

NTU



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February 2008 / No. 4

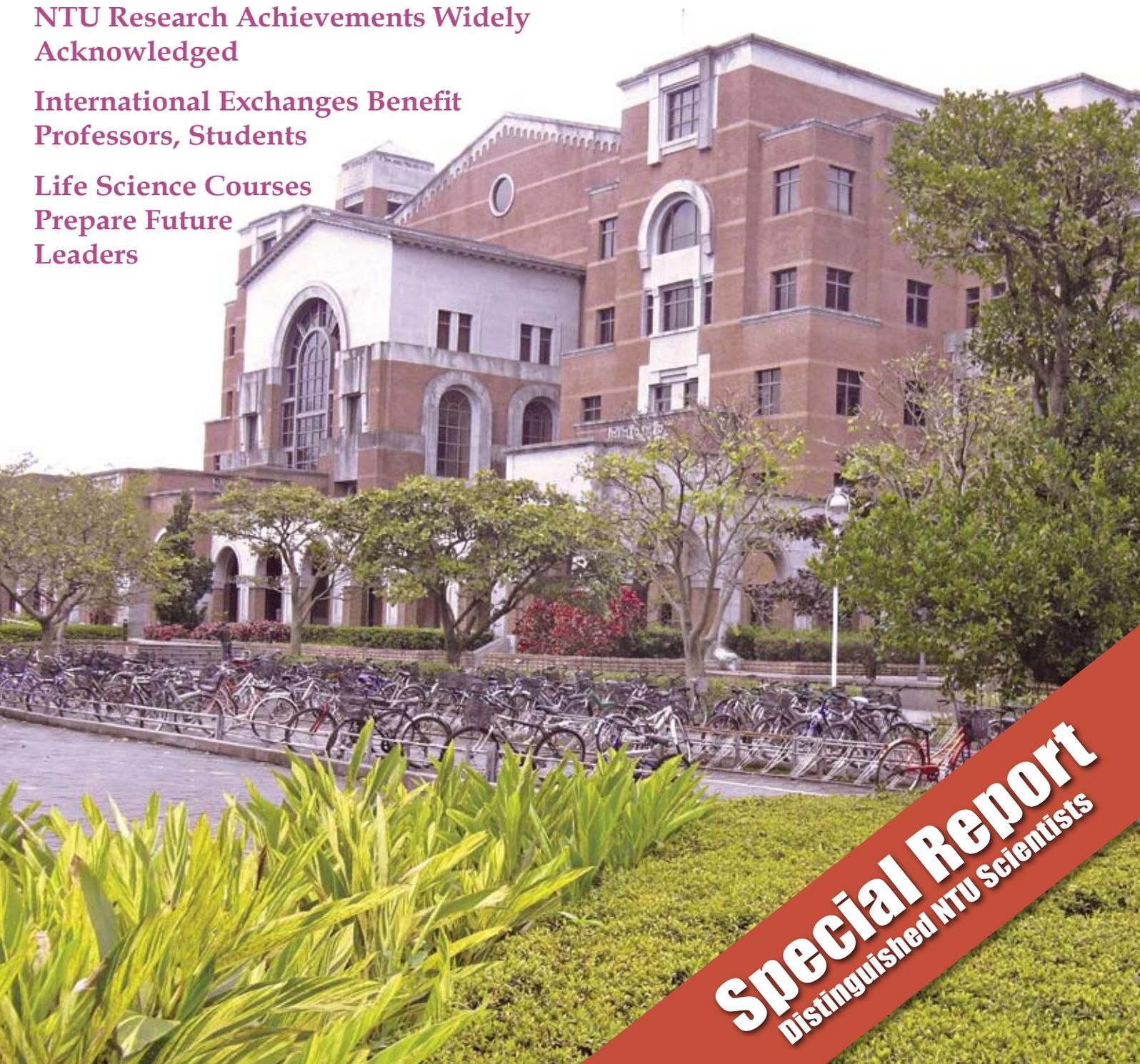
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NTU Library Conducts Digitization of Taiwan Cultural Assets

NTU Research Achievements Widely Acknowledged

International Exchanges Benefit Professors, Students

Life Science Courses Prepare Future Leaders

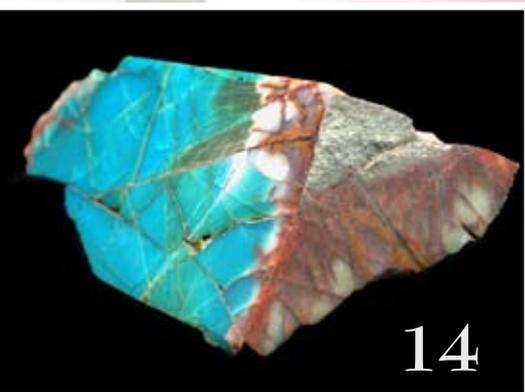


Special Report
Distinguished NTU Scientists



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Dr. Yang has repeatedly received the Distinguished Research Award from the National Science Council (1988-98) and has been named...



NTU Library Continues to Digitize Important Collections of Cultural Assets

Digitization of important cultural heritages has become a trend in the operation of libraries and museums in developed countries...

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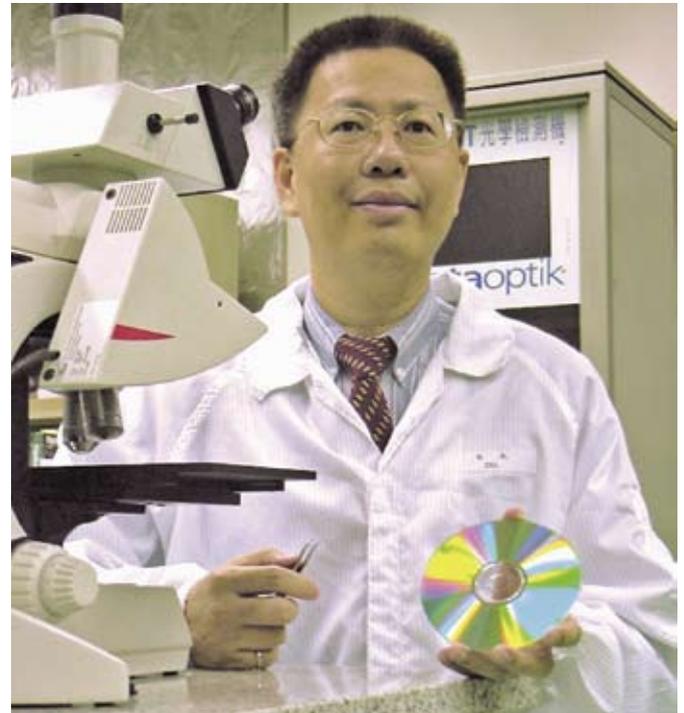
Computer and Information Networking Center Continues to Upgrade NTU's Computing Environment

NTU Physicist Dr. Din-ping Tsai Elected to American Physical Society Fellowship

Dr. Din-ping Tsai of the Department of Physics has added his name to the growing list of NTU professors earning prestigious international academic honors. The American Physical Society elected Dr. Tsai to its fellowship class of 2007 "for his contributions in nano photonics, plasmonics, and near-field optics, especially in near-field scanning optical microscopy, nano storage and nano imaging." Every year the APS awards fellowships to members who have made outstanding contributions and demonstrated ingenuity in physics research. Since the election process is extremely rigorous—less than 0.5% of APS members are named to fellowships each year—and fellowship nominations are made by other APS members, these fellowships signify recognition by professional peers and are regarded all over the world as one of the highest honors awarded to physicists.

Dr. Tsai has pursued research in the area of near-field optics and nano photonics since 1986. In 1990, he published the world's first experiment and application of near-field optical microscopy in the study of optical waveguides and, in 1994, he reported the world's first near-field Raman scattering spectra. Also in 1994, he became the first scholar to authenticate the experimental observation of localized surface plasmons of fractal metal colloid clusters in the near field. Since being published in *Physical Review Letters*, Dr. Tsai's article describing these research findings has been cited 133 times in other academic papers and has blazed the trail for near-field optical experiments and applications of localized surface plasmon of nano random media.

Dr. Tsai's main research area is in nano photonics and applications of optical engineering. He has won numerous awards both at home and abroad for his achievements, including the Outstanding



Dr. Tsai Din-ping examines an optical disc in his laboratory at the NTU Department of Physics.

Achievement Award in Science and Technology from the Executive Yuan, the Excellent Industry/Academy Cooperation Award from the Ministry of Education, the Distinguished Optical Engineering Award from the Optical Engineering Society of the Republic of China, the Fu-Ssu-nien Award from NTU, and the best paper award at many international conferences.

In addition to his new fellowship in the APS, Dr. Tsai is also a fellow of the International Society of Optical Engineering, the Optical Society of America and the Physical Society of the Republic of China, as well as a senior member of IEEE. He also holds many important international academic positions, including membership on the editorial board of three major international journals, membership on the nano optical committee of IEEE and membership on the fellowship review committee of OSA.

Founded in 1899, the American Physical Society is a non-profit scientific and educational organization with 46,000 members around the world.

NTU Civil Engineer Dr. Yeong-bin Yang Elected to Austrian Academy of Sciences in 2007



Austrian Academy of Sciences President Peter Schuster (left) presents NTU Distinguished Professor Dr. Yeong-bin Yang (right) with a membership certificate during a celebration ceremony for new AAS members on May 23rd, 2007.

Dr. Yeong-bin Yang of the Department of Civil Engineering was named a corresponding member of the Austrian Academy of Sciences in April of 2007. Membership in the AAS is the highest honor presented to scholars in Austria and only 24 new members, half of whom are non-Austrian nationals, were elected in 2007. Dr. Yang was named to this prestigious academy for his pioneering research in the areas of vehicle-bridge interaction dynamics and structural nonlinearity. All of the new members were presented with certificates by AAS President Peter Schuster at a celebration ceremony on May 23rd, 2007.

Dr. Yang, who received his Ph.D. in structural engineering from Cornell University in 1984, is an NTU Distinguished Professor and is currently serving as president of the Chinese Institute of Civil and Hydraulic Engineering (2005-09). He has served as Chairman of the Department of Civil Engineering (1995-98) and Dean of the College of Engineering (1999-2005) at NTU and as Chairman of Civil Engineering Disciplines at Taiwan's National Science Council (2002-2005).

Dr. Yang has repeatedly received the Distinguished Research Award from the National Science Council (1988-1998) and has been named a Special Invited

Researcher (1998-2004) at the council for several years as well. Among his other academic honors are the Outstanding Teaching Award from the Ministry of Education (1994), the Outstanding Scholar Award (1998-2003) from the Foundation for the Advancement of Outstanding Scholarship, the Munro Prize from Engineering Structures (2003), the Best Paper Award from Advances in Structural Engineering (2005), and the position of C. C. Zong Chair Professor from the NTU College of Engineering.

Dr. Yang is currently a fellow of the American Society of Civil Engineers and two other academic societies in Taiwan. He also serves as editor-in-chief of both the International Journal of Structural Stability and Dynamics (2000-present) and the international journal Interaction and Multiscale Mechanics (2007-present).

In a previous interview, Dr. Yang declared that he would do his utmost to help promote academic cooperation and scholarly exchanges between institutes in Taiwan and Austria.

NTU's Dr. Phone Lin Becomes First Taiwanese to Win Top IEEE ComSoc Asia-Pacific Young Researcher Award



NTU's Dr. Phone Lin (second from right) shows off his IEEE ComSoc Asia-Pacific Young Researcher Award for 2007. Dr. Lin is the first young researcher in Taiwan to be honored with this award. He is accompanied in this photograph by, from left to right, IEEE APB Director Dr. Dae-Hyoung Hong, Award Committee Chair Dr. Seung-Woo Seo and Dr. Byeong Gi Lee.



Dr. Phone Lin of the Department of Computer Science and Information Engineering and Graduate Institute of Networking and Multimedia has been honored as the recipient of the IEEE ComSoc Asia-Pacific Young Researcher Award for 2007 in recognition of his outstanding contributions to the research of design and performance modeling for mobile communications networks.

Once every three years, the APB (Asia-Pacific Board) of the IEEE (Institute of Electrical and Electronics Engineers) awards researchers under the age of 35 who have been active in ComSoc (Communications Society) publication and conference activities over the previous three years. Candidates are submitted to a rigorous two-month review. In addition to Dr. Lin, who won this year's top award, three other young researchers—one each from Taiwan, Korea, and Japan—were named Outstanding Young Researchers, the

IEEE APB's second highest award for young researchers.

Dr. Lin accepted the Best Young Researcher Award during the APB meeting at the annual IEEE Global Telecommunications Conference (IEEE GLOBECOM 2007) in Washington, DC in late November. With a global membership of 70,000 researchers, IEEE ComSoc is one of the largest international academic research organizations. Dr. Lin has demonstrated NTU's excellence to the world by becoming the first Taiwanese to claim this prestigious honor.

Dr. Lin's research has focused on mobile networking systems in recent years, and has been directed in particular at the three important topics of mobility management, resource allocation and design, and implementation of application platforms for heterogeneous wireless networks. The results of Dr. Lin's research in these three areas have been accepted and published in IEEE Transactions series or ACM

series journals. His research has already been taken to the level of industrial application.

Dr. Lin was a guest editor for the IEEE Wireless Communications special issue on Mobility and Resource Management and a guest editor for the ACM/Springer Mobile Networks and Applications Journal special issue on Broadnets. Dr. Lin is also an associate editor for IEEE Transactions on Vehicular Technologies and an associate editorial member for the Journal of Wireless Communications and Mobile Computing. He is the winner of the 2005 Wu Ta You Memorial Award from Taiwan's National Science Council, the winner of the 2004 Fu Ssu-Nien Award from National Taiwan University, the winner of 2004 K.T.Li Young Researcher Award from ACM Taipei/Taiwan Chapter, and the winner of 2004 Research Award for Young Researchers from the Pan Wen-Yuan Foundation. Dr. Lin is an IEEE senior member and ACM member as well.

NTU Delegation Attends International Education Exhibition 2007 in Mongolia



NTU's delegation to Mongolia's International Education Exhibition 2007 set up an information booth and made a presentation that was attended by around 100 visitors.

A three-person NTU delegation traveled to Ulaanbaatar, Mongolia, at the end of October to attend that famous nation's two-day International Education Exhibition 2007. The exhibition was organized by Mongolia's Intellectual Development Support Association Oyunlag-Uils NGO and took place at Chinggis Khaan Hotel from October 26th to October 27th. NTU's representatives to the education fair were Ms. Shu-hsien Tseng and Ms. Hsiu-wen Hsieh of the Office of International Affairs and Mongolian Ph.D. student Ms. Oyunbileg Shagdarsuren from NTU's Institute of Occupational Medicine and Industrial Hygiene. While in Ulaanbaatar, the delegation also paid a visit to NTU's partner university in Mongolia, Health Science University of Mongolia.

Other academic institutions and organizations participating in the fair included Southern Alberta Institute of Technology and College of New Caledonia from Canada, German Academic Exchange Service, Shelton College International from Singapore and Malaysia's KDU College. A press conference held one day before the fair drew a throng of journalists and television reporters.

The fair was a great success. Apart from setting up an information booth, each exhibitor made a 35-minute presentation. The NTU presentation attracted around 100 visitors, many of whom were eager to take part in follow-up discussions afterwards. NTU's booth received around 300 visitors made up of students

as well as professionals wishing to pursue further study abroad. The fields in which they expressed the greatest interest were management, social sciences, medicine and agriculture. About half were interested in undergraduate study, while the other half inquired about NTU's graduate programs.

While visiting Health Science University of Mongolia, the NTU delegation met with the university's Vice-president of International Relations Dr. S. Narantuya and agreed to offer two scholarships to HSUM faculty to pursue Ph.D.s at NTU. This was a follow-up meeting to the visit paid to NTU by HSUM's president in May of 2007. Furthermore, with the support of the dean of HSUM's School of Public Health, Dr. N. Sumberzul, the NTU delegation made two presentations to the school's faculty and students.

The rapid rate of economic development and foreign investment in Mongolia means that a growing number of Mongolian youth and professionals have the opportunity to study abroad. More importantly, they consider Mandarin Chinese a language of the future, and are therefore very interested in studying Chinese language and degree programs in Taiwan. Mongolia's geographical location and the great character of its people make it a country with which NTU hopes to enjoy a long-term, mutually beneficial relationship.

Cross-Strait Exchange Program Favorably Impresses Chinese Students



Participants pose for a group photograph at the NTU 2007 Chinese Foreign Exchange Student Forum, which was held by the Office of International Affairs on December 19th, 2007.

NTU's Office of International Affairs held a forum on December 19th for fourteen students from universities across China who were taking part in a first-ever four-month study program designed to promote interaction and encourage better understanding between university students on both sides of the Taiwan Strait.

The forum was chaired by NTU President Si-chen Lee. Dr. Sun Chen, former NTU president and now chairman of the Far Eastern Memorial Foundation, who had donated funds to help establish the exchange program, was also invited to hear the Chinese students' thoughts and feedback.

President Lee reminded the audience that NTU inherited a precious legacy of academic freedom and an intellectual spirit from Beijing University and that both students and teachers at NTU are independent thinkers. Dr. Sun mentioned that he had longed to create opportunities for student

exchanges between Taiwan and China ever since he met President Ding of Beijing University when he attended the Pan-Pacific University Forum in 1989, and said he was genuinely touched to see his dream fulfilled.

The Chinese students were immensely impressed by NTU's facilities. In particular, the new NTU Library, with its huge collection of books and luxurious reading environment, earned their unanimous praise. Most of them said they had not encountered major problems in Taiwan and would love to study at NTU, whose students they characterized as energetic and eager to participate in extra-curricular activities. They noted especially NTU students' friendliness and enthusiasm, which were evident when they asked NTU students for directions.

Competition to participate in this exchange program was fierce, and, as expected, all fourteen students were well-prepared and performed

extremely well in the program. As a comprehensive university with an emphasis on offering an education balanced between the sciences and the humanities, NTU's strong humanities and liberal arts studies inspired especially those students from science and technology universities.

A medical student, for example, who did his internship at the NTU Hospital, was moved by his medical professors, who did not just teach medical knowledge and skills, but also taught students to think from the patient's point of view.

Some liberal arts and social science students took courses such as Mainland China Policy and Marxist Thought, which proved to be eye-opening by forcing them to renegotiate the Marxism they had learned since childhood. Experiences like these, which widened and expanded the exchange students' academic horizons, were the most frequently mentioned rewards of participating in the program.

IGU Commission on Gender and Geography Holds Symposium at NTU in November



Participants pose for a group photograph during the symposium *Transnational Lives: Feminist Perspectives on Citizenship, Home, and Belonging*, which was hosted by NTU's Department of Geography in late November, 2007.



The Commission on Gender and Geography, a unit of the International Geographical Union with a nearly 23 history, held a symposium in Taipei from November 23rd to November 26th. The conference's title, *Transnational Lives: Feminist Perspectives on Citizenship, Home and Belonging*, reflects the current abundance of scholarly work on gender and transnational migration, an aspect of globalization that is being eagerly explored at personal, institutional and national levels.

The local organizing committee also arranged a Gender and Geography Week around the symposium, which included special lectures on gender and geography research, posters, and a display of publications from different countries.

Twenty-four papers from the United Kingdom, Ireland, Norway, the Netherlands, Israel, Sri Lanka, Thailand, Singapore, Malaysia, Hong Kong, China, Taiwan, Australia, the United States, and Canada were presented over two days. The papers were organized under four themes: 1) Citizenship, rights, and identity formations; 2) Homemaking, everyday life, and transnational families; 3) Mobility aspirations, decisions, and adjustments; and 4) Cosmopolitanism, belonging, and transnational subjectivity. Besides the speakers, about 50 people from Taiwan attended the conference.

During the first two days, visits were made to two of the landmarks of women's culture in Taipei, Fembooks (www.fembooks.com.tw) and the Homemakers' Union and Foundation (<http://www.huf.org.tw/>). On the third day, 32 people, including the conference speakers, two of their family members, and six students took a day trip to Yangmingshan National Park and the Beitou hot springs district. The trip started with a visit to Chung Shan Hall, which was meticulously designed by noted female architect Tze-lan Hsiu, and included lunch at the Shann Garden, a Japanese officers' club in the 1920s and a reception site for kamikaze pilots during World War II. The tour ended with a two-hour visit to a tea factory where the guests were shown how Taiwanese tea is manufactured and were invited to sample the tea by their hosts, whose ancestors started the business in 1890 in Xiamen, China.

The symposium, though small, ran smoothly. Participants stated that it set a high standard for future symposia, demonstrated attention to details, and maintained a high level of participation throughout. Since the papers presented at the symposium are of high quality, original, and cover a wide spectrum regarding the subject of transnational lives, plans are underway to publish them in several journals in the near future.



Bottom: From left to right, R. Longhurst, N. Chiang and J. Monk, D. Conlon, N. Chiang and T. Fenster, and R. Fincher.



NTU Engineering Deans and Graduate Students Attend Second AOTULE Deans' Meeting in South Korea



The first AOTULE Deans' Meeting was held at the Tokyo Institute of Technology in Japan from March 7th to March 9th, 2007.

Dean Huan-jang Keh of the College of Engineering and Dean Soo-chang Pei of the College of Electrical Engineering and Computer Science were present as delegates from NTU at the Second Deans' Meeting of the Asia-Oceania Top University League on Engineering (AOTULE) held at the Korean Advanced Institute of Science and Technology (KAIST), in Daejeon, Korea, from November 28th to November 30th, 2007. Two Ph.D. students from the Department of Mechanical Engineering and the Department of Chemical Engineering also made the journey to KAIST to give oral presentations on their research in graduate student workshops that were organized in conjunction with the Deans' Meeting.

Twelve leading universities in the field of engineering in the Asia-Oceania region formed AOTULE in March of 2007 in order to improve the quality of engineering education and research in the region and to facilitate international collaboration. The 12 universities are Monash University in Australia, Tsinghua University in China, National Taiwan University in Taiwan, Hong Kong University of Science and Technology in Hong Kong, Indian Institute of Technology in India, Bandung Institute of Technology in Indonesia, Tokyo Institute



The second AOTULE Deans' Meeting was held at the Korean Advanced Institute of Science and Technology in Korea from November 28th to November 30th, 2007.



of Technology in Japan, KAIST in Korea, University of Malaya in Malaysia, University of Auckland in New Zealand, Nanyang Technological University in Singapore, and Chulalongkorn University in Thailand.

The First AOTULE Deans' Meeting and the signing ceremony for the formation of AOTULE took place at the Tokyo Institute of Technology from March 7th to March 9th, 2007. Dean Keh and Dean Pei represented NTU at this meeting also.

AOTULE promotes various cooperative programs among its members, including:

- Annual meetings of deans of engineering schools/faculties
- Joint research symposia and student workshops
- Exchange of students
- Exchange of academic and administrative staff
- Exchange of academic information and materials
- Other agreed academic exchanges and cooperative programs

The implementation of each of the above cooperative programs is separately negotiated and agreed upon in writing by the relevant universities. The formation of AOTULE has facilitated multilateral rather than bilateral cooperation, leading to a broader and more effective relationships among the member universities.



Dr. Chiun-chuan Chen Awarded Morningside Silver Medal of Mathematics at ICCM 2007



1. Dr. Chiun-chuan Chen is a professor in the Department of Mathematics. **2.** Cheng-chiang Tsai is currently a student in the Department of Mathematics. **3.** Dr. Melissa Chiu-chu Liu earned her Bachelor of Science degree from NTU's Department of Mathematics in 1996.

Dr. Chiun-chuan Chen of the Department of Mathematics was awarded the Morningside Silver Medal of Mathematics at the Fourth International Congress of Chinese Mathematicians, which was held at Zhejiang University in Hangzhou, China, from December 17th to December 22nd. Dr. Chen received this medal in recognition of his significant research contributions to nonlinear elliptic equations and the regularity of Navier-Stokes equations.

ICCM is a triennial event that brings together mathematicians from China and other countries to discuss the latest research developments in pure and applied mathematics. This congress, the most important event for Chinese mathematicians, is hosted by institutes in China, Taiwan, and Hong Kong on a rotating basis. The first ICCM was held in Beijing in 1998, the second in Taipei in 2001, and the third in Hong Kong in 2004. Over 1,000 mathematicians from China and around the world attended the 4th ICCM, and more than 100 distinguished mathematicians presented speeches regarding their work.

At each ICCM, the Morningside Medal of Mathematics is awarded to exceptional mathematicians of Chinese ancestry to encourage them in their pursuit of mathematical truth. Two gold medals and four silver medals are awarded to mathematicians of Chinese descent under the age of forty-five for their outstanding achievements in pure and applied mathematics.



Also at ICCM 2007, Dr. Melissa Chiu-chu Liu, who earned her Bachelor of Science degree from NTU's Department of Mathematics in 1996 before going on to receive her Ph.D. from Harvard University in 2002, was awarded a Silver Medal for her significant contributions to the definition of open Gromov-Witten invariants, the mathematical theory of topological vectors and a new definition of quasi-local mass in general relativity. Dr. Liu is currently an associate professor at both Northwestern University and Columbia University.

Another member of the NTU family, Mr. Cheng-chiang Tsai, a student in the Department of Mathematics, also demonstrated NTU's strength in mathematics at ICCM 2007 by winning a Gold Prize Bachelor Thesis Award.

Education Ministry Awards National Chair Professorship to College of Management's Dean Hung

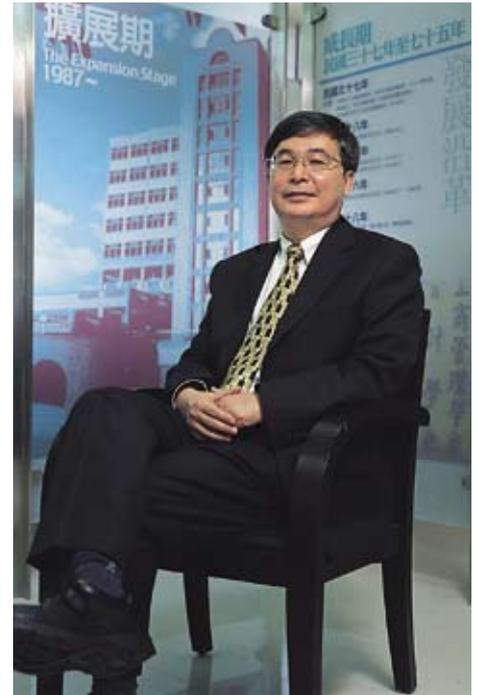
The Academic Review Committee of the Ministry of Education named Dr. Mao-wei Hung, Dean of the College of Management, as one of the recipients of its 11th Annual National Chair Professorships for 2007. Dean Hung's excellent academic achievements have won him several other honorary awards from the Ministry of Education over the years.

Dean Hung has devoted himself to academic research for many years and has achieved outstanding results. His primary areas of interest are financial engineering, behavioral finance, asset pricing theory, international investment, and asset management.

Dean Hung received the Distinguished Research Award in Management from the National Science Council in 1997, becoming the first award recipient from NTU's College of Management. In 1999, he was the only finance scholar to receive the Outstanding Scholar Award from the Foundation for the Advancement of Outstanding Scholarship. He was also the only person from Taiwan to be ranked among the Top 20 Financial Researchers in the Asia



A view of the entrance to Building One of the College of Management.



Dr. Mao-wei Hung, Dean of the College of Management, was named to a National Chair Professorship in 2007.

Pacific region in 2001. Moreover, in 2004 Dean Hung received Taiwan's 48th Annual Academic Award, the highest honorary award presented by the Ministry of Education.

In addition to his academic work, Dean Hung also works in many professional capacities. He sits on the board of the Taiwan's Securities and Futures Institute as well as the External Committee of the Taiwan Stock Exchange Corporation's Council of Stock Listing. Dean Hung has also been the director of the Taiwan Finance Association since 2002 and a research fellow of the Chinese Securities Association since 2001.

He has also served in various editorial roles for such publications as the Review of Securities and Futures Markets, Taiwan Academy of Management Journal, Journal of Financial Studies, Review of Securities and Futures Markets, Sun Yat-Sen Management Review, Chinese Business Horizon, Journal of Risk Management, Industries and Finance Quarterly, Chaoyang Business and Management Review, and Taipei Economic Inquiry.

The Ministry of Education hosted an award ceremony at the end of 2007 to present awards to its most recent National Chair Professorship and Academic Award recipients.

The Integration of Quality of Life and Survival for Comparative Risk/Outcome Assessment in the Healthcare Industry



The following is from a report presented by Dr. J. D. Wang (top) of NTU's Institute of Occupational Medicine and Industrial Hygiene.

The integration of quality of life (QOL) and survival for the quantification of healthy life expectancy was first proposed for the evaluation of the treatment of chronic renal disease in the late 1960s. Over the last few decades it has been developed into a summary measure for population health with quality-adjusted life year (QALY) and/or disability-adjusted life year (DALY) as the common unit for international comparison.

However, the direct application of the DALY approach may not be feasible for health policy decision making at the country and/or company level because it assumes a universal life expectancy and utility values for physical disability only, which does not reflect the actual conditions in each country or state. A more practical method of assessing of health risk is to quantify the changes or loss of life expectancy and QOL simultaneously for different health events or diseases for the purpose of comparison. While life expectancy for a disease may be obtained through the long-term follow-up of a cohort of patients, the QOL function must usually be surveyed in a sample of patients with the disease. Then, the life expectancy of the patients can be multiplied by the overall mean of QOL to obtain a crude estimate of QALE (quality-adjusted life expectancy).

However, since patients' QOL fluctuates after the development of a disease, the overall average may not represent the dynamic changes that occur over the course of the disease. To more accurately estimate the QALE for the disease x_i , one can collect QOL data from a cross-sectional sample of patients to calculate the mean QOL at each time point t_i through a smoothing method. Then, the mean QOL is multiplied by the survival probability for each time point t_i , and the lifetime summation of these values, or the total area under the quality adjusted survival curve, is the QALE of patients with disease x_i under the unit of QALY, if the measurements are taken yearly, as shown on Figure 1.

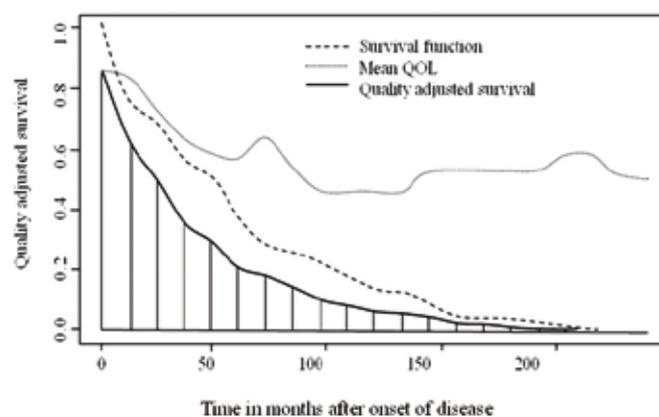


Figure 1: The survival probability, mean quality of life (QOL), and quality-adjusted survival of patients with diseases and quality-adjusted life expectancy (i.e., the total sum of the shaded area under the quality adjusted survival curve), modified from Hwang et al.

$$\text{Or, QALE} = \int E[Qol(t|x_i)] S(t|x_i) dt$$

Because many patient cohorts with a specific chronic disease are not followed for a sufficiently long time, the available data has such a high censored rate (over 50%) that we may be unable to obtain the lifetime survival function. For such cases, we have developed a method for the extrapolation of the survival function of a disease x_i . The validity of this method has been demonstrated in several real examples.

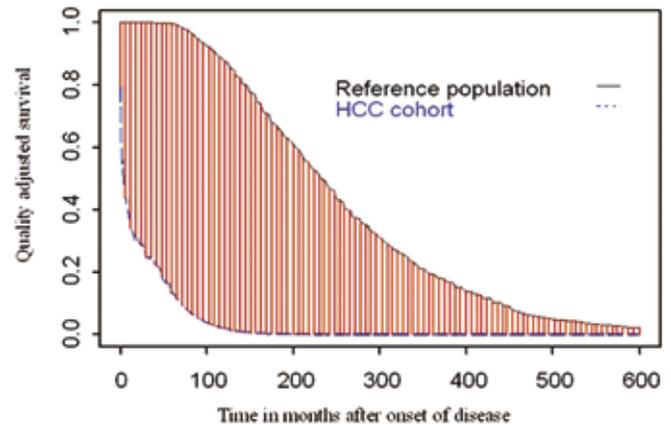
One example is the quantification of loss due to hepatocellular carcinoma (HCC), a prevalent cancer in Taiwan. We first established a cohort of about 2,600 HCC patients at the NTU Hospital and followed it for five years to estimate the survival function of HCC. A cross-sectional survey of 161 HCC patients with the utility values of their QOL provides the expected value or mean at each time t_i , which can serve to adjust the survival curve. The area under the quality-adjusted survival curve is the QALE for HCC. Then, for each patient with HCC, we may apply a Monte Carlo method to simulate an age- and gender-matched person with the survival function (or hazard function) of the general population from a nation's vital statistics and produce an average survival curve for the reference population without HCC, of which the QOL value can be assigned to be 1. The difference between these two QALE is the area between the two quality-adjusted survival curves, or 233.6 quality adjusted life months (QALM), which is the consequence of developing HCC, as shown in Figure 2. If we replace the QOL function with a general utility function, as Freeman has proposed, the equation can be regarded as a special condition of lifetime utility for the health condition x_i , or:

$$\int E[U(t|x_i)] S(t|x_i) dt$$

One of my studies evaluated the potential health impact of groundwater pollution caused by the dumping of chlorinated solvents by an electronics manufacturing company. After measuring the concentrations of seven major pollutants in water samples from 43 local wells downstream from the pollution source, we estimated that the probabilities of developing liver cancer from vinyl chloride, trichloroethylene, and tetrachloroethylene in the groundwater were 8.4×10^{-6} , 1.4×10^{-4} , and 1.9×10^{-4} , respectively, based on cancer slopes and the estimated RME (reasonable maximum exposure) obtained from measurements of water samples. As the population at risk in the exposed downstream community included approximately 1,000 people, we estimated that the potential health impact would be losses of 2, 32, and 44 QALM (quality-adjusted life months). Similarly, we have estimated that the health impact resulting from the enforcement of the helmet law for motorcycle riders in Taipei City is about 6,240



Figure 2: The difference (shaded area) of quality-adjusted life expectancy (QALE) between the cohort of liver cancer and age- and gender-matched reference population, which represents the average utility loss of developing a case of liver cancer, or 233.6 quality-adjusted life months (QALM).



QALY per year. We have also estimated the utility gained from different occupational health policies aimed at protecting the offspring of female lead workers.

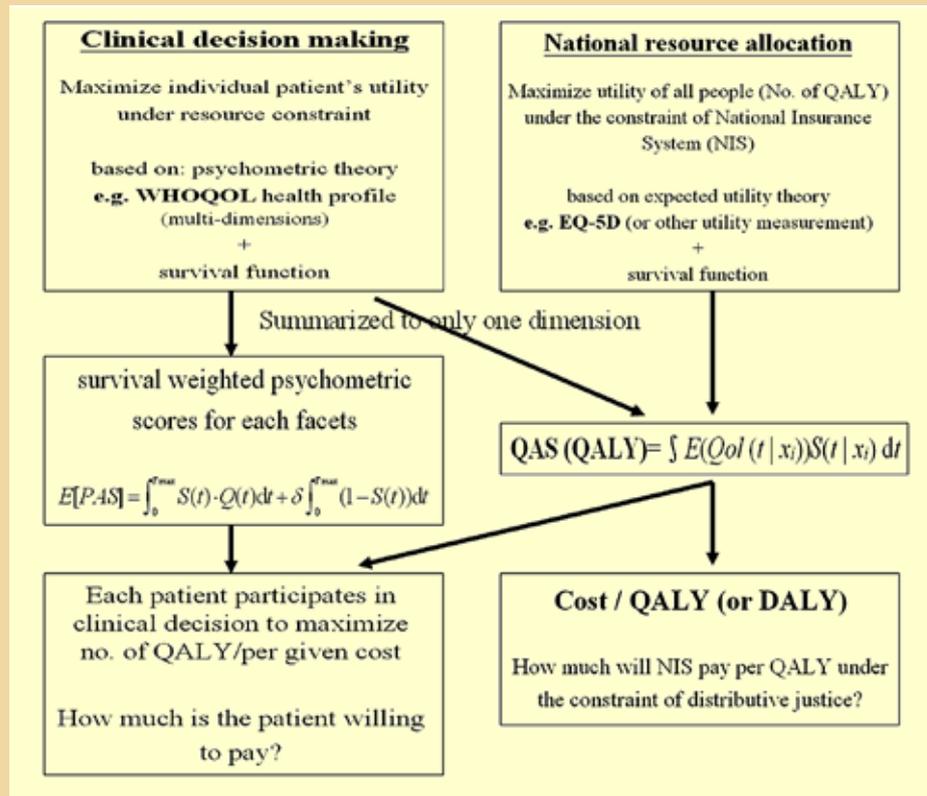
This method can also be extended to calculate the direct medical cost of illness paid by the Bureau of National Health Insurance. Based on reimbursement data, one can calculate the average financial burden for disease x_i for each time point t_i . This amount can be multiplied by the survival probability at each time point t_i and summed up to estimate the lifetime cost for different diseases after considering the annual discount rate. The total lifetime cost of a disease x_i can be expressed as follows:

$$\int E[Cost(t|x_i)] S(t|x_i) dt$$

With the QOL function at time t replaced by the cost function, denoted as $Cost(t/x_i)$. We have demonstrated the feasibility of this method on the 17 most frequent cancers in Taiwan, HIV/AIDS, thalassemia, and other illnesses. In addition, we have tried to demonstrate that the loss of utility due to smoking includes at least the financial burden of smoking related diseases, impaired QOL, and premature mortality.

In addition, the method can be extended to the

➤ **Figure 3: The integration of quality of life (QOL) and survival can be used in outcome research in the healthcare industry. When QOL is measured in utility or preference values or units, such as quality-adjusted life years (QALY), they are useful for the assessment of cost-effectiveness analysis and the efficient allocation of resources. When QOL is measured in psychometry, the score-time units can be applied to the quantification of clinical outcomes for comparison across different health conditions and healthcare settings.**



measurement of QOL under psychometry, with the unit changed to score-time or score-year. Unlike the measurement of QOL under expected utility theory, there might be conditions under which a patient would rather die than live uncomfortably with the disease x_i . In other words, there might be health conditions that are worse than death in QOL. Thus, we must add another term for the score-time saved by the deceased, and the equation becomes as follows:

$$\int [E(Qol(t | x_i)) S(t | x_i) + (1 - S(t | x_i)) \bar{x}]$$

in which a constant \bar{x} is assigned to the QOL of the deceased for sensitivity analysis. This method was demonstrated in a study comparing the quality-adjusted survival of patients with and without bone marrow transplantation after chemotherapy for leukemia. But a score-time may not be directly linked to any particular meaning in life. Thus, we have tried to quantify the monetary value that a worker might be willing to pay for a unit of score-time in a study concerning the removal of physical pain resulting from permanently-disabling occupational injuries using a contingent

valuation method. As a result, we have shown that workers in Taiwan would be willing to pay about 65-70 US dollars for a painkilling pill with an effect lasting for 24 hours.

In conclusion, the integration of survival with a QOL measurement can be summed up for the estimation of the consequences of different health events or diseases with the unit of QALY, which can be multiplied by the likelihood of the event in usual risk assessment to obtain the expected health impact. When the medical cost can be estimated for a specific disease for each time point t (that is, monthly or yearly) based on the reimbursement data of the Bureau of National Health Insurance, we are able to calculate the lifetime financial burden of a specific disease after calculating the lifetime medical cost. These concepts and methods are useful for comparative risk/impact assessment for public health policy regarding the allocation of national health services. Moreover, when the QOL measurement is replaced by psychometry, it can also be applied in the area of clinical medicine for taking patients' reported outcome into consideration, as summarized in Figure 3. By doing so, preventive, therapeutic, rehabilitative, and alternative healthcares can be evaluated with the same unit.

NTU-Designed MEDock Outperforms Popular AutoDock for Simulation of Protein-Ligand Docking

The research team at the Center for Systems Biology and Bioinformatics employed the RAME algorithm for the implementation of its MEDock program in order to design a protein-ligand docking program with a highly efficient optimization algorithm for virtual screening. As shown in Figure 1, MEDock substantially outperforms AutoDock, which is one of the most popular protein-ligand docking programs, in the four benchmark cases shown in Figure 2.

Due to its outstanding performance, the MEDock webserver has attracted users from all over the world, including those from such countries as the United States, the United Kingdom, Japan, France, Germany, Italy, and Switzerland. The number of jobs submitted to the MEDock server currently exceeds 1,500 every month.

Prediction of ligand binding sites on proteins is an essential element of the drug discovery process. Knowing the location of binding sites greatly facilitates the search for hits, the lead optimization process, the design of site-directed mutagenesis experiments, the hunt for structural features that influence the selectivity of binding, and the reduction of a drug's adverse effects. In this regard, successful virtual screening of chemical libraries in the drug discovery process requires: 1) a sufficiently large and chemically diverse compound library, 2) a highly accurate scoring function and, 3) an efficient optimization algorithm for predicting the correct binding conformation, location and orientation of ligands.

These three components are in fact highly interrelated. For example, if the optimization algorithm is not sufficiently efficient, the prediction of correct binding modes will remain a question of serendipity,

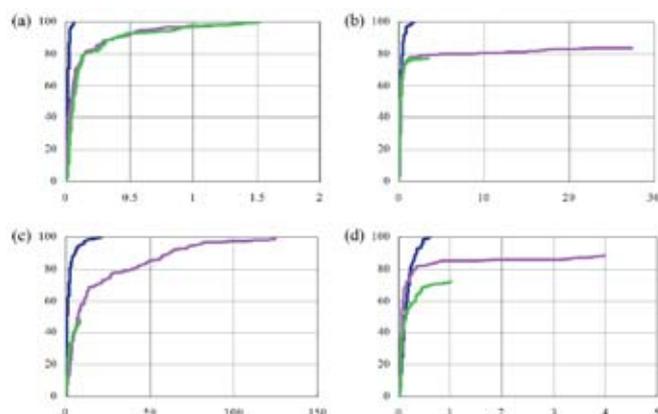


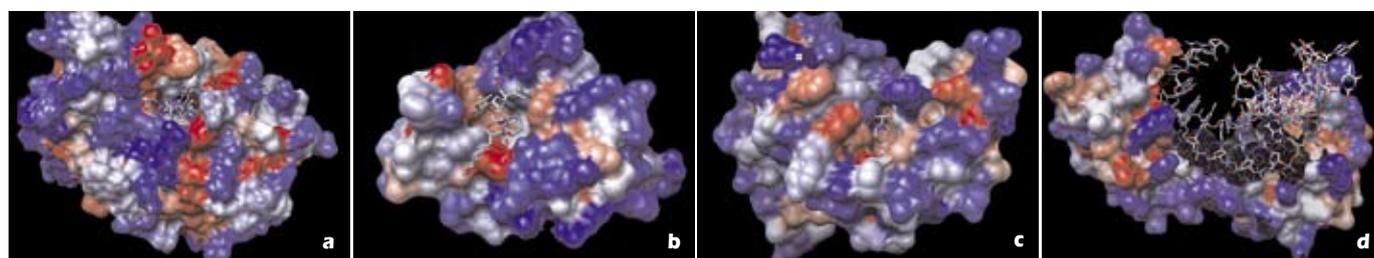
Figure 1

Comparison of the effectiveness of alternative optimization algorithms in four benchmark cases (blue: RAME; magenta: LGA (Lamarckian genetic algorithm) with parameters tuned; green: LGA with default parameters). The x-axis corresponds to the number of energy evaluations consumed in units of 107 and the y-axis corresponds to the number of simulation runs out of 100 independent runs in which the global minimum of the energy state is successfully located. (a): The results with the HIV-II protease complexed with its inhibitor L-735,524 (PDB ID: 1HSH); (b): The results with the FKBP-FK506, an immunophilin-immunosuppressant complex (PDB ID: 1FKF); (c): The results with the complex formed between phospholipase A2 and aspirin (PDB ID: 1OXR); (d): The results with the TATA-box binding protein (YTBP) complexed with DNA containing a TATA-box (PDB ID: 1YTB).

even when the scoring function has reached a satisfactory degree of accuracy. On the other hand, if the scoring function achieves only limited accuracy, then no matter how efficient the optimization algorithm is, it is highly unlikely the correct binding modes will be found. At the same time, it is improbable that the most effective compounds or new chemical entities will be discovered if the chemical space under investigation is not large enough. In practice, the structures of target receptors at atomic resolution (from X-ray crystallography, NMR spectroscopy, or even homology modeling) are used for the docking simulations, which rely heavily on the first and second components of the aforementioned process.

Figure 2

Molecular graphics displays of the four benchmark cases, a, b, c, and d, in the comparison graphs above.



NTU Library Continues to Digitize Important Collections of Cultural Assets



The soaring peristyle of the NTU Library rises to a height of four stories.

The digitization of important cultural heritages has become a major trend among libraries and museums around the world. Here in Taiwan, the government began to promote digital archives for the nation's cultural assets as far back as the late 1990s. The National Science Council now provides funding to national-level institutions under its National Digital Archives Program, which it launched in 2001, while the Council for Cultural Affairs funds local cultural institutions, such as libraries and private art galleries, in its effort to establish the National Repository of Cultural Heritage, which it instituted in 2002.

NTU Library's long history of maintaining valuable special collections began when NTU acquired the massive collection of materials amassed by Taihoku (Taipei) Imperial University (the antecedent of NTU) when Japan ceded Taiwan to the Nationalist Government in 1945, and the acquisition of new materials has continued to this day. The library also became a pioneer in digitization projects in Taiwan when it started the Digital Museum of the Tamsui River project in 1998. The skills and knowledge the library gained through this effort have made the library an important participating institution in both the NDAP and NRCH.

As part of the first phase of the NDAP, which ran from 2002 to 2007, NTU Library carried out the NTU Digital Taiwan-Related Archives Project. This project included the digitization of the Tan-Hsin Archive (a collection of administrative and judicial documents



from Hsin-chu Hsien, Tamsui Ting, and Taipei Fu in northern Taiwan dating from 1776 to 1895), the Kanori Ino Manuscripts (a collection of manuscripts, field notes, journals, newspaper clippings, photographs, and books accumulated by this Japanese pioneer researcher in Taiwan studies during the early days of Japanese colonization in Taiwan), and the Rubbings of Taiwan Cultural Relics (originally collected by Taihoku Imperial University, this includes 189 rubbings made from steles at historical sites in Taiwan).

In the second phase of the NDAP, which began in 2007 and will end in 2012, the library is continuing its digitization efforts with the Extended Digital Taiwan-Related Archives Project. This project concerns the Yasusada Tashiro Collection (a collection of field notes, reports, and other research manuscripts left by this pioneer in Taiwanese botanical studies who worked for the Taiwan Governor General's Office during the period of the Japanese occupation), a remarkable collection of more than 600 books of Taiwanese Opera lyrics which were published in Taiwan and China over half a century ago, and the V. S. de Beausset Collection (documents, diaries, manuscripts, and even color films donated in 2006 by the family of V. S. de Beausset, an

engineer and advisor of the J. G. White Corporation, a consulting firm to the United States government in charge of allocation planning for U.S. Aid to Taiwan between 1950 and 1957).

Digitization work for these six valuable collections (for which more information can be found online at <http://www.lib.ntu.edu.tw/project/en/>) includes the creation of image files, full-texts, and metadata records, as well as the integration of all of these products in a searchable database system so as to provide easy access to these cultural legacies and fulfill the library's mission to preserve Taiwan's cultural heritage.

As for the Council for Cultural Affairs' NRCH, the library's participation in this program in 2002 and 2003 helped it digitize a number of old document collections, which included contracts regarding land and financial loans belonging to the NTU Library, private collectors, and local city government archives, and a collection of nearly 40,000 photographs taken in Taiwan from 1895 to 1945.

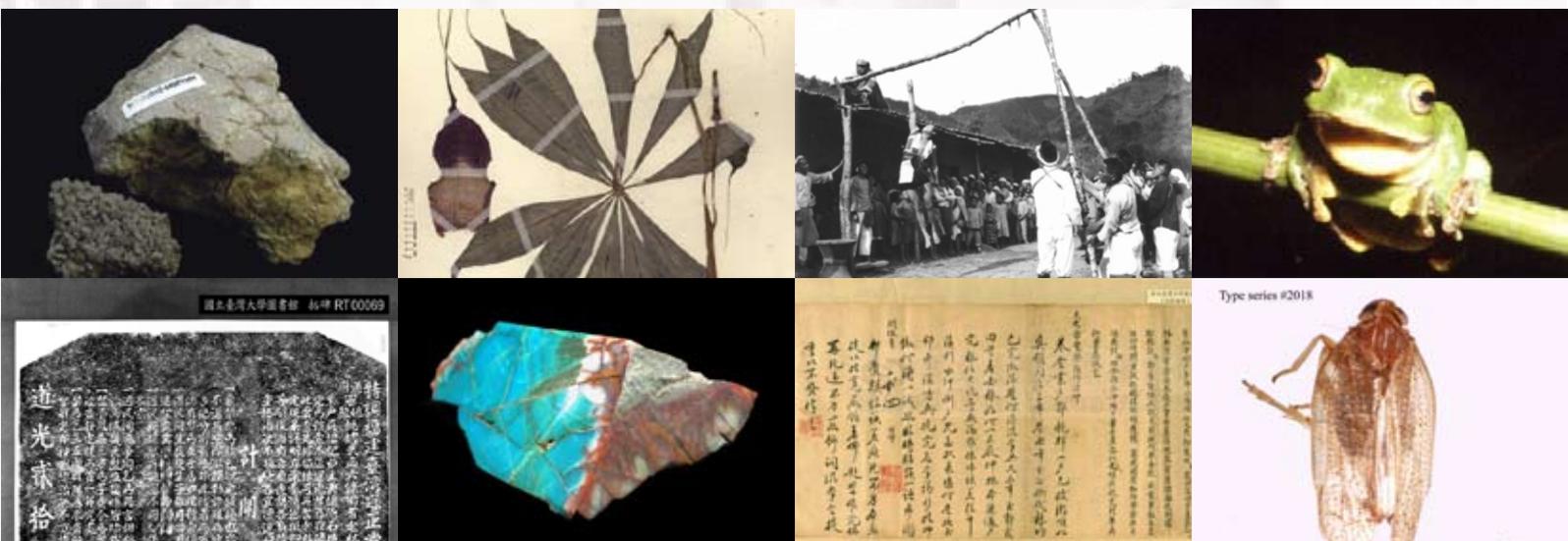
Other digitization projects being conducted under the Digital Archives Project of NTU include the TAI Herbarium, the Museum of Zoology of the Institute of Ecology and Evolutionary Biology, the Insect Museum of the Department of Entomology, the Geosciences Collections of the Department of Geosciences, and the Anthropological Collections of the Department of Anthropology. More information concerning these projects is available online at <http://140.112.114.21/newdarc/darc/english/introduction.htm>.

Related Website:

- ◆ NTU Library: <http://www.lib.ntu.edu.tw/>
- ◆ Digital Archives Project of National Taiwan University: <http://www.darc.ntu.edu.tw/>
- ◆ Special Collections Databases of NTU Library: <http://www.lib.ntu.edu.tw/CG/resources/db-index.htm>



NTU and the NTU Library are digitalizing a wide variety of Taiwan's valuable cultural and scientific assets under the NTU Digital Archives Project and NTU Digital Taiwan-Related Archives Project.



College of Life Science's GE Courses Prepare Students to be Leaders of Society

The College of Life Science offers a wide selection of high-quality general education courses which help prepare the university's undergraduate students for their future roles as leaders of Taiwanese society by expanding their understanding of humans' position within the environment and the role of biology in everyday life.

These unique interdisciplinary courses that fulfill NTU's general education requirements have proven to be quite popular among students. In particular, Dr. Shau-chi Chi's *The Exploration of Life*, Dr. Chu-fang Lo's *Biology and Everyday Life*, and Dr. Yu-teh Lin's *Ecology and Human Society* have been named the best GE courses at NTU several times.

A look at Dr. Lin's *Ecology and Human Society* will reveal why these courses are so effective and so popular. The goal of this course is to encourage students to develop eco-centric attitudes in their daily lives. Through lectures, reflection and discussions, Dr. Lin and his teaching assistants encourage students to live environmentally responsible lives and become active supporters of environmental conservation. The curriculum links social issues and scientific concepts to research findings that contribute to the preservation of biodiversity. Students are instructed to reflect upon required readings before lectures. Dr. Lin's 60-minute lectures present students with issues to consider over the following week. An essential element of this course and others like it is that lectures are followed immediately by a 90-minute small-group (20 students or fewer) discussion session during which TAs lead the students in sharing their thoughts on the issues

During Life Science GE courses

1. Students share their ideas during a discussion session.
2. Students act out their views on an issue concerning GMOs and biodiversity.



raised during lectures. The TAs use creative methods to stimulate the exchange of ideas. For example, a food web game is used to help students learn about the interdependence of different species and the roles humans can play in an ecosystem. These interactive discussions are intended to foster productive social interactions between students from various academic backgrounds and to challenge students to extrapolate their scientific ideas. Power Point presentations and on-line databases are also used to convey the aesthetic value of biodiversity and share stories about the collaborative efforts of conservationists. The course also features an active after-class on-line discussion forum. This forum is meant to expand upon in-class discussions and give stage-shy students a platform for expressing their ideas. During the fall 2007 semester, the students and TAs together posted more than 1,700 articles through this forum.

NTU at a Glance

Computer and Information Networking Center Continues to Upgrade NTU's Computing Environment

The Computer and Information Networking Center has been working on multiple fronts to improve NTU's digital infrastructure. In its effort to provide high-performance computing services for NTU research groups, the CINC is setting up one large mainframe computer and two grid computing clusters. The large mainframe computer contains 64 CPUs and 256 gigabytes of memory. In addition to this hardware, CINC has also provided software packages—including Matlab, Mathematica, SAS, SPSS, Gaussian, VASP, Discovery Studio, and Material Studio—that may be jointly used by researchers in a wide variety of fields, including mathematics, scientific computing, statistics, physics, and mechanics.



Furthermore, in order to provide high-speed, high-quality network services for all faculty members and students, the center is upgrading core campus networks to ten gigabytes and uplinking all buildings to one-gigabyte connections. This project also includes Giga Switch purchasing and the installation of a campus-wide fiber optic network.

In other news, the CINC is proud to report that in the Webometrics Ranking of World Universities, NTU's overall web performance ranked 73rd in the world in January of 2008, up from 96th place in 2007. Even more impressive is NTU's achievement in the Asia Pacific region, where NTU now enjoys a third-place ranking behind only Australian National University and the University of Tokyo, which achieved global rankings of 47th place and 61st place respectively.

The Webometrics Rankings have been conducted twice every year since 2004 by the Center for Scientific Information and Documentation of the Spanish National Research Council in Madrid.

The Webometrics Rankings have been conducted twice every year since 2004 by the Center for Scientific Information and Documentation of the Spanish National Research Council in Madrid.



Condensed Matter Science and Physics Building

NTU established the Center for Condensed Matter Sciences in 1992 in order to promote advanced condensed matter science research that possesses both academic and application potentials, to spur closer cooperation between the university's colleges and departments and with other academic institutions, and to develop interdisciplinary academic curricula with the aim of cultivating for the cultivation of technological talent capable of innovation. The center also planned the construction of the new Condensed Matter Science and Physics Building, a 26,000-square-meter, 14-floor building housing dedicated laboratories, lecture halls, a library, a computer room, and a 206-seat conference hall. More information about the CCMS is available online in English and Mandarin Chinese at <http://www.ntu-ccms.ntu.edu.tw/index.html>.

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