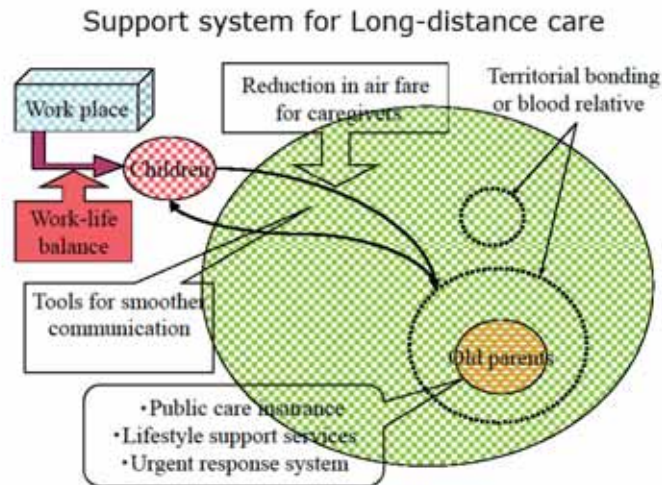
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Research Activities

Ms. Nabeyama's research focuses on the new phenomenon of "long-distance care" and its influence on the work-life balance in Japan. In 2007 in Japan, people who are older than 65 years old exceeded 21% of the population. This led to the notion that the Japanese society has become a "super aged society". This aging rate has continued to rise and, as predicted, will reach 40% by 2050. Since Japan is set to become a super aged society, it will encounter many social problems. The percentage of elderly persons living with their children or grandchildren traditionally has been and will be quite high in comparison with other countries. Because of the entrenched idea of gender division of labor, elderly people who need nursing have, in most cases, been taken care of by their female family members such as wives and daughters-in-law.

However, in contemporary Japan, children leave home when they come of age, to make a living on their own by working as wage earners in urban regions. Despite this shift in lifestyle, the Japanese welfare system has relied predominantly on family members as the caretakers of their elderly parents. Of late, a new way of supporting elderly parents, called "long-distance care", has been practiced in Japan. It was, however, only in 1996 that the definition of "long-distance care" was introduced in Japan. Many workers who need to look after the needs of their parents now face the difficulty of fulfilling their responsibility with regard to both their work and parental care under the rigid Japanese labor system.

Ms. Nabeyama directed her attention to the progress of work-life balance in Japan by interviewing children who care for their elderly parents from a long-distance. She has established a supporting long-distance care system in Yamaguchi as a model for emulation by other society.



Message

Japan is now a country where the number of elderly people is increasing rapidly. Traditionally, female family members are tasked with taking care of their elderly parents.

However, in a rapidly aging society, many limitations on the care provided by family members began to appear as social problems. To provide solutions to these problems, it will be very interesting to do research and make proposal for the care system for the elderly as well as community-based welfare, work-life balance and the labor policy of this country.



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Research Activities

Mud volcanoes (MV) are usually conical, and formed by an accumulation of mud and rock thrown to the surface by escaping petroliferous gases. They are distributed widely onshore and offshore in tectonically active areas and have been studied mainly from the viewpoint of energy resources. The activity of onshore mud volcanoes may affect the stability of infrastructure and man-made underground structures through the eruption of huge volumes of mud and groundwater. For example, Lusi MV in Indonesia, from 2006 to present, caused serious disaster in the regional area. To prevent the catastrophe brought about by the activity of MV, it is very important to answer to the following questions, “Which MV is active?” “How high will the highly saline groundwater ascend?”, and “How will the MV affect the human life?”. Dr. Tanaka and his co-researchers found new onshore MVs in Japan. They then carried out geophysical exploration of MV area in Japan and in Taiwan by doing geochemical analysis of erupted mud, gas and groundwater, as well as bore hole drilling. They obtained the following results;

1. Highly saline and pressurized groundwater ascend from about 3500m deep underground about 3500 m deep bringing with it dehydrated clay minerals, groundwater and gas, which together destroys the mudstone into the fragments by hydro-fracturing like a volcano.
2. An ascending groundwater increases the pore water pressure along the landslide plane and consequently triggers landslides.
3. Regional groundwater flow caused by the ascending pressurized groundwater may affect the long-term stability of groundwater.
4. The migration of highly saline groundwater causes rapid weakening and erosion of sedimentary rock via the interaction of clay minerals and groundwater.
5. Mud volcano activity is controlled by the geological setting, that is, fault and anticline.

Since onshore areas support considerable human activities, these mud volcanoes activity can potentially cause various degree of disasters. Through their investigation of geological and hydrological phenomena related to mud volcanoes, Dr. Tanaka and his team have significantly contributed to the prevention of potential disasters.

Fig.1

Wushanting Mud Volcano, Kaohsiung Prefecture, Taiwan. Groundwater, mud hydrocarbon gas erupted intermittently from the top of the gyphons.



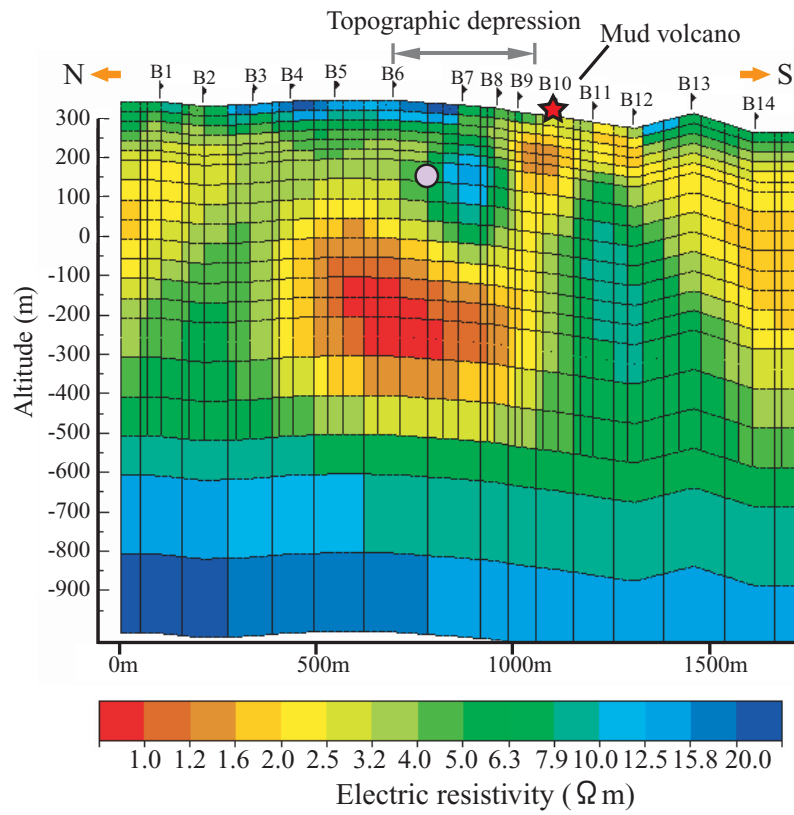
Message

Mud volcano erupts groundwater, gas, oil and mud onto the sedimentary basin and forms the caldera feature just like a volcanic caldera. Little information, particularly the onshore one, are available. Usually, its activity is inconspicuous. However, we had a surprising experience with the Lusi mud volcano in Indonesia. This mud volcano has been active for the last 4 years during which several thousands people were evacuated due to the huge volume of groundwater swelling out from the ground (a maximum of 180,000 m³/day). Moreover, mud volcano activity also causes the weakening of rocks and destroys underground infrastructure such as tunnels and large caverns. Therefore, it is important to predict the future activity of mud volcanoes, especially where it will occur, and how to prevent the disaster that it can bring about.

Research Results of Dr. Tanaka.

Fig.2

Resistivity profile analyzed by 2-D inversion of CSA-MT survey in Niigata, Japan. Low resistivity zone filled with highly saline groundwater is distributed under the mud volcano 400 m deep.





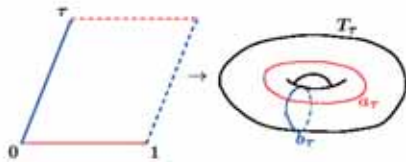
Makoto Masumoto Professor

Graduate School of Science and Engineering
Complex Analysis

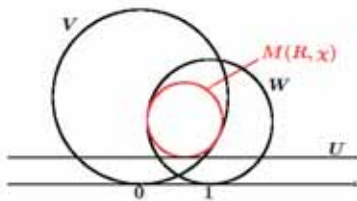
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Research Activities

Dr. Masumoto is a mathematician, who studied the complex analysis of holomorphic functions, that is, differentiable functions of complex variables. Properties of these functions are quite different from those of real variables though the definitions of differentiability are very similar. Some holomorphic functions lead us to multi-valued functions, which cannot be easily treated as single-valued ones. In the middle of 19th century, B. Riemann overcame this difficulty by remaking the domain of a multi-valued function with scissors and glues so that the function is single-valued on the new



domain, which is now called the Riemann surface of the multi-valued function. Early in the 20th century, H. Weyl gave the definition of a Riemann surface in an abstract manner. Intuitively speaking, a Riemann surface is a surface on which angles are defined. Riemann surfaces are considered as the most general domain where one can speak of holomorphic functions. A one-to-one holomorphic mapping of a Riemann into another is sometimes called conformal since it preserves the angles.



Dr. Masumoto's work also include several topics in complex analysis such as Kleinian groups and potential theory. Inspired by M. Shiba's results, he started research on Riemann surfaces. He has been studying the existence problem of conformal mappings of a given Riemann surface into another. He has obtained several novel results in terms of some quantities attached to curve families on Riemann surfaces. He is particularly interested in the effects of handles of Riemann surfaces on the existence of conformal mappings. He is now applying his methods to more general holomorphic mappings.

Message

Mathematics is an art. Like music and paintings, mathematics is beautiful and elegant. Unlike music and paintings, though, mathematics requires you to work hard just to appreciate it. Some people condemn modern abstract mathematics for being of no practical use. Actually, many mathematicians just enjoy doing mathematics and do not care whether their work is applicable directly to science and technology. However, mathematics silently supports modern civilization. Without mathematics, our daily life would be completely different, not to mention that there will be no commerce or any modern amenities in our livelihood. No one can say modern mathematics is of no use. Anyway, mathematics is one of the highest products of human mind. It matters little if mathematics is construed to be practical or not. I am proud to say that I am an inhabitant in the land of mathematics.



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Research Activities

Nowadays, computer science plays important roles in academic, industrial, and social fields as the essential techniques that support these fundamental activities. After getting his doctorate in computer science with the study of automata theory, Dr. Matsuno has expanded his research to a variety of subjects including bioinformatics, computer networks, and linguistic application of computer engineering.

His current interest is focused on wireless communication and systems biology. Although these two subjects seem totally different, they have a common basic concept – “network.” It is easy to see that the wireless communication is a network system, because it is indispensable for our daily life. On the other hand, systems biology is a novel science that investigates cell functions, whose underlying mechanisms are usually described by “networks of gene products.”

He is now developing a wireless communication system for relief activities in disaster area through collaboration with other universities, the prefectural institute, and some Information Technology (IT)-companies. This project is supported by a grant from Fire Disaster Management Agency of Japan. This system enables quick and accurate exchange of evacuee information in shelters at a damaged area, helping relief activities of firefighters and officers working for the recovery of distressed area.

Huge amount of data have been produced from biological laboratories all over the world. The biological data produced from the activities of biologists have been accumulated in the database. The size of the data is too huge to be processed with only the hands of biologists. Hence, the application of computational technique becomes indispensable for the progress of biology. Dr. Matsuno has developed a new computational method to simulate gene networks, which allows biologists to obtain suggestive insights into the cell system of their interests. Due to the attractiveness and novelty of this method, many researchers in biology as well as in computer science have invited Dr. Matsuno to present his researches at international and national conferences.

Message

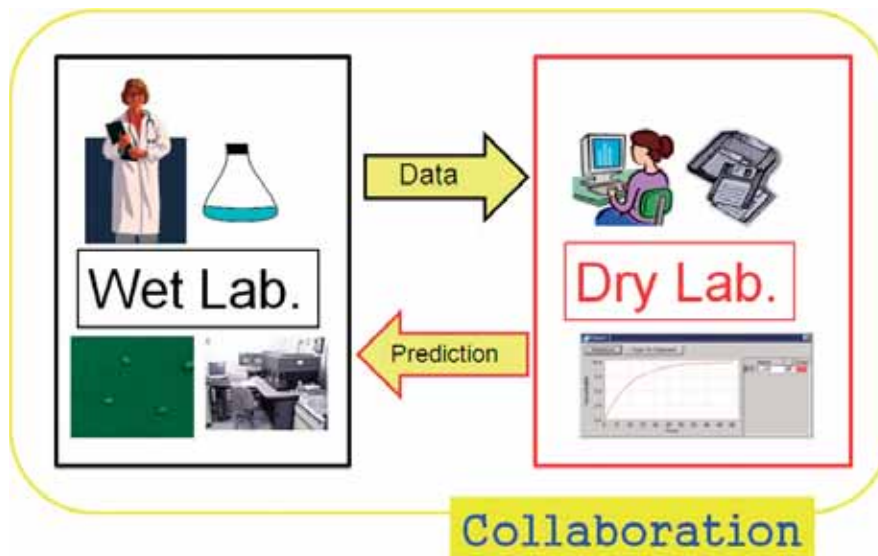
“Choshu” is another name of Yamaguchi, which was used during the Edo Period. In 1863, five young men, called “Choshu five,” visited England from Choshu in the late Edo Period to study the latest culture and technology of Europe, despite that overseas travels were prohibited by The Japanese ruler (Shogun) at that time. After coming back to Japan, they contributed to the reformation of a new era of Japan called Meiji Period, by establishing a new political system and laid the foundation of engineering education in Japan.

Yamaguchi University is one of the oldest universities of Japan, originating from “Yamaguchi Koudou” which was established in 1815, about fifty years earlier than the visit of “Choshu five” to England. Alumni of our university are now playing active roles in various fields in Japanese society. We are proud of such a long and prominent history of Choshu and Yamaguchi University. We welcome all young people from all countries outside of Japan to join our university and study with us !

Research Results of Dr. Matsuno.



A scene of wireless communication experiment at the rooftop of a campus building



Collaboration between computer scientists and biologists is important for the further progress of biology.



Masahiro Fujishima

Professor

Graduate School of Science and Engineering
Protistology

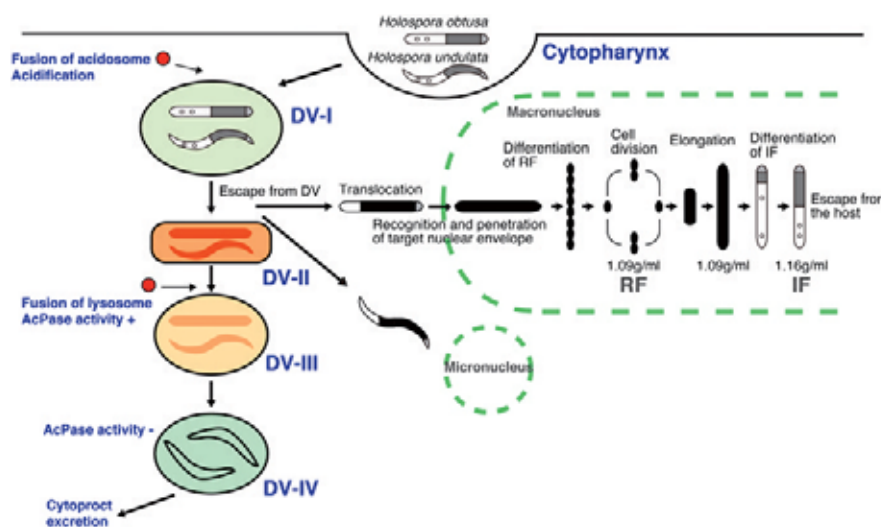
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Research Activities

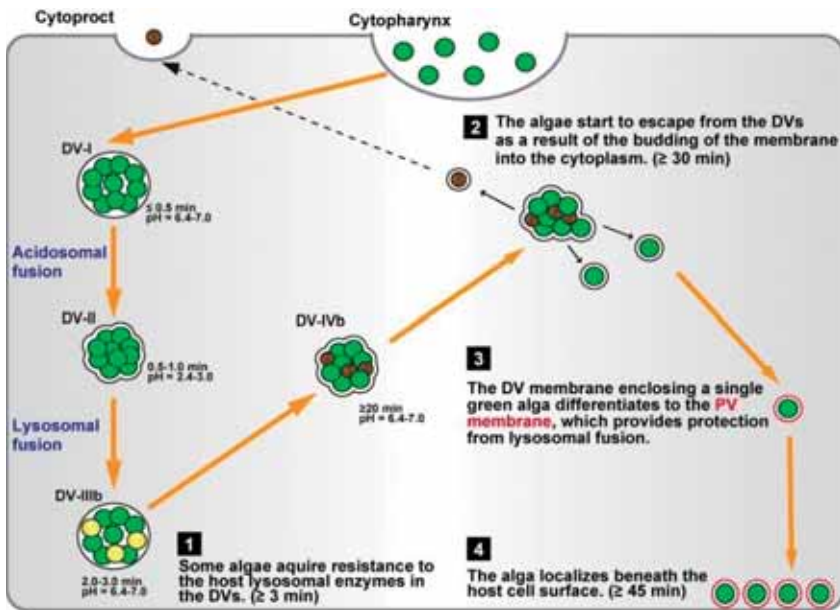
Endosymbiosis is a primary force in eukaryotic cell evolution. Recent studies of algal evolution show that this phenomenon has occurred several times and has yielded a wide diversity of eukaryotic cells. Despite the importance of this phenomenon, molecular mechanisms for induction of endosymbiosis between different microorganisms are not known. To elucidate this phenomenon, experiments for reestablishment of endosymbiosis by symbionts isolated from the symbiont-bearing host cells and the symbiont-free host cells are indispensable. In many endosymbiotic communities, however, both the endosymbionts and the aposymbiotic host cells have already lost the ability to survive and grow independently.

The ciliated protista, *Paramecium* species, are extremely valuable cells that enable the reestablishment experiments of endosymbiosis, which frequently bear prokaryotic, eukaryotic, or both types of endosymbionts in the cell. Although most endosymbiotic bacteria of *Paramecium* species cannot grow outside the host cell as a result of their reduced genome size, these bacteria, even when isolated from the host cells, can maintain their infectivity to new host cell. Consequently, reestablishment of endosymbiosis between the symbiotic bacteria-free host cells and the symbionts isolated from the host cells can be induced easily by mixing them. This provides an excellent opportunity to elucidate not only the infection process but also to assess the associations leading to eukaryotic cell evolution.

Dr. Fujishima and his colleagues elucidated the molecular mechanisms for induction of endosymbiosis between *Paramecium* and its symbiotic bacteria, *Holospora* species, and between *Paramecium* and the symbiotic *Chlorella* species. The finding of four checkpoints for the reestablishment of the secondary symbiosis reveals that *Paramecium* is an excellent model for studying the infection process of algae and the evolution of eukaryotic cells. He authored a book entitled, *Endosymbionts in Paramecium*, published by Springer Publisher in 2009. This is the first monograph on the endosymbionts of the protists. Figures below show the infection processes of *Holospora* and *Chlorella* as discovered by him and his colleagues.



Infection process and life cycle of *Holospora* species (Fujishima M. *Endosymbionts in Paramecium*, Springer, pp. 201-225, 2009)



The process of infection of algae-free *Paramecium* cells by symbiotic *Chlorella* species (Kodama Y, Fujishima M. Int. Rev. Cell Mol. Biol., Elsevier Inc., 279, 33-77, 2010)

Message

Important principles in research are “originality and reproducibility of the result”. In addition, you should carefully select the most suitable organism for your experiment. If your experiment proceeds well using that organism, then the organism will be a new model organism in your research field. Therefore, you should not stick to preexisting model organisms that have been developed and used in other research fields. *Paramecium* is now becoming such a new model organism for researches in endosymbiosis and eukaryotic cell evolution.



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Research Activities

Dr. Kawamata's current interest is the development of novel functional organic materials, especially optical materials. To maximize the functionality of a molecule, he explored the means for optimizing its molecular architecture.

In the last decade, two-photon absorption (TPA) has become one of the most attractive nonlinear optical (NLO) phenomena. In this phenomenon, a molecule absorbs two photons simultaneously when irradiated with an intense laser light. This can be applied to two-photon excited fluorescence microscopy, optical limiting, three-dimensional optical data storage, and two-photon-induced biological caging studies. However, most known organic molecules have a relatively small TPA spectrum which is insufficient for such applications. Dr. Kawamata has formulated a principle for designing an efficient TPA molecule, and on the basis of this principle, developed several organic molecules exhibiting large TPA spectrum.

Although NLO coefficients of several organic materials are known to be three orders of magnitude larger than those of inorganic materials, only inorganic crystals are used for practical NLO devices. This is because it is very difficult to obtain an organic material suitable for optical device, as there are difficulties involving size and light-scattering. To overcome this problem, Dr. Kawamata has developed fabrication techniques for organic materials that produce a medium suitable for NLO devices. For example, films fabricated under an optimized condition, by filtering water-dispersed clay and an organic dye composite through a membrane filter, exhibited superior NLO properties.



Fluorescence from TPA dyes developed for biological imaging



Hybrid films exhibiting very high TPA efficiencies. These films consist of a clay and a fluorescent dye.

Message

We have installed many high tech instruments, such as femto-second pulsed optical parametric amplifier, liquid-nitrogen cooled CCD camera, circular-dichroism spectrometer, and absolute photo-luminescence quantum yield measurement system in our laboratory. We are happy to conduct collaborative project with you making use of these instruments.



Fumihiko Hirose

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Partial Differential Equations

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Research Activities

Dr. Hirose's current research interest is the initial value problem for partial differential equations of the hyperbolic type. He particularly focused on the derivation of the asymptotic behavior of energy and smoothness properties of the solution for linear and nonlinear wave equations, while taking into account the singular behaviors of variable coefficients and nonlinearities.

Although the problems tackled by him are purely mathematical, they can be reduced to problems of mathematical physics. Indeed, wave equations describe actual physical phenomenon, and variable coefficients denote non-constant external force and non-homogeneous structure of the medium.

He has observed many complicated wave properties as well as interesting problems from the mathematical point of view, and they correspond to actual physical phenomenon like resonance, blow-up, decay and scattering. Some of these properties are not easy to be considered in numerical analysis. However, his recent proposal was demonstrated to be applicable for estimating the qualitative and quantitative properties of the solutions to such problems.

$$\frac{\partial^2}{\partial t^2} u(t, x) - \left(\varepsilon + \int_{-\ell}^{\ell} \left| \frac{\partial}{\partial x} u(t, x) \right|^2 dx \right) \frac{\partial^2}{\partial x^2} u(t, x) = 0$$

1D Kirchhoff equation with Dirichlet boundary condition

Message

One of the most difficult factors on the analysis of wave equation with variable coefficients is the oscillation of the coefficients. Indeed, oscillating coefficient can affect some crucial influence on the solutions, as blow-up and loss of derivatives. However, it is known that these oscillations do not always have negative effects, as they have been shown by a new method, taking into account the smoothness of the coefficients, which was developed by our research group. Consequently, we succeeded in improving the previous results for energy estimates of dissipative wave equations, Levi conditions of second order hyperbolic equations, and well-posedness of weakly hyperbolic equations.

However, there remains many interesting problems, which can be expected to be solved with our proposal, and some of them could be solved by young people with innovative minds. Moreover, our methods will be applicable for the problem of global solvability of non-linear wave equations of Kirchhoff type, which is a famous difficult universal problem in the research of partial differential equations. We hope that our research will be able to contribute some answer to such problem in the future.



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Research Activities

Dr. Fujisawa specializes in radio astronomy. The major subjects of his study are birth of stars and radio astronomic activity of blackholes. The observational equipment used for his research in Yamaguchi is a 32m diameter radio telescope. Previously, this radio telescope was a hyperbolic antenna used for commercial satellite communication. Its use for communication was terminated in 2001 and was transferred to the National Astronomical Observatory of Japan. Then, Dr. Fujisawa and his colleagues of Yamaguchi University changed the antenna into a radio telescope. Now it is an established radio telescope and used in many aspects of radio astronomy.

Strong radio wave, called maser, is emitted when a massive star is formed, and one can study the process of star formation by observing the maser. Dr. Fujisawa is the first person in Japan to observe maser emitted from methanol molecules around young stars. Since the stars are compact and the star forming regions are small in the universe, very high angular resolution is required to take a radio-photo of the stars/star forming regions. Dr. Fujisawa is now collaborating with more than ten radio observatories in Japan to organize and construct a VLBI (Very large baseline Interferometry) network (Japanese VLBI Network) which has the capability take radio-photo of maser emitting gas with angular resolution 10 times higher than that of the Hubble Space Telescope. Dr. Fujisawa and his colleagues have discovered a rotating gas cloud around a massive star during its formation.

The name "blackhole" is well known, but the nature of blackhole is not well understood. One of the most interesting feature of blackhole is radio jet: blackhole often exhibits very fast, long elongated jet which emit very strong radio wave. Dr. Fujisawa and his colleagues are studying the properties of the radio jet of blackholes with the Japanese VLBI Network.

Message



A 32m diameter radio telescope at Yamaguchi.

We are doing research in astronomy at Yamaguchi with a 32m diameter radio telescope. It is rare, even in the world, that students can use such a large telescope for their research with free access to this equipment. Our subjects of research are star formation and the activity of blackhole. You can see with our telescope the gas motion around a young star that had just formed, or a very fast jet ejection from a blackhole. Don't you think this is interesting? Since it is necessary to use many radio telescopes in many countries for such a research, joint research with foreign countries is important. We hope to collaborate with peoples in foreign countries to achieve better results. Why don't you come and join us in our pursuit of better understanding on extra terrestrial phenomena?



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Research Activities

Dr. Fukuchi's basic research interest focuses on determining the absolute age of seismic fault movement. Since active faults, which cause earthquakes, repeatedly move at certain intervals, the time of the next movement can be estimated from the absolute age of the latest fault movement. The results of his research have contributed to the forecast and disaster prevention of earthquakes. His dating technique is based on the ESR (electron spin resonance) detection of unpaired electrons trapped at lattice defects in minerals. Since natural radiation attacks rock-forming minerals during the geological period and ionized electrons are trapped at point defects such as vacancies or impurities in minerals, ESR signals derived from the trapped electrons increase with radiation dose or time.

The accumulated dose of natural radiation (Total Dose:TD) is determined from the growth line of ESR signal, which is obtained by the additive dose method that is a technique to make time proceed with artificial irradiation. ESR ages are obtained from TD divided by annual dose, which is calculated from radioactive elements in and around the mineral. The objects for ESR dating range from minerals or volcanic glasses to stalactites, faults, potteries or fossil bones. To determine the absolute age of a fault, the complete resetting of ESR signals by frictional heating is assumed. This assumption has been verified by using deep drill core samples penetrating through active fault zones such as the Nojima fault that caused the 1995 Kobe Earthquake (M7.3) in Japan or the Chelungpu fault that caused the 1999 Chi-Chi Earthquake (M7.6) in Taiwan.

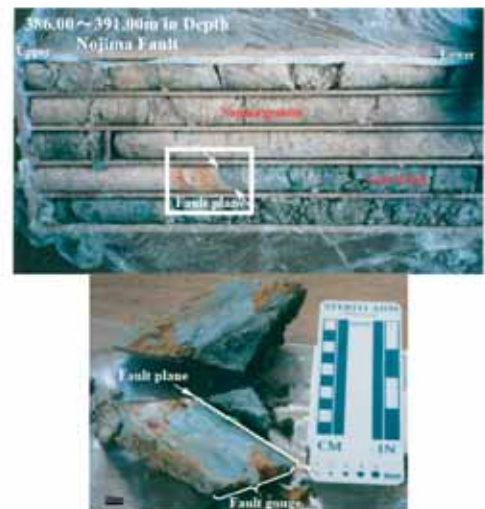


Figure 1. Deep drill core samples of the Nojima fault that caused the 1995 Kobe Earthquake. The fault gouge just on the fault plane has been magnetized by frictional heating (see Fukuchi et al., 2005; 2007).

Message

Modern sciences developed from ancient Greek philosophy. Socrates questioned his students as a means of instruction, to let them think a problem through to a logical conclusion. This method of considering problems through dialogue and discussion, which is known as the Socratic dialectic method, is still a basic means of deep understanding for all students and academic staffs who study at University. Therefore, a doctorate is called Ph. D. (Doctor of Philosophy). However, Japanese students and even academic staffs tend to dislike discussing problems with others. This is due to the Japanese spirit of valuing harmony with others. This Japanese spirit was embodied in the Constitution of ancient Japan in 604 A.D, which was enacted by the famous Japanese Crown Prince called "Shotoku-taishi" who regarded the Japanese-style harmony as the most important fundamental principle.

Although this Japanese spirit is peaceful and wonderful, it often prevents Japanese students from growing into cosmopolitans or international researchers. Therefore, we need active international students or researchers who can provide a good stimulus to Japanese students and academic staffs at Yamaguchi University. In our laboratory, we also carry out the laboratory experiment and computer simulation of seismic frictional heating besides the absolute dating of geological materials using ESR. You are all welcome to discuss various problems with us!



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Research Activities

Based on the principle of “the integration of electrochemistry and plasma technology”, Dr. Honda established the method for the synthesis of ideal polarized electrode materials (i.e. boron doped diamond; BDD and nitrogen doped diamond-like carbon; N-DLC) with plasma enhanced chemical vapor deposition. He also developed new ideas on electrochemical application using the surface of polarized electrode as electrochemical reaction field. Recently, he demonstrated that n-type semiconductor material based on diamond-like carbon (DLC) could be successfully produced by doping nitrogen atoms in DLC thin film that is inherently an insulator. It showed extremely higher overpotentials for hydrogen and oxygen evolution and was found to be the ideal polarized electrode material with approximately 3 V of working potential range. Its surface could detect the reaction of electro-active species with higher standard reduction potential (i.e. $\text{Ce}^{3+/4+}$), which is not possible for the surface of conventional electrode (like Pt) owing to the interference of O_2 evolution.

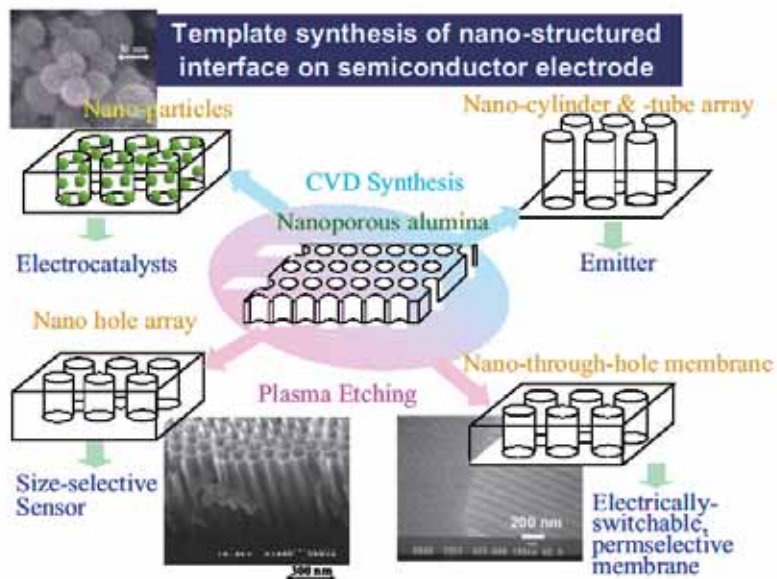
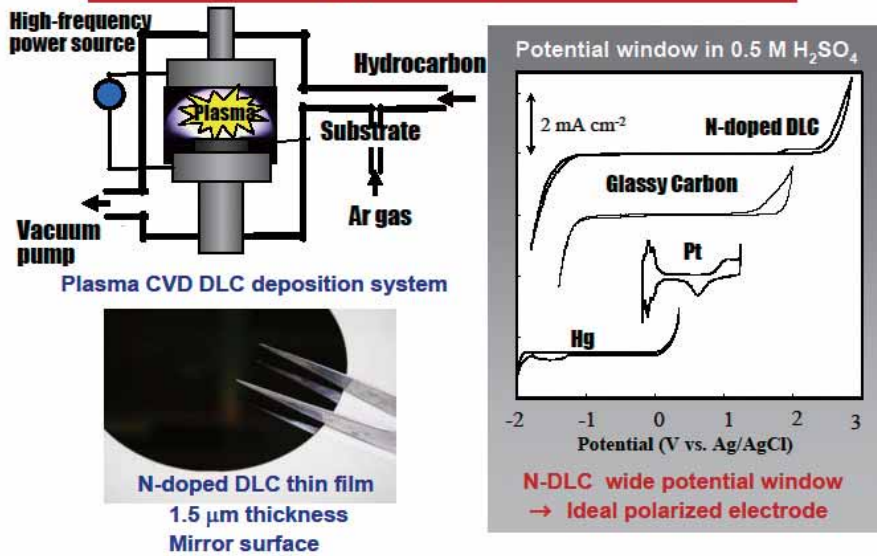
Dr. Honda is also engaged in a research project to establish the synthesis method for the highly-ordered nano-structured interface on semiconductor materials such as diamond or DLC with the combination of electrochemically-synthesized template materials and plasma technique. Furthermore, he also aim to clarify the electrochemical specificity of the nano-structured interface and to create new potential applications by linking the specificity and unique characteristics of the semiconductor materials.

He was able to synthesize the conductive diamond nano-particles of ca. 50 nm diameter using ball mill crushing. Moreover he also produced the diamond nano-hole array of 30 ~ 400 nm diameter fabricated by O_2 plasma etching of diamond surface through nano-porous alumina template. The conductive DLC through-hole membrane produced by DLC coating on nano-porous alumina surface was found to be able to work as electrically-switchable ion permselective membrane, thus, endowing the electrochemical system with a new concept.

Message

The progress of science and technology during the past several decades has contributed to the change in our daily lifestyle, making it more convenient. Nano-technology is expected to open up a new vista of further development. Scientists and researchers engaged in technological development can feel the joy and a glowing pride in finding not only the truth in natural phenomena, but also the technological innovation that can enrich our lives. Researchers earnestly study in laboratory and are in communication with society by means of their technological development. Our research group believes it is important to develop the materials that are practically useful for our daily life. We always aims to contribute to technological advancement that makes our life more progressive by developing novel nano-structured semiconductor materials with new function using the plasma enhanced chemical vapor deposition technique. We hope that you will be interested in our innovative studies and achieve splendid future with members of our research group.

Development of new semiconductor material using plasma synthesis





Masunori Matsuzaki

Professor

Graduate School of Medicine
Cardiology

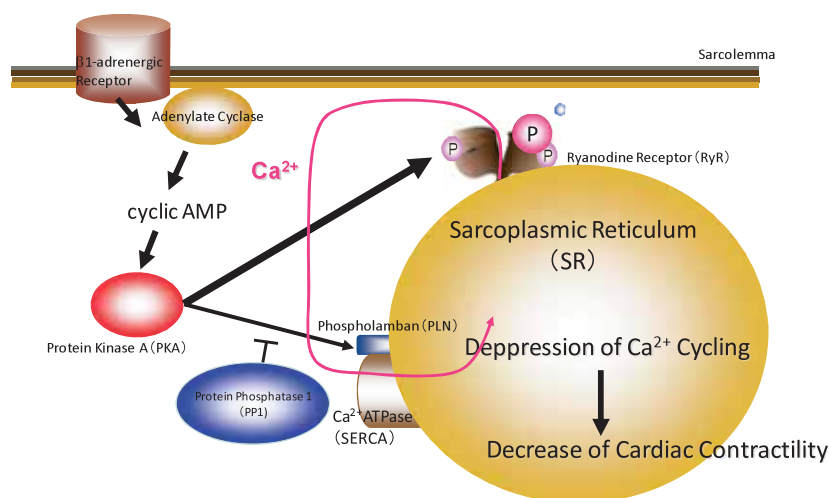
Research Activities

Cardiovascular diseases are the leading causes of morbidity and mortality in developed countries. In recent years, Dr. Matsuzaki and his colleagues focused on two major cardiovascular diseases, that is, chronic heart failure (CHF) and abdominal aortic aneurysm (AAA). Both of these are intractable and a better understanding of their pathophysiology to develop new therapeutic strategy is urgently needed.

In their CHF research, they suspected the disorderly regulation of Ca^{2+} signaling as a responsible factor. A growing body of evidence indicates that there is a final common pathway of heart failure progression which relates to the dysregulation of the Ca^{2+} cycling regulators localized in subcellular microdomains of the sarcoplasmic reticulum (SR), sarcolemma, and intercellular cell-cell junction. Chemical or genetic correction of abnormalities in cardiac Ca^{2+} cycling is emerging as a potential target in the treatment of heart failure. In this regard, they found that functional and structural disorganization of SR key proteins and its aberrant phosphorylation significantly contributed to heart failure pathophysiology. It involves transcriptional maladaptation of SR/ER ATPase pump, aberrant phosphorylation in phospholamban (PLN) and the ryanodine receptor (RyR). Dr. Matsuzaki and his team are now undertaking further research to clarify the mechanism of Ca^{2+} dysregulation in heart failure and to apply their findings to the clinical settings.

AAA is another important disorder that is characterized by progressive enlargement of the abdominal aorta. It is also known as the silent bomb in the abdomen of elderly people. In the elderly patient, surgical treatment of AAA is restricted due to many concurrently coexisting illness. Dr. Matsuzaki observed that the molecular signaling of a protein known as c-Jun N-terminal Kinase (JNK), is the key to the progression of AAA. Inhibition of JNK restored the normal structure of abdominal aorta and this protein was shown that it could be a pharmacological therapeutic target. Thus, instead of using the conventional surgical strategy, Dr. Matsuzaki has open up new treatments that are being applied clinically to patients with AAA.

Dysregulation of Ca^{2+} Cycling in Heart Failure Therapeutic target



Message

We hope we can share a fulfilling research time with young foreign researchers to identify new therapeutic strategy and to clarify new molecular mechanism in cardiovascular diseases.



Masaaki Oka

Professor

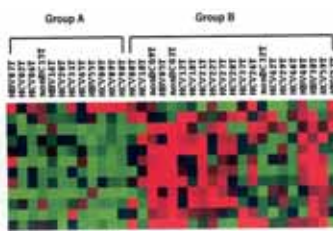
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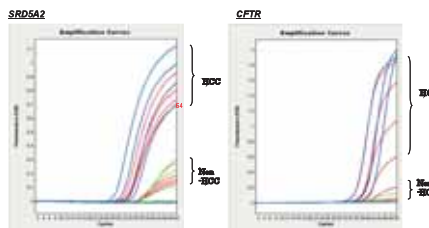
Research Activities

Dr. Oka used the study of genome, proteome and immunity to tackle the problem of gastroenterological and endocrine malignancies. For gene research, his final target is the development of a cancer therapy. He used the microarray technique and bioinformatic analysis to develop array-based predictors for metastasis, recurrence and outcome of hepatocellular carcinoma (HCC). This method was a breakthrough in microarray analysis. Dr. Oka and his team discovered various methylated genes related to HCC. They then developed an efficient surveillance system to identify small HCC in blood using a hybrid detector consisting of methylated genes (*SPINT2* and *SRD5A2*), AFP, and PIVKA-II. The accuracy, sensitivity, and specificity of this detector of HCC were 81.4%, 73.2%, and 87.7%, respectively.

Polymorphism of the cancer cell is closely related to the adverse effect of anti-cancer agents. Thus, Irinotecan plus 5'-DFUR combination therapy can be used safely and effectively for patients with colorectal cancer by monitoring the (TA)_nTAA promoter polymorphism of UGT1A1. Dr. Oka's team is on the way to developing a micro-chip for UGT1A1 polymorphism. Proteome analysis has been reported to lead to the finding of new tumor markers. Using proteome analysis on resected tissues obtained from breast cancer, Dr. Oka found anti-cyclophilin A antibody and anti-TPI (Triosephosphate isomerase) antibody in the patients' sera. These auto-antibodies might turn out to be new tumor markers in breast cancer. Pancreatic cancer has the poorest prognosis among the gastrointestinal cancers. In his laboratory, adoptive immunotherapy using T lymphocytes stimulated with a MUC1-expressing human pancreatic cancer cell line, YPK-1, were performed in pancreatic cancer patients who had undergone resection surgery. Liver recurrence was prevented and overall survival (OS) rate improved significantly. Recently, combination of this Cytotoxic T-Lymphocyte (CTL) therapy and gemcitabine administration after resection of pancreatic cancer, showed an even higher OS. Dr. Oka used MUC1 mRNA transfected dendritic cells to treat unresectable pancreatic cancer. His cancer peptide vaccine therapies for unresectable colorectal cancer, gastric cancer, and pancreatic cancer in HLA-2402 patients also showed promising results.



Microarray analysis of HCC having recurrence within 1 year (Group A) and no-recurrence within 1 year (Group B)



Amplification curve on a LightCycler: HCC and non-HCC tissues: MIP vs Sequencing

Basic Research of MUC1-CTL

- MUC1 expression in primary and metastatic lesions (Primary n=55) (Liver metastasis)**

 All pancreatic cancer cells expressed MUC1, but not in normal pancreatic ductal cells.
- Characterization of MUC1-CTL**
 CTLs induced directly recognized MUC1 antibodies in an HLA-transfected mouse unlike conventional CTLs.

Message

Our studies in gastroenterological and endocrine malignancies are based on genome, proteome, and immunity research. Basically, our researchers use molecular techniques such as RT-PCR (Reverse-Transcriptase Polymerase Chain Reaction), Western Blot, and cell culture in their work. We have many postgraduate students in our department; thus, cooperative attitude is essential. Since exchanging information and idea is fundamental to learning, researchers in our department are expected to be proficient in either English or Japanese. We are also doing translational research with industries and other departments. I hope that researchers will always bear in mind the need of application of their research results to human healthcare.



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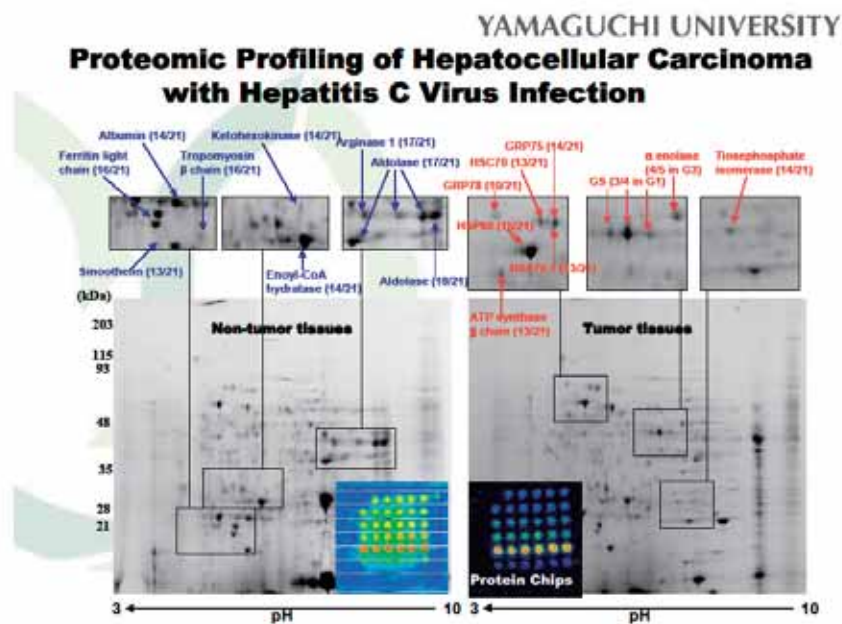
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Research Activities

Dr. Nakamura is currently a Professor of Biochemistry and Functional Proteomics at Yamaguchi University Graduate School of Medicine. He serves in the promotion of human proteomics as a Council member and as Asian representative of Education & Training (E&T) Committee in Human Proteome Organisation (HUPO). His research is at the forefront of the discovery of biomarkers and therapeutic targets for malignant tumors such as HCV (Hepatitis C virus)-related hepatocellular carcinoma, pancreatic cancer, breast cancer and T lymphoblastic leukemia, using two-dimensional gel electrophoresis combined with tandem mass spectrometry.

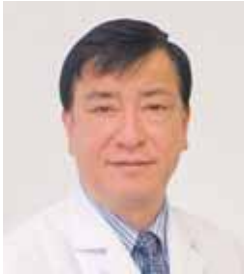
He has also developed Cys-tag-Protein Chips for the rapid and precise analysis of protein-protein interactions. He combined membrane proteomics, cancer immunology and immuno-proteomics to develop new diagnostic tools and non-invasive curative treatments for malignant tumors.

His team works on immunotherapy including the use of specific peptide of cancer cell to activate the dendritic cells as well as the stem cells, which is a basic concept in “missile therapy”, to combat against tumor cells.



Message

The aim of our research is to systematically clarify molecular mechanisms involved in functional regulation of human proteins (proteome). We are studying human proteome expression and function in physiological and disease state using two-dimensional gel electrophoresis and mass spectrometry in combination with protein chip technology. Our data are integrated to construct an international database for understanding the molecular basis of life and for developing new diagnostics and therapeutics for hepatocellular carcinoma with hepatitis C virus infection, T lymphoblastic leukemia, pancreatic cancer, breast cancer, malignant mesothelioma, and gastric cancer with *Helicobacter pylori* infection. To promote international collaborations for studies on human proteome, we founded the Human Proteome Organisation (HUPO) and Japan HUPO to develop the standards for proteome research and platform of international proteome database. We are also making guidelines for international education and training course for graduate students under the name of HUPO. They will learn “serendipity” as a gift to scientists who make every effort to do research with their wisdom.



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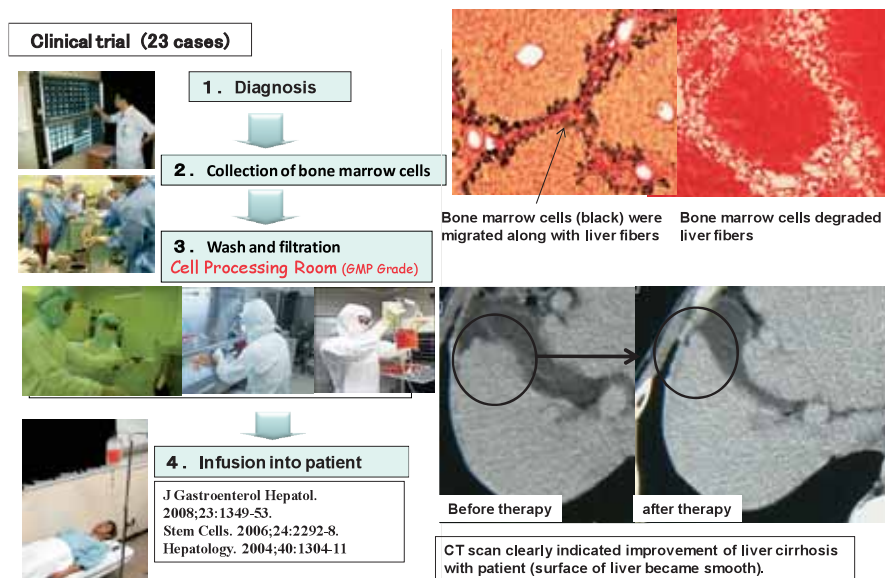
PhD.1990

Research Activities

Dr. Sakaida's main research field is hepatology, which include hepatitis, liver cirrhosis(LC) and carcinogenesis. His major interest now is translational research with stem cell therapy for liver cirrhosis using autologous bone marrow cell. The plasticity of bone marrow cells (BMC) has been confirmed by autopsy results of female recipients of BMC from male donors. To establish new clinical therapies for patients with liver cirrhosis using autologous BMC, Dr. Sakaida and his team developed an *in vivo* murine model using green fluorescent protein (GFP) and repeated carbon tetrachloride (CCl4) injection. They found that BMC infused through the tail vein effectively repopulated the cirrhotic liver tissue. Moreover, such BMC infusions into mice with cirrhosis improved liver function and reduced mortality.

The latter observation correlated well with the strong expression of matrix metalloproteinases (MMP), particularly MMP-9, and reduced hepatic fibrosis. Dr. Sakaida and his colleagues have carried out clinical trials designated as autologous bone marrow cell infusion (ABMi) therapy in more than 23 patients. Autologous bone marrow (BM; 400 ml) was collected from the ilium under general anesthesia. Mononuclear cells (MNCs), separated by cell washing, were infused into the patient via the peripheral vein. Significant improvements in serum albumin levels and total protein were observed at 24 weeks after ABMi therapy ($p < .05$). Significantly improved Child-Pugh scores were seen at 4 and 24 weeks ($p < .05$). Alpha-fetoprotein and proliferating cell nuclear antigen (PCNA) expression in liver biopsy tissue were significantly elevated after ABMi therapy ($p < .05$). No major adverse effects were noted. ABMi therapy has thus been demonstrated as a promising novel treatment for patients with decompensated LC. Dr. Sakaida's team is now developing another regimen of improved ABMi therapy.

Autologous bone marrow cell infusion (ABMi) therapy



Message

Many foreign students and researchers from Korea, China, Taiwan, India, Egypt and Poland have visited our laboratory to learn about stem cell therapy. We are awaiting your visit !



Akira Nakai

Professor

Graduate School of Medicine
Biochemistry & Molecular Biology

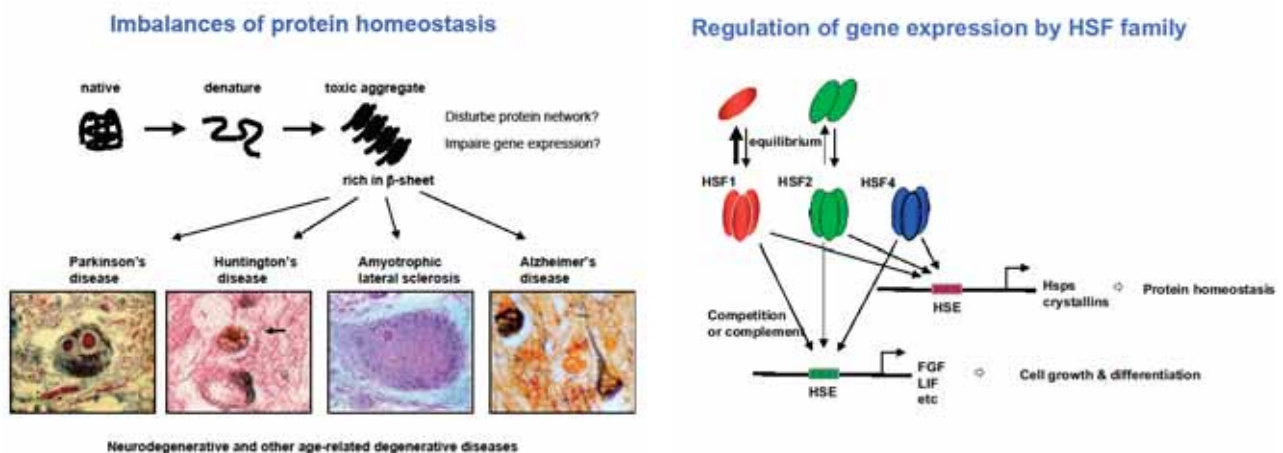
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Research Activities

Protein homeostasis in cells enables healthy cells development and aging, and protects against diseases. Dr. Nakai aims to understand the molecular mechanisms of protein homeostasis by focusing on heat shock response, heat shock transcription factors (HSFs), and therapeutic strategies for stress-related diseases such as neurodegenerative diseases and cancers. He and his colleagues found that HSF1 suppresses protein aggregation through regulation of yet unknown genes as well as heat shock genes, and that overexpression of HSF1 improved the lifespans of the protein misfolding disease model mice. He would like to find novel mechanisms that suppress protein misfolding.

Dr. Nakai has also clarified the mechanisms of how heat shock transcription factors support cell survival against detrimental effects of various stresses by generating chicken B lymphocyte DT40 cells which are deficient for HSF1 and HSF3. Paradoxically, he also observed that HSF1 activates expression of pro-apoptotic genes in addition to anti-apoptotic heat shock genes. He is trying to understand the pathophysiological significance of these pathways.

Furthermore, he also generated HSF1-null and HSF4-null mice for his experiments. Analysis of these mice revealed developmental abnormalities in the lens and olfactory epithelium, indicating that HSFs are essential for development of the sensory organs, and also implies that some tissue developmental pathways are linked to stress response. His team is examining the molecular links between protein homeostasis and development.



Message

A cell is a fundamental unit of life. Researchers in Biochemical and Molecular Biological fields are trying to understand elementary processes in cells that regulate cell growth, differentiation, death, and responses to stimuli. Discovery of a new elementary process contribute not only on establishing a novel concept but also on understanding and treatment of diseases. Our laboratory welcomes researchers who are enthusiastic to find out the truth in nature.



Kimikazu Hamano Professor

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Research Activities

Cardiovascular diseases are becoming more and more prevalent due to the aging of society and changes in lifestyle. Advancement in medical science is anticipated to reduce morbidity and mortality as well as improving the quality of life by providing new therapeutic strategies. Dr. Hamano is an active surgeon, who has trained many young surgeons at Yamaguchi University Hospital. His clinical expertise includes surgery for all forms of cardiovascular diseases, such as coronary artery bypass surgery, valve surgery, aneurysm surgery and minimally invasive surgery. Dr. Hamano also specializes in treating chronic intractable cardiovascular diseases, including severe ischemic heart disease and critical limb ischemia.

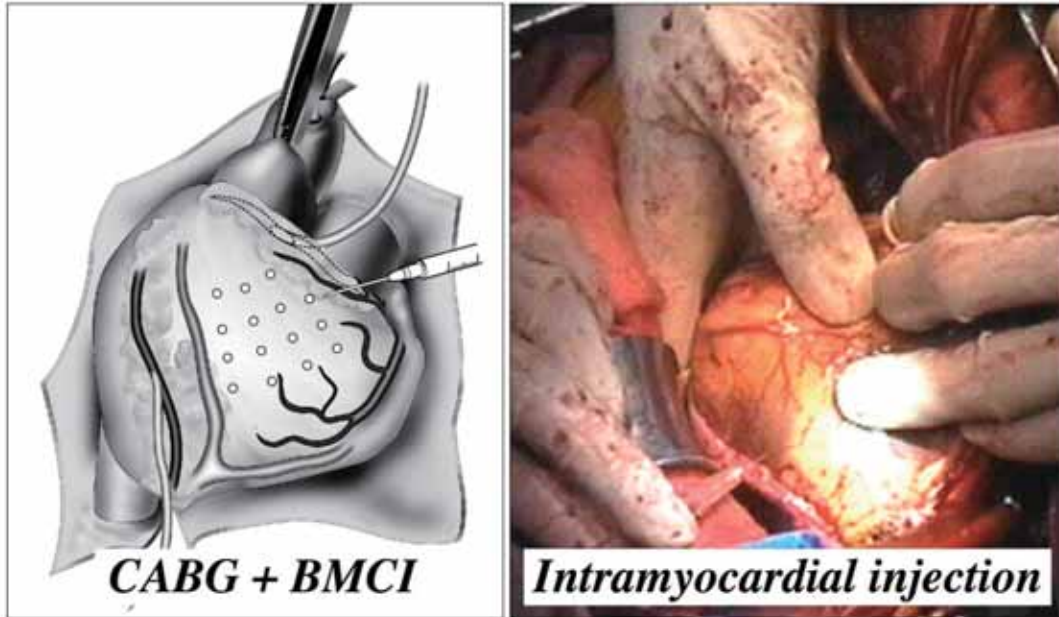
Dr. Hamano's research group has developed a new therapy for severe ischemic diseases; therapeutic angiogenesis induced by the bone marrow cell implantation (BMCI). They used bone marrow mononuclear cells (BM-MNCs) in their work because BM-MNCs consist of many endothelial progenitors and cytokine-producing cells. This can do away with the problem of immunological rejection and ethical conflict for clinical application. After confirming that no detrimental changes were induced by this treatment in a canine heart model, a human clinical trial was successfully carried out.

Dr. Hamano treated the severely ill patients with this new treatment in concomitant with coronary artery bypass grafting and reported that BMCI treatment resulted in specific improvement in coronary perfusion in 3 out of 5 patients with no obvious adverse effects. This is the first report describing the safety and feasibility of BMCI in patients with ischemic heart disease. Thus, Dr. Hamano is a world-renowned pioneer in regenerative medicine and a key member of the Center for Reparative Medicine in the Yamaguchi University Graduate School of Medicine.

BMCI for the treatment of peripheral artery disease



BMCI for the treatment of ischemic heart disease



Message

Our research group has been pioneering the clinical application of autologous bone marrow cell transplantation to restore the function of the failing heart and peripheral circulation. We hope that you will be interested in our research, and also that you will come to Yamaguchi University to join us in our bench to bedside research.



Michiyasu Suzuki

Professor

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Research Activities

Dr. Suzuki's recent research achievements include study on the strategic use of focal brain cooling in the field of neurophysiopathology, especially in epilepsy. Epilepsy is characterized by recurrent seizures associated with loss of consciousness. Focal brain cooling, which is safer than the surgical removal of the lesion, has been recognized to suppress seizure discharges (Fig. 1).

Dr. Suzuki and his colleagues also reported on the mechanistic insight into neurotoxicity of tissue plasminogen activator-induced thrombolysis products in a rat intraluminal middle cerebral artery occlusion model. They found that thrombolytic therapy with recombinant tissue plasminogen activator (rtPA) after ischemic stroke was effective. However, rtPA potentiates neuronal damage. The mechanisms underlying rtPA- and thrombolysis product-induced neurotoxicity were being elucidated in their study.

Dr. Suzuki's team experimented on the antitumor effects of vaccination with dendritic cells transfected with modified receptor for hyaluronan-mediated motility mRNA in a mouse glioma model. To date, attempts to develop a treatment for malignant glioma, a life-threatening brain tumor, has been unsuccessful. Dr. Suzuki and his colleagues found that the receptor for hyaluronan-mediated motility (RHAMM) is expressed in brain tumors and this molecule has recently been identified as an immunogen. They reported that vaccination with dendritic cells transfected with RHAMM mRNA have therapeutic potential (Fig. 2). In addition, treatment of subarachnoid hemorrhage and cerebral vasospasm are the major concerns of Dr. Suzuki. Intercollegiate studies on embryonic stem cells, glioma stem cells, and spinal dysraphism are in progress in his lab.

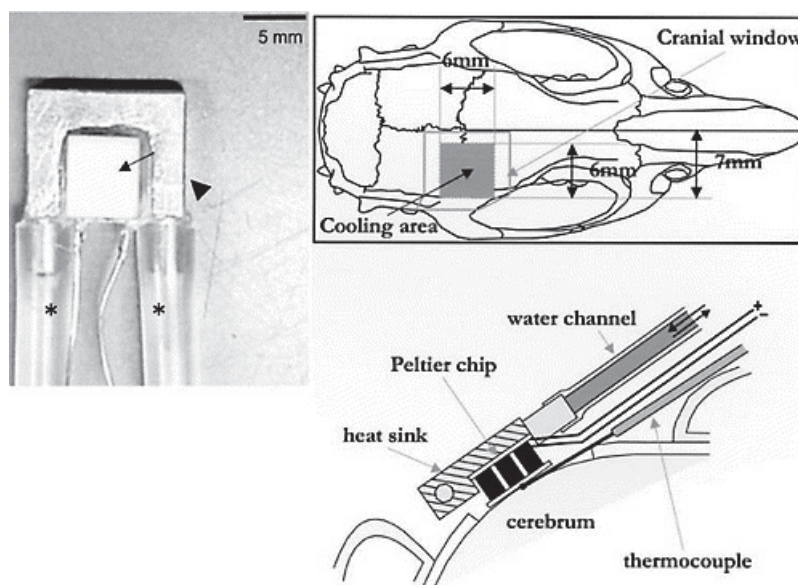


Fig. 1. *Left*: Cooling system. *Right*: Craniotomy (*upper*), the cooling device, and a thermocouple (*lower*).

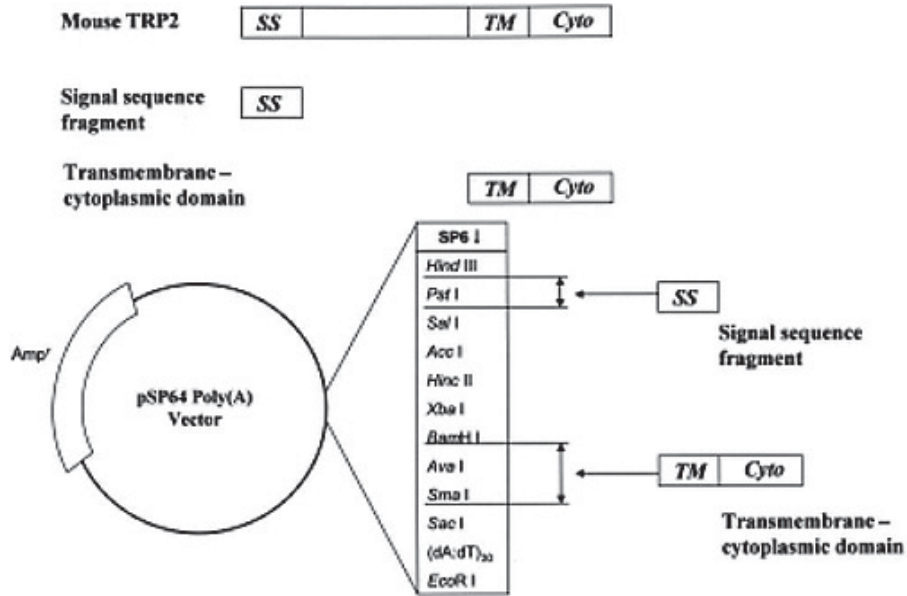


Fig. 2. Plasmid cassette for tumor antigen mRNA transcription. The signal sequence fragment (SS) and transmembrane-cytoplasmic domain (TM-Cyto) were amplified from TRP-2 cDNA by using PCR.

Message

Besides research activities, we offer clinical works, accurate diagnosis, and individualized treatments based on the latest evidence and knowledge. We employ subspecialists in cerebrovascular disease, brain oncology, neurotrauma, functional neurosurgery, pediatric neurosurgery, and spinal disorders who can satisfy any clinical requirement. Our well-structured department conducts an excellent training program that is designed to groom academic neurosurgeons and neuroscientists. If you are interested in learning neurosurgery or neuroscience, apply to our institution. The Department of Neurosurgery, Yamaguchi University will help to make you a leader in the field of neuroscience.



Hideyasu Matsuyama

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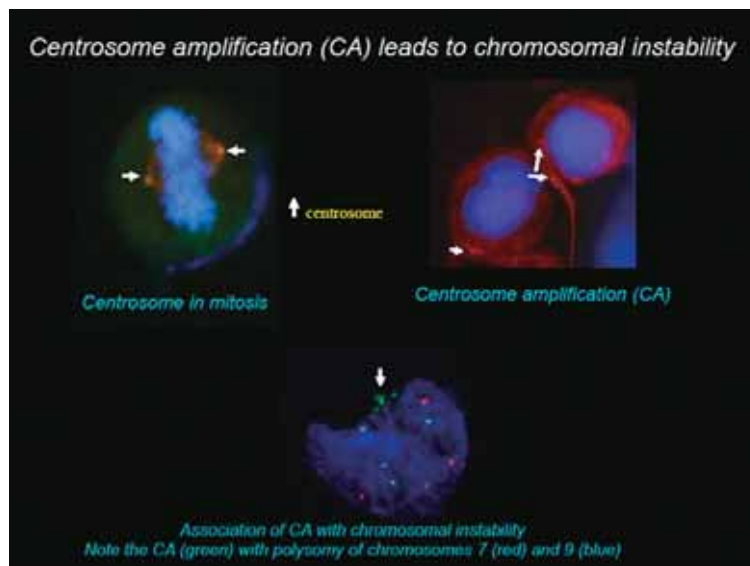
Ph. D. 1987 Yamaguchi University

Ph. D. 1996 Karolinska Institute (Stockholm, Sweden)

Research Activities

Dr. Matsuyama's major research theme is comparative analysis of genomic alterations in urogenital malignancies and its clinical significance as genetic markers. Current ongoing research at his lab is centrosome amplification (CA) and its potential as a prognostic marker in urothelial cancer. Centrosome is an organelle which forms bipolar spindle pole, and its number is strictly regulated to one or two per cell during cell division. Abnormal copy number (≥ 3 centrosomes/cell) is defined as CA, which occur as numerical aberrations of chromosomes, leading to chromosomal instability. Dr. Matsuyama was the first to demonstrate that CA occurs in approximately 60% of urothelial cancer of the bladder due to several different mechanisms including p53 mutations, or overexpression of Aurora A kinase protein resulting from chromosome 20q 13.2 gain. Since CA is significantly associated with chromosomal instability and has poor prognosis in the clinical setting, Dr. Matsuyama has applied for a patent that uses CA as a biomarker for predicting tumor progression in non-muscle invasive bladder cancer.

Another clinical research of his is the clinical application of photodynamic diagnosis (PDD) using 5-aminolevulinic acid (5-ALA) in bladder cancer. Although PDD is being accepted as a highly sensitive diagnostic technique for finding flat urothelial cancer (carcinoma *in situ* [CIS]), specificity remains at around 50-60%. By focusing on mucosa, which was not pathologically diagnosed with cancer in spite of positive visualization with specific red fluorescence in PDD, he found that this supposedly false positive area on the mucosa is significantly associated with the instability of chromosome 9, a key chromosome that is associated with oncogenesis in bladder cancer. This result suggests that a substantial portion of these supposedly false positive mucosa harbors premalignant genetic alterations. Thus, this gives theoretical justice in clinically treating of all such regions for preventing further recurrence in bladder cancer.



Message

My belief is that our ultimate goal of clinical research is the improvement of patient care and QOL (Quality of Life). I would like to assist young colleagues to find joy in research that is wonderful and useful not only for themselves but also for the patients. Please join us to find something new in the field of urology.



Junzo Nojima

Professor

Graduate School of Medicine
Immunology, Thrombosis and Hemostasis

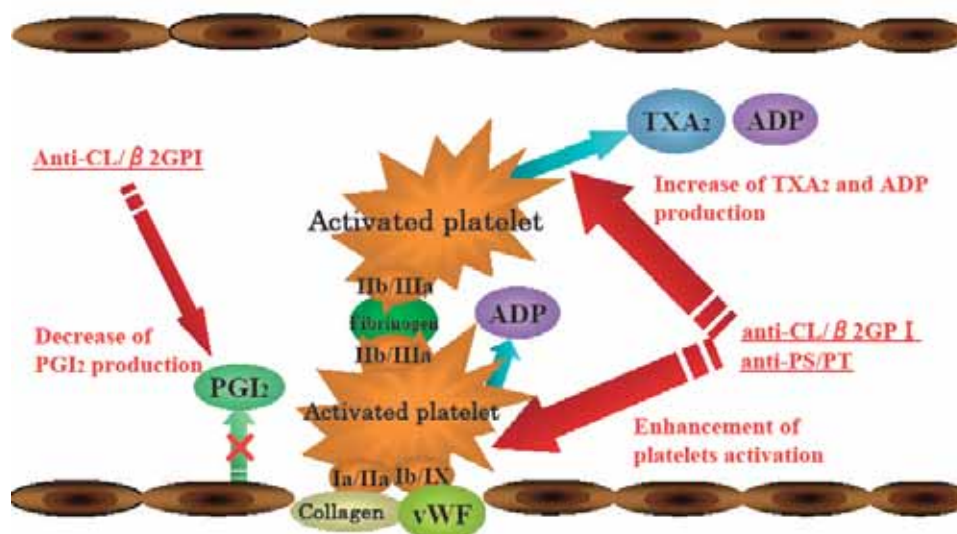
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Research Activities

Anti-phospholipid syndrome (APS) is defined by both clinical findings (recurrent arterial and/or venous thrombosis and recurrent fetal loss) and laboratory evidence of persistent anti-phospholipid antibodies (aPLs). The aPLs are a distinct group of autoantibodies that occur in a variety of autoimmune diseases, particularly systemic lupus erythematosus (SLE). It is now generally accepted that aPLs do not bind primarily to the negatively charged phospholipid itself but rather to complexes of the phospholipid and phospholipid-binding proteins. The most common and best characterized aPLs are anti-cardiolipin / β 2-glycoprotein I antibodies (anti-CL/ β 2-GPI), anti-phosphatidylserine / prothrombin antibodies (anti-PS/PT), and lupus anticoagulant (LA) antibodies. Several clinical studies have established that the presence of anti-CL/ β 2-GPI, anti-PS/PT, and/or LA activity is associated with clinical events such as arterial and/or venous thromboembolic complications and obstetric complications. However, the precise mechanism responsible for arterial and/or venous thromboembolic complications in APS patients remains unclear.

The main objective of Dr. Nojima's studies is to clarify the pathogenic mechanisms of anti-phospholipid syndrome (APS). To reveal the association between the various types of aPLs and thrombotic complications, he examined the prevalence of seven types of aPLs [anti-cardiolipin / β 2-glycoprotein I antibodies (anti-CL/ β 2GPI), anti-phosphatidylserine/prothrombin antibodies (anti-PS/PT), anti- β 2-glycoprotein I antibodies (anti- β 2GPI), anti-prothrombin antibodies (anti-PT), anti-protein C antibodies (anti-PC), anti-protein S antibodies (anti-PS), and annexin V antibodies (anti-AN)] in 168 patients with systemic lupus erythematosus (SLE). He and his colleagues confirmed that the presence of anti-CL/ β 2GPI, anti-PS/PT, and anti- β 2GPI are closely related to arterial thrombosis, and that of anti-protein S to venous thromboembolism, respectively. Furthermore, their in-vitro experiment demonstrated that anti-CL/ β 2GPI and anti-PS/PT activate platelet and caused an increase in TXA₂ and ADP production. Their clinical studies showed that anti-CL/ β 2GPI and anti-PS/PT were specifically associated with cerebral vascular changes in APS patients. They observed that anti-CL/ β 2GP caused persistently high expression of tissue factor on the surface of monocyte, and also release pro-inflammatory cytokines such as TNF- α and IL-6. These effects of aPLs account for a high prevalence of arteriosclerosis in APS patients. In Dr. Nojima's lab, further studies are currently in progress to clarify the role of aPLs in atherosclerosis and ischemic heart disease at the cellular level in patients with SLE.





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Research Activities

Oral cancer is a significant public health problem throughout the world because oral function is very important for breathing, eating and conversation. In spite of recent advances in surgery, radiotherapy, chemotherapy and immunotherapy, the mortality rate of oral cancer is about 50% in the advanced stage. Dr. Harada and his colleagues set their eyes on the development of effective oral function-conserving therapy using the fluoropyrimidine anticancer agent, S-1, against oral cancer. They reported that S-1 has a radiosensitizing effect, an anti-angiogenic effect and a survival signal inhibitory effect. They then established the S-1 resistant oral cancer cell lines to clarify the mechanism of resistance to S-1 in oral cancer cells by proteome analysis. Furthermore, they are using the aforementioned predictive factors as target in their chemotherapeutic strategy for advanced or recurrence oral cancer. In their study on tongue muscle-derived stem cells in bone tissue engineering, they observed that tongue-derived stem cells have the ability to differentiate into osteoblast-like cells or those of odontogenic lineage.

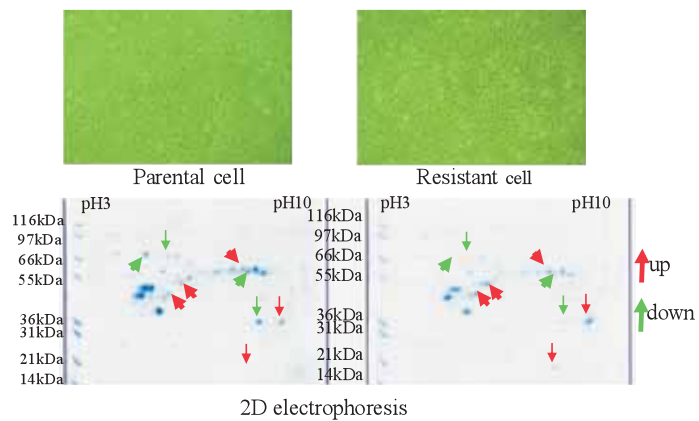
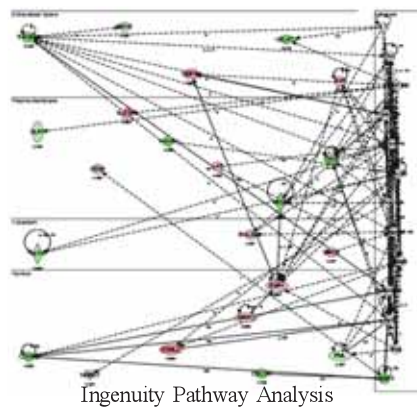
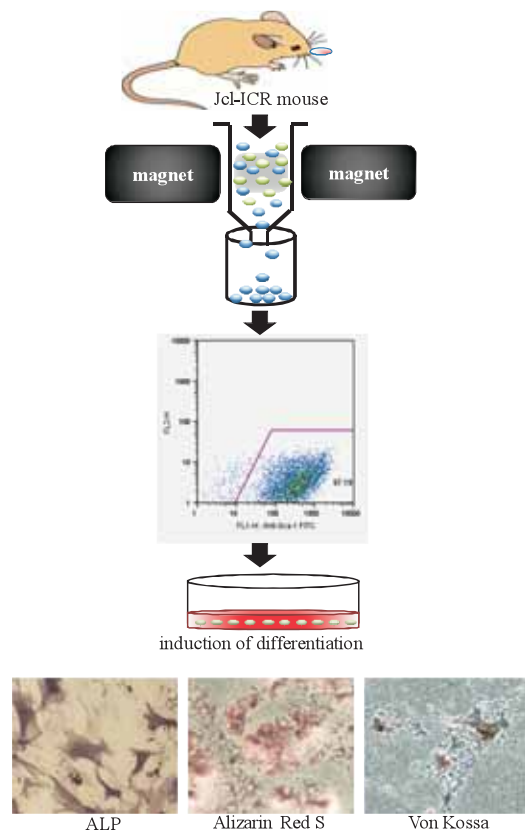
Message

Globalization and modernization have influenced the student to pursue a higher formal educational. It is necessary to enhance the student's professionalism to face global competition so that the innovation momentum of science and technology can be maintained to implement sustainable development. Student has an obligation to increase his/her knowledge and learn the development of dental technology through continuing dental education. Following the latest development of science and technology in dentistry, and to take a bold stand to fulfill the public demand, we at the Department of Oral and Maxillofacial Surgery, Graduate School of Medicine, Yamaguchi University, Japan, invite all of the students in Asia, Africa, America and Europe to study at our laboratory or do clinical research, or join our Doctoral (Ph.D) program course in Oral Maxillofacial Surgery and Oncology. Our Doctoral program is carried out by the lecture and research system.

GOALS OF EDUCATION

The purpose of our education program is:

1. To provide scientific information and technology in Oral Maxillofacial Surgery and Oncology field for advancing the dental professional knowledge to anticipate the global era.
2. To foster talented specialist with an ethical view and high-level clinical abilities in dental field who can exploit advances in scientific technology.
3. To foster talented specialist with basic research ability.





Fusanori Miura Dean

**Faculty of Engineering, Graduate School of Science and Engineering
Earthquake Engineering, Disaster Prevention Information System**

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Research Activities

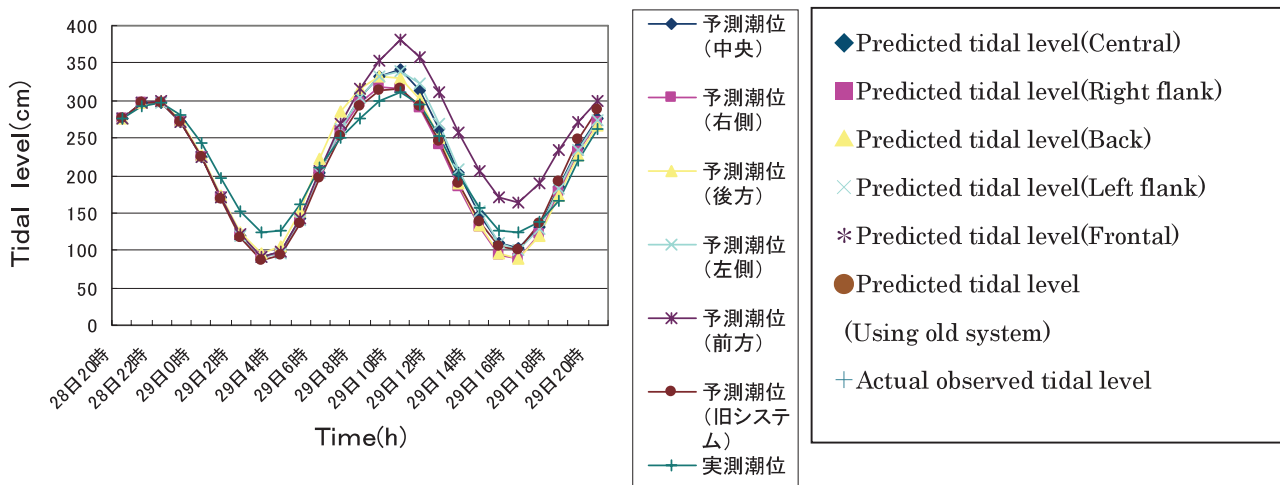
Dr. Miura and his lab contributed greatly to natural disaster prevention through three categories of research. They are, 1) simulation of earthquake fault rupture mechanism using nonlinear finite element method, 2) elucidating the dynamic nonlinear soil structure interaction problems, and 3) development of disaster prevention information systems.

In the simulation method of the fault rupture, joint elements, which represent the dynamic dislocation of the fault plane are employed as a model for fault plane and a new concept called process zone near the fault was introduced by Dr. Miura. The simulation results explain well the retrofitting distribution of seismic intensity seen during the 2000 Tottori-ken seibu earthquake.

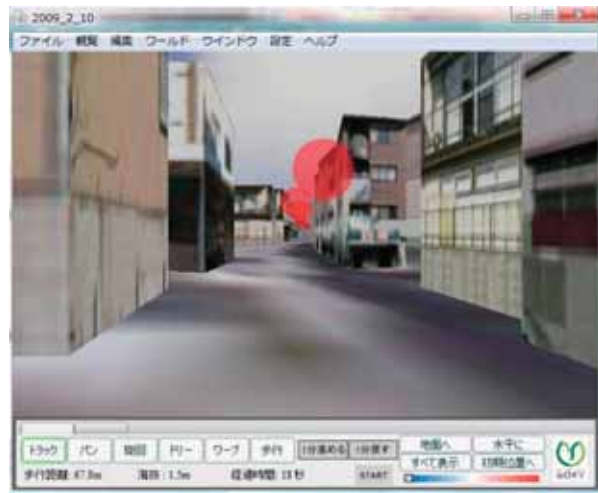
Dynamic and static responses of pile foundation, especially micro-piles, that were subjected to seismic loads were investigated using nonlinear numerical method, such as finite element method. This method measures not only the material nonlinearity but also geometrical nonlinearity. The method was expanded for 3D problem, using a new numerical technique called overlaying mesh method which can be applied to 3D beam elements.

For the disaster prevention information system, an estimation and prediction system for rise in water level of a river due to heavy rain fall, rise of sea water level due to tidal surge brought about by typhoon several hours prior to the occurrence of dangerous level, and also a dynamic hazard map system for tsunami disasters to help in the evacuation of the coastal residents, were formulated by his group of researchers and applied successfully to real life.

He serves as the chairman of the special committee for disaster prevention education, under the Japanese Association of Natural Disaster Science, and also the chairman of the special committee for disaster prevention planning in Yamaguchi prefecture.



Comparison of predicted tidal water levels with that of actually observed



Dynamic simulation program for hazard that can be brought about by tsunami.

Message

If you have the urge to study earthquake engineering and disaster prevention information system, please feel free to contact me. I am willing to study together with you. Yamaguchi prefecture is a suitable place to study because of the low cost of living, good natural environment and convenient access to Tokyo.



Akio Kamimura

Professor

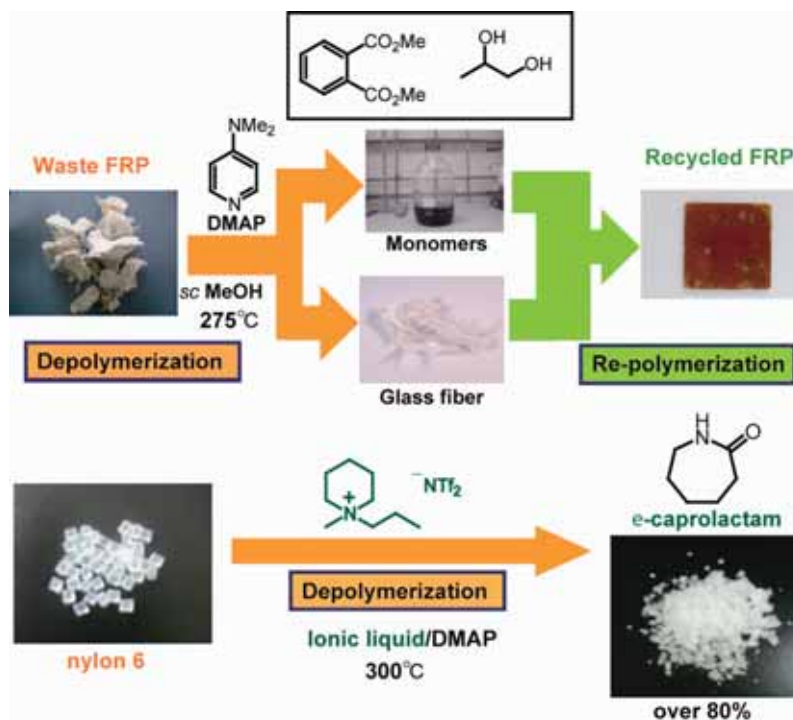
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Research Activities

Dr. Kamimura's research interest is in synthetic organic chemistry. Research currently underway in his laboratory are focused in four fields: 1) development of new stereoselective domino reactions; 2) asymmetric synthesis and total synthesis of bioactive products; 3) development of a new plastic chemical recycling methodology; and 4) new functional materials including electronic devices, ionic liquids, and fluorescent materials.

Development of new domino reactions is one of his main projects relating to the first two research interests. The domino process offers a new efficient methodology for organic synthesis; it also leads to a better understanding of each reaction. Recently, he and his colleagues discovered a new preparative method for optically active aza-Baylis-Hillman adducts: this is the first method for the synthesis of chiral adducts of aliphatic imines. Dr. Kamimura and his colleagues are also exploring a new aspect of nitroalkene chemistry and organoradical chemistry for convenient syntheses of cyclopropanes and heterocyclic compounds, which are being applied to find a new medication through collaboration with a research group in their medical school. The synthetic methodology provides useful solutions not only for problems related to organic synthesis but also those related to environmental problems. They have recently succeeded in developing several innovative methods that open new possibilities for chemical recycling of plastics. The method entails recycling of recovered monomeric and inorganic materials into plastics, thereby achieving zero-emission recycling. Other ongoing research projects in Dr. Kamimura's lab include development of new organic electronic devices, development of new bidentate ligands for asymmetric synthesis and ionic sensors, and investigation of ionic liquids containing new functional capabilities.



Message

In our lab, we are trading on new frontiers in synthesizing new bioactive products and producing new functional materials.



Hidetoshi Kita

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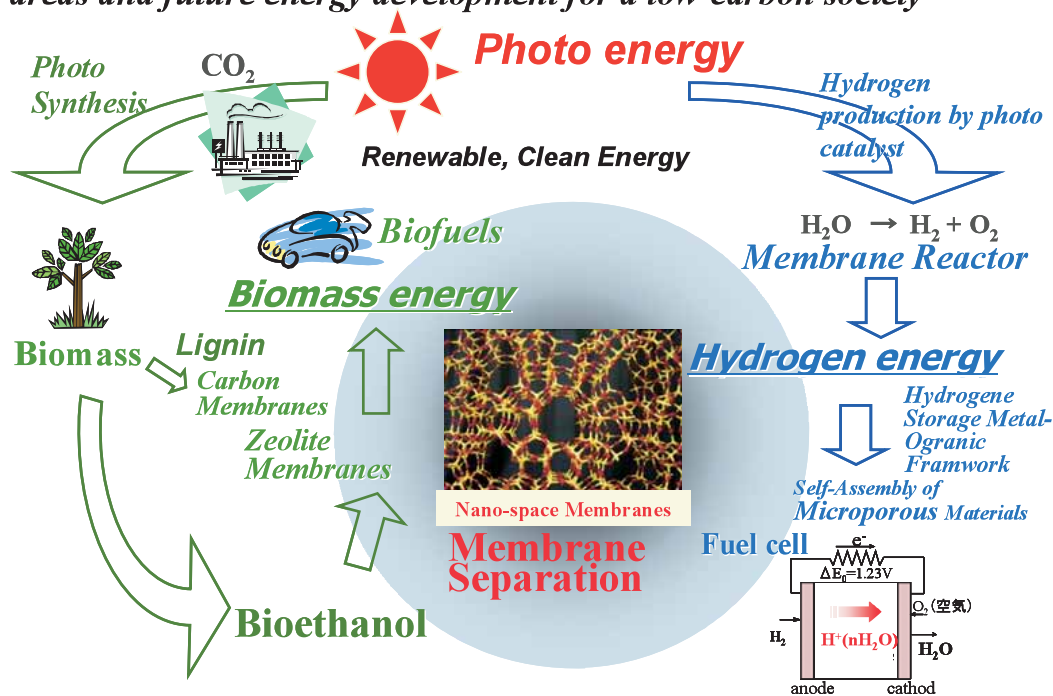
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Research Activities

Dr. Kita's research laboratory (Green Chemical Process Lab.) is a member of the Research Center for Environmental Safety (RCES) of Yamaguchi University which was officially authorized by Graduate School of Science & Engineering of Yamaguchi University in January 2008, to build a rational and worldwide framework for a sustainable low-carbon society. His division of "Membrane Science and Engineering" aimed to apply nano-structured molecular sieve membranes such as zeolite membranes and carbon membranes to environmental conservation and future energy development.

Since separation processes play critical roles in manufacturing, their proper application can significantly reduce costs and increase profits. Alternative energy-saving system and high efficiency separation process will be in high demand by many industries. Membrane separation appears to be a promising candidate because of low energy consumption, compact unit, simple operation and low environmental impact. During the past decade, Dr. Kita and his colleagues developed several microporous inorganic membranes. Among them, zeolite membranes have been used commercially in water removal pervaporation and vapor permeation processes. Zeolite membrane provide potentially higher selectivity compared to conventional polymer membranes. Thus, pervaporation process using zeolite membranes will create possibilities for the separation of liquid mixtures for which polymer membranes are not applicable and will certainly advance the acceptance of microporous ceramic membranes as a tool of environmentally friendly technology.

Nano-structured molecular sieve membranes applied to environmental areas and future energy development for a low-carbon society





Ayaho Miyamoto

Professor

Graduate School of Science and Engineering
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Research Activities

Dr. Miyamoto's recent research activities are in the area of structural safety assessment of concrete bridges including bridge management system using the latest information technologies, and also establishment of optimal design concept for concrete structures under soft impact loads.

The final goal of his research is to develop a world-oriented civil infrastructure management platform for the sustainable civil(eco-civil) society on the foundation of the Research Center for Environmental Safety(RCES) of Yamaguchi University. This will foster young researchers with rich knowledge and technologies needed for the development of advanced infrastructures management system and for appropriate maintenance of the ecosystem with expertise in biology. Since lifetime management of civil infrastructure in an environmentally-friendly way has become a critical issue, it is imperative to build safer and more secure eco-civil system to be passed on to the next generation not only in advanced countries but also in developing countries. By actively seeking such goals, through advancing and applying science and technology, Dr. Miyamoto and his colleagues have gained global competitiveness in the field of research to develop technologies for establishing the sustainable civil society. Genuine cooperation and engineering-based innovation on the field of sustainable civil society are needed to develop an integrated lifetime management system for infrastructures combined with the latest information processing technologies and intelligent health monitoring techniques, while establishing the "INFRADOCTOR", (see *Fig. 1*),

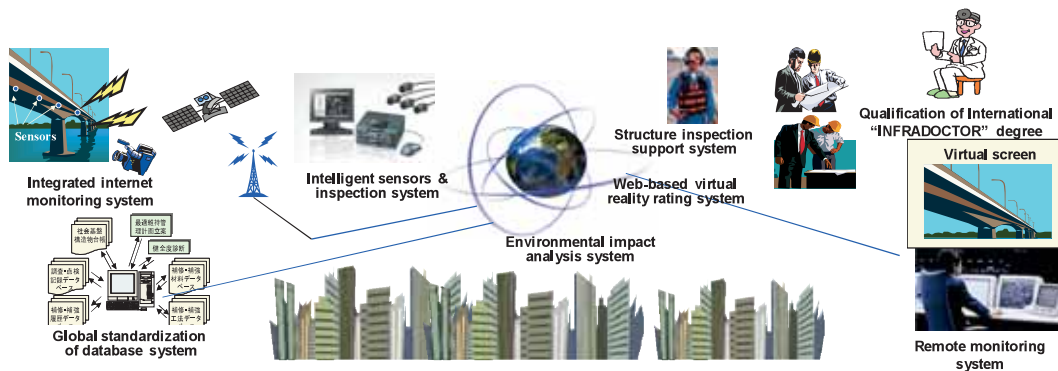


Fig. 1 Civil Infrastructures for Safety & Securer Society to be carried over into Next Generation

Message

In Japan, it has become important to develop an integrated lifetime management system for the large number of civil infrastructures such as bridges, dams and tunnels. Therefore, an innovative system for long-term lifetime management engineering, as a major part of a Doctor for Infrastructure Systems program, needs to be developed. Specifically, engineers need to develop an integrated lifetime management system for civil infrastructure systems combined with the latest information processing technologies and intelligent health monitoring techniques, while establishing the Doctorate Degree for Civil Infrastructure Systems (INFRADOCTOR).

We are now developing a practical Bridge Management System (J-BMS) integrated with the Concrete Bridge Rating Expert System that can be used to evaluate the serviceability of existing concrete bridges. The proposed J-BMS not only evaluates the performance of bridges but also offers the rehabilitation strategy based on a combination of maintenance cost minimization and quality maximization. In this system, the Genetic Algorithm (GA) technique can be used to search for an approximation of the optimal maintenance plan. Furthermore, a comparison of the results of applying this system to some actual in-service bridges with the results of questionnaire surveys to experts shows that optimal maintenance planning as well as bridge rating can be predicted accurately using the system.

Would you like to join us? It is my great pleasure to have you in my lab in the near future!!



Kazuyuki Tadatomo

Professor

Graduate School of Science and Engineering
Semiconductor Device

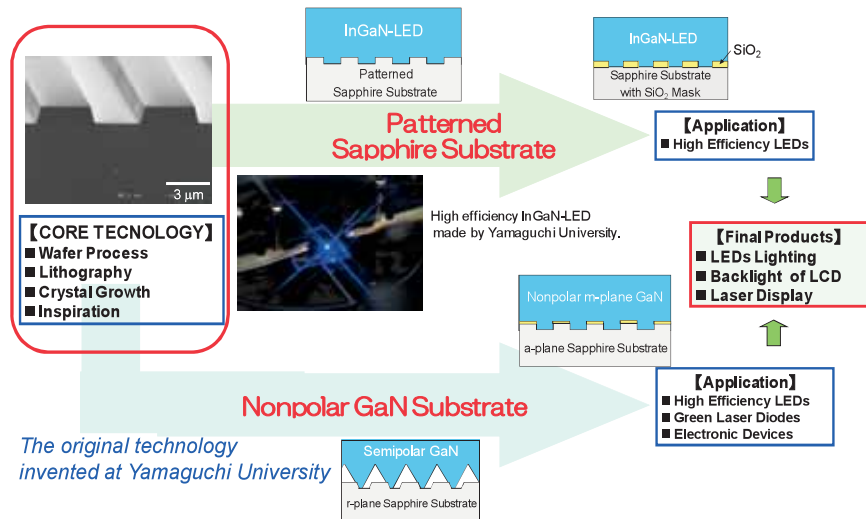
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Research Activities

Patterned Sapphire Substrate (PSS) is widely used as the substrate of high brightness InGaN-based light emitting diodes (LEDs) in industries all over the world. This is because the PSS can effectively increase the external quantum efficiency (EQE) of the LEDs. It is well known that the PSS was invented by Dr. Tadatomo and his colleagues. Since 2004, he has been a professor at Yamaguchi University, where he has done fundamental research on the PSS, crystal growth using metal-organic vapor phase epitaxy (MOVPE), wafer process such as dry etching and ITO transparent electrode, and InGaN-LEDs. Recently, Dr. Tadatomo and his colleagues developed a new PSS with SiO₂ mask deposit by using sputtering, which enables the fabrication of InGaN-LED with low dislocation density and high EQE of more than 50%.

Moreover, they also invented a novel epitaxial growth technology using the GaN growth on the side wall of the PSS. Consequently, they have grown m-plane nonpolar GaN on a-plane sapphire substrate and {11-22} plane semipolar GaN on r-plane sapphire substrate. This technology enables them to construct high quality and large-diameter nonpolar and semipolar GaN. These nonpolar and semipolar GaN are expected to increase EQE of green LED due to the absence of quantum confinement Stark effect (QCSE).

The accompanying figure shows the strategies of their research and development. They plan to invent a new PSS with highly improved EQE, develop nonpolar GaN template and GaN substrate, and produce highly efficient green LED using nonpolar and semipolar GaN. These technologies will ultimately contribute to the improvement of LED lighting, backlight of LCD, and laser display system.



Message

What mental spirit, do you think, is important for young scientists? I believe that the spirits of concentration (Ki-ai in Japanese), guts or never giving up mentally (Kon-jyou), and intellectual curiosity (kou-ki-shin) are important for young scientists. This slogan is shown at the entrance of our laboratory to remind us of our mental spirits as well as for those coming to our laboratory.





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Research Activities

Dr. Tanaka's main research interests are, 1) dynamic sensing system, 2) intelligent acoustic sensing system, and 3) non-destructive inspection system. The first theme deals with the construction of sensing systems while taking into account the dynamics of object. The second theme focuses on extracting as much information as possible using the acoustic sensor to measure various parameters, such as the depth of cracks in concrete structures and the periods of heart-beat and respiration (both unconstrained). The third theme involves non-destructive inspection using elastic wave, ultrasonic wave and electromagnetic wave. He now focuses on the non-destructive inspection using electromagnetic wave radar. He is very enthusiastic in contributing to society by developing non-destructive inspecting systems for various infrastructures. Concretely, the non-destructive inspection systems his laboratory has developed are, for example, the systems for measuring or inspecting

- 1) the cover (depth) and diameter of the reinforcing bars in concrete
- 2) the thickness of the corrosion of the reinforcing bars in concrete (resolution is only 0.02mm)
- 3) the crack and cavity inside concrete structures
- 4) inner deficits of resin-made tanks and pipes in chemical plants

The essential idea of the sensing systems is to separate various reflected waves from inside the structure based on a physical model. Dr. Tanaka never forgets to carefully consider the physical background of any practical object, and he does not adopt any easy conventional signal processing method. This is because the problem of sensing is equivalent to solving an inverse problem. Unlike the conventional methods using the B-mode image of received signals, the systems he has developed automatically reveals almost all anomalies in concrete and other media very accurately and rapidly.

Fig.1 shows a part of the radar system to search for anomalies in concrete wall of tunnels.



Figure 1.

Message

I have developed many creative practical sensing systems under the motto "Theory without applications is meaningless." I think the most important factor that decides a quality of the sensing system is how to model the actual system or situation adequately and smartly.

I would like to share the joy of constructing valuable sensing systems with you that people yearn for.



Yukio Nakata Professor

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Research Activities

Dr. Nakata's research interests are as follows;

1. Micromechanics for granular materials,

To understand the mechanical behaviour of granular materials, experimental and numerical investigations have been conducted using Distinct Element Method. (See Figure 1 & 2)

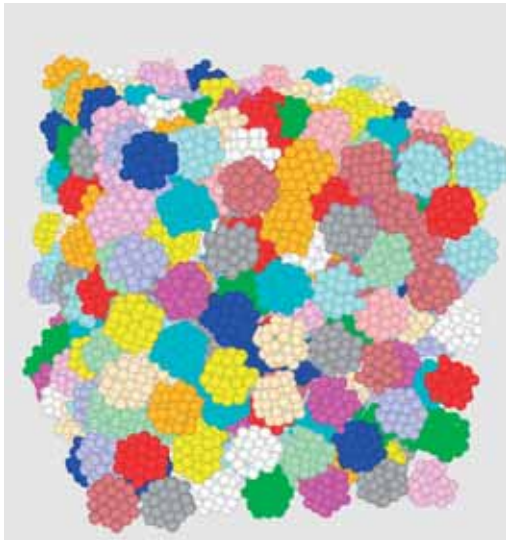


Figure 1. Numerical modeling for crushable granular materials using DEM

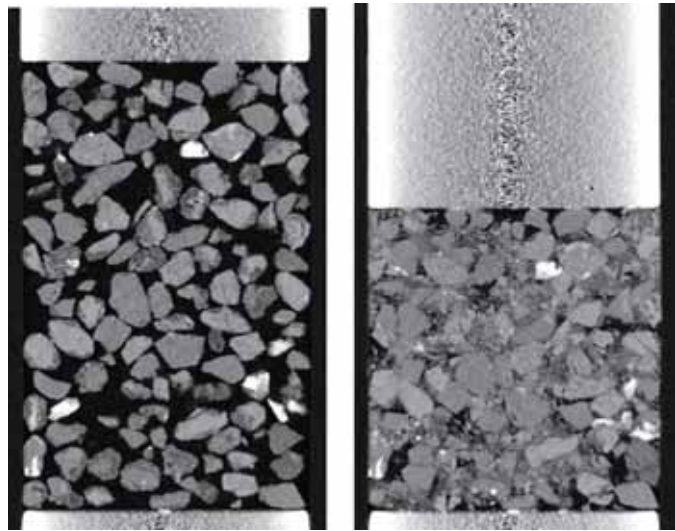


Figure 2. Visualisation for particle crushing during 1D compression

2. Mechanical properties and elasto-plastic modeling of geomaterials

Based on the mechanical behaviour obtained from laboratory tests, mechanical constitutive models have been developed for many types of geomaterial such as crushable soils, cemented soils, unsaturated soils and compacted soils. (See Figure 3)

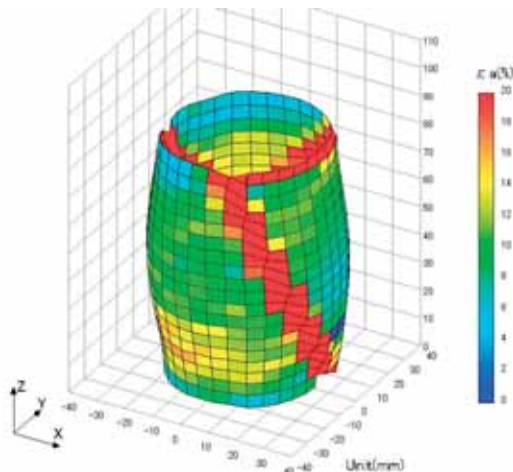


Figure 3. Image (PIV) analysis for triaxial compression test

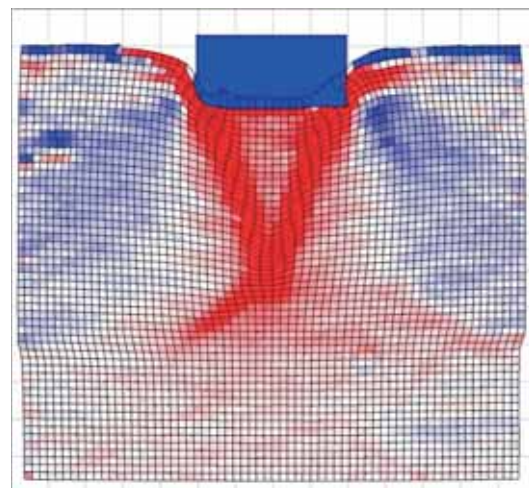


Figure 4. Image (PIV) analysis for bearing capacity model test

3. Mechanical and seepage properties of unsaturated geomaterials,
Mechanical and seepage properties have been investigated by new experimental apparatus to simulate the deformation with gas and fluid flows in unsaturated soils.
4. Bearing capacity of compacted soils,
Bearing capacity of compacted soils has been studied experimentally and numerically in order to construct the soil structure with higher stability. (See Figure 4)
5. Stability of embankment and natural slope,
In order to solve some slope stability problem due to heavy rain, a series of small model tests and numerical simulations has been carried out. (See Figure 5)

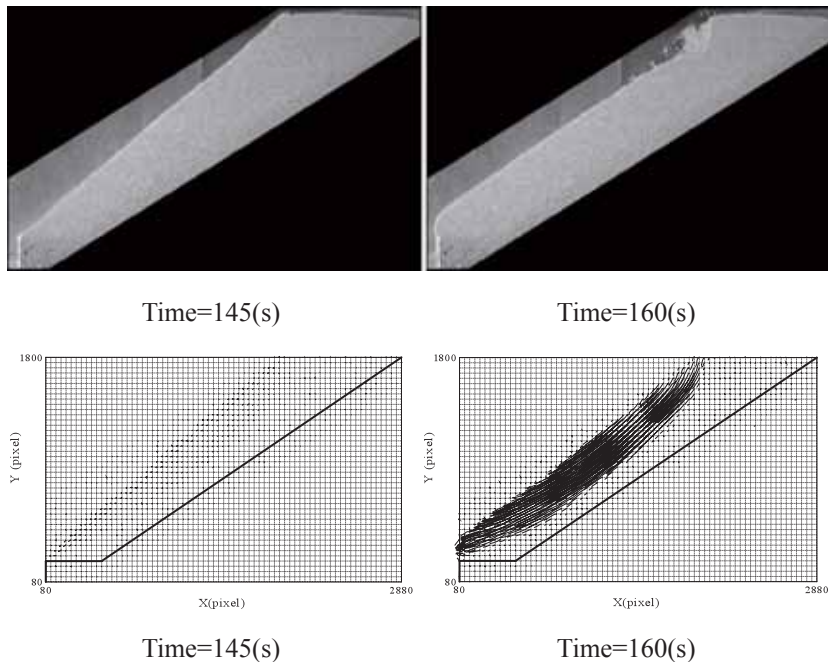


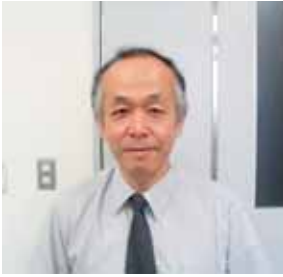
Figure 5. Digital images and image analysis results for small model test on slope stability

6. Methane-hydrate production.
The possible existence of vast amounts of methane hydrate around Japanese islands has attracted interest as the largest potential hydrocarbon resource in Japan. Therefore, it is highly necessary to collect the fundamental mechanical data regarding the properties of methane hydrate and/or its sand mixture.

Message

Our laboratory has many analysis equipments, testing apparatus, model test devices and simulation software to be used as research tool to conduct researches in geotechnical engineering. We used these apparatus to carry out monotonic and cyclic triaxial tests, unsaturated triaxial tests, plane strain tests, hollow cylindrical torsional tests, and high confining pressure triaxial tests with temperature control. Moreover, innovative measurement systems have been developed to elucidate the mechanical behaviour of geomaterials in aforementioned laboratory tests, for example, shear wave velocity were measured using bender element and displacement measurement by image analysis. Model tests have been conducted to study the bearing capacities for footing and pile, the slope stability due to rainfall and seismic force. Simulation tools such as finite element method, finite differential method and distinct element method have been applied to many research activity.

Many foreign researchers and students have already visited or stayed our laboratory to conduct research, including those from Korea, China, India, Australia, New Zealand, United Kingdom, Norway and USA. On the basis of these international connections, several international research projects have been successfully carried out. If you have any interests in our research activities, please contact me through e-mail.



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Research Activities

Dr. Hyodo's main research interest lie in the field of Geotechnical Engineering, particularly, in the production of methane hydrate (MH) from deep seabed as a new source of energy. A lot of attention has been paid to MH as the major energy source for the next generation. Applications of this research have been widely reported in the field of geotechnical, civil and mining engineering. This has been augmented by strong links with oil industries, and with other research groups, at national and international level. One of Dr. Hyodo's most significant contributions in this field is the development of apparatus for investigating the mechanical properties of MH bearing sand which is useful for the production of MH from the reservoir in deep seabed. A low temperature and high pressure triaxial testing equipment was developed to reproduce the temperature and pressure condition of the deep seabed where the MH reservoir exists. In addition, this device is able to simulate the dissociation of MH for production of methane gas by increasing the temperature or decreasing the pore pressure. This work has been presented in an extensive series of publications and also at seminars and international conferences. Other major achievements in his research are on earthquake geotechnical engineering such as liquefaction and cyclic failure of grounds composed of various kind of soils. In order to pursue better research results, he developed the 4 cyclic triaxial, 2 hollow cylindrical torsional shear and one on-line pseudo-dynamic response testing apparatus which are considered as the highest caliber equipments in the world. Many papers had been published by summarizing the outcome of the works using these apparatus.



Figure 1. Triaxial testing apparatus for methane hydrate bearing soils



Figure 2. Production test of methane hydrate in Canada

Message

Geotechnical Engineering group in Yamaguchi University is one of the biggest and strongest groups in the world. Many testing equipments such as high stress triaxial testing apparatus, dynamic and static hollow cylindrical torsional shear apparatus, on-line seismic response testing equipment, triaxial testing equipment for methane hydrate, and triaxial equipments for unsaturated soils are available for cutting edge research in our laboratory. Additionally, software such as computer codes for finite element analyses and DEM are also available. There are many oversea Master and PhD students in our department.



Masayuki Morita Professor

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Applied Electrochemistry

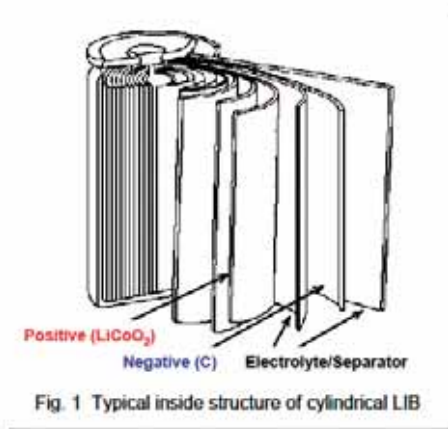
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Research Activities

Dr. Morita's research interest is applied electrochemistry, especially electrochemical energy conversion and electrochemical processes. His current research subjects are; 1) Materials designing for advanced lithium ion batteries, 2) Basic research on electrochemical capacitors, 3) Electrocatalysts of direct-alcohol fuel cell and, 4) Advanced surface technologies for electrochemical processes. Examples of his research subjects for each of the above category are as follows;

- 1) Development of novel electrolyte systems for lithium ion battery (LIB): Utilization of gel electrolyte systems including nonflammable components. Nonaqueous electrolytes based on ionic liquid for LIBs with safer and more reliable properties.
- 2) Charge-storage mechanisms of electrochemical capacitors: Influences of the electrolyte composition on the double-layer capacitance at carbonaceous electrodes. Development of novel charge-storage processes for capacitor devices.
- 3) Development of active electrocatalysts for direct alcohol fuel cell (DAFC): Anodic oxidation of ethanol as novel metal electrocatalyst. Effects of modification by conducting polymer on the anodic oxidation of alcohol.
- 4) Electrodeposition of metals, alloys, and oxides as novel preparation methods for electrocatalysts of chloro-alkali process and dye-sensitizing solar cell (DSSC) electrode.



Message

Our electrochemistry lab is composed of Prof. Minato Egashira's group and my group.

Research in our group is generally based on experimental work with continuous discussion among the research groups. Main apparatus available in the lab include electrochemical systems for conventional measurements (cyclic voltammetry, chrono-potentiometry, AC impedance spectrometry), spectroscopic (NMR, UV, IR, Raman, XRD), and thermal analysis equipments (DSC, TSC).



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Research Activities

Ultrahigh vacuum (UHV) from 10^{-5} Pa to 10^{-9} Pa, and the extremely high vacuum (XHV) of less than 1×10^{-9} Pa are required for the fabrication systems of advanced nano-devices and high energy accelerators. The current interest of Dr. Kurisu's group is development of novel vacuum system made of titanium materials with high vacuum performance, and it is called Titanium Vacuum Technology.

It is important to reduce the outgassing from vacuum system to achieve the UHV and XHV. The achievement pressure P in a vacuum system is expressed by $P = (q \times A) / S$ under UHV region and below, where q ($\text{Pa} \cdot \text{m} \cdot \text{s}^{-1}$), represent outgassing rate, is the amount of outgassing from a material surface per unit area and unit time, A (m^2) denotes the area of the internal chamber surface and S ($\text{m}^3 \cdot \text{s}^{-1}$) represents the effective volume flow rate of the vacuum system. Thus, the outgassing rate, q , is the important physical quantity representing the vacuum performance of materials.

Standard vacuum materials, such as stainless steel and aluminum alloy have outgassing rates of the order from 10^{-9} to 10^{-11} $\text{Pa} \cdot \text{m} \cdot \text{s}^{-1}$ under pre-treatments such as surface finishing and the baking process. The outgassing rate for titanium materials with developed surface finishing is 6×10^{-13} $\text{Pa} \cdot \text{m} \cdot \text{s}^{-1}$ after conventional baking process. They are two orders of magnitude smaller than that of the standard vacuum materials. Dr. Kurisu has developed vacuum chambers and components for UHV/XHV systems utilizing the titanium materials, which showed excellent vacuum property.

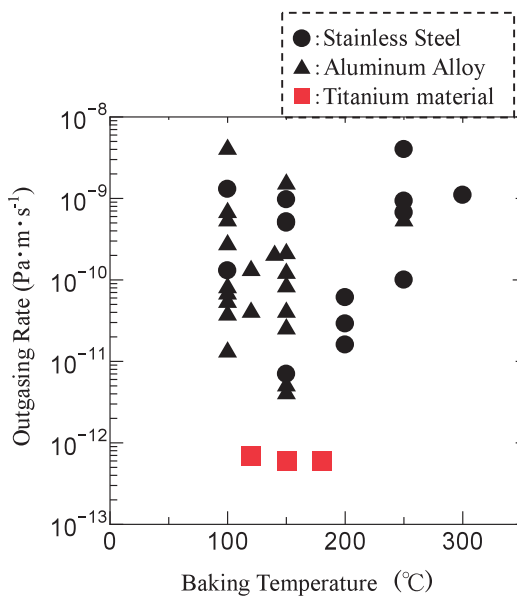


Fig. 1 Outgassing rates for titanium material, stainless steel and aluminum alloy.



Fig. 2 Vacuum chambers and components made of Titanium materials developed by Dr. Kurisu.

Message

Being a scientist, it is extremely important to create original ideas. This is because research based on original idea can easily explain the principle and appearance of a new phenomenon. It is also necessary to develop novel equipments based on original ideas, and that is the whole point of research and development. The vacuum science and technology have been developed as infrastructure for various industries such as electronic industry and the energy industry. Titanium Vacuum Technology, which achieves a new frontier in the extremely high vacuum discipline, will contribute to progress in science and technology well into the 21st century.



Takashi Saeki

Associate Professor

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Research Activities

Dr. Saeki's research focuses on the understanding of drag reduction caused by surfactant solutions, analogy of momentum and energy transport for drag-reducing surfactants. Reduction in drag flow when compared to a Newtonian fluid is called the *drag-reduction effect*, and it is well known that certain polymer solutions and surfactant aqueous solutions exhibit this effect. He advocated that this technology, which has been investigated primarily at the academic level, should be widely disseminated through cooperation between business, university, and government to bring enormous energy-saving benefits, and to contribute to the goals of green sustainable chemistry.



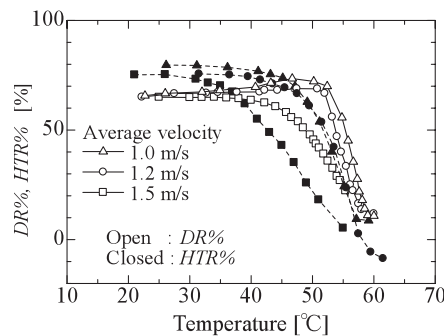
$$f = \frac{1}{4} \Delta P \frac{D}{L} \frac{1}{\rho u^2 / 2}$$

$$DR \% = \frac{f_w - f_n}{f_n} \times 100$$

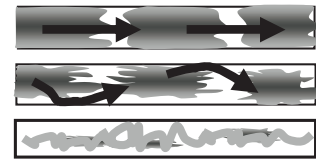
$$T_2 = T_1 - \frac{Q (r_1 - r_2)}{k A_{in}}$$

$$Nu = \frac{Q / \Delta T A_2 \cdot D}{k}$$

$$HTR \% = \frac{h_w - h_a}{h_w} \times 100$$



Schematic diagram of drag reducing



Dr. Saeki also conducts research on fluid and particle mechanics, rheology of suspensions and polymer solutions, and minerals processing. Understanding the correct flow characteristic of process fluids is important for design, selection and optimization of equipments and processes. Rheology of materials might be exploited to improve product quality, process performance and economics, or to minimize energy requirements. To bring the results of his research for the benefits of mankind, he has several collaborative research projects with the industries every year.

Message

Research in chemical engineering is not only academic but directly connected to the fields of process and design, development of the operating procedure, the optimization and troubleshooting of various types of equipments for engineering. We have been doing research projects with extensive applications, for example, integrating them within the field of rheology based on fundamental knowledge, including: transport phenomena, unit operation and chemical reaction engineering. The development of energy saving technology by using drag-reducing additives and preparation techniques for various suspensions are typical examples of the environmental programs that we have been implementing. Our research projects have mainly been conducted in collaboration with corporations for the purposes of investigating the actual process, conducting various evaluations of samples collected from each manufacturing facility, and forming the guiding principles for the design of equipment and the process, to the development of the operating procedure. Would you like to participate in our group project in order to help create practical technologies in this manner?



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Research Activities

Metamaterials are artificial materials composed of a large number of small structured sub-wavelength elements. They can be seen as homogeneous materials by electromagnetic waves with much longer wavelength than the elements' sizes. With special shapes and arrangements as well as the material characteristics of the unit elements, metamaterials can possess extraordinary electromagnetic properties which cannot be found in natural materials, such as negative refractive index, or invisible cloaking. The Applied Physics Laboratory (APL) in Yamaguchi University is one of the world leading laboratories in this field from the early stage of the metamaterial research since the early 2000's. In 2002, an innovative composite right/left-handed (CRLH) theory of left-handed materials based on the transmission line theory was proposed and the first distributed planar left-handed metamaterial was developed by Dr. Sanada in collaboration with a UCLA microwave laboratory group. This concept led to the invention various novel metamaterials using state-of-the-art planar and three-dimensional fabrication techniques and epoch-making devices. These new metamaterials can be used in a diverse range of modern wireless/wired systems like mobile communications, radar/sensor systems, wireless power transmissions, electromagnetic compatibilities, and the like, in the microwave frequency region. The APL has produced many patented materials and devices using this novel concept of metamaterials. Since 2008, interdisciplinary research activities in the APL have been accelerated by scientists/engineers/graduate and undergraduate students in physics, electronics, nanofabrication, and chemical departments with a special support program from the Japanese government. As a manager of this project as well as the director of APL, Dr. Sanada is exploring novel use of microwave to optical wave frequency regions for application in the academic and industrial fields.

Message

The research in our APL is so diverse that researchers from various professional areas are now participating and playing major roles in research activities. Interaction with other universities and institutes are also active and on a worldwide basis. Using original equipments and facilities, we are tackling problems to open new vistas of science and technologies, which is very exciting.



Masaharu Nakayama

Professor

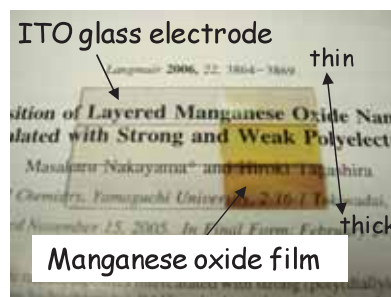
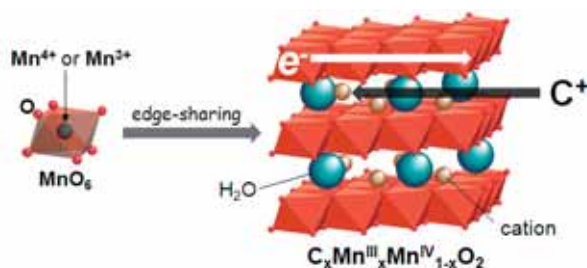
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Research Activities

Dr. Nakayama is currently involved in the studies of electrodeposition of nanostructured materials and their electrochemistry. Electrodeposition is one of the most promising methods for obtaining thin, uniform films on substrates of complex shapes with a high degree of reproducibility. Conducting films that adhere well to a substrate need no binders or conductive additives for electrochemical use.

Birnessite (7A manganite), a manganese oxide mineral, has a two-dimensional layered structure that consists of edge-sharing MnO_6 octahedra with interlayer cations and water molecules. In such a layered structure, all of the material can be regarded as “surfaces”, while “bicontinuous” networks of solid and pore on the nanometer scale enable both electrons and cations to move fast and reversibly. A wide variety of methods have been developed to synthesize birnessite-type manganese oxides because of their unique adsorptive, catalytic, ion exchange, and electrochemical properties.



In 2004, Dr. Nakayama presented an innovative technique for fabricating a transparent thin film of layered manganese oxide. The process consists of potentiostatic oxidation of aqueous Mn^{2+} ions in the presence of guest cations. This methodology is simple, environmentally benign because no heating is required, and is remarkably versatile because the inorganic host can adjust itself to accommodate guest molecules during electrodeposition. This has enabled Dr. Nakayama and his colleagues to design various MnO_2 -based layered materials. Moreover, hierarchical structures can be formed through the specific self-assembly of MnO_2 nanosheets. He is also interested in application of the product as electrode materials for catalysts, sensors, secondary batteries, and supercapacitors.

Message

Manganese is one of the most abundant metals in the earth's crust. Manganese oxides with various valence states and crystalline structures including spinel, layered, and one-dimensional tunnel have been extensively studied on their synthesis, structures, and physicochemical properties. The new electrochemical technique we proposed will provide a lot of possibilities to create micro-, nano- and hierarchical structures in a thin film form. Thin films are the desirable form of metal oxides for use in electronic, optical, magnetic, and electrochemical applications. In fact, we have developed electrode materials for lithium-ion batteries and supercapacitors based on the nanostructured manganese oxides. I believe that international work experiences are essential for young scientists to find new ways of seeing, thinking, and acting, which are qualities necessary to be a forefront researcher, as well as improving their communication skills. It would be my pleasure to have the opportunity to conduct international collaborative studies and to work with foreign researchers.



Masato Mikami Professor

Graduate School of Science and Engineering
Combustion Science and Engineering

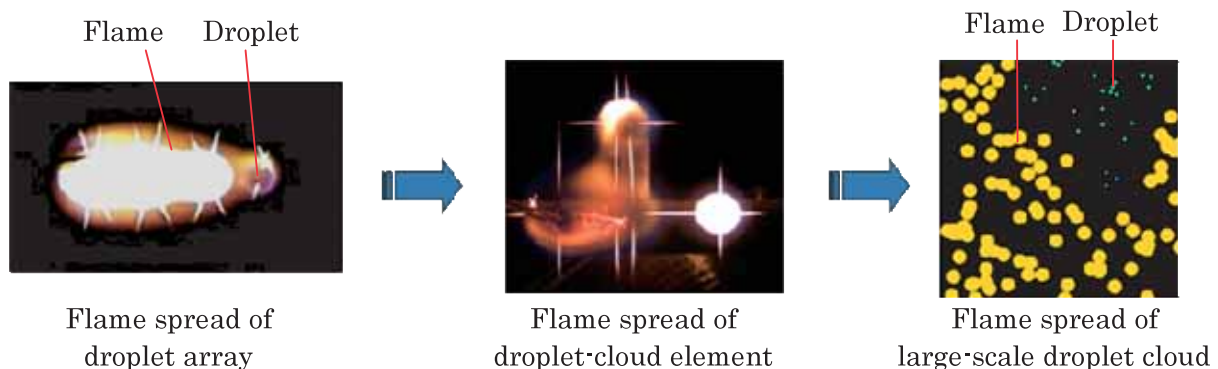
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Research Activities

Spray combustion is utilized in many liquid-fueled combustors. Flame spread in fuel spray occurs immediately after ignition in diesel engines and also near the flame base in gas turbine engines. Flame spread plays an important role in heat release in the initial stage in the former case and in the stability of group combustion of fuel spray in the latter case.

To better understand the flame-spread mechanism, Dr. Mikami and his research group have investigated the flame spread along evenly spaced droplet arrays in microgravity. In spray combustion, however, fuel droplets distribute at random in the combustion chamber. The findings on flame spread along droplet arrays have not been well utilized for elucidation of spray combustion.

Dr. Mikami's proposal on a combustion experiment, "Elucidation of Flame Spread and Group Combustion Excitation Mechanism of Randomly-distributed Droplet Clouds" will be carried out in the Japanese Experiment Module "KIBO" of the International Space Station (ISS). The purpose of this experiment is to verify flame-spread hypotheses, which are based on the percolation theory and the findings from short-duration microgravity experiments, using large-scale droplet clouds to develop a percolation model which well describes the group combustion excitation through the flame spread. The droplets are arranged randomly on thin-fiber lattice points, and the flame and droplet positions and temperature distribution are measured during the flame spread over the droplets. The result of this space experiment will make a high impact on industries as well as in the academic field of combustion science; it will provide a clear guideline for designing a spray combustor with stable combustion and will make it possible to theoretically bridge knowledge between the droplet combustion and the spray combustion.



From flame spread of droplet array in short-duration microgravity to that of large-scale droplet cloud in ISS

Message

The role of combustion science researchers and engineers is vital to solving world energy issues, such as fossil fuel shortage and global warming. A novel technology to improve combustion efficiency directly leads to a solution of these issues. Not only a firm foundation in related science but also a flexible way of thinking will be required to obtain innovative ideas.

Engine System Engineering Lab (ESEL) at Yamaguchi University has extensive research themes, as related to the internal combustion engine, from fuel-droplet combustion in the space station to engine emission, noise and vibration. These researches are conducted by the research staffs, students and collaborators from other organizations with different cultural backgrounds. The situation in our lab may look chaotic, but unexpected novel ideas would come out from such chaotic situation if you communicate with others and are not afraid to take the first step for any challenges. I hope that you will join us and enjoy stepping forward to find something new!



Naoki Yamauchi

Dean

Faculty of Agriculture
Postharvest Horticultural Science

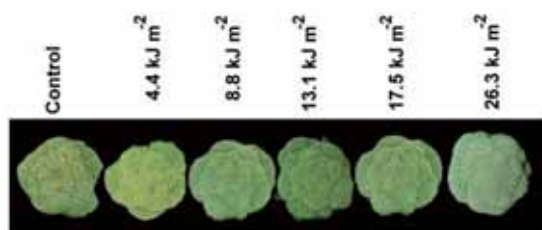
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Research Activities

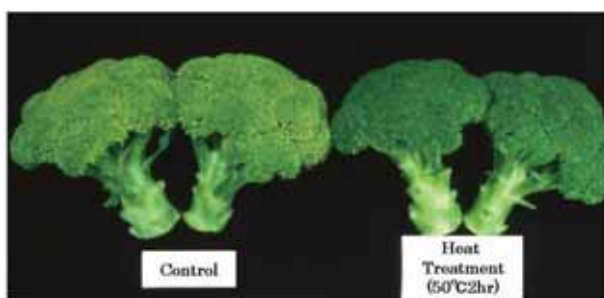
Dr. Yamauchi's research focuses on the effect of UV irradiation and heat treatment on quality maintenance in postharvest horticultural crops, as well as the mechanism of chlorophyll degradation in postharvest crops.

Low temperature storage is usually needed to maintain quality during storage in harvested fruits and vegetables. However, UV irradiation and heat treatment of horticultural crops after harvest is also known to maintain its quality during storage, even if the crops are stored at ambient temperature. Dr. Yamauchi found that the suppression of senescence by these treatments could be due to the activation of the ascorbate-glutathione cycle. Moreover, he also clarified the physiological role of antioxidative systems on scavenging active oxygen species in relation to quality maintenance in horticultural crops.

In horticultural crops, one of the factors in quality deterioration is the loss of greenness that comes with degradation of chlorophyll. To elucidate the pathway of chlorophyll degradation, especially peroxidase-mediated chlorophyll degradation in postharvest horticultural crops, Dr. Yamauchi used heat treatment to control isoperoxidases involved in chlorophyll degradation of stored broccoli (*Brassica oleracea*) florets. He is establishing a suitable method which can suppress chlorophyll degradation and also maintain the quality of the crop during transport and storage.



Changes in surface color of broccoli florets with UV-B irradiation during storage at 15°C. Photograph shows broccoli florets on day 4 of storage. UV-B doses of at least 8.8 kJ m⁻² delayed floret yellowing.



Broccoli florets stored for 4 days at 15°C

Heat-treated broccoli florets maintain the greenness for longer period of time than the non-treated ones.

Message

Agricultural research is closely related to food and environmental issues which society needs to resolve promptly. We encounter community-based challenges facing the world today, and our faculty members are working to resolve them from the standpoint of agriculture. Moreover, we approach education and research with the feeling that agricultural science and technology will open up the future of the 21st century. Come to the Faculty of Agriculture and do research together with us!

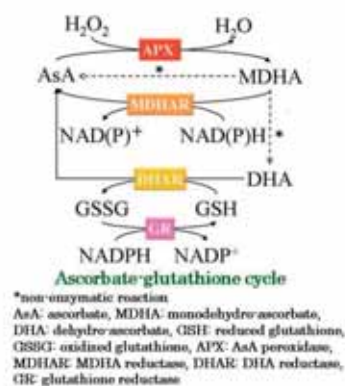


Diagram of the Ascorbate-glutathione cycle



Yasuho Taura Dean

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Research Activities

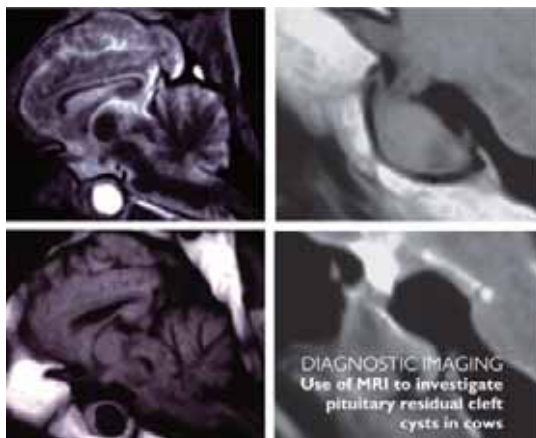
Dr. Taura's research interest is in veterinary surgery, radiology and clinical immunology. He is currently involved in the studies of lameness of small and large animals, brain and spinal diseases of animals, transplantation immunology, and translational research unit for developing advanced regenerative cell therapy.

In 1993, he started the use of MRI (Magnetic Resonance Imaging) examination for bovine cranial diseases. MRI presents a lot of merits in the form of the visualization of "quantity" and "quality" of pathologic lesions. By using MRI, pathological inferences of brain lesions, quantitative investigations of brain structures, definitive demonstrations of brain structures during antemortem in bovine practice could be demonstrated. His research result graced the cover page of May, 2009 issue of the *Veterinary Record* journal. (Figure)

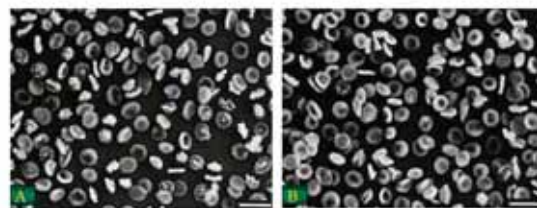
Dr. Taura also demonstrated the therapeutic efficacy of mammary irrigation regimen fluids using ozone water for the treatment of dairy cattle diagnosed with acute coliform mastitis caused by gram-negative bacteria. This indicates that mammary irrigation with ozone water is an effective treatment for acute coliform mastitis in dairy cattle.

To elucidate the pathogenesis of hepatic encephalopathy (HE), he developed a new HE model with behaviour disorder. He demonstrated that increased excitatory neural amino acids and morphological change in astrocytes were involved in the behaviour disorder that occurs with HE.

Phosphoenolpyruvate (PEP) is a phosphorylated glycolytic intermediate that can penetrate the red blood cell (RBC) membrane and be metabolized to 2,3-DPG and ATP. Dr. Taura and his colleagues found that PEP treatment enhanced the preservation of canine RBC when it is cryopreserved with 12.5%(w/v) HES. (Figure)



Scanning electron microscopic observations



Frozen and thawed RBCs of the control group (A) and the PEP group (B). In PEP treated group (B), there are fewer deformed cells than the control group (A).
Bar = 10 μ m
-Kim H et al., *Low Temp Med* 2005²

Message

The objective of the United Graduate School of Veterinary Science, Yamaguchi University (UVY), is to contribute to academic progress and social development by fostering technicians and researchers; 1) with highly specialized skills and veterinary knowledge, 2) with flexible thoughts and broad views, 3) with the capability to work in various fields in our society, 4) with ability to conduct original research, and 5) with the aptitude to contribute to international cooperation, on the foundation of the union of the four universities.

We have energetically implemented improvement of the structures of the UVY as an educational and research institution. The UVY boasts the highest number of students of all doctoral research programs in veterinary sciences in Western Japan, and many graduates are now veterinary doctors working domestically and internationally. Veterinary science is a discipline that can contribute to animal and human well-being. We are devoting ourselves to doing more advanced and specialized research.

The motto of Yamaguchi University is, "Discover it. Nourish it. Realize it. A Place of Wisdom." We offer you an opportunity to take up the challenges and study with us at the UVY in your academic endeavor.



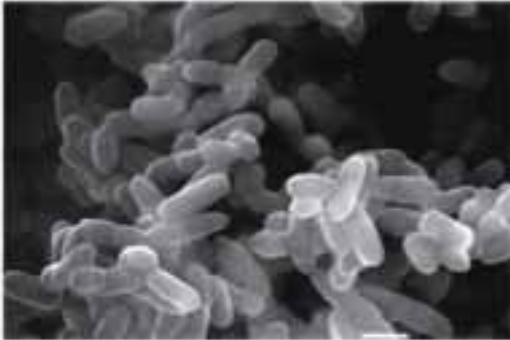
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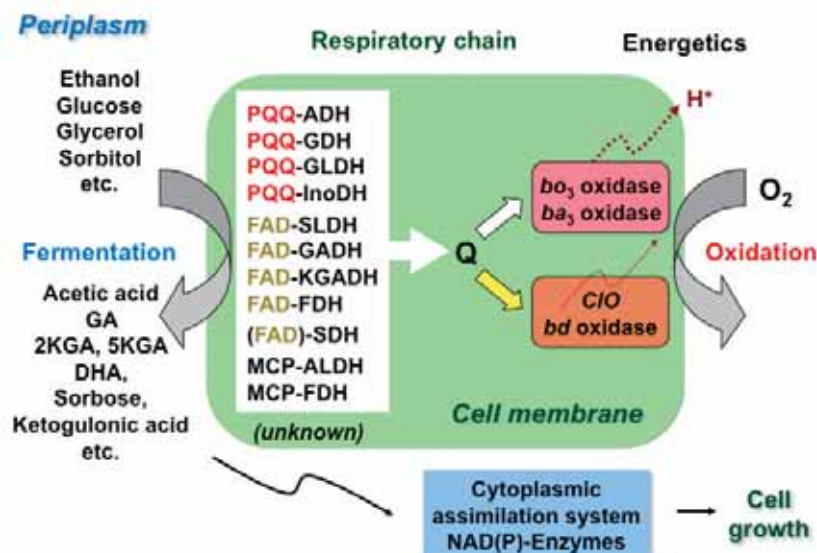
Research Activities

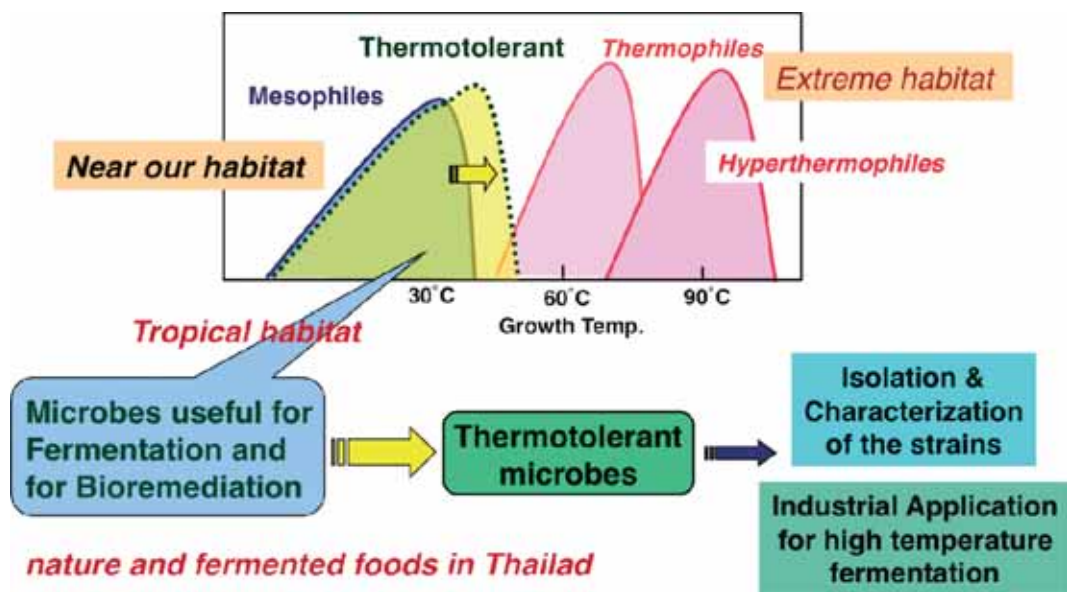


Acetic acid bacteria (AAB) are known to have an ability to oxidize various sugars or sugar alcohols into their corresponding acids. These oxidations, called oxidative fermentation, are uniquely carried out by membrane-bound enzymes located on the outer surface of the cytoplasmic membrane, and the oxidation products usually accumulate in the culture medium. These features of the microorganisms lead to industrial fermentation for valuable products such as vinegar, L-sorbose, dihydroxyacetone, D-gluconate, and keto-D-gluconates. Dr. Matsushita has studied these oxidative fermentations extensively, especially the membrane-bound enzymes

and the respiratory chain. He found that many of these enzymes are unique quinoproteins having PQQ as the prosthetic group, and also that AAB has a unique truncated respiratory chain which is terminated via ubiquinone by ubiquinol oxidases including an energy-generating cytochrome *bo3* (*ba3*) and a novel non-energy-generating cyanide-insensitive oxidase. Thus, the oxidative fermentation system of AAB has been unequivocally shown to be unique and useful for rapid and stereo-specific bioconversion to obtain not only foods or food additives but also many useful pharmaceutical intermediates.

Since these fermentations with AAB are usually done below or around 30°C, the optimum growth temperature for the bacteria, a large cooling expense is required in the industrial fermentation processes, especially in these days of global climate warming. Thus, the development of thermotolerant AAB would release us from strict temperature control, and enable us to perform stable fermentation without using a sophisticated cooling system. Dr. Matsushita has successfully isolated such a thermotolerant AAB in collaboration with Thai researchers, and developed a high temperature acetic acid fermentation system. This was done by creating more useful strains adapted to acetic acid fermentation condition at higher temperature by *in vitro* evolutionary mutagenesis (adaptation). Thus, his study may lead to the establishment of an oxidative fermentation system using such a superior AAB strains without temperature control in industrial fermentation of Japan, or more importantly in tropical countries.





Message

Microorganisms have elegantly evolved by adapting to their habitat. Human beings have used such microbes for fermentative production for food stuff or pharmaceuticals, for microbial treatment in bioremediation or in energy production. However, sometimes these microorganisms can cause serious health problem despite being the same species but of different strains.

Thus, we have to learn their evolutionary background or their strategy to overcome environmental stress or biological competition. Only from such a straightforward approach, can we really get to the heart of their strategy to extract useful information from them to confer benefits on ourselves. Although they are very small, they are a powerful entity as a mass or population. So we must respect their activity or their presence itself on this earth as our counterpart in this earth community. Thus, my study is not only on to the application of microorganisms for human benefits, but more importantly, deeply related to the physiological study to understand their characteristics.



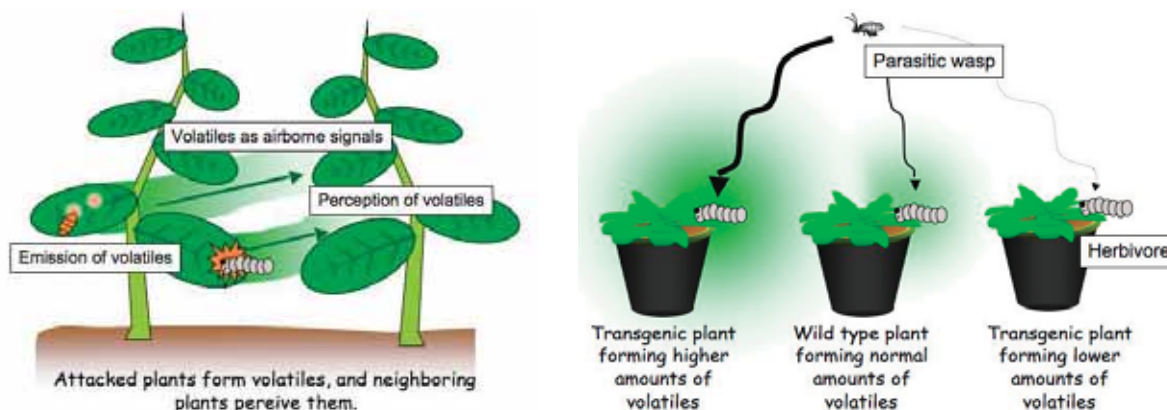
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Research Activities

Plants can produce various kinds of volatile organic compounds, which have been used as perfumes and food ingredients from ancient time. Plants acquired the abilities to form these diverse volatile chemicals through co-evolution with other organisms, such as herbivores and microbes, in an ecosystem surrounding the plants. In these contexts, plant volatiles should be appreciated from two different standpoints; that is, their usefulness to improve the quality of our lives, and their significances that provide benefit to plants in coping with the pressures brought about by the surrounding ecosystem. In Dr. Matsui's lab, they are studying plant volatiles from these two standpoints. First, they attempted to improve flavor qualities of food originated from plants. They observed that manipulating the genetic composition of plant is a strategic way to improve the flavor quality, and also found a promising rational way to process crops based on the biochemical knowledge of flavor biogenesis. Secondly, they elucidated the significances of volatiles for plants. They found that some volatile compounds are very important defense weapons for plants to cope with herbivores and pathogens. Specifically, some plants form volatiles after a herbivore attack in order to recruit the enemy of the herbivore. Dr. Matsui and his team also demonstrated that plants could communicate with each other through the use of volatile compounds. This might sound like a fantasy, but scientific approach employing molecular biology has proven this phenomenon.



Message

We are proposing a new concept, Ecological Volatiles, in order to comprehend the significances of volatile organic compounds in biosphere. Volatiles are perceived by mankind as flavor or aroma, and make us happy. Volatiles are employed by plants to establish an ecosystem that gives benefit to itself. By setting volatile compounds as keys, we can find new aspects of their significances in our biosphere by using knowledge and techniques in molecular biology, chemical ecology, and food chemistry. If you are interested in our novel approach, please feel free to contact me.



Masayoshi Shigyo

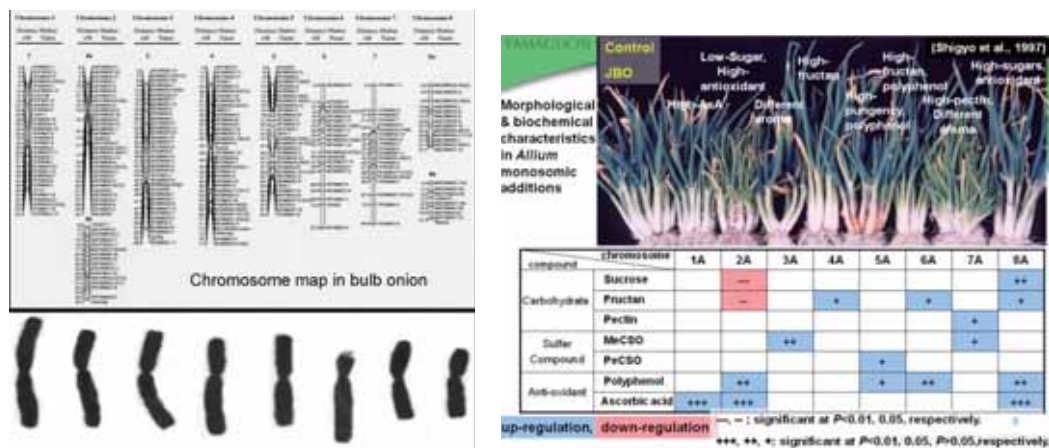
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Research Activities

In Dr. Shigyo's laboratory, a complete set of *Allium fistulosum* – shallot monosomic addition lines ($2n=2x+1=17$, FF+1A -FF+8A) has been used to obtain information on genetic studies of genome organization in *A. cepa* and for improving *A. fistulosum* cultivars. His studies have identified more than one hundred chromosome-specific genetic markers in bulb onion as well as shallot. As a result of these marker analyses, Dutch and US onion linkage maps were successfully assigned to *A. cepa* physical chromosomes. Furthermore, the monosomic additions proved to be very effective in revealing the effect of single alien chromosome from *A. cepa* on the production of several functional chemical compounds, such as flavonoids, non-digestible carbohydrates, organosulfur compounds, vitamin C, polyphenols, in the leaf tissue of *A. fistulosum*. The assignment of a number of structural genes involved in their biosynthesis and metabolisms to individual chromosomes could be accomplished not only by SCAR (Sequence Characterized Amplified Region) analyses of candidate genes in the monosomic additions but also by direct comparisons between the chromosomal constitution and chemical contents of scaly leaves in the set of *A. fistulosum* – shallot multiple additions ($2n=18-23$). Dr. Shigyo observed that FF+1A is a high production line for Vitamin C and also a resistant line, at least at seedling stage to *Puccinia allii*, which causes the rust disease in *A. fistulosum*. He thus converted this line into a disomic addition 1A of tetraploid *A. fistulosum* ($2n=4x+2=34$, FFFF+1A1A) via chromosome doubling for the practical utilization of *Allium* alien addition lines for breeding purposes. Thus, through systematic analyses of *Allium* alien addition lines, Dr. Shigyo revealed a number of authentic genetic information on the chromosomal locations of genes related to the biosynthesis and metabolism of several functional chemical components. This led to his attempt in the combination of species, such as *A. fistulosum* – *A. cepa*, with the former being the recipient and the latter being the donor, as well as for other combination of *A. cepa* – *A. fistulosum*.



Message

‘Science and Horticulture for People’, the theme of my laboratory, emphasizes horticulture’s scientific components and how it relates to scientists, producers, consumers and society at large. Horticulture is concerned with a number of plants whose cultivation brings rewards, whether in the form of profits or personal pleasure, sufficiently warrant the expenditure of intensive effort. Modern horticulture integrates many natural phenomena with advanced technology, and so becomes a scientific discipline in its own right. Our laboratory for horticultural science mainly deals with the genetics and breeding of vegetable crops.

We recently established a chromosome-specific molecular marker maps together with our research partners in Europe and the United States. This map will be really useful for opening the door to a new era of onion breeding research in the world. We are currently developing a novel vitamin C-rich green leaf onion by means of our original chromosome engineering technique. I wish our knowledge and cultivars will contribute to human society around the globe.



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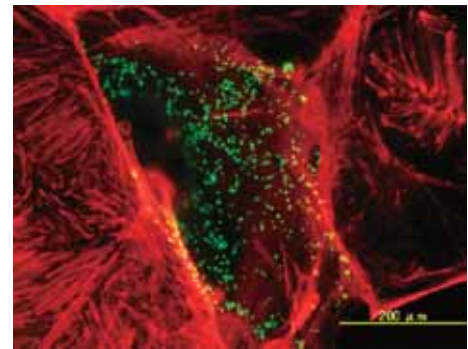
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Research Activities

Dr. Watarai's research interest is in the interaction between bacterial pathogen and host cell, focusing on the molecular mechanisms of *Brucella* spp. infection.

Brucella is a facultative intracellular pathogen that causes abortion, retained placenta and infertility in many domestic and wild mammals, and a disease known as undulant fever in humans. A key aspect of the virulence of *Brucella* is its ability to proliferate within professional phagocytic cells such as macrophage and neutrophils, and non-professional phagocytic host cells such as epithelial cells, thereby successfully bypassing the bactericidal actions of phagocytes, which is thought to explain its virulence and ability to cause chronic infection.

The mouse model has been used extensively to study various aspects of the pathogenesis of brucellosis. However, these studies have been limited to the use of non-pregnant mice. While brucellosis is known to primarily affect the reproductive tract in its natural host, little is known regarding the cellular and molecular mechanisms of *Brucella* infection in the pregnant mice. Dr. Watarai developed the infectious abortion model using pregnant mouse for investigating the mechanisms of *Brucella* pathogenesis. He observed that there was a higher degree of bacterial colonization in the placenta than in other organs, and that many bacteria were seen in trophoblast giant (TG) cells in the placenta. However, an intracellular replication-defective mutant of the bacteria did not induce abortion. These findings suggest that bacterial infection of TG cells plays a key role in abortion induced by *Brucella* infection. Currently, he is investigating a receptor for *Brucella* which is expressed on TG cells and the immunological functions of TG cells in infectious abortion.

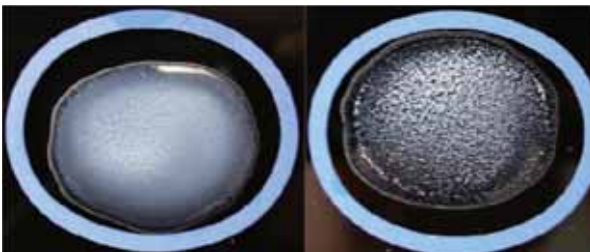


Brucella (green) infecting in trophoblast giant cells (red) in the placenta.

Message

Remarkable progress in the prevention, control and even eradication of infectious diseases has been made with improved hygiene and development of antimicrobials and vaccines. However, infectious diseases still remain a leading cause of global disease burden with high morbidity and mortality. There have been threats of new diseases during the past three decades due to the evolution and adaptation of microbes and the re-emergence of old diseases due to the development of antimicrobial resistance and the capacity to spread to new geographic areas.

We are studying specific antigens of *Brucella* for serological diagnosis and vaccine development. Current serological diagnosis of brucellosis sometimes give false-positive reaction due to cross-reaction with other pathogens, and a general strategy for eliminating such cross-reaction is to use purified antigen with unique epitopes. We recently developed antigens coated latex beads and showed that it is useful in the serological diagnosis of brucellosis. We hope to develop a good method for prevention of *Brucella* infection.



Latex bead agglutination test. Left: negative, right: positive.



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Research Activities

Dr. Yokota has been studying the formation of the working class in the Republic of Korea, primarily during the period from the beginning of the process of rapid economic growth, known as the “Miracle on the Hangang River,” in the latter half of the 1960s to the present. Her central concern has been to analyze historical developments in the labor movement, industrial relations, employment patterns, and labor policies in South Korea, in conjunction with the structural changes in the Korean labor market during that period. She observes that the rapid economic development has brought about drastic changes in Korean traditional values, including people’s views on livelihood and their perception of family values, which in turn have drastically changed workers’ perception on work and significantly influenced their political behavior.

She argued that the South Korea’s working society faced a turning point in 1997 when the Asian currency crisis broke out. The economic turmoil caused by the currency crisis led to a rapid weakening of labor unions, enabling the government and large corporations to carry out a policy of bringing more flexibility into the domestic labor markets of larger companies. As a result, a rapidly growing portion of the labor force was faced with the prospect of becoming “irregular” workers, or being made “peripheral.” Her main research objective is to take a fresh look at this rapid process which has been gaining momentum with the spread of globalization, and the process through which an increasing portion of the labor force has been reduced to being “irregular” and “peripheral” workers.

Recently, Dr. Yokota extended her research to include areas in South Asia, by making a comparative study of labor and gender issues in Export Processing Zones in South Korea, Bangladesh and India. With her knowledgeable background on labor problems, she was able to provide new insights into this emerging social problem.

Message

It is most urgent to resolve the problem of “irregular” and “peripheral” workers who are faced with bad working conditions and insecure employment and increasing rapidly in East Asian society, especially in Japan, Korea and China. We should eliminate discrimination between irregular workers and regular workers and establish the principle of equal pay for equal work. Join us in the new research movement to improve our labor practice into decent work in the East Asian society.



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Research Activities

One of the research topics of Dr. Abe is investigation of the Bao-gong legend. Bao-gong was a government official and a judge during the north Song dynasty, but he is being venerated by people in China even today. It was rumored that he was able to hear appeals of the dead people. This is because it was believed in olden times in China that the dead could be reincarnated. The powerless masses were always dreaming that justice could be served even in death. Dr. Abe argued that the people's earnest wishes appeared in the Bao-gong legend. To prove this hypothesis, Dr. Abe not only collected and studied ancient texts in domestic and foreign libraries, but also went about looking for Bao-gong Temple in China and Taiwan. As a result, he demonstrated that the legend of Bao-gong had spread through the centuries and taken roots in many local communities.

The second topic of his research is investigation of the Xuan-jiang art and literature in Hubei province. Xuan-jiang is a classical art and literature which leads people in the virtuous path through the power of poetry. The history of Xuan-jiang starts from *Shi-jing*. Its preface says that poetry has the power to impress and educate people. Characters in the story frequently recite poetry. Thus, statesmen had governed and educated people through using the power of poetry. In this way, Xuan-jiang art and literature has continuously led the people right up to the present time. Although Chinese literature has a long history, its thoughts from ancient literature are being expressed even at the present age. Dr. Abe tried to correlate and explain the contemporary traditional art and literature from the viewpoint of this ancient literary thought.



A Scientific International Forum of East Asia in 2008
- The World of East Asian Traditional Performing Arts -



Message

Modern civilization has succeeded the ancient civilization. To understand modern literature, we must first understand ancient literature, and the most important text is the Confucian Classics; *Yi-jing*, *Shu-jing*, *Shi-jing*, *Li-jing*, *Chunqiu-zuoshizhuan*. Confucianism is deep-rooted and alive in modern Chinese society and the neighboring nations. To know modern Chinese society and its neighboring nations, we have to read Confucian Classics first, which is quite difficult at times. The annotation book was needed even during ancient times. However, many annotation books have been published. The history of Japanese research on the Confucianism is long enough for our study. Let us study together with our seniors. By reading Confucian Classics, you will understand Japanese or Asian society better. Doing research alone has its limitation and research results are usually accumulated through cooperation. We welcome your collaboration.



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Research Activities

Dr. Kaminishi investigated the impact of Computer Aided Engineering (CAE) on product development process from the integrated perspective of technology and management. The explosive popularity and performance advances of Personal Computer changed the situation in which CAE is being utilized. This environmental change expanded the application of CAE in product development and manufacturing, and even designers can easily examine the feasibility of their ideas during conceptual planning. While existing knowledge tells the impact of Computer Aided Digitalization (CAD) or digital engineering tools as a whole (incl. CAD, CAE, CAM and others), that of CAE itself is not fully explained in an organized study. Dr. Kaminishi argued that CAD emphasis can help to explain the impact of Digital Evolution (DE) during the introductory phase of digital tools at the end of 20th century, when operational efficiency was a priority in engineering.

Therefore, to explain the current picture of CAE centered product development process, Dr. Kaminishi took a slightly different view and assumed that CAE and its accompanying skills are the keys to current digital engineering framework and the requisite for advanced up front engineering. From his case study, he found results contrary to previous research. CAE helps to shorten product development period, in addition to upgrading the product quality. The exploitation of CAE at the very early stage in the process seems to determine its effect during the development period. However, all relevant information must be stored and reflected in the early stage of CAE examination. Moreover, relevant processes including human resources should be simultaneously updated. Otherwise, the huge investment in CAE will sooner or later become "dead stock".



Message

We are studying the characteristics of innovation process in Japan from Management of Technology (MOT) perspective, which is a synthesis of technological and management study to provide practical education for the purpose of cultivating human resources driving innovation. We welcome those who would like to study with us the primitive strength of "Monozukuri," which is the soul of the Japanese manufacturing system.



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Research Activities

One of Dr. Matsuura's researches is the negotiation for coordinated waste heat utilization between two parties based on the stag-hunt game framework in response to Japanese political emphasis on coordinated energy reduction activities. He took interest in the typical measures of subsidy and value transfer between the participating parties. His motivation stems from the fact that few cooperative efforts were undertaken even when joint exploitation apparently creates beneficial values for the participants.

Stag hunt game framework well describes the situation in which cooperation apparently generates higher payoff for the players as the exhibit shows. In this setting, "defect-defect" represents risk dominant (safer) equilibrium, while "cooperate-cooperate" means payoff dominant equilibrium. His research has thus explained that there is a requisite minimum of additional value creation for successful cooperation even when no risk exists. However, considering the value transfer between participants, even when the efficiency gain is smaller than the critical value, he found energy cooperation can be achieved without government subsidy under certain conditions. His research also suggested that there is a requirement of minimum amount of subsidy for the coordination agreement, and also a method for granting the subsidy. He observed that optimized energy usage within certain domain could be achieved through active cooperation among entities.

His research shows that the bottom up approach is more efficient to facilitate optimal energy usage, which contrast with the attempts induced by governmental strategic initiatives.

Message

Our department was established to teach students to be successful in commercialization of attractive technological seeds. Needless to say, commercialization process needs a wide range of knowledge and their integration. In accordance with the reasons for the establishment, our faculties have a wide variety of business and scientific background. Teaching experience and interaction among the professionals allow us to open our eyes and thoughts as scholars.

The atmosphere surrounding today's academia led us to concentrate on specific and narrow expertise for chalking up our track records. While we know the excitement and the contribution that thoughtful research brings, we also feel that this attitude can sometimes shut our eyes to what is going on in other fields.

If you agree that intellectual curiosity is a fundamental driving force for all academic research, why don't you share your intellectual excitement with someone from a different field? Interaction with experts possessing different knowledge and way of thinking may lead us to explore new academic horizons.

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