

# NTU



## NEWSLETTER

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### Scientific Knowledge Leads to More Respect for Nature

New European Union Center  
Azalea Festival Multicultural  
NTU Contributes to Life-Long Learning

**Special Report**  
Int'l Scholars visits NTU



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APRIL 2009 / NO.11

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## NTU AT A GLANCE

2009 Azalea Festival Spotlights Integration of Science and Humanities, Cross-Cultural Encounters



# NTU Discusses Cooperation with Palau's President Toribiong During His Visit in February



Dean of International Affairs Tung Shen (far left) poses for a group photo with the Palauan presidential delegation as they listen to a performance of classical Chinese music outside of the NTU Smart House.

The President of the Republic of Palau, Johnson Toribiong, paid a visit to NTU on February 23 as part of his six-day official state visit to Taiwan, February 22 to 27. At the invitation of the Taiwan government, Toribiong headed a 13-member delegation, which included Palau's first lady, Valeria Toribiong.

The delegation first attended two specially-arranged briefings on recent developments at NTU, after which NTU President Si-chen Lee formally welcomed President Toribiong at the Gallery of NTU History. Palau's president was escorted for the entirety of his visit here by NTU Vice President Ming-je Tang and Dean Tung Shen of the Office of International Affairs. Ministry of Foreign Affairs Amb. Matthew S. Lee, Chief of Protocol, and Taiwan's ambassador to Palau, Amb. Maggie Tien, also accompanied the delegation during its visit.

Palauan Princess Uroi Ngerdokou Salii, who currently attends NTU as a non-degree student, also accompanied the delegation during its visit to NTU. Princess Salii is preparing to apply for admission to NTU's Global MBA Program in the fall.

At the NTU Smart House, an experimental ecologically-designed building, Dean Bao-ji Chen of the College of Bioresources and Agriculture reported to the delegation on Taiwan's research projects on the tropical fruit plant noni (*Morinda citrifolia*), fisheries restoration, as well as the Smart House itself.

Dean Shen, together with Prof. Yanwing Leung of NTU's advisory committee, later briefed the delegation on developments in international affairs at NTU and welcomed Palauan students to come to NTU to pursue their advanced education. Noting that Palau has abundant natural resources, they said that the university would welcome cooperation on research related to Palau's development, adding that NTU could organize NTU student volunteer groups to serve in Palau during summer vacations which would also provide the students the chance to experience Palau first hand.



Palauan President Johnson Toribiong leaves an imprint of his hand along with his signature at the NTU Smart House.



NTU Vice President of Finance Ming-je Tang offers his welcoming remarks to the Palauan presidential delegation.

Following the briefings, the delegation was escorted by motorcade to the Gallery of NTU History for an official welcoming tea party hosted by Pres. Lee. In his welcoming remarks, Pres. Lee stated that he cherished the friendship between the two nations and looked forward to further academic cooperation between the allies. President Toribiong presented a speech expressing his gratitude to the university for providing Princess Salii with such a complete learning environment and affirming his great expectations for future exchanges.

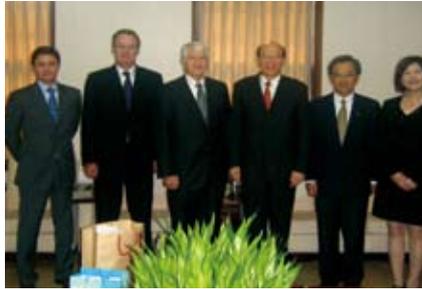
The visit further consolidated the friendship between Taiwan and Palau while also opening the door to future cooperation with the nations of Oceania.



# UCLA Chancellor Gene Block Visits NTU in February



UCLA Chancellor Gene Block (left) speaks with NTU President Si-chen Lee during their meeting.



UCLA and NTU officials pose for a group photo.



Chancellor Block presents President Lee with a gift to mark their meeting.

University of California, Los Angeles Chancellor Gene Block visited NTU on February 19 to discuss possible future collaboration plans between NTU and UCLA.

Chancellor Block was accompanied by UCLA Vice Provost and Dean of the UCLA International Institute Prof. Nicholas Entrikin and Executive Director of External Affairs (UCLA International Institute) Mr. John Peralta. This visit was, in part, suggested by Vice Provost Entrikin to Chancellor Block after his recent visit to NTU in December 2008. Vice Provost Entrikin said he saw "the need of collaboration" between UCLA and NTU after his previous visit to NTU with Dean Judy Olian of the UCLA Anderson School of Management and Executive Director Peralta.

During Chancellor Block's meeting with NTU President Dr. Si-chen Lee, the two leaders of these elite Pacific-region universities discussed many possible avenues for collaboration. For one, the universities agreed to focus on research collaboration and the exchange of graduate

students and research faculty. Dean Ji-wang Chern of the NTU Office of Research and Development and Dean Tung Shen of the Office of International Affairs joined President Lee in presenting a report on NTU's on-going research and international developments.

NTU faculty currently includes 46 UCLA alumni who received their highest degrees at UCLA. The College of Science and the College of Electrical Engineering have the most UCLA alumni (12 and 8, respectively) serving on their faculty. Both President Lee and Chancellor Block expressed awe at the large number of UCLA alumni at NTU, and noted that more collaboration plans could arise from these professors because they not only excel in their disciplines but are familiar with the programs and strengths of both UCLA and NTU.

In concluding the meeting, Chancellor Block and President Lee spoke about the importance of international alumni and about ways of increasing communication between universities.

## European Union Center in Taiwan to be Inaugurated at NTU in May

The European Union Center in Taiwan will be inaugurated at NTU's Xuzhou Road campus on May 18. NTU, representing a consortium of local universities, signed an agreement with the European Commission to establish the center on December 31, 2008. The EUTW will be the fourth EU center in East Asia, after Japan, South Korea and Singapore. The local university consortium is composed of NTU, National Cheng

Chi University, Fu-Jen Catholic University, Tamkang University, National Chung Hsing University, National Sun Yat Sen University and National Dong Hwa University, and represents over 120,000 students and 5,000 faculty members.

The EUTW will require an estimated budget of €1,509,360 (Approx. NT\$ 66,411,840) from 2009 to



# NTU Cosmology and Particle Astrophysics Center Seeks to Understand Universe

The Leung Center for Cosmology and Particle Astrophysics was founded with an NT\$205 million (approximately US\$6 million) donation from Chee-chun Leung, co-founder and vice president of Taiwan's Quanta Computers in November 2007. The center's goal is to contribute to the understanding of the origin, composition and evolution of the universe.

LeCosPA supports four projects: ANITA, NuTel, the NTU Array and TELIS. ANITA is a Taiwan-US-UK collaboration that aims to detect the first cosmogenic ultra-high energy neutrino in Antarctica. NuTel is a neutrino telescope based on a different detection mechanism that looks for the Cherenkov light from air showers generated by the conversion of the cosmic tau-neutrino into the tau-lepton in a mountain. The NTU Array project, located in Nevada, studies the cosmic microwave background, the remnant of the Big Bang that provides critical information concerning the early universe. TELIS is an infrared telescope searching for the interstellar medium within our galaxy. TELIS is located in Tibet, but can be operated for remote observation from NTU. LeCosPA also currently runs five working groups that focus on some of the most critical theoretical topics in cosmology and particle astrophysics: cosmic neutrinos, dark matter, dark energy, large scale structure formation, and galactic dynamics and evolution.

LeCosPA is currently formulating collaboration



Mr. Chee-chun Leung (left, seated) and NTU President Si-chen Lee (right, seated) sign the LeCosPA Donation Contract as they are watched by (from left to right) Department of Physics Chairman Yee Bob Hsiung, NTU Vice President of Finance Ming-je Tang, Mrs. Leung, NTU Vice President of Academics Tai-jeen George Chen, LeCosPA Director Pisin Chen and Ceremony Chairman Pauchy W. Y. Hwang.

agreements with the Kavli Institute for Particle Astrophysics and Cosmology at Stanford University and the Institute for Physics and Mathematics at the University of Tokyo. It is also pursuing partnerships with institutions in China and Europe.

The center presently employs 20 fellows, about two-thirds of whom are from NTU, while others are adjunct fellows recruited from other leading institutions in Taiwan. Its merit-based "Distinguished Junior Fellows Program," with internationally competitive salaries, has succeeded in attracting some of the best young scholars in the world to Taiwan.

2012. One-third of the funding will be provided by the university consortium while the remainder will come from the European Commission. This funding will permit the EUTW to set up EU study areas in university libraries, an EU policy forum, EUTW fellowships and scholarships and an EUTW website, the organization of international symposiums and conferences related to the EU, summer-school programs for EU studies, EU study programs and a national workshop on EU policy.

The new center will boost EU policy research in Taiwan,

deepen EU studies in all academic fields, strengthen people-to-people and academic links between Taiwan and the EU, and integrate Taiwan's universities into the network of EU centers around the world.

NTU is the best equipped university in Taiwan to host the EUTW. In 2004, she established a "Certificate of European Studies Program" as well as the Jean Monnet Module on EU Studies. The European Study Center was established under the Department of Political Science in 2005.



# NTU Offers Free Professional Courses to Benefit Unemployed and Those on Unpaid Leave

**N**TU, in coordination with the nationwide effort to revitalize the economy and reduce unemployment, has launched two continuing education programs deigned specifically to benefit people who are currently unemployed or on temporary unpaid leave. One program is called the "Professional Skills and Knowledge Upgrading Program," while the other is a selection of 11 on-line management courses. The university has created these opportunities for continuing professional education to allow people who are temporarily deprived of their salaries to make good use of their downtime by developing their professional competitiveness. This new initiative is expected to help over ten thousand people.

A wide range of courses has been offered through the professional skills program including, among others, electrical engineering and information science, engineering, management, law, social sciences and literature.

As management skills are in high demand in all professions, the School of Professional and Continuing Studies collaborated with Chunghwa Telecom to set up an on-line platform management courses and increase the number of management courses provided through synchronous cybercasting. Students can choose from 11 major management courses, including economics, introduction to management science, financial report analysis, management statistics, management accounting, marketing management, entrepreneurship and innovation management, international business administration, investment science, financial management and strategy management. By offering these courses on line, the university permits students attend classes free from the constraints of time and location. The courses last from seven to 34 hours, and all courses are recorded on video by full-time faculty at NTU's College of Management.



NTU Vice President of Finance Ming-je Tang speaks about the university's free courses for professionals that are unemployed or on unpaid leave.

The university has hired teaching assistants to enhance the teaching quality of these courses. Teaching assistants will provide tutoring help on line to the students who encounter problems. Enrollment in these courses has been limited to 100 students per course.

No academic credits will be offered for these free courses, and, while an NT\$2,000 deposit is required for each course, deposits will be refunded in full when students finish their courses and earn their learning certificates.

The deadline for the submission of applications for the "Professional Skills and Knowledge Upgrading Program" was February 22, while the deadline for the on-line management courses was March 15. For more information, please call (02) 2362-0502 or visit <http://training.dpd.ntu.edu.tw>, where program guides and application forms can be downloaded.

In addition to these free courses, NTU also offers courses in such fields as electrical engineering and information science, engineering sciences, law, social sciences and literature to the general public. These courses include both undergraduate and master's level classes, and a 10% quota is reserved for outside registration.



## NSC Names Ten NTU Professors Recipients of 2008 Outstanding Research Award in March

The National Science Council announced the recipients of the 2008 National Science Council Outstanding Research Award in March, naming ten NTU professors as winners of this prestigious award. The recognition thus bestowed on these eminent intellectuals reflects on not only their research achievements but also the quality of the academic environment here at NTU. Furthermore, this

marks yet another year in which NTU leads all other local academic institutions in the number of professors receiving this award.

NTU's recipients of the 2008 NSC Outstanding Research Award are: Prof. Feng-wu Chou (Department of Chinese Literature), Prof. Chun-hsien Chen (Department of Chemistry), Associate Prof. Sheng-hsien Chiu (Department of Chemistry),

Associate Prof. Yih-min Wu (Department of Geosciences), Prof. Shu-chun Teng (Department of Microbiology), Prof. Fu-chun Wu (Department of Environmental Systems Engineering), Prof. Shey-shi Lu (Institute of Electronics Engineering), Prof. Homer Chen (Institute of Communication Engineering), Prof. Chung-wu Chen (Department of Law) and Prof. Tzu-ming Pan (Institute of Microbiology and Biochemistry).

## Nanoparticle Applications Pioneer Prof. Ping-hei Chen Named ASME Fellow in 2009

The American Society of Mechanical Engineers has named Prof. Ping-hei Chen, a distinguished professor in the Department of Mechanical Engineering, to its Class of 2009 of ASME fellows. The Society elected Prof. Chen as a fellow in recognition of his innovative research achievements in nanofluids, biosensors and thermal sensors, and inkjet printheads. In its profile on Prof. Chen, ASME affirms that he is "a pioneer in research areas for engineering applications of nanoparticles" and has "developed several novel devices, including miniature heat pipes, sensors, a real-time PCR [polymerase chain reaction] machine and biochips for detection of biomolecules."

Upon receiving his Ph.D. at the University of Minnesota and returning to Taiwan to teach at NTU in 1988, Prof. Chen researched mainly thermal energy.

Subsequently, he became interested in MEMS (microelectromechanical systems), particularly regarding the development of sensors. In recent years, he has focused on the integration of biochips and medical devices. Prof. Chen and his research team successfully applied integrated CMOS (complementary metal-oxide-semiconductor) and MEMS technology to make biochips with signal amplification for detecting DNA. This integrated technology offered enhanced volume, precision and convenience for biomolecular detection platforms. Prof. Chen's research team is one of the few such teams in the world capable of integrating CMOS and MEMS production processes to manufacture biomolecular sensors.

Prof. Chen has received numerous important awards in Taiwan as well, including the National Science Council's Outstanding Research Award. He has published over 90 journal



Prof. Ping-hei Chen

articles and presented more than 40 international conference papers on engineering applications related to his research. Prof. Chen also holds ten patents.

Three other NTU professors also are ASME fellows: Prof. Chien-ching Ma of the Department of Mechanical Engineering and Prof. Tsung-tsong Wu and Prof. Lee Chih-kung of the Institute of Applied Mechanics. ASME accepts nominations of members to be elected fellows four times a year and limits fellows to one-thousandth of total ASME membership.

## Department of Chemistry's Prof. Yu Wang Wins L'Oreal Taiwan's Outstanding Women in Science Award for 2009

L'Oreal Taiwan announced that Prof. Yu Wang, a distinguished professor in the Department of Chemistry, was the winner of its Outstanding Women in Science Award for 2009. Prof. Wang has focused her research on electron density distribution, chemical bonding, the electronic structure of metal ions and X-ray crystallography. The presentation ceremony was held on January 19 and officiated by Dr. Chao-han Liu, Vice President of Academia Sinica and also Chairman of the Wu Chien-shiung Education Foundation. Former President of Academia Sinica Dr. Yuan-Tseh Lee and Chairman of the National League of Women Mrs. Cecilia Yen Koo were also present. Event organizers arranged for female high school students to have the opportunity to speak with Prof. Wang with the hope of stirring their interest in science.

L'Oreal Taiwan initiated the Outstanding Women in Science Award in 2008 for the explicit purpose of recognizing and rewarding women scientists' contributions to Taiwanese society. The Wu Chien-shiung Education Foundation is responsible for reviewing the candidates. Starting this year, the award is fully sponsored by the National League of Women, organized by the Wu Chien-shiung Education Foundation and the National League of Women, and co-organized by L'Oreal Taiwan.

Prof. Wang graduated from NTU's Department of Chemistry in 1966 and earned her Ph.D. from the University of Illinois, specializing in crystallography, in 1973. In 1979, she returned to NTU to teach in the Department of Chemistry, where she has remained for thirty years.

In addition to earning numerous national science awards over the course of her



Prof. Yu Wang

exceptional career, Prof. Wang is also known for her administrative skills. She became the first female dean of NTU's College of Science, the first female director of the Department of Natural Science and Mathematics at the National Science Council and she served as the president of both Taiwan's Crystallographic Society and the Asia Crystallographic Association.

The goal of the Outstanding Women in Science Award is to recognize and reward Taiwanese women scientists' efforts in scientific research and their contributions, carry forward Dr. Wu Chien-shiung's legacy in 20<sup>th</sup> century scientific research, and, by setting examples of outstanding women scientists, to encourage young female students to pursue scientific research as their lifelong careers. Moreover, the award aims to elevate the reputation of Taiwan's woman scientists in international academia, and to spur international academic exchanges. Winners are to be selected from among women scientists who have made outstanding achievements in the areas of the life sciences or the physical sciences (in even and odd years respectively) and who have made remarkable contributions to the scientific progress of Taiwan. As 2009 is an odd year, the winner was selected from the physical sciences category.



# OIA Conducts International Cooperation and Exchange Forum with Germany in February

In order to promote exchanges and cooperation between NTU and universities in Germany, the Office of International Affairs conducted the "Germany-NTU In-Depth Exchange Forum" on February 25, which attracted dozens of faculty and students from a broad range of the university's departments and administration branches. The forum included briefings, information about scholarship programs and discussions of issues and opportunities for experience sharing, all of which spurred the lively participation of attendees and presenters alike.

The Office of International Affairs plays an active role in expanding relations between NTU and academic institutions in Germany as part of its mission to assist NTU in internationalizing its academic programs and campus. NTU enjoys partner-university relations with 18 German universities, including Heidelberg University, the Free University of Berlin and the Technical University of Munich. NTU has also established ten programs for the exchange of faculty and student with its partner universities.

Dean Tung Shen of the Office of International Affairs led the forum and presented an introduction of current exchanges between NTU and German universities. Dr. Stefan Rummel, director of the German Academic Exchange



Dean of International Affairs Tung Shen (left) speaks as Dr. Stefan Rummel (right), director of the German Academic Exchange Service, listens during the "Germany-NTU In-Depth Exchange Forum" on February 25.

Service, reported on the exchange service's activities and financial support programs. Dr. Rummel spoke about information provided on the German Academic Exchange Service website, scholarships for university summer-term courses, financial support for research and study conducted by former recipients of the exchange service's scholarships after they have returned to Germany, as well as other programs between NTU and Germany. He also offered NTU students advice on studying at German universities during the forum. In addition, professors from the College of Liberal Arts, College of Engineering, College of Bioresources and Agriculture and College of Life Science shared their experiences of studying in Germany and

discussed their academic and research cooperation projects with German academics.

The Office of International Affairs is planning to hold a series of in-depth international cooperation and exchange forums similar to the "Germany-NTU In-Depth Exchange Forum." In addition to arranging such meaningful activities, the Office of International Affairs provides up-to-date information on international affairs at NTU on its website for the convenience of students, faculty and staff. The Office of International Affairs invites interested students and faculty to take the time to visit its website and participate actively in its future international cooperation and exchange forums.



# International Events Turn 2009 NTU Azalea Festival into Multicultural Wonderland



An artistic invitation was designed for the opening ceremony of NTU's Global Lounge, called "Alice in the Wonderland."



NTU's annual Azalea Festival blossomed anew in March, when the warming weather stirs NTU's signature flowers from their frosty winter slumbers. The 2009 NTU Azalea Festival officially commenced on March 7, with a speech by President Si-chen Lee and performances by the NTU Affiliated Kindergarten and various NTU student clubs.

This year's festival had two themes—integration of science and the humanities, and cross-cultural encounters. Under the heading of cross-cultural encounters, International Week was organized. Titled "Alice in the Wonderland" to reflect the many wonderful events to happen at NTU during the festival, International Week included performances by the university's international students and other international theme activities.

NTU's Nepali students were one of the groups performing on opening day. The Nepalese,

the official name of the Nepali students' band, put on such a lively show that they were invited to perform in Lu Ming Square on March 11 as one of the arts events of the festival.

This year, International Week formally kicked off with the opening of the NTU Global Lounge on March 21. The NTU Global Lounge is jointly operated by the Office of International Affairs and the Office of Student Affairs. Located on the third floor of the university's Second Student Activity Center, the Lounge will be used as a venue for cross-cultural events for both students and faculty. Other "Alice in the Wonderland" cultural events included an international food fair, a movie night, a karaoke contest and an international night.

African Culture Night stood out as one of the most exciting international events during the 2009 Azalea Festival. Organized by NTU's African students, this

event was intended to display the diversity of African cultural expression and provide an opportunity for Africans in Taiwan to get to know each other. The night featured an African drum performance by a Pan-African drum group, African choreography, Ussua dance, a traditional Gambian musical dance game (Yusuph Touray), traditional dance of Swaziland, an African fashion show, and an African food and drink exhibition.

The Nepalese, NTU's Nepali students' band, put on an energetic performance during this year's Azalea Festival.





## NASA's JPL Features NTU Study on How Pre-Existing Warm Ocean Water Fueled Deadly Cyclone Nargis

Claiming more than 130,000 lives, cyclone Nargis (2008) was the most devastating cyclone on earth in recent years (Fig. c). New results from Lin et al. (GRL Feb. 2009) found that due to the presence of pre-existing warm ocean feature (as observed by satellite altimeters, Fig. a), Nargis rapidly intensified (RI) from a weak category-1 cyclone to an intense category-4 cyclone within 24h (06Z 1 May to 06Z 2 May, Fig.b). As the RI took place just prior to landfall, the impact was catastrophic (Fig. d).

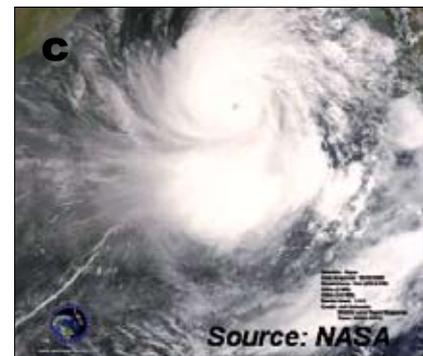
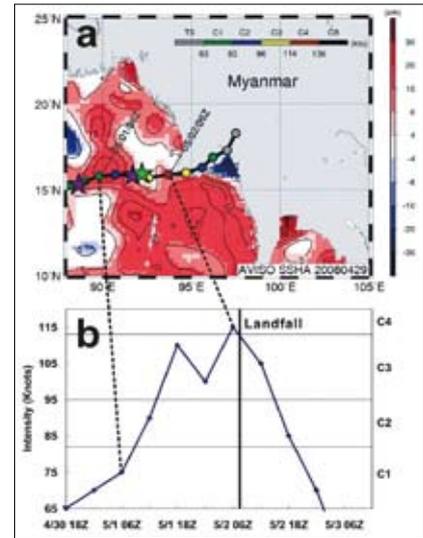
On its official website (Feb. 26), the National Aeronautics and Space Administration's Jet Propulsion Laboratory featured a recent NTU-NASA study on the anomalous pre-existing warm ocean water condition that led to the sudden intensification of cyclone Nargis just before it hit land with massive deadly results for the people of Myanmar on May 2, 2008. Undertaken by four scientists from NTU's Department of Atmospheric Sciences and one from JPL, the study makes important contributions to the monitoring and forecasting of tropical cyclones. The JPL news report led to subsequent reports in *Science Daily*, *USA Today* and other media outlets.

The study findings were presented in the article, "Warm Ocean Anomaly, Air Sea Fluxes, and the Rapid Intensification of Tropical Cyclone Nargis," in *Geophysical Research Letters* (Feb.'09) (36, L03817, doi:10.1029/2008GL035815). The lead writer was I-I Lin, NTU, Department of Atmospheric Sciences, with co-authors Chi-hong Chen, lam-fei Pun and Chun-chieh Wu, also of her department, and W. Timothy Liu of JPL.

The paper examines the role played by a pre-existing warm ocean water anomaly in the Indian Ocean in the sudden intensification

of cyclone Nargis. On May 1, 2008, Nargis was observed to intensify suddenly from a relatively weak storm (category-1) to an intense category-4 storm in just a 24 hour period. Landfall occurred immediately after the cyclone reached its peak strength, devastating Myanmar with a death toll exceeding 130,000 as well as causing other catastrophic social and economic losses.

The study relied on satellite altimetry data from NASA, recently-available in situ Argo floats data from the United State's National Oceanic and Atmospheric Administration, and numerical modeling. Lin and her team found that an abnormally deep sub-surface ocean warm layer that extended to a depth of 73 to 101 meters had formed in the Bay of Bengal about a month prior to the cyclone and that the presence of this anomaly prevented deeper ocean cold water from mixing with and cooling the surface water. Cyclones typically draw deep cold water to the surface as they develop, a process that acts as a negative feedback system on cyclones by reducing the availability of heat energy. Tragically, in the case of Nargis, this thick layer of warm water increased the energy available to the cyclone by 300% and fueled its rapid intensification.



The NASA news report quotes co-author Tim Liu as saying, "This research demonstrates a significant potential benefit of using altimeter data for operational weather forecasting and tropical cyclone intensity predictions."

The NASA article can be viewed in full at [http://www.nasa.gov/mission\\_pages/hurricanes/archives/2009/nargis\\_study.html](http://www.nasa.gov/mission_pages/hurricanes/archives/2009/nargis_study.html).



# Meteorologists Observe Mesoscale Convective Systems that Cause Torrential Rains During Plum Rains

An obviously increasing trend of torrential rains in Taiwan has emerged in recent years. The frequency of extreme downpours in which hourly rainfall exceeds 100 millimeters has also greatly increased, particularly during periods with prevailing southwesterly air currents. The region comprising Tainan County, Kaohsiung County and Pingtung County has experienced a relatively high frequency of torrential downpours. These types of environmental changes not only make the job of weather forecasting more

6,000 personnel from seven countries.

The experiment's atmospheric sounding observations included measurements of atmospheric pressure, temperature and horizontal wind direction and speed in the troposphere (the layer of the earth's atmosphere from the surface of the earth to 15 kilometers in altitude). The soundings collected in this experiment are divided into three types based on the location of the release platforms:



A map showing the extent of the area covered by atmospheric soundings during NTU's "The Rainchasing Experiment."

difficult; they create enormous pressure for the need to adjust disaster prevention and rescue measures.

This study of southwesterly air currents was named "The Rainchasing Experiment." It was designed to gain a better understanding of the process of rainfall so as to be able to forecast rainfall volumes more accurately. Every year, during Taiwan's Plum Rains (which occur during May and June), the warm and humid southwesterly air currents on the interiors of the south sides of storm fronts easily generate mesoscale convective systems, which are the primary weather systems behind the creation of heavy rainfall. Since these storms arise suddenly, the distribution of experimental resources is the greatest challenge for our researchers at this stage. "The Rainchasing Experiment" carried out the concentrated sea, land and atmospheric collection of weather data about these mesoscale convective systems. Using weather balloons and radar as its main meteorological instruments, the experiment took place over 42 days from May 15 to June 25, 2008. The project covered an area including the Taiwan Strait, the northern part of the South China Sea, Tainan County, Kaohsiung County and Pingtung County, and enjoyed the participation of approximately

■ **Ground-released soundings:** The Central Weather Bureau, Air Force Weather Wing and National Science Council helped by increasing the number of sounding stations in coastal and mountain regions. This type of sounding method relies on unmanned balloons released from fixed ground-based stations.

■ **Ship-released soundings:** The ROC Navy and Air Force both provided ships and meteorology instruments, while students participating in the experiment were responsible for releasing the balloons; one was released at a southern location and one at a northern location.

■ **Aircraft soundings:** With budgetary support from the Central Weather Bureau, airplanes were piloted deep into mesoscale convective systems to allow researchers to drag sounding probes. These soundings were conducted in the northern part of the South China Sea.

"The Rainchasing Experiment's" initial results include:

■ Using aircraft soundings in the northern part of the South China Sea, the researchers observed for the first time mesoscale vortex disturbances concealed in the southwesterly air currents during the early part of the summer monsoon. These disturbances are among the main causes of heavy rainfall.

■ Using a highly precise and sensitive radar system, the experiment observed for the first time a marine boundary layer air current convergence zone near the coast. Such zones facilitate the development of shallow cumulus cloud zones in marine boundary layers, and may be signs of the formation of organized heavy rain systems near coastal areas.

■ Taking advantage of multiple dual polarimetric Doppler radar systems to observe torrential rain

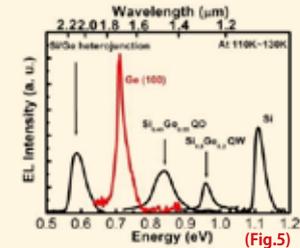
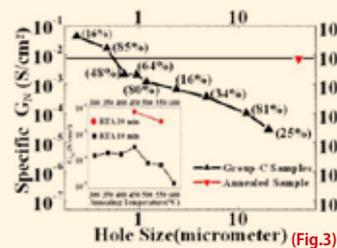
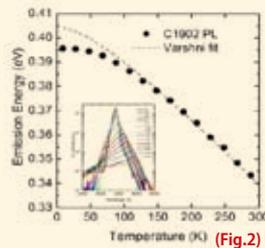
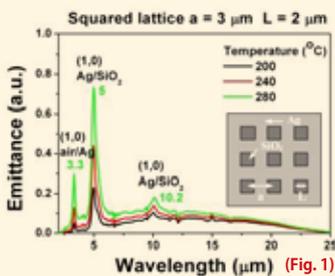


weather for the first time in Taiwan, the researchers tracked rainfall, motion, and the distribution of hydrometeor particles within mesoscale convective systems. The experiment achieved a complete sampling and collection of data that can be used to comprehend better the reasons torrential downpours occur and how they change.

■ The experiment established the first comprehensive "super" rainfall measurement network in Taiwan, a

network that is also the first of its kind in Asia. The network can simultaneously employ multiple telemetric instruments, including radar, laser and acoustic wave instruments, to carry out observations by rainfall Doppler spectrum and raindrop spectrum. The changes in these observations can be used to investigate rainfall processes during heavy rains. This achievement will facilitate the improvement of mudslide warning technology.

## Center for Advanced NanoMaterials Developing Novel Infrared Devices and Applications



(Fig.1) Measured emission spectra of plasmonic emitter at different temperature. (Fig.2) PL peak energy against temperature plot of an InAsPSb/InAsSb QW. (Fig.3) Samples with the small enough hole sizes have the better specific  $G_N$ . (Fig.5) Infrared emission of  $\sim 1.3 \mu\text{m}$ ,  $\sim 1.5 \mu\text{m}$ ,  $\sim 1.8 \mu\text{m}$ , and  $\sim 2 \mu\text{m}$  wavelengths from Si/Ge structures.

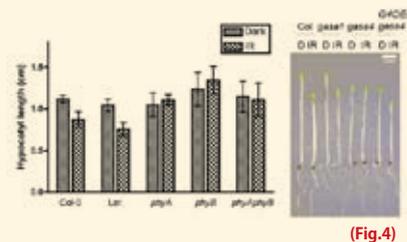
The following is an introduction to research on the development of novel infrared devices and applications by NTU researchers Chee-wee Liu, Si-chen Lee, Hao-hsiung Lin, Chieh-hsiung Kuan and Hsu-liang Hsieh at the Center for Advanced NanoMaterials.

A high performance mid-infrared narrow-band plasmonic thermal emitter has been invented (Fig. 1) and applied successfully to the study of the growth and gene expression of plants. The gene expression for GIR1(GA and IR induced gene 1) of mungbean and GASA4(GA-stimulated in Arabidopsis gene 4) of Arabidopsis thaliana displays the conspicuous difference by exposing mungbean and Arabidopsis to infrared light with peak wavelength between 3.8 to 4.5  $\mu\text{m}$ . InAsPSb alloys were grown with lattice-matched to InAs substrates, for the first demonstration of the growth of this important mid-infrared quaternary using molecular-beam

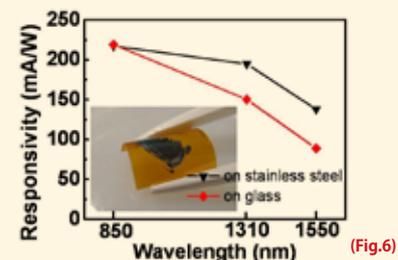
epitaxy. Multiple quantum wells comprising of InAsPSb and InAsSb with spectral range  $\sim 3.5 \mu\text{m}$  have also been grown (Fig. 2). The Al/Si interface strain can be modified by the Si square-hole array by the electron-beam lithography. As a result, the metal-semiconductor contact conductance is changed with various hole sizes and pitches. In Fig.3, the samples with the small enough hole sizes have the specific  $G_N$  w better than that of the planar Si annealed at 450°C for 30 mins. We have also found that GASA4, a VrGIR1 homolog in Arabidopsis, can be induced by IR and GA. Its mutant exhibited an insensitive phenotype under IR. GASA4-overexpressed transgenic seedlings exhibit as short hypocotyls as wild-type Col. Moreover, we demonstrated that phyA and phyB are also insensitive to IR irradiation, which implies that phyA and phyB may be involved in IR signaling (Fig. 4). The near infrared emission of  $\sim 1.3 \mu\text{m}$ ,  $\sim 1.5 \mu\text{m}$ ,  $\sim 1.8 \mu\text{m}$ , and  $\sim 2 \mu\text{m}$  wavelengths

from Si<sub>0.8</sub>Ge<sub>0.2</sub> quantum well, Si<sub>0.45</sub>Ge<sub>0.55</sub> quantum dot, bulk Ge, and Si/SiGe heterojunction, respectively, was implemented (Fig. 5). For the near infrared detection, a flexible thin-film Ge detectors was fabricated by wafer bonding and smart-cut (Fig. 6).

(Fig.4) GASA4, phyA and phyB mutants show insensitivity to IR irradiation.



(Fig.6) A flexible GOP photodetector has been fabricated. Reflected infrared can be absorbed again (on stainless steel).





## NTU Physicists Pursue In-Depth Investigation on Surface Plasmon Polaritons

The following are abstracts from studies involving Prof. Juen-kai Wang from NTU's Center for Condensed Matter Sciences that were published in *Optical Express* in 2008.

In the first study, Prof. Wang, who also works at Academia Sinica, collaborated with scientists from the Industrial Technology Research Institute. In the second study, Prof. Wang cooperated with Prof. Huai-hsien Wang and Prof. Yuh-lin Wang of NTU's Department of Physics as well as a researcher from National Tsing-Hua University.

**Fourier analysis of surface plasmon waves launched from single nanohole and nanohole arrays: unraveling tip-induced effects**

We have investigated surface plasmon waves (SPW) generated by single nanohole and nanohole arrays. Scattering-type scanning near-field microscopy was used to directly observe near-field distribution. The images after Fourier transformation display characteristic patterns that match with the derived analytic formula. The correspondence helps to identify the role of the scanning tip in generating SPW, making possible the removal of this tip-induced effect. This study provides a means to perform in-depth investigation on surface plasmon polaritons.

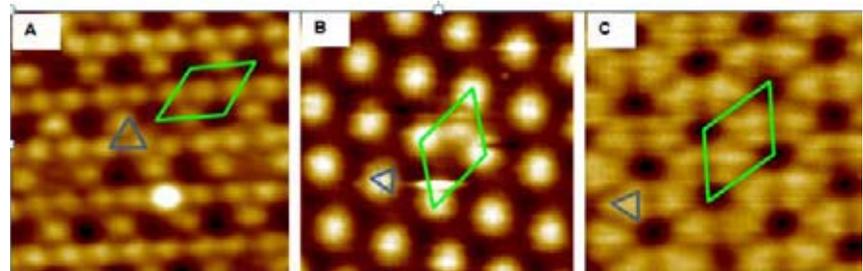
**Light scattering from 2D arrays of monodispersed Ag-nanoparticles separated by tunable nano-gaps:**

**spectral evolution and analytical analysis of plasmonic coupling**

Two dimensional arrays of monodispersed Ag-nanoparticles separated by different gaps with sub-10 nm precision are fabricated on anodic alumina substrates with self-organized pores. Light scattering spectra from the arrays evolve with the gaps, revealing plasmonic coupling among the nanoparticles, which can be satisfactorily interpreted by analytical formulae derived from generic dipolar approximation. The general formulism lays down a foundation for predicting the Q factor of an array of metallic nano-particles and its geometric characteristics.

## Center for Condensed Matter Sciences Researchers Unravel Ionic Ordering of New Materials

Some observed sodium trimer ordering structures. (A) a kagome phase; (B) a hexagonal phase; (C) a pinwheel phase. Green rhombus indicates the structure unit cell and dark blue triangle indicates the Na trimer.



To understand the properties of new materials, atomic structure is required. In conducting layered sodium cobaltate,  $\text{Na}_x\text{CoO}_2$ , sodium (Na) atoms are intercalated between  $\text{CoO}_2$  planes and their ordering plays a critical role in the material's properties. This material has received a great deal of attention in the condensed physics community in recent years. Prof. Woei-wu Pai and Prof. Fang-cheng Chou at the Center for Condensed Matter Sciences have unraveled direct Na ordering on a  $\text{Na}_x\text{CoO}_2$  surface using scanning

tunneling microscopy for the first time. Considered a breakthrough, the finding was published in *Physical Review Letters* under the title "Sodium trimer ordering on a  $\text{Na}_x\text{CoO}_2$  surface."

Prof. Pai's group conducted the STM experiments using the material synthesized by Prof. Chou. A new nationwide and world-class novel material synthesis center led by Prof. Chou has been funded and will provide samples to other research scientists as well. Prof. Pai's main

finding is that Na atoms, though considered cations, do not repel each other to maximize mutual distance due to Coulomb interaction. Instead, it was found that surface Na atoms aggregate into trimers (three Na atoms) and these trimers in turn order in long range, forming various ordered structures. This is at odds with all theoretical predictions reported so far. Therefore, the STM results indicate a new driving force for Na clustering that must be understood better.



# NTU LeCosPA Hunting for Cosmic Neutrinos in Antarctica

The following is a summary of an article by Prof. Pisin Chen, director of NTU's Leung Center for Cosmology and Particle Astrophysics.

We learn about the universe by observing fundamental particles that act as messengers of their origins. Unfortunately, a large fraction of the cosmic volume is not accessible with charged particles, such as protons. There is, however, the possibility that neutrinos, a necessary by-product of the Greisen-Zatsepin-Kuzmin (GZK) process, could reach Earth from deep space.

That ultra-high energy cosmic rays have been observed, and almost certainly include a significant proton fraction, guarantees the existence of neutrinos at 10<sup>17</sup>--10<sup>19</sup> eV, as required by standard-model particle physics, specifically the GZK process.

In 1962, Askaryan proposed that high energy showers might produce a powerful coherent radio emission in dense media. The exceptional RF clarity of cold ice suggests that the ice cap at the South Pole may provide a cost-effective way to detect GZK neutrinos. ANITA (Antarctic Impulsive Transient Antenna), a balloon borne antenna array, is such a pioneering Taiwan-UK-US project. The Taiwan team is led by LeCosPA Director Pisin Chen, who carried his ANITA membership from Stanford when he joined the NTU faculty in 2007. ANITA made flights for several weeks in the austral summers of 2006-2007 and 2008-2009. It surveyed the entire continent for RF emissions emanating from horizontal neutrino-induced showers that are refracted at the surface of the Antarctic ice.

ANITA is season-limited and its vantage point reduces its ability to reject surface noise. However, an opportunity has been created by the ongoing construction of the IceCube neutrino observatory at the South Pole. With an instrumented area of a cubic kilometer, IceCube is the largest optical Cherenkov observatory in existence. IceCube searches for cosmic neutrino induced secondary leptons, which typically carry 75-80% of the primary neutrino energy, through their optical signals while the remaining energy would turn into e-e<sup>+</sup> shower in ice, which would be detectable through Askaryan emission. The possibility of a synergy between the well-established optical and the pioneering radio technique has triggered

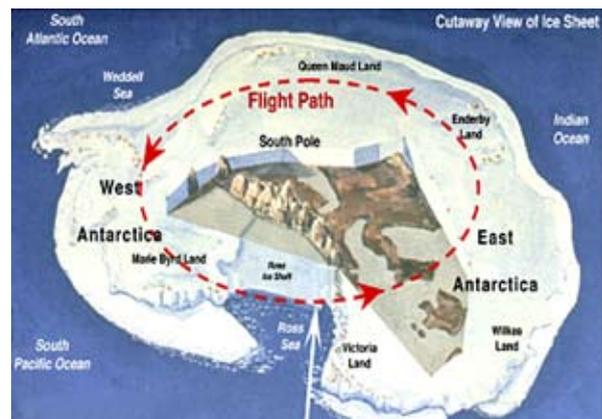


The ANITA (Antarctic Impulsive Transient Antenna) team works in Antarctica to take advantage of the exceptional radio frequency clarity of ice in its search for neutrinos emitted from deep space.

collaboration between ANITA and IceCube. A concentric array of RF antennas surrounding IceCube, which we will call IceRay, could observe the radio emissions from the primary vortex of some of the same events that produce detectable leptons in IceCube.

Playing a key role in the IceRay project, Taiwan is developing a prototype antenna station that would provide a comprehensive temporal measurement of the detected power spectrum in the 30-to-1000-MHz range down to power levels of -110 dBm/MHz for both continuous and episodic events, the radio signal transmission as a function of the sub-surface antenna depth, and long-term monitoring of RFI backgrounds at the South Pole. Our immediate goal is to deploy a 50-100 km<sup>2</sup> Radio Antenna Array around IceCube that would provide an event rate of 3-5 GZK neutrinos per year. However, the array could be extended to 300-1000 km<sup>2</sup>, making it capable of detecting at least 20-50 GZK neutrinos per year.

5 Possible orbit of ANITA over Antarctica that is driven by the circumpolar air.





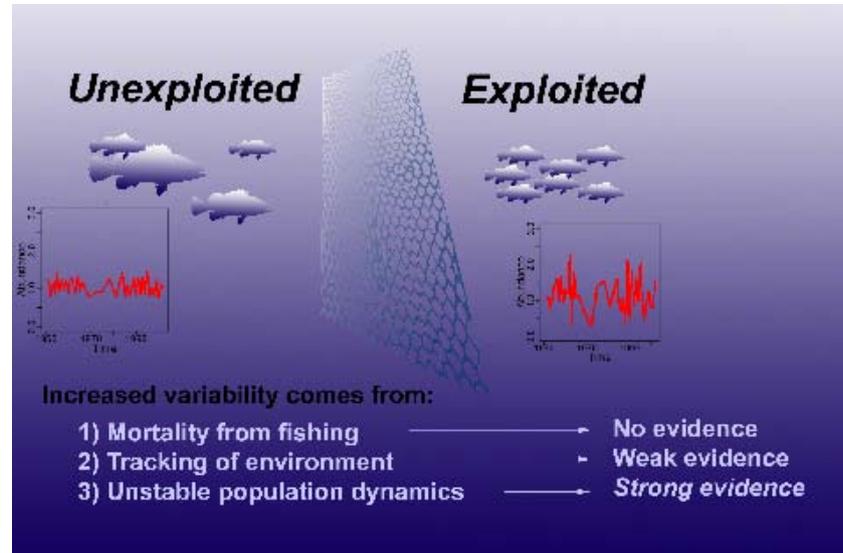
# Fisheries Research Shows Taking Big Fish over Small Leads to Greater Population Fluctuations

**T**he following is a summary of a report on recent research conducted by Prof. Chih-hao Hsieh of the Institute of Oceanography and Institute of Ecology and Evolutionary Biology.

In addition to fishery exploitation, it is clear that both environmental forcing and fishing mortality can affect fluctuations of exploited fish populations. Therefore, investigating fishing effects in the context of a changing climate is important for sound fisheries management. The objective is to gain mechanistic understandings of how fishing affects the exploited populations, and then through these understandings, to devise sound management policies and regulations for world fisheries.

However, separating the effects of environmental variability from the impacts of fishing has been elusive largely because we do not have baseline data regarding the condition of the fish populations before we started to exploit them, and thus no comparison can be made. Even when we have such data, the comparison remains speculative, because environmental conditions might have changed since then.

To overcome this difficulty, we devised a perhaps naïve approach. We distinguished environmental effects from fishing effects by comparing the temporal variability of exploited versus unexploited fish stocks living in the same environments. The concept is to consider the variation of unexploited



Ⓐ How exploited and unexploited fish populations differ. (Credit: University of California - San Diego)

populations as representations of natural environmental variability and variation of exploited populations as results of interactive effects of fishing and environments. Using the 50-year-long larval fish surveys from the California ecosystem, we analyzed fishing as a treatment effect in a long-term ecological experiment. For the first time, we presented evidence from the marine environment that exploited species exhibit higher temporal variability in abundance than unexploited species, after accounting for life history variation among species.

Fishing elevates the variability of the exploited fishes due to the altered age structure caused by selective fishing. Fishing can alter the "age pyramid" by lopping off the few large, older fish that make up the top of the pyramid, leaving a broad base of faster-growing small younglings. We found that this rapidly growing and transitory base is dynamically unstable—

a finding fraught with profound implications for the ecosystem and the fishing industries built upon it.

Fishing typically extracts the older, larger members of a targeted species and fishing regulations often impose minimum size limits to protect the smaller, younger fishes. Thus, the danger is that current policies that manage according to current biomass targets while ignoring fish size pose risks that can further destabilize the population. This instability can in principle propagate systemically to the whole ecosystem, much like a stock market crash or a domino effect, and magnify risk for the fishing industry itself as well as those of ecologically related fisheries. Paradigm shift in fisheries management policies is necessary to avoid ecological catastrophes in exploited populations and ecosystems.



## Department of Geography's SPIRIT Volunteers Conduct Geographic Survey in Kiribati and Tuvalu

Members of NTU's SPIRIT volunteer team pose with President Anote Tong of the Republic of Kiribati.



The Department of Geography organized a team of "knowledge volunteers for global development" that traveled to the Pacific island nations of Kiribati and Tuvalu to conduct a one-month geographic-survey project at the end of the summer of 2008. Known as South Pacific Islands Research and Inquiry Team (SPIRIT), the volunteer team made its trip in coordination with the ROC Ministry of Foreign Affairs' International Cooperation and Development Fund, Ministry of Education and NTU's Office of International Affairs and College of Science.

SPIRIT included five undergraduate students, five graduate students and two faculty members from the Department of Geography, Prof. Jun-chun Lin and Prof. Shih-shen Chien. The team conducted its fieldwork in Kiribati's South Tarawa and Tuvalu's Funafuti from mid August to mid September 2008.

The team's research covered four areas: environmental challenges facing Pacific islands, social and economic development in Kiribati and Tuvalu, Pacific ways of daily life, and the formation and transformation of the Taiwan Technical Mission (TTM) and its local contributions.

Aiming to establish a wide-ranging geographical and environmental development information database, SPIRIT adopted four data collection methods: land-use and landscape surveys, water quality testing and ecological investigations, participatory observations and in-depth semi-structured interviews.

SPIRIT also employed Geographical Information System (GIS) techniques to help the TTM transform its performance presentation, which is used to promote agriculture improvements in these nations, from statistical numbers and pencil drawings into visualized

maps and computer animations.

Prof. Sue-ching Jou, chairperson of the Department of Geography, says that SPIRIT represents a good example of the value of applying the concept of knowledge volunteers for global development. She points out that the team achieved a three-win situation: NTU students working as overseas volunteers were able to apply their academic learning in practice, Kiribati and Tuvalu were able to obtain geographic development information databases, and, with SPIRIT serving as an exchange platform, Taiwan and the two island states were also able to enhance their mutual understanding and friendship.

Prof. Lin believes SPIRIT was an innovative course for three reasons. First, it required students to combine knowledge and techniques artfully from three sciences--human geography as a social science, physical geography as an earth science and GIS as a computer science--in constructing their comprehensive planning and development databases. Also, the comprehensive nature of the project helped students master such skills as proposal writing and presentation, teamwork and leadership, and time and budget management. Furthermore, as an international education course, students gained global insights and experience through extensive readings of materials pertaining Kiribati and Tuvalu from such sources as the Asian Development Bank, Pacific Islands Applied Geoscience Committee and World Bank.

After returning, the SPIRIT members gave an oral presentation on November 19 and held a poster presentation from November 19 to December 1. These events were scheduled as part of the university's 80<sup>th</sup> anniversary celebrations.

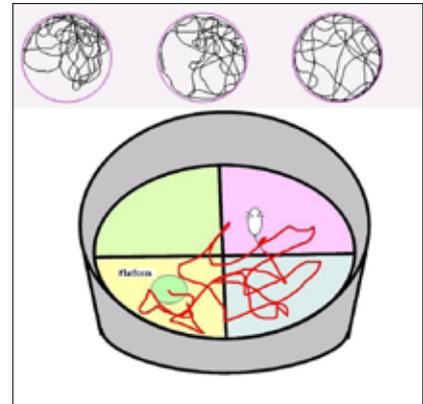


## Neurobiology and Cognitive Science Center's Behavior Core Lab Offers Facilities for Translation Research

Mammalian animal models are becoming increasingly important for translation research in the post-genomic era. Phenotypes of genetically engineered mice need to be closely monitored in a modern animal facility often for the lifetimes of the mice. The Behavior Core Laboratory of the Neurobiology and Cognitive Science Center has been established within the Animal Center of the College of Medicine specifically for this purpose. Within this core lab, NTU researchers from various disciplines can study the brain/behavioral connections in these precious mice, and examine the effects of drugs on behaviors of mice models to

gain an understanding of human neurological and psychiatric disorders. The laboratory provides equipment, facilities, consultation and technical expertise for the performance of behavioral experiments. It is equipped to conduct a comprehensive battery of behavioral tests relevant to a wide range of neurobiological and cognitive science issues, such as learning and memory, locomotor activity, sensorimotor gaiting, motor function and gaiting, pain/analgesia, and depression- and anxiety-related behaviors.

Currently available behavioral paradigms include: the Morris water maze, the elevated plus maze, rotarod test, forced-



The Behavioral Core Laboratory uses the Morris water maze to assess spatial memory in rats and mice.

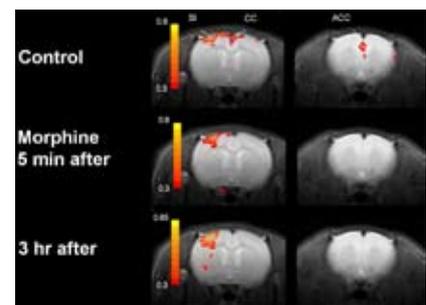
swimming test, prepulse inhibition and fear-potentiated startle response, passive avoidance test, grip force test, automated locomotor activity analysis, catwalk gait analysis, and nociception measurement.

## Neurobiology and Cognitive Science Center's Animal MRI Core Lab Encourages Interdisciplinary Research

The Neurobiology and Cognitive Science Center is establishing a 7T Animal MRI Core Laboratory for non-invasive, in vivo and longitudinal imaging of small animals for neuroscience and biomedical research. Installation of the 7T animal MRI imager began in September of 2008. The imager is undergoing functional testing at present, and is expected to commence normal operations soon. The lab will permit a wide-range of interdisciplinary research, including in foods, materials, pathology, pharmacology, cognitive science, oncology and molecular imaging.

In recent years, magnetic resonance imaging has become

widely used in neuroscience research, and is now the gold standard for such research. Its major applications include dynamic functional MRI studies, oncology and metabolic disorders research, and molecular biology and genome research. Molecular imaging and rapid phenotyping of transgenic animals are two applications that have enhanced the role of MRI in pharmacology. Its unique ability to provide noninvasively a combination of functional/physiological and anatomical information sets MRI apart from other in vivo imaging modalities. The specific advantage of MRI is such that it does not depend on a single physical property but allows scientists to play with a



Images from an fMRI study of morphine suppression of forebrain nociception processing in the rat.

multitude of contrast parameters depending on the application. Moreover, animal MRI can significantly reduce the numbers of test animals in a study due to its high information content and ability to carry out lifetime studies on the same animal.

## 2009 Azalea Festival Spotlights Integration of Science and Humanities, Cross-Cultural Encounters

Spring is all the more colorful and exciting here at NTU because of the Azalea Festival, which takes place every March. This year, the festival kicked off on March 7 with an opening statement by President Si-chen Lee, followed by musical performances by the NTU Chinese Orchestra, international students from Nepal and children from the NTU Affiliated Kindergarten.

That same weekend, the Departmental Expo and the Student Associations Fair took place in and around the NTU Sports Center. All 54 NTU departments set up booths to highlight their achievements and future visions while the university's student associations offered fun activities and encouraged visitors to join in.

The twin themes of this year's Azalea Festival were the integration of science and humanities and cross-cultural encounters. As 2009 marks the 200<sup>th</sup> anniversary of Charles Darwin's birth and the 150<sup>th</sup> anniversary of the publication of *The Origin of Species*, the College of Life Science held its "Life Science Rite," which included a book fair, guided tours and lectures on popular science. It also opened its animal specimen room, wherein details of Darwin's life and evidence of the theory of evolution were displayed.

Also, from March 13 to 15, the Dongjianti Ensemble presented British playwright Timberlake Wertenbaker's recent work *After Darwin* in collaboration with NTU's Department of Drama and Theatre. Several exhibitions were organized in coordination with the NTU Art Festival as well. These included "The Eternal Darwin" visual art competition, the "Special Exhibition on Bio-Art," the "Evolutionary Themes Exhibition" and the "Ecological Photography of the Galapagos Islands" exhibit.

See Page 8 of this issue of the NTU Newsletter for more information about the fascinating cross-cultural activities that brightened this year's Azalea Festival.

# NTU Center For Arts Renovates Abandoned Church into Performance Hall, Offices

The NTU Center For Arts, following its recent upgrade from the Arts Promotion Office, has taken up residence in a newly-renovated building now call the The Odeum. Formerly a simple church built by the United States military, the new facility provides the center with a professional-quality exhibition and performance hall and dedicated offices.

The center's new home is a unique and charming structure on the NTU campus. From the outside, its soaring roof and colored windows catch the eye. Visitors enter through a secluded, winding corridor to arrive in a lofty performance hall filled with colored light streaming in though the stained glass windows.

The center has organized nearly 100 activities each year since 2006. Among the activities the center promotes are exhibitions and performances by on-campus artists, weekly afternoon performances, a humanities lecture series, as well as the annual month-long Azalea Festival. The center also presents the NTU Literature Award.

The center's English website is located at <http://homepage.ntu.edu.tw/~ntuartpro/English/index.htm>.



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