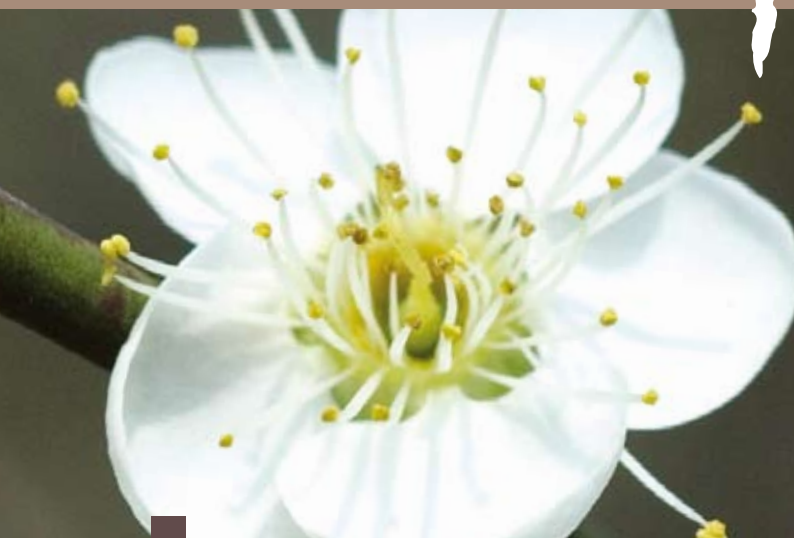




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NTHU CONTINUES ASCENDING IN QS WORLD UNIVERSITY RANKINGS

Based on the recently released reports, NTHU continues to improve her positions in two important QS rankings. Firstly, QS ranked selected disciplines/fields of study offered in universities worldwide and on September 10th, it announced the result of world university ranking. In the ranking of various disciplines, NTHU has 12 of its departments/institutes ranked in the top 200, and seven of these 12 disciplines were actually ranked within the top 100. These are: English Language and Literature, Linguistics, Modern Languages, Computer Science and Information System, Chemical Engineering, Materials Science and Mathematics. The remaining 5 disciplines that were ranked within the top 200 are: Electrical Engineering and Electronic, Engineering Aeronautical and Manufacturing, Statistics and Operational Research, Chemistry, as well as Physics and Astronomy. Secondly, the newly released QS

World University Ranking placed NTHU at the 192th, an improvement of 21 positions from the 213th last year. There are only two Taiwanese universities that are ranked within the top two hundred. President Lih J. Chen is pleased but not surprised by this new ranking. As a comprehensive research university, President Chen indicated that we have devoted a great deal of effort to upgrade our research capability as well as our teaching programs. The research accomplishments are clearly demonstrated in the increasing number of research papers published in prestigious international journals, such as *Science*, *Nature*, and *Cell*, and the results of our excellent instructional programs are also manifested in the achievements of our students, graduate and undergraduate. Furthermore, many of our graduate students are also co-authors of important research papers and won awards in international competitions.



A MAJOR BREAKTHROUGH IN 3D MICROSCOPY

After a decade of cooperation, Prof. Fu-Rong Chen, Department of Engineering and System Science, NTHU, and Physics Professor Dr. Dirk Van Dyck of Belgium University at Antwerp, broke through the limit of atomic structure of the two-dimensional projection image analysis. The new technology they have developed is capable of displaying three dimensional atomic structure of Graphene. This important research was recently published in the prestigious *Nature* magazine.

According to Prof. Chen, in order to understand and control biological protein's nature and functions, defining its atomic three dimensional structure is a must. Current tomography materials recognize close to one hundred projection directions for image restructuring but, such image does not reach the standard for atomic analysis. Prof. Chen used the frozen electron microscopy tomography for organisms as an example to demonstrate that this technique picks out thirty seven thousand protein molecules from three thousand electron microscopy images,

utilizing approximately seven thousand computer clusters and a long time of calculations to restructure the three dimensional conformation. But, even then the resolution of the best structure rebuilt is not up to the atomic level. Prof. Chen stated that the starting point of their research was the Big Bang Theory from astrophysics, which was developed into "The Big Bang Atomic Resolution Tomography" to enhance the rebuilding of three dimensional atomic structures. Furthermore, like astrophysicists speculating the time and origin of the Big Bang using the Hubble equation, we can use similar scientific theory to calculate the three dimensional arrangement of atoms from the relationship of "phase" and "phase speed" between different angles of atomic. Currently, a program is being developed based on this theory. With the combination of this program and the electron microscope, materials or protein will be displayed automatically as a three dimensional atomic structure image. Prof. Fu-Rong Chen pointed out that although the current study uses graphene with crystalline bilayer

outgoing waves to verify the accuracy of the Big Bang Atomic Resolution Tomography, the theory also has great potential to expand its application to materials and protein with non-periodic structures. This technique can also be applied to the field of biomedical and materials science, bringing revolutionary changes in three dimensional structure analysis of protein and non-crystalline materials.

As the host for this press conference at the headquarter of National Science Council, President Lih J. Chen mentioned that *Science* has published Prof. Ann-Shyn Chiang's research in February this year and *Cell* has published Prof. Chuang-Rung Chang's research in the same month. In March, *Nature* published the thesis written by Professors Rong-Long Pan and Yuh-Ju Sun. Thus the research done by Prof. Fu-Rong Chen is the 4th article NTHU researchers have published in the most prestigious academic research journals within four months. All these important researches were partially supported by NSC and NTHU would like to take this opportunity to thank NSC for its long term assistance.

- a Prof. Fu-Rong Chen explaining how to calculate the three dimensional arrangement of atoms.
- b Prof. Chen at the press conference.



PROF. GWO'S RESEARCH TEAM DEVELOPED THE WORLD'S SMALLEST SEMICONDUCTOR LASER

An international research team consists of researchers from Taiwan and the United States, led by NTHU's Physics Professor, Dr. Shangjr Gwo, broke through the traditional laser diffraction limit and successfully developed the world's smallest semiconductor laser, a new photonic technology with potential applications in computing and medicine. This important research was published in *Science* on July 27, 2012, and reported at a press conference held at the National Science Council on the 30th when President Lih J. Chen introduced the team members from NTHU, National Chiao Tung University and University of Texas at Austin to the general public in Taiwan. Miniaturization of semiconductor laser is the key in the development of high speed, broadband, low-powered optic computing and optic communication system. Unfortunately, it was restricted by the optical diffraction-limit and scientists have been searching new ways to break through the limit to upgrade semiconductor technology. During their research process, Dr. Chih-Kang Shih, Professor of Physics at University of Texas at Austin, first used Quantum Epitaxial Growth

method to grow an atomic level silver epitaxial films in his laboratory. Such silver film possesses excellent crystalline property and is used to create low energy-loss plasma resonance cavity. To enhance the conductivity of the semiconductor, Prof. Gwo's laboratory utilized the Molecular-Beam Epitaxy (EBM) method to grow InGaN/GaN core-shell structure nano pillars. "We have developed a nanolaser device that operates well below the 3-D diffraction limit," said Prof. Shih, "we believe our research could have a large impact on nanoscale technologies." The green florescent enhancing medium, InGaN, not only has extremely high light enhancing-medium coefficient, but also has perfect crystalline and core-shell structure as verified by Prof. Lih J. Chen's laboratory. The first author of this research paper, Ms. Yu-Jung Lu, a second year doctoral student at the Department of Physics at NTHU, successfully fused a single nano pillar with the low-power loss plasma resonance cavity. She created the plasmonic nanolaser that can emit light in continues waves and has an extremely co-efficient low lasing threshold. Moreover, Prof. Wen-

a Professor Gwo Shangjr presenting his team's research results.

b President Lih J. Chen with Prof. Shangjr Gwo and the research team at the press conference in NSC.

Hao Chang of National Chiao Tung University provided the crucial single photon measurement technology which proves the time coherence of plasmonic laser for the very first time. Prof. Gwo explained at the press conference that "while we know optical fiber communication is fast, due to the fact that we have yet to have the technology to shrink the light component, the CPU inside computer still uses electronic computation. If the light component can be reduced and made into a type of optical chip, the speed of computing can be increased by thousand folds." Although this research has proved that plasmonic nanolaser can reach beyond the optical diffraction-limit, it still requires more research and experiment before this new technology can be commercialized. This important research, however, opened a brand new passage and provided a classic example of Active Plasmonic System. It will also provide a platform to facilitate the integration of plasmonic and nano electronic elements on single silicon chip, and open a new chapter in the developmental history of high speed, broad band, low-power lose technology.



NTHU DEVELOPED STATE OF ART LIVING CELL IMAGING

Breaking through the limit of traditional cell staining method, Dr. Ta-Jen Yen and his research team successfully combined human stem cell on the surface of the metamaterial -- artificial materials engineered to have property that are not commonly found in nature -- by using the interaction between the metamaterial and the penetrating light to create an image of cell interior without damaging or killing the cell. This is the world's first major breakthrough in the use of metamaterial for bio-imaging; the research has recently been published in the prestigious journal, *Advanced Materials*. Dr. Yen, Department of Materials Science and Engineering, indicated that to do the intracellular imaging in the past would require cell staining for calibration. However, staining usually causes damages or death, which makes living cell interior imaging unfeasible. "Equipment does exist that can get images while maintaining the cells' integrity, but

the process and equipment would be very costly, and the resolution delivered by these instruments is less than ideal" said Dr. Yen. In recent years, Dr. Yen has been concentrating on the development of non-destructive cell imaging. He taught and trained his students, Yueh-Chun Lai, Hsin-Cheng Lee, and Cheng-Kuang Chen, to combine human stem cell with the surface of the metamaterial and analyze its infrared image. They discovered that the radiation spectrum of the metamaterial changes in response to its environment. Thus, the composition of the stem cell can be determined by scanning the radiation from different parts of the metamaterial and acquire the image of cell component. This method essentially amounts to the creation of a new "microscope" for cell research that does not require dyeing calibration and gives real time imaging. "Immediate, fast, non-evasive and non-destructive biological imaging

is the current goal to achieve when doing live cell imaging. The metamaterial resolves this bottleneck," said Mr. Chen. He further stated that nano-metamaterial biological cell microscope has characteristics of customized radiation spectrum (such as infrared or other visible lights), needs neither calibration nor special optical components, and has nano-length detection. Therefore, comparing to the other type of none invasive imaging like the plasma resonance imaging, metamaterial microscope imaging is more suitable for observing living cell. Mr. Chen pointed out that their research result can observe the spread of cell organs in the human stem cell and provides information on cell chemical. Hopefully, the metamaterial-microscopy will have more simplistic configuration and better depth of detection for the cell imaging in the near future.

a Prof. Ta-Jen Yen displaying his publication.
b Prof. Yen and his student research associate Cheng-Kuang Chen.



NTHU PRESENTED AN HONORARY DOCTORATE TO PRESIDENT SHU-HUNG LIN OF CHANG CHUN GROUP

- a Dr. Lin and a group of his young admirers.
- b Mr. Shu-hung Lin received an Honorary Doctorate Degree in Engineering from NTHU.

Mr. Shu-Hung Lin, the Founder and the President of Chang Chung Group (CCP) contributed greatly to Taiwan's industries and economy. In recent years, he led a CCP team to develop a new mechanism to convert carbon dioxide into an industrial product, and secured a leading position for CCP in Taiwanese chemical industries. To recognize such achievements, NTHU's Honorary Doctorate Review Committee recommended to present President Lin an Honorary Doctorate Degree in Engineering to recognize his contribution to the society. President Lih J. Chen stated that President Lin is a legend in the industrial circle in Taiwan. In 1949, he and two schoolmates, the current CEO, Mr. Hsin-Yi Cheng, and former Chairman, Mr. Ming-kun Liao, jointly founded the Chang Chung Artificial Resin with a very small capital. This factory has become one of the

major chemical enterprises and the most important domestic supplier of chemical raw materials in Taiwan with an annual turnover of 180 billion NTD.

Under his leadership, CCP has become the most innovative petrochemical group in Taiwan. It invested approximately 10% of its human resources on research and development, which is a much greater budget than the average of Taiwanese high-technology industry. Such effort has brought them over 200 patents. Moreover, in November of 2011, *Vision* magazine invited industrialists and scholars to name a most important domestic petrochemical company; CCP was selected with a vast majority votes. President Lin also place a strong emphasis on work safety and environmental protection; he believes that the leaders in chemical field should lead the society and the industry not just in person but also in action when it comes to the

issues of safety at work place, as well as environmental conservation. Moreover, Mr. Lin believes that it is more important for professionals to have a righteous work ethics than simply being knowledgeable. The leaders should constantly review literatures, and absorb information while interacting with others in the industry. He further stressed that corporations should develop its own research and development strategy so that it would know when is the right time to introduce new technology and what production procedure is required. President Chen praised President Lin as a gentle scholar who works quietly and patiently to build an outstanding group and provide us with a wonderful example of "action over words."



WORLD RENOWNED HEMATOLOGIST DR. KENNETH K. WU JOINS NTHU

President Chen and Mr. Ho presenting the
Letter of Appointment to Dr. Wu (center).

On September 11, 2012, NTHU announced that Academician Kenneth K. Wu, former Vice Chairman of the Department of Medicine of The University of Texas, as well as the Director of Taiwan's National Health Research Institutes and a world renowned hematologist, will become the Ho Chin-Tui Chair Professor of Life Sciences.

Speaking about his new appointment in NTHU, Academician Wu said that "I am excited to re-enter academic life in one of Taiwan's most research intensive and prestigious universities. I look forward to interacting with the outstanding faculty members and students not only in life and medical sciences, but throughout the entire university." "Having Academician Wu's enormous wisdom, deep knowledge in life and medical/clinical sciences, and eminent international stature as a scientist and medical practitioner to join our College of Life Sciences

at this moment is simply perfect timing," according to President Chen. President Chen went on to indicate that NTHU's College of Life Sciences was founded exactly two decades ago. Recently, it has reached a new height, i.e., it is fast gaining international recognition in its multifaceted research. For example, just this year, breakthrough areas of research which had been incubated for many years in various aspects of life sciences were reported in top journals of the field. They included the following:

A *SCIENCE* article entitled Visualizing Long-term Memory Formation in Two Neurons of the *Drosophila* Brain, which is an important research conducted by an international team led by Professor Ann-Shyn Chiang.

The *NATURE* article entitled Crystal Structure of a Membrane-embedded H⁺-Translocating Pyrophosphatase by a national team jointly led by Professors Yuh-Ju Sun and Rong-

Long Pan.

A *CELL* article published entitled Spt4 Is Selectively Required for Transcription of Extended Trinucleotide Repeats which Prof. Chuang-Rung Chang of NTHU is part of an international team led by Prof. Tzu-Hao Cheng of Yang-Ming University.

"These and many more life-sciences and related breakthroughs and the new addition of Academician Kenneth Wu to NTHU are truly exciting moments for the university! I have no doubt that Prof. Wu and his colleagues will soon bring new heights to NTHU's research of life and medical sciences!" concluded President Chen.



A FEAST OF KNOWLEDGE: NOBEL LAUREATES ON PERSONALIZED MEDICINE AND PROTEIN FORMATION

a Nobel Laureates with NTHU faculty members.

b President Lih J. Chen with Dr. Eda E. Yonath (left) and Dr. Aaron Ciechanover (right).

The 2004 and 2009 Nobel laureates in Chemistry, Dr. Aaron Ciechanover and Dr. Ada E. Yonath, lectured on the NTHU campus on May 19, 2012, to celebrate the 20th anniversary of College of Life Sciences. To introduce Taiwan's innovative research and development of biotech products and the success stories of breaking into the international market, a Biotechnology Forum was also held in the afternoon of the 19th, hosted by Senior Vice President Da-Hsuan Feng with the two invited Israeli Nobel laureates.

Dr. Aaron Ciechanover is a professor at Israel Institute of Technology, also a physician who has devoted years in the research of biochemistry. During his study in the School of Medicine, he had a profound realization of how little understanding we, humans have on the cause of diseases, and decided to dedicate his life to research in this field.

Prof. Ciechanover indicated that

currently many clinical cases revealed that patients with similar symptoms could have different physiological responses to the same drug due to the fact that the disease had different molecular basis. He also pointed out that it is extremely difficult to use traditional Chinese herbal medicine to treat disease in current state of science because of the unclarified ingredients and the lack of concrete scientific data. However, Prof. Ciechanover believes that the herbal medicine has great potential to become the trend for future disease treatments.

"The medical profession is entering an era of personalized medicine," said Dr. Aaron Ciechanover, "A fast and inexpensive method to sequence a person's gene should be developed first, and through pathogenic mechanism-oriented search to target specific disease molecular and administer drug treatment." These transitions require, however, changes in education and cross disciplinary

research. Issues such as how to protect the privacy of one's genetic data is a topic that government health related agencies should pay attention to.

Dr. Ada E. Yonath is not the only female Nobel Prize winner from Israel, but also the only female Nobel laureate from Middle Eastern region. For decades, she has focused on the field of ribosomal research, using X-ray crystallography to resolve the three dimensional structure of "Ribosome" (the protein factory of biological cells). Prof. Yonath further utilized other biophysical methods to completely resolve the mechanism of ribosomal protein synthesis.

Currently, Dr. Yonath is the director at the Weizmann Institute of Science, as well as a Chair Professor at the Department of Structural Biology. Her research on ribosome molecular structure and biological functions brought Professor Ramakrishnan and Professor Steitz and herself the 2009 Nobel Prize in Chemistry.



MR. ROBERT TSAI AND PROF. CHEN-FU CHIEN ARE TWO PROUD WINNERS OF THE NATIONAL QUALITY AWARD

Recently, The Executive Yuan announced the list of 22nd National Quality Award winners, and held an award ceremony on June 14th. Awards were presented to the Chairman of Swancor Corporation Ltd, Mr. Robert Tsai, a Distinguished NTHU alumnus and the President of Tsing-hua Entrepreneur Network; and to Distinguished Professor, Dr. Chen-Fu Chien, who is also the newly appointed Chief of Staff of the university. Under the leadership of Chairman Robert Tsai, Swancor Corporation Ltd. places a strong emphasis on research and development, and have become the largest vinyl resin distributor in Asia and one of the top three worldwide. Swancor is a company devoted to "Conservation and Green", and is the first enterprise actively participated in the development of Taiwan Strait offshore wind farm in support of the national renewable resource policies. Mr. Tsai indicated that his colleagues in Swancor strictly adhere to the eight dimensions of quality control and comprehensively designed their

respective stations to achieve greater quality control, which eventually won the recognition from National Quality Award.

Keenly aware of the fact that high-tech industry has a great impact on the development of Taiwan's competitiveness and economy, Prof. Chen-Fu Chien devoted a great deal of his research effort to develop methods and systems to solve practical problems faced by Taiwanese high-tech industry. His expertise are in the field of: decision analysis, manufacturing strategy, data mining, modeling and the analysis of semiconductor manufacture management, service systems, as well as PDCCCR (Pricing-Demand-Capacity-CapEx-Cost-Return). Moreover, to remedy problems caused by the fast technological changes, complex production factors, short product lifespan, supply chain bullwhip effect, and the neglect of quality management and industrial engineering; Prof. Chien and his Decision Analysis Lab (DALab@NTHU)

a Mr. Chun Chen, Premier of Executive Yuan presenting National Quality Award to Chairman Robert Tsai.

b Prof. Chien and his Decision Analysis Lab with Mr. Tsai at the National Quality Award Ceremony.

formulated "Enabling A+ Decisions" as their model and work with leading manufactures such as TSMC, Macronix, MediaTek, and Delta Electronics, to develop strategies that will enhance the quality and competitiveness of their industry. Through NTHU's Advance Manufacturing and Service Management Research Center, Prof. Chien and his research team have opened up significant and innovative research direction for management to improve the efficiency and increase the value of Taiwanese high-tech industry. Furthermore, his team also holds a high position in the international management community and is recognized worldwide by scholars and industrialists for its academic and practical value. They have published over one hundred journal papers, edited three books and several case studies on Taiwanese high-tech companies in Harvard Business School, and have several invention patents and successful technology transfers to semiconductor companies.



PROFESSORS RAY-KUANG LEE AND MENG-FAN CHANG WON THE ACADEMIC SINICA'S JUNIOR RESEARCH AWARD

a Prof. Meng-Fan Chang is the rising star in the field of integrated RAM circuit design.

b Prof. Ray-Kuang Lee and his beloved family.

After winning the Ta-You Wu Memorial Award last year, Prof. Ray-Kuang Lee, Institute of Photonic Technology, and Prof. Meng-Fan Chang, Department of Electrical Engineering, both won the 2012 Academic Sinica Junior Researcher Award.

Due to the fact that current quantum optics research placed a great deal of emphasis on quantum communication technologies and quantum chaotic theory, any technical and theoretical breakthrough will not only affects traditional coded communication, but also provides theoretical basis to examine many unexplained physics phenomenon. The quantum theory of phase transition formulated by Prof. Lee in 2008 remove the limitations of past theories. Optical Society of America recognizes this accomplishment and stated that Prof. Lee's theory will provide a new model for future experiments.

Moreover, Prof. Lee also used the quantum optics theory to provide theoretical basis for ultra-slow optical soliton and dark optical soliton, which provides a platform for the application on quantum information processing and communication experiments. The review panel at Academic Sinica praised Prof. Lee's work as offering a new research direction which could make Taiwan the international center of quantum optics and quantum chaos study.

Prof. Meng-Fan Chang dedicated years designing high yield, low-power consumption and low-operating voltage RAM circuit. In recent years, the focus of his study has been centered on the high yield non-volatile RAM, low voltage and three dimensional volatile RAM. Prof. Chang's research is both theoretically significant and practically applicable; the quality and quantity of his research findings are

ranked the highest in the world and were frequently published in IEEE Journal of Solid-State Circuits, the most highly regarded chip design journal. Furthermore, Prof. Chang has many research papers published by ISSCC, the top international organization in his field of study. His design will be implemented to verify its efficacy through the combined effort of Taiwan Semiconductor Manufacturing Company Ltd, Industrial Technology Research Institute and National Chip Implementation Center, to explore the future application of this design in the related industry. It is believed that when Prof. Chang's design of low-power consumption, extended battery idle time and increased chip efficiency is fully materialized, it is possible that the future hand-held devices and biomedical electronics could be operated with solar power, making future electronic product more energy efficient.



THE 34TH GENERAL MEETING OF THE PHI TAU PHI SCHOLASTIC HONOR SOCIETY

President Lih J. Chen took over the chairmanship of The Phi Tau Phi Scholastic Honor Society in last February, and has presided over two General Meetings within the year. The Second 34th General Meeting was successfully held on Aug 15-16 and participated by 31 members representing their respective institutions.

During the meeting, Chairman Chen thanked the members for their participation and contribution to the association. Reports on the state of Phi Tau Phi and their financial status were followed by the discussion of the budget and agenda for the rest of the year. The elections of supervisors and council members were also successfully accomplished. An award ceremony was also held during the meeting to recognize individuals who have made outstanding contributions to the society. This year, 18 candidates were recommended by 15 member

institutions for the Outstanding Achievement Award. Out of the 18 candidates, two were finally selected to receive this honor. They are Dr. Ching-Hsien Wang, Honorary Professor of National Dong Hwa University and Chair Professor of the Institute of Taiwan Literature at National Chengchi University, and the Chairman of Eric Yao Creative Consultancy, Mr. Eric Yao. Chairman Yao accepted the award in person, and presented an inspiring speech on the topic of "University 2.0, the Shrinking Market and the New Philosophy of University Education." The Phi Tau Phi Scholastic Honor Society was originally named The

- a Representatives of the 34th General Meeting.
- b An Outstanding Award was presented to Chairman Eric Yao.
- c President Chen with the representatives and NTHU staff members.

Phi Tau Phi Scholastic Honor Society of The Republic of China. It was founded in 1921 by an American Professor from the Imperial Tientsin University (now Peiyang University), Dr. J. H. Ehlers. Phi, Tau, Phi stands for "philosophy, engineering and science." The Society's mission is recognizing excellence, rewarding outstanding academic researches, and promoting professionalism among individual from its member institutes. The Phi Tau Phi Scholastic Honor Society headquarter was re-established in Taiwan in March 1964. Currently, it has 52 branches with a total of 44,458 honorary members.





NTHU SIGNED A STRATEGIC ALLIANCE AGREEMENT WITH NATIONAL IMMIGRATION AGENCY

In the morning of July 12th, President Lih J. Chen and Director-General Li-kung Hsieh of the National Immigration Agency, Ministry of Interior, signed an agreement to integrate their resources and expertise to improve immigration services that will enhance Taiwan's globalization and improve our capability to attract world-class human resource. President Chen observed that the issues Taiwan is facing in the area of immigration include adoption, recruitment and retention of skill personnel to our education and research institutions. He further explained that currently we have a great opportunity to further improve our education system by recruiting

world-class scholars and researchers to join our universities and research institutions and, to recruit and retain international and mainland students. President Chen is very pleased that National Immigration Agency agreed with his view and is willing to cooperate with NTHU to find ways to facilitate the globalization of Taiwan's academic institutions. Director-General Hsieh indicated that his agency will cooperate with NTHU to formulate new policies to recruit and retain skilled personnel abroad and, to liberalize its existing policies so that new immigrants will have greater liberty, social and economic opportunity in Taiwan. Vice President of Student Affairs, Dr. Ping-Chiang Lyu, Vice President

- a President Lih J. Chen and Director-General Li-Kung Hsieh of National Immigration Agency signed a strategic alliance agreement.
- b The signing ceremony was attended by NTHU faculty and representatives from Immigration Agency.

of Academic Affairs, Dr. Sinn-Wen Chen, and Vice President of Global Affairs, Dr. Wei-Chung Wang, all attended the signing ceremony and expressed their enthusiasm towards the cooperation. "The staff members of NTHU and the National Immigration Agency intend to work together not just on the academic level, but also on the formulation of policies," said President Chen. He also pointed out that this cooperative project is also a great opportunity for the faculty and students in the Colleges of Humanities and Social Sciences and Technology Management to develop new research projects to further improve current immigration policy.



NATIONAL TSING HUA UNIVERSITY NEWSLETTER

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PUBLISHED BY OFFICE OF THE SECRETARIAT

PUBLISHER : President Lih J. Chen
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