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# Contents

## News



## Feature



## Research Highlights



## Intellectual Property and Enterprise



## Topics



## News

# Okayama University Hospital surgeons perform a record 100 lung transplants exceeding any other hospital in Japan.

Okayama University Hospital is one of the few certified multi-organ transplant centers in Japan, dealing with heart, kidney, lung, liver, small intestine, and the transplant of other organs. The Okayama University Hospital Organ Transplant Center was opened in January 2011 as the first facility of its kind in Japan to specifically handle all aspects of transplantation surgery.

Doctors at Okayama University Hospital have performed a large number of organ transplants, including kidneys, livers, and lungs. The hospital succeeded in performing the first living-donor lung transplant in Japan in 1998, as well as a successful lung transplant from a brain-dead donor in 2002. In November 2012 the hospital was the first in Japan to reach a total of 100 lung transplants, including 39 from brain-dead donors, giving it the highest number of such operations in Japan.

According to data published by the International Society for Heart & Lung Transplantation, the global average success rate for lung transplantation is 90% with a survival rate after one year of 70% and after five years of 50%. Okayama University Hospital's lung transplant survival rate after five years stands at 82% (87% for transplants from living donors). This is an extremely good performance in comparison to the global average, garnering attention worldwide for the hospital as a top level lung transplant facility.

The hospital also performed the first successful simultaneous kidney and liver transplant from a brain-dead donor in Japan in September 2012.

Okayama University Hospital: One of Japan's foremost transplant facilities

Surgical staff at Okayama University Hospital performing a lung transplant.

## News

# International symposium on Structure and Dynamics of Photosynthetic Systems

Okayama University held the "Structure and Dynamics of Photosynthetic Systems" symposium at the 50th Anniversary Hall 22–23 October 2012 to highlight the university's internationally recognized 60 year-old research on photosynthetic systems with roots going back to the founding of the modern structure of the University 60 years ago.

Professor Nathan Nelson from Tel Aviv University, Israel (center) and Professor Jian-Ren Shen, Graduate School of Natural Science and Technology, Okayama University (right) answering questions at the public seminar.

Twenty prominent researchers from Japan and other countries described their research on areas including the structures of photosynthetic systems and hydrolytic mechanisms, with junior researchers giving poster presentations.

A public seminar on "Solar Energy and Photosynthesis" was held on 21st October 2012, just before the symposium. Nathan Nelson, professor at Tel Aviv University, Israel, and a global authority on research into photosynthesis, and Jian-Ren Shen, professor at the Graduate School of Natural Science and Technology, Okayama University (whose research was selected as one of the ten scientific "Breakthroughs of the Year 2011" by the US journal Science) both explained the mechanisms underlying photosynthesis and potential artificial applications to members the general public.

This was first international symposium/public seminar held by Okayama University on photosynthesis. The University plans to become an international research hub for research on photosynthesis.

## News

# Okayama University Holds Special Lecture: Higgs Boson—the Last Elementary Particle

Okayama University organized a special lecture on the Higgs boson—known as the 'last elementary particle'—at the 50th Anniversary Hall on 1 August 2012. Theoretical physicists have predicted the existence of 17 elementary particles, including the Higgs boson. Recently, after years of experimental research efforts an international research team based in Europe announced the possibility of the existence of the Higgs boson.

The scene at the Okayama University Special Lecture on the Higgs Boson

This lecture was given by Professor Itsuo Nakano, Director of Research Center of Quantum Universe at Okayama University, and a member of the research team searching for the elusive particle, where he described the significance of the discovery.

Professor Itsuo Nakano gives his presentation

The lecture was attended by about 350 people, including students from Okayama University students, high school students, and members of the general public. Prior to Professor Nakano's lecture, Hirokazu Ishino, an associate professor at the Department of Physics gave a presentation entitled 'Seeking the Secrets of Particle Physics in Space' explanation the types and sizes of particles and why a high energy accelerator is needed to detect them. "Particle physics will lead us to discover the origins of the universe," he said.

In his lecture Professor Nakano started with a general introduction to the Higgs boson—thought to be the origin of mass itself—and then gave a detailed explanation about the structure and operation of the detector he participated in developing as part of the series of experiments performed using the Large Hadron Collider. According to Professor Nakano, "we cannot rest on the laurels of this great discovery." Emphasizing that, "the real research starts now. We need to continue our research into the properties of the new particle and ascertain that it is, in fact, the Higgs boson."

Professor Nakano also had a message for the high school students in attendance: "There are many particles besides Higgs-Boson that remain a mystery to us and the onus is on you to unlock those mysteries in future."

## Feature

# Professor Shunji Sano
# Department of Cardiovascular Surgery, Okayama University Graduate School of Medicine, Dentistry and Pharmaceutical Science:Benchmark for Surgical Treatment of Congenital Heart Disease.

Cardiovascular surgeon Professor Shunji Sano is Deputy Director of Okayama University Hospital and internationally renowned for his contributions to the surgical treatment of congenital heart disease including the 'Sano Procedure' for the hypoplastic left heart syndrome (HLHS)—"A Benchmark for the Surgical Treatment of Congenital Heart Disease".

Professor Shunji Sano

"Breaking my arm when I fell out a tree and the fact that I had a weak body, were two childhood experiences that inspired me to become a doctor," says Professor Sano. "I do not regret my decision. I thoroughly enjoy my work in giving health and hope to children with heart problems."

Professor Shunji Sano in the operating theatre

After graduating from Okayama University Medical School, Professor Sano spent 8 years as a resident at two hospitals in Japan. "During my experience as a cardiovascular surgical resident in Japan, I wanted further experience as a cardiovascular surgeon in an international environment," explains Professor Sano. "So I looked for positions and in 1985, at the age of 32, accepted the post of Senior Fellow, Green Lane Hospital in Auckland, New Zealand. I was privileged to work with Sir Brian Barrett-Boyes, who invited to the hospital after I met him at a conference in Taiwan."

Professor Shunji Sano during a ward round at Okayama University Hospital

Sir Brain was a pioneer of cardiac surgery and one of the most famous cardiovascular surgeons in the world. Professor Sano says that he learnt a lot from Sir Brain and other staff at the hospital. "I experienced about 1400 heart operations during my two years at Green Lane. Much more than I would have been allowed to do at any hospital in Japan."

In 1987 Professor Sano moved to the Royal Children's Hospital at Melbourne University Medical School. "At Melbourne I worked with Roger Mee and his team," explains Professor Sano. "I consider

Roger Mee to be my mentor and a great friend. A short time after arriving, I was made Consultant Cardiac Surgeon and Associate Professor at the hospital. During my stay in Green Lane and Royal Children's, I had a precious experience from Sir Brian and Roger Mee, who were the world's most renowned heart surgeons. I learned a lot from them and made lots of good friends during my oversea training.

Professor Sano returned to Okayama University in late 1990 and two years later was given a full professorship at the age of 40. "I was 13th on the list of candidates for the post," confides Professor Sano. "In 1995, Okayama university became the first cardiovascular surgical unit among the National universities in Japan to perform more than 200 cases in a year."

Professor Sano has maintained his passion for children's heart surgery with more than 7000 operations since his return, which have included innovative surgical procedures such as the total right ventricle exclusion procedure for isolated congestive right ventricle failure. "Since my return to Okayama, I have redesigned the hospital to standards of the foremost hospitals in the world," says Professor Sano. "I have also started research on cardiac regeneration therapy to treat severe congestive heart failure, where the patient's own stem cells are used to generate new heart cells. Also, I am working with Japan's JICA to go to other countries in Asia, such as Vietnam, to treat children with heart problems as well as teaching local surgeons in these countries some of my surgical procedures."

In February 2010, Professor Sano was invited to be the 19th honorary member of German association for Thoracic and cardiovascular surgery. In June 2012 Professor Sano was also invited to give the prestigious 24th Robert E. Gross-Memorial Lecture at the Harvard Medical School, Boston, USA. "I think that the invitation to give these two lectures recognizes the far-reaching contributions made by the medical staff at Okayama University Hospital and the University administrators for their support."

## Research Highlights

# Inflammation and diabetic nephropathy

One of the most challenging issues in clinical nephrology is the relentless and progressive increase in the number of patients with end-stage renal disease (ESRD) worldwide. Among the various kinds of kidney diseases, the impact of diabetic nephropathy on the increasing population of patients with chronic kidney disease (CKD) and ESRD is enormous. Diabetic nephropathy is characterized by the accumulation of extracellular matrix in glomeruli—called exudative— diffuse and nodular lesions. These pathlogical changes are finally followed by glomerulosclerosis and interstitial fibrosis, and in such situations, the patients inevitably undergo dialysis therapies and renal transplantation to survive.

The three major classical pathways in the progression of diabetic nephropathy are (1) the activation of polyol and protein kinase C (PKC) pathways;(2) the formation of advanced glycation end-products; and(3) intraglomerular hypertension induced by glomerular hyperfiltraion. In the upstream of the three pathways, hyperglycemia is the major driving force for progression to end-stage renal diseases from diabetic nephropathy. Downstream of the three major pathways, many researchers are convinced that the inflammation pathways play central roles in the progression of diabetic nephropathy and the identification of inflammatory molecules may lead to the development of therapeutic strategies.

Some of the molecules related to the inflammation pathways in diabetic nephropathy include transcription factors, proinflammatory cytokines, chemokines, adhesion molecules, Toll-like receptors, adipokines, and nuclear receptors, which are candidates for molecular targets for the treatment of diabetic nephropathy.

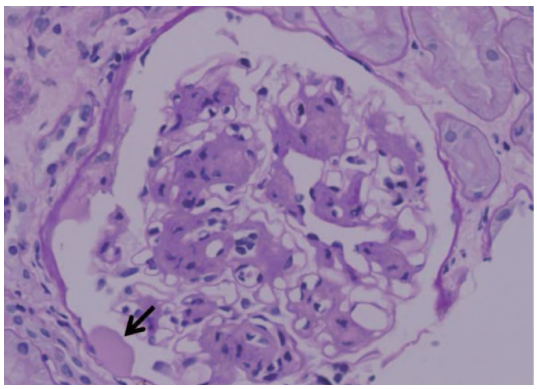


Figure 1 The glomerulus reveals diffuse lesion, i.e. accumulation of extracellular matrix in mesangial area, and exudative lesion (capsular drop; arrow) is seen. (PAS stain)

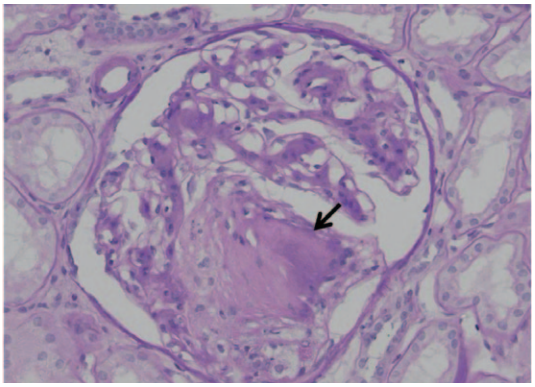


Figure 2 Characteristic nodular lesion is demonstrated in the glomerulus (arrow). (PAS stain)

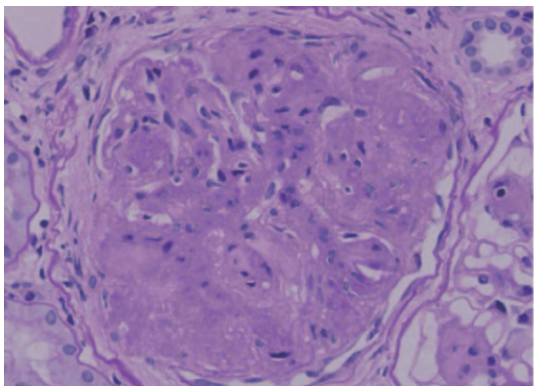


Figure 3 The glomerulus demonstrats global sclerosis, i.e. glomerulosclerosis, and the glomerular capillary structures are not seen. (PAS stain)

Recently, we have focused on elucidating the anti-inflammatory effects of modulators for nuclear receptors. We reported that peroxisome proliferator-activated receptor-γ (PPARγ) agnonist (Diabetes 2006), PPARγ agonist (Diabetes 2011), RXR antagonist (J Pathol 2012), and liver X receptors (LXR) agonist (J Am Soc Nephrol 2012) ameliorated the progression of diabetic nephropathy in rodent models by suppressing inflammatory pathways. We believe that the understanding of molecular pathways of inflammation could be translated into the development of anti-inflammation therapeutic strategies for diabetic nephropathy.

Reference:

• Authors: Jun Wada, Hirofumi Makino
• Title of original paper: Inflammation and the pathogenesis of diabetic nephropathy
• Journal, volume, pages and year: Clin Sci (Lond) 2013 Feb 1;124(3):139-152.
• Digital Object Identifier (DOI): 10.1042/CS20120198
• Affiliations: Department of Medicine and Clinical Science, Okayama University Graduate School of Medicine, Dentistry and Pharmaceutical Sciences, Okayama, Japan.

## Research Highlights

# Identification of new plant activator compounds for sustainable agriculture

Plant activators are chemical compounds that protect crops from diseases in the field by activating the plant's immune system. Unlike pesticides, plant activators are not overcome by drug resistant pathogens, and thus provide durability. Plant activator technology was developed in Japan and is widely used in wet-rice cultivation in East Asia. However, the molecular mechanisms of plant activators remain unclear.

Despite their advantages, the applications of plant activators are still limited due to the lack of appropriate high-throughput screening procedures. Also one of the key problems is that the constitutive activation of immune responses is often associated with arrested growth and reductions in crop yield.

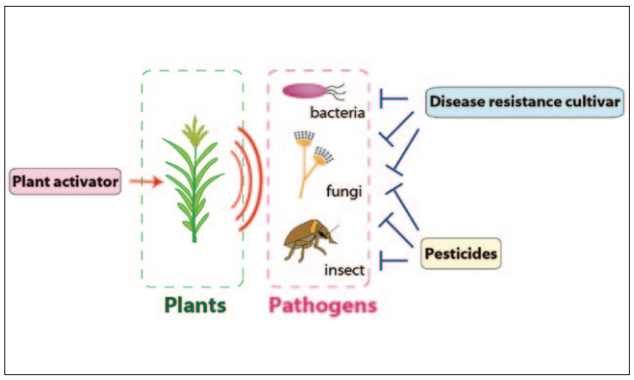
Now, Yoshiteru Noutoshi and colleagues at Okayama University and RIKEN Plant Science Center have established a new screening technique that can distinguish between compounds that induce immune responses on their own, from those that do so exclusively in the presence of a pathogen.

Five compounds—named Imprimatin—were successfully identified from a total of 10,000 compounds and they increased disease resistance in Arabidopsis plants against pathogenic Pseudomonas bacterial by priming immune response without direct induction of defense genes.

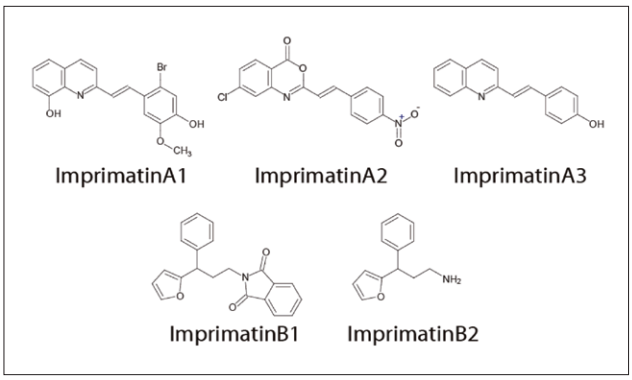
Further investigations revealed that these Imprimatins inhibit two enzymes that inactivate the plant immune hormone salicylic acid (SA glucosyl transferases or SAGTs), and this targeting was confirmed by gene knockout experiments, where plants without these enzymes mimicked the chemically-treated phenotypes and exhibited enhanced disease resistance.

Our results demonstrate the effectiveness of the new screening technique for finding useful plant activators and the power of SA metabolism as a strategy for crop protection.

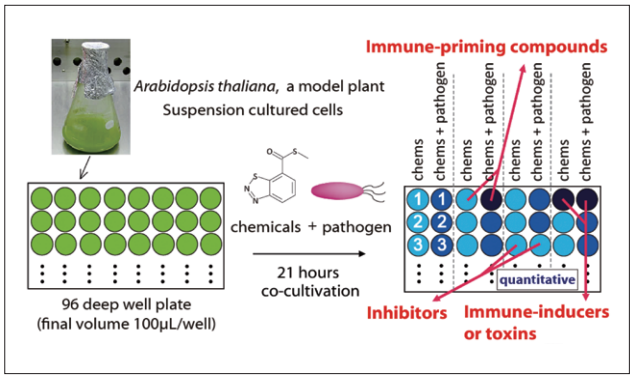
 



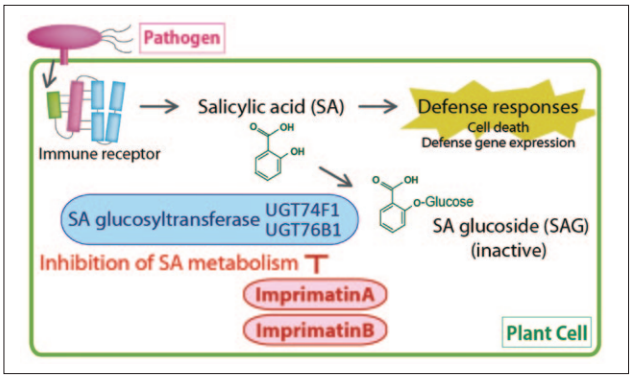

The established original screening method for immune response regulators.




Action point of Imprimatins in immunity signaling in plants




The established original screening method for immune response regulators.




Action point of Imprimatins in immunity signaling in plants

## Reference:


- Authors: Yoshiteru Noutoshi, Masateru Okazaki, Tatsuya Kida, Yuta Nishina, Yoshihiko Morishita, Takumi Ogawa, Hideyuki Suzuki, Daisuke Shibata, Yusuke Jikumaru, Atsushi Hanada, Yuji Kamiya, and Ken Shirasu.
- Title of original paper: Novel plant immune-priming compounds identified via high-throughput chemical screening target salicylic acid glucosyltransferases in Arabidopsis.
- Journal, volume, pages and year: The Plant Cell 24(9), 3795-3804. (2012).
- Digital Object Identifier (DOI): 10.1105/tpc.112.098343
- Affiliations: Research Core for Interdisciplinary Sciences (RCIS), Okayama University, 3-1-1 Tsushima-naka, Kita-ku, Okayama, 700-8530 Japan
- Author website: http://noutoshi-lab.com/english/index_e.html

# Research Highlights

## A new future for an old crop: barley enters the genomics age

First cultivated more than 15,000 years ago, barley is the world's fourth most important cereal crop both in terms of area of cultivation and in quantity of grain produced.

The barley genome is almost twice the size of that of humans and determining the sequence of its DNA has proved to be a major challenge. This is mainly because its genome contains a large proportion of closely related sequences, which are difficult to piece together.

A Japanese team led by Kazuhiro Sato of Okayama University participated in the International Barley Sequencing Consortium (IBSC). They succeeded in producing a high resolution assembly of the majority of barley genes in linear order.

By developing and applying a series of innovative strategies that allowed them to circumvent these difficulties, IBSC describes the location of dynamic regions of the genome that carry genes conferring resistance to diseases. This achievement also highlights the unprecedented detail in the differences (15 million positions) between a range of different barley cultivars. The report provides a detailed overview of the functional portions of the barley genome, revealing the order and structure of its 26,000 genes.

Access to the assembled catalogue of gene sequences will streamline efforts to improve barley production by breeding varieties that are better able to withstand disease and deal with adverse environmental conditions such as drought and heat stress.

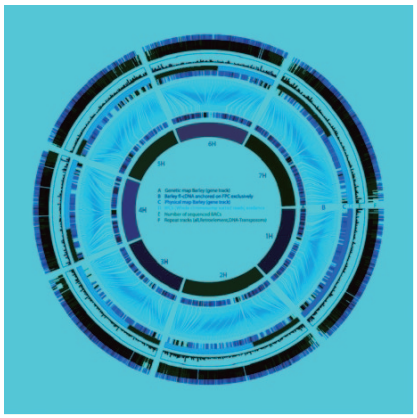


Figure caption: Barley gene space

Figure caption: Haruna Nijo used for gene identification

Figure caption: Haruna Nijo used for gene identification

Reference:


- Authors: The International Barley Sequencing Consortium
- Title of original paper: A physical, genetic and functional sequence assembly of the barley genome.
- Journal, volume, pages and year: Nature (on line)
- Digital Object Identifier (DOI): 10.1038/nature11543
- Affiliations: Institute of Plant Science and Resources, Okayama University
- Department website: http://www.rib.okayama-u.ac.jp

# Research Highlights

## Piezoelectric actuator for cryogenic temperature

Piezoelectric actuators find a wide range of applications in scientific instruments and industrial equipment. This is because piezoelectric actuators can generate large stress, have simple structures and are not significantly affected by external electromagnetic fields.

Certain types of scientific instruments using electromagnetic fields and operating at cryogenic temperatures require small piezoelectric actuators. However, the piezoelectric effect—namely the magnitude of change in the size of the piezoelectric material with applied electric field—is very small atcryogenic temperatures and materials exhibit nonlinear temperature-dependent properties under these conditions. Therefore, it is difficult to use piezoelectric actuators under cryogenic temperature conditions.

Now, Daisuke Yamaguchi, Takefumi Kanda, and Koichi Suzumori at Okayama University have fabricated a piezoelectric actuator operable at cryogenic temperatures.

The actuator is an ultrasonic motor, which is one kind of piezoelectric actuator. The motor consists of a rotor and a vibrating transducer. The structure of the transducer consists of abolt-clamped Langevin-type vibrator, and was designed with evaluating thermal stress on the transducer.

The vibration of the transducer and the rotation generated in the motor were evaluated under cryogenic conditions. The motor was successfully driven in 4.5 K helium gas.

This type of actuator could find applications for scientific and industrial instruments that use electromagnetic field at cryogenic temperature conditions.

Figure caption: Transducer of piezoelectric actuator for cryogenic temperature.

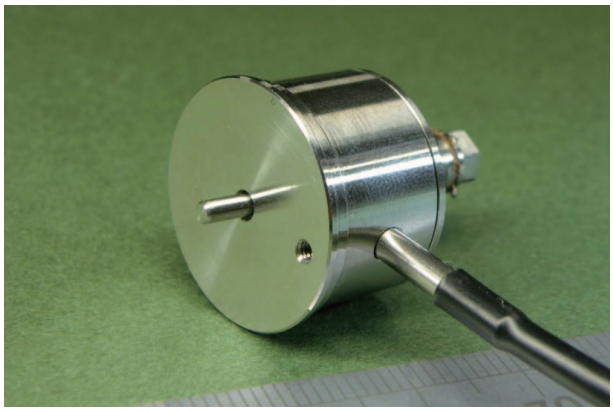


Figure caption: The piezoelectric actuator fabricated for cryogenic temperatures.

Reference:


- Authors: Daisuke Yamaguchi, Takefumi Kanda, and Koichi Suzumori.
- Title of original paper: An ultrasonic motor for cryogenic temperature using bolt-clamped Langevin-type transducer.
- Journal, volume, pages and year: Sensors and Actuators A: Physical 184, 134 (2012).
- Digital Object Identifier (DOI): 10.1016/j.sna.2012.06.024
- Affiliations: Graduate School of Natural Science and Technology, Okayama University, Japan

## Intellectual Property and Enterprise

# The invention of an antibody drug for the treatment of brain infarction

Brain infarction is one of the major causes of death in industrially advanced countries. In ischemic stroke, interruption of blood flow by thrombus or embolus induces neuronal death in the ischemic core as a result of the inability to maintain membrane ion gradients in neurons, excitotoxicity due to elevated glutamate levels, and disruption of the blood-brain barrier. A diversity of neuroprotective candidate drugs targeting varieties of factors associated with ischemic insult have been subjected to preclinical and clinical studies. Despite these extensive efforts, an effective therapy has not yet been successfully established.

High mobility group box-1 (HMGB1), originally identified as an architectural nuclear protein, exhibits an inflammatory cytokine-like activity in the extracellular space. HMGB1 was reported to be released from necrotic cells. Therefore, it was hypothesized that this factor may be released from plural types of cells in the brain during ischemic insult leading to facilitation of inflammatory response and that the regulation of the activity of HMGB1 may produce a beneficial effect on brain tissue. Three rat monoclonal antibodies (mAb) against bovine HMGB1 were raised and characterized. One clone (#10-22) recognized C-terminal sequence of HMGB1 protein.

Treatment with this neutralizing mAb remarkably ameliorated brain infarction induced by 2-h occlusion of the middle cerebral artery in rats, even when the mAb was administered after the start of reperfusion (Fig. 1). Consistent with 90 % reduction in infarct size, the accompanying neurological deficits in locomotor function were significantly improved. Notably, anti-HMGB1 mAb protected the structure of blood-brain barrier and inhibited the increased permeability of the blood-brain barrier. Moreover, the mAb suppressed the brain edema induced by traumatic brain injury (Fig.2). This invention for neutralizing anti-HMGB1 mAb provides a novel therapeutic strategy for ischemic stroke and traumatic brain injury.

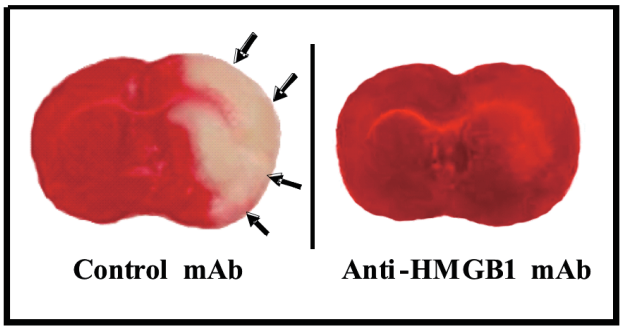



Fig. 1. Arrows indicate infarct area induced by MCAO.

Fig. 1. Arrows indicate infarct area induced by MCMO.

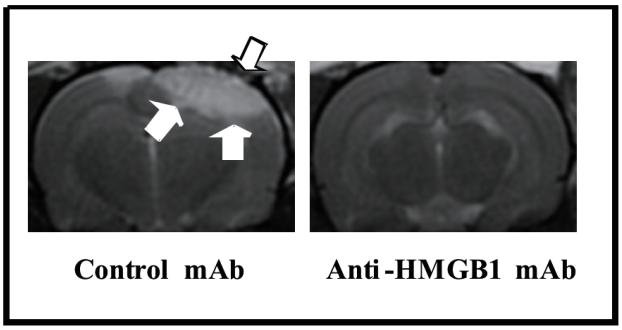



Fig. 2. Arrows indicate edematous area induced by traumatic brain injury.

Fig. 2. Arrows indicate edematous area induced by traumatic brain injury.

## Further information:

Invention: Brain infarction inhibitor

Patent number: PCT/JP2006/320436, WO2007/049468 A1.

Inventors: Masahiro Nishibori, Shuji Mori, Hideo Takahashi, Yasuko Tomono, Naoto Adachi, Keyue Liu

Affiliation: Okayama University, Okayama, Japan.

# Topics : Letters from alumni


## Nguyen Quang Co
## Doctoral student at the Division of Agricultural and Life Science, Graduate School of Environmental and Life Science, Okayama University


I hold a Master's degree from Okayama University, Japan, having studied in the Plant Production Science laboratory from April 2011 to March 2012. Following this, I began studying for my PhD at the Graduate School of Environmental and Life Science at Okayama.

Nguyen Quang Co (right)

After graduating with my undergraduate degree from Hue University of Agriculture and Forestry in Vietnam, I decided I would like to continue studying and work abroad. I had heard about the International Master's Program in Sustainability of Rural and Environmental Systems, established as a collaboration between Okayama University and Hue University in 2007. Eight students are selected each year to study at Hue University for 18 months, followed by one year studying at Okayama University. Each graduate from the program receives a certificate from Okayama University. I am proud to be a member of the Okayama – Hue Program.

Okayama University creates many great opportunities for studying and researching. The teaching method is "learning by doing" which helps students gain a deep understanding of both theory and practice. In my laboratory, as well as the challenging classes, weekly seminars and progress reports are also very important. These focus on developing strong research methods, and require us to spend a lot of time sourcing and reading materials before completing reports and participating in discussions. I have had many chances to study and conduct experiments with students and teachers in the laboratory of Plant Production Science. This has helped me immensely, with teachers and others guiding me and allowing me to take part in many discussions. Their suggestions and advice have led me to complete my Master's thesis, and grow not only as an academic but also as a person.

Last but not least, I sincerely hope that the International Master's Program in Sustainability of Rural and Environmental Systems continues to develop and generate even more opportunities for students to study and collaborate with others in the same academic field.

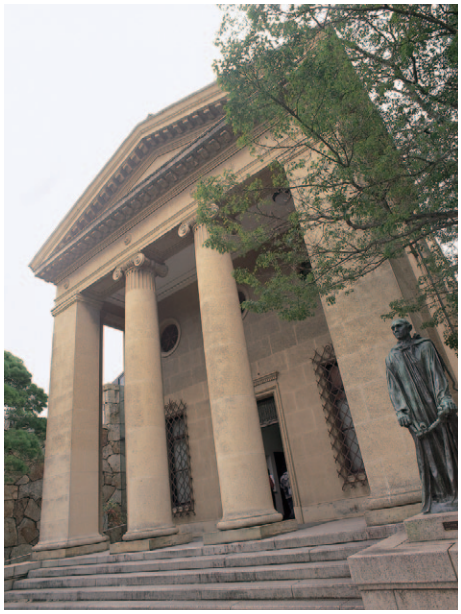
# Topics : Okayama Travelogue

## Kurashiki: Time slip to an era of monochrome storehouses, weeping willows, and stone bridges

Okayama University is located a few kilometers from Kurashiki—a town of exquisitely preserved white-walled-black tiled storehouses sharing the banks of a canal with weeping willows, mills, and shops. Kurashiki—literally translated 'town of storehouses'—had its heyday in the Edo era (1603–1867) as a rice distribution center, and later in textiles during the Meiji era in the late 1800s.

The Bikan area is of the focal point of old-Kurashiki with its rows of stunningly preserved black and white warehouses, which have been converted to shops, traditional Japanese restaurants, and museums. One particular place to visit during a stroll through Kurashiki is the Ohara Museum of Art—opened in 1930 by Kurashiki entrepreneur Magosaburo Ohara, as Japan's first museum displaying western art.

Okayama University students are admitted free.



The entrance to the Ohara Museum of Art

Iconic Kurashiki with a monochrome warehouse, weeping willows, and a stone bridge.

Further information:

Official website of Kurashiki City:http://www.city.kurashiki.okayama.jp/

Ohara Museum of Art:http://www.ohara.or.jp/200707/eng/menu.html

# Topics : Club Activities

## Okayama University Dance Club: Contemporary dance with a hint of ballet

"Many of the students in the Okayama University Dance Club have strong personalities and want to express their inner emotions via dance," says club captain Shizuka Imai. "Our performances of contemporary dance have their roots in ballet."

Shizuka Imai, captain of the Okayama University Dance Club

The club was established 50 years ago and currently has 14 members. "Quite coincidently, we have equal numbers of male and female members," explains Shizuka. "We meet four times a weeks to do muscle and general body training in addition to practicing moves for new dance routines for competitions and other such performances."

The Club is known for its unique, sometimes unconventional dance steps, and original accompanying music produced in collaboration with local musicians.

Members of the Okayama University Dance Club after being awarded the Special Prize at the All Japan Festival.

" Our members from many different departments at Okayama University," says Shizuka. " I am a third year at the Department of Education. The club members have strong personalities, which leads to lively discussions about dance routines. I guess our club is for people who want to dance but cannot do ballet!"

Club members are now busy preparing for a major national dance completion that will be held in May 2013. "We have produced many videos of our performances that can be found on the web," says Shizuka. "Check them out!"

Okayama University Dance Club website:
http://www.veengle.com/s/%E5%B2%A1%E5%B1%B1%E5%A4%A7%E5%AD%A6%E3%83%80%E3%83%B3%E3%82%B9%E9%83%A8.html