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NATIONAL TSING HUA UNIVERSITY

NTHU

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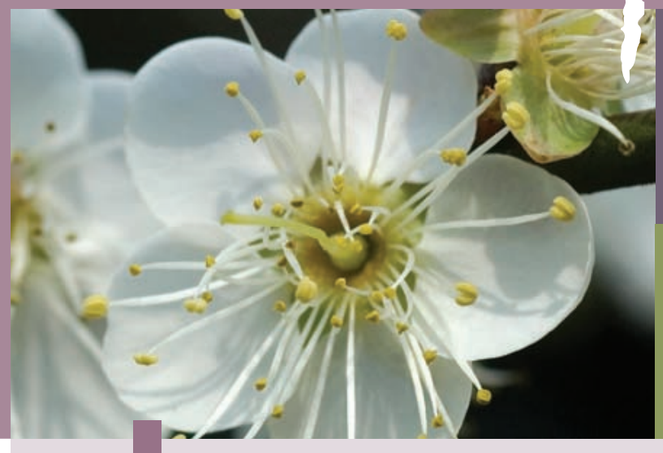

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NTHU

CELEBRATING NTHU'S 104TH ANNIVERSARY AND 59 YEARS IN TAIWAN

a President Hocheng
b President Hocheng and VIPs singing the NTHU school song.

We recently celebrated NTHU's 104th anniversary, as well as the 59th anniversary of the university's reestablishment in Taiwan. During the ceremony, held in the Auditorium and attended by over 1,000 people, President Hong Hocheng stated that NTHU goes all out to provide students with the best education. He also pointed out that during this challenging time of economic stagnation we need to persevere and work together to forge a brighter future.

This year's anniversary was accompanied by a series of special events, including a footrace around the campus, an exhibition of the bird-worm seal script by a 105-year-old calligrapher Mr. Muh-he Chao, and a memorial concert for NTHU alumnus Chi-jen Chen, the former chairman of Giga Solar and Gigastorage. Among the distinguished guests were Minister Bau-tscheng Dung of the Ministry of Examination and Simona Halperin, Representative of the Israel Economic and Cultural Office in Taipei.

During his speech President Hocheng mentioned that NTHU has become one of the leading institutions of higher education not just in Taiwan but also internationally. He also pointed out that this is due to NTHU's excellent faculty and state-of-the-art facilities, as well as its long-term commitment to academic excellence and the tradition to encourage lifelong learning.

During the ceremony, speeches were given by T. J. Tseng, President of the NTHU Alumni Association; Minister Dung, Simona Halperin, and Ovid Tseng, the Chancellor of the University System of Taiwan.

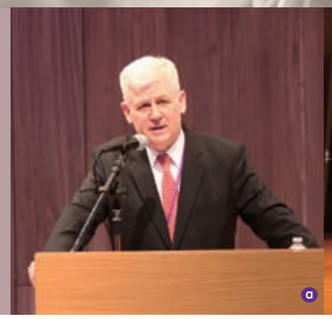
In his speech T. J. Tseng of NTHU Alumni President Association praised the innovative ideas adopted under the leadership of President Hocheng. He also mentioned that in preparation for the celebration of NTHU's 60 years in Taiwan, the Alumni Association is undertaking a fund-raising campaign to enhance NTHU's educational resources.

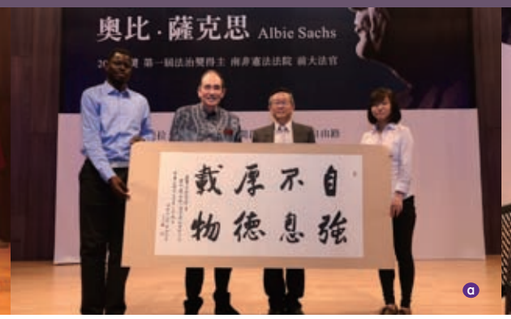
Minister Dung mentioned that as a boy his mother had always hoped that he would one day attend NTHU, and even though he never did, he is proud to be the parent of a current NTHU student. He also encouraged NTHU students to make the most of their time cultivating the skills and character needed for success in today's rapidly changing world.

In addition to a number of outstanding NTHU students and student organizations, honorable mentions made during the ceremony included alumni Eric Tsai, Wei Wang, Yi-cheng Shih, and Sharon Liao. The ceremony came to a dramatic conclusion with a rousing rendition of the NTHU school song.

In conjunction with the main ceremony, a number of exciting events were also held on campus, including a lively fair, a cultural exhibition by NTHU's international students, a Malaysian kick volleyball match, and a "bubble football" match. The fair included a booth set up by the library where children made colorful bookplate rubbings, and a booth selling Malaysian handicrafts and explaining the cultural conservation work currently being carried out by NTHU's Malaysia Volunteer Team.

c Information and fundraising booth of the Malaysia Volunteer Team.
d Children making colorful bookplate rubbings at a booth set up by the NTHU library.





AIT DIRECTOR DELIVERS MEMORABLE SPEECH ON THE TAIWAN-US RELATIONSHIP

a AIT Director Christopher J. Marut
b VIP group photo featuring Director Marut (fifth from right), NTHU President Hong Hocheng (center), Director-General Tu Chi-Hsiang of Hsinchu Science Park Bureau, and TSMC Chairman Morris Chang.

On April 22 Christopher J. Marut, the Director of American Institute in Taiwan (AIT), delivered a speech at NTHU titled "Three Years at the Helm of AIT: Reflections on the U.S.-Taiwan Relationship." Director Marut reflected on Taiwan's role on the international stage and also provided quite a few valuable suggestions for young people getting established in their careers.

In his introduction William A. Stanton, Senior Vice President for Global Affairs, pointed out that Marut's speech has special significance, since it is delivered during the week when NTHU commemorates its founding, in which the US played an important role. In accordance with the Boxer Protocol, China began paying indemnities to the US and other foreign powers in 1901. In 1909 President Roosevelt and the US Congress decided to divert a large portion of these payments to a program for sending Chinese students to American universities. To prepare the students chosen for this program, in 1911 Tsing Hua College (the predecessor of NTHU) was established in Beijing to teach English and to serve as a preparatory school. Thus, right from its inception NTHU has had a close relationship with the US. A large number of NTHU faculty members earned their PhDs in the US, and since 1974 a total of 33 NTHU faculty and students have participated in the prestigious Fulbright Program. In addition, NTHU has established student exchange programs with a number of universities in the US; at present there are 14 American exchange students enrolled at NTHU, and 12 NTHU students currently studying in the US. Notably, this is the first time a serving director of AIT gives a speech at NTHU, and we sincerely hope that this precedent will result in the establishment of a new tradition.

In his speech, Director Marut noted that around 60 percent of the world's population is under 30 years of age, these young people constitute the primary driving force for social and economic progress. He also mentioned that in recent years the US government has redoubled its efforts to connect with the youth worldwide. Commenting on the social changes made evident by last year's elections in Taiwan, Director Marut stated that in his view young people in Taiwan don't really fit the stereotype of the "strawberry generation," but instead exhibit a high degree of motivation, resilience, and confidence. He also encouraged young Taiwanese to not become discouraged by temporary setbacks and to continue moving ahead with a sense of purpose and resolve.

Director Marut also pointed out that Taiwan is the US's tenth largest trading partner, while the US is Taiwan's second largest trading partner, and that since 2012 trade between the two nations has increased by six percent. He also emphasized that Taiwan and the US have always had a stable relationship in terms of trade, security, and human rights, as made evident by the opening of AIT's new office in the Neihu district of Taipei.

After concluding his speech Marut opened the floor to questions, a number of which concerned the US position on the failure of Taiwan's recent bid to join the Asian Infrastructure Investment Bank (AIIB). Marut replied that the US supports Taiwan's efforts to participate in various international organizations, and suggested that it is important to anticipate the changes and challenges that such participation might also incur.

TANG PRIZE LAUREATE ALBIE SACHS VISITED NTHU AND RECOUNTED THE STRUGGLE IN SOUTH AFRICA

a NTHU President Hong Hocheng (second from right) presenting Albie Sachs with a copy of the NTHU school motto: Self-discipline and social commitment.
b Sachs autographing copies of his books.
c Group photo.

On April 30 Albie Sachs, a former Justice of the Constitutional Court of South Africa and winner of the first Tang Prize in Rule of Law, visited National Tsing Hua University and gave a talk at the International Conference Center. In his talk, titled "Nelson Mandela, from a Lawbreaker to a Lawmaker," Sachs spoke on the importance of human dignity and human rights, and also recounted his association with Mandela and their long struggle on the road to freedom.

Following the welcoming address by Senior Vice Chancellor Lin Sheng-Fen, Dr. Raymond Chen-En Sung of the Tang Prize Foundation provided an introduction in which he lauded Sachs' commitment and important contributions to human right, equality, justice, and the rule of law.

Sachs began his talk with a laudatory recollection of Mandela and the sweeping changes he presided over in South Africa. He then described the severe racial segregation and inequality in the 1950s, as well as the government censorship of the media. It was in such an environment that Mandela joined the African National Congress (ANC) and began his lifelong struggle to bring racial justice and equality to South Africa. Sachs also recounted how countless numbers of people who actively opposed apartheid in South Africa were oppressed, imprisoned, and assassinated.

Having been under foreign rule and martial law for most of the twentieth century, Taiwan has also had a long struggle for justice and democracy. After Sachs' talk, a panel of NTHU junior faculty including Professors Huang, Chu-Cheng, Lin Yun-Hsien, and Chen Chung-Lin presented a forum where they discussed Taiwan's experience in the promotion of human rights, gender equality, and same-sex marriage.

When the floor was opened for questions, a student asked Sachs if he had any regrets about all the sacrifices he made in order to hold fast to his ideals. Sachs replied by pointing out that the most important things in life can't be purchased with money, and encouraged students to listen to their inner voice when making important career decisions.

Dr. Samuel Yin, chairman of the Ruentex Financial Group, established the Tang Prize in December 2012 to recognize distinguished individuals and groups working in the fields of sustainable development, biopharmaceutical science, sinology, and rule of law. Intended to serve as the Asian equivalent of the Nobel Prize, the Tang Prize is truly global in reach, with laureates selected on the basis of the originality of their work along with their contributions to society. Rooted in the long-standing cultural traditions of Chinese philosophical thinking, the Tang Prize aims to bring about positive change to the global community and to create a brighter future for all humanity.

TAKING INSPIRATION FROM NATURE: PROFESSOR WEI ZUNG HANG'S RESEARCH GAIN INTERNATIONAL RECOGNITION

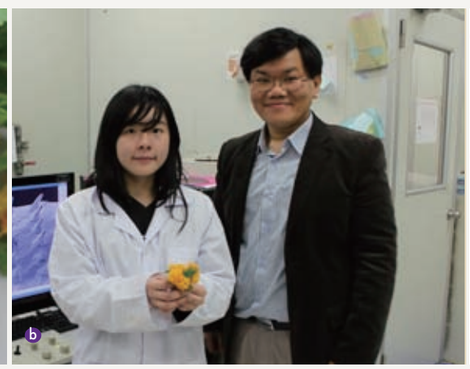
The attractive landscape and great variety of plants and trees on the NTHU campus has long served as a source of creative inspiration for researchers. As a case in point, inspired by the lotus plants on campus, a research team led by Wei Zung-Hang of the Department of Power Mechanical Engineering (PME) has recently used magnetic technology and a micro/nano structure mold to develop a material with a nanometer superhydrophobicity structure similar to that of the lotus leaf. Due to its ability to channel water droplets in a particular direction, such a material is suitable for use in windshields and marine craft. The research team has already applied for a patent and their research report was published in the latest issue of *Advanced Functional Materials*.

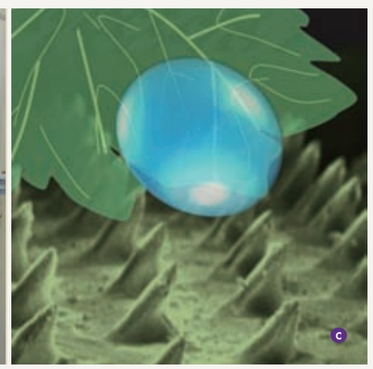
According to Dr. Wei, contemporary engineers have begun to recognize that natural structures have become highly refined while evolving over eons of time. As a result, learning from the nature has become an important part of contemporary engineering.

According to team member and PME doctoral student Huang Zhen-Yu, many organisms have a microstructure which channels water away so as to keep it dry and clean. Notable examples include the lotus leaf, butterfly wings, and flower petals. The main inspiration for the present research came from the *Lantana camara* (wild sage) commonly seen on the NTHU campus. Huang smilingly recalls how surprised she was when Professor Wei suggested collecting plant specimens from around the campus and using an electron microscope to inspect the microstructure of their leaves. She was even more surprised to discover that most of the leaves had a trichome microstructure which channels water in a particular direction.

While investigating the influence that the angle of a leave's trichome has on its superhydrophobicity and ability to store water, the research team developed an innovative way of using ferrofluid as a mold for producing conical microstructures of various angles similar to those observed in leaves. In the process, they discovered how the angle of the conical structure affects superhydrophobicity and the channeling of water. Their research continued for over a year, during the course of which they determined the optimal angle for both superhydrophobicity and the channeling of water. They were also impressed by the key role that the angle of a leaf's trichome has on a plant's ability to store and channel water. The research team has already applied for patents for the production process and the method for determining the optimal angle of the nanometer super-hydrophobicity structure. The applications of this innovative technology could include the glass used in tall buildings, bathroom fixtures, automobile windshields, motorcycle helmets, and watercrafts.

The report is titled *"Anisotropic Wettability of Biomimetic Micro/Nano Dual-Scale Inclined Cones Fabricated by Ferrofluid-Molding Method"* (DOI: 10.1002/adfm.201500359), and appears in the March issue of *Advanced Functional Materials*.





a The main inspiration for this innovative research came from the *Lantana camara* (wild sage) commonly seen on the NTHU campus.

b A research team led by Professor Wei Zung-Hang of the Department of Power Mechanical Engineering has recently used magnetic technology and a microstructure mold to develop a material with a micro/nano superhydrophobicity structure. Using images of leaves produced with an electron microscope, the research team developed an innovative way of using ferrofluid as a mold for producing conical microstructures of various angles similar to those observed in leaves.

c This innovative research project is featured on the cover of the latest issue of Advanced Functional Materials.

NTHU SPEARHEADS GROUNDBREAKING RESEARCH IN THE TREATMENT OF CANCER

ⓐ Simulation of cancer patient receiving BNCT.
ⓑ Press conference for publicizing the results of the international research project on BNCT.

In March of 2010 NTHU's Nuclear Science and Technology Development Center (NSTDC) teamed up with the Department of Oncology at Taipei Veterans General Hospital and the Particle Radiation Tumor Treatment Center (PRTTC) of the Research Laboratory for Nuclear Reactors at the University of Tokyo to carry out clinical research on Boron Neutron Capture Therapy (BNCT). Over the past five years the team's research has made significant contributions to the treatment of recurrent head and neck cancer.

BNCT is a binary radiation therapy modality that brings together two components. When kept separated, these two components have only minor effects on cells. The first component is a stable isotope of boron (boron-10) that can be concentrated in tumor cells by attaching it to tumor-seeking compounds. The second is a beam of low-energy neutrons. Boron-10 in or adjacent to the tumor cells disintegrates after capturing a neutron and the high energy, heavy charged particles produced will destroy only the cells in close proximity to it, primarily cancer cells, leaving adjacent normal cells largely unaffected.

The neutron beam portion of the BNTC research was carried out using Tsing Hua Open-pool Reactor (THOR), which has played an important role in non-military nuclear research in Taiwan for nearly half a century. Over 20 years ago the NSTDC began using THOR to carry out research on BNCT, including the design of neutron beams and the development of boron for medical applications. The high quality and suitability for medical applications of the neutron beams developed using THOR has been validated by international experts, and today NTHU is one of only six universities in the world with facilities for conducting research on BNCT. In March 2010 the THOR-BCNT research proposal was approved by Taiwan's Ministry of Health and Welfare, and in August of the same year clinical trials were started, the first time that heavy particles have been used for medical treatment in Taiwan.

The main role of the Taipei Veterans General Hospital was to organize a clinical team consisting of physicians, physicists, and nurses in the Department of Oncology and to determine the dosage of boron to be used in the treatment. Currently clinical trials are being conducted on head and neck cancer, and future trials are being planned for patients suffering from brain cancer and liver cancer. According to Yan Shang-hui, the director of the Taipei Veterans General Hospital, the goal of such treatment is to eliminate as many cancerous cells as possible while minimizing the collateral damage done to healthy cells, and BNCT is one of the most promising types of"targeted radiation therapy" recently developed.

According to Dr. Ono, the director of the PRTTC, based on his experience using BNCT with nearly 1,000 cancer patients, the use of THOR in conducting BNCT research has much potential to advance clinical treatment of cancer.

Under the leadership of its Director, B.S. Pei, the NSTDC which includes Dr. Hong-Ming Lin, Dr. Peir Jinn-ger and Dr. Wang Mei-ya, has made a concerted effort to apply THOR to research in BNCT. Moreover, each year over 20 teachers, students, and research personnel at NTHU's College of Nuclear Science participate in the ongoing research on BNCT. Every month the research teams at NTHU and the Taipei Veteran's General Hospital hold a seminar to discuss the latest progress in the program, and twice a year a workshop is held in conjunction with the PRTTC at the University of Tokyo.

These three institutions have also established a partnership with the Taiwan Biotech Company to conduct research for developing high-quality boron for medical purposes. Also, between 2010 and 2014 the program has conducted BNCT at MacKay Memorial Hospital in Hsinchu for 17 patients with recurrent head or neck cancer not amenable to other forms of treatment. The treatment was given twice to each patient, and resulted in significant improvement in both their medical condition and quality of life; more importantly, for six of the patients the tumor had completely disappeared.

This cooperative project marks a new chapter in the history of targeted heavy-particle therapy in Taiwan. Thus far the results have been very encouraging, and it is expected that in the future related research will be conducted on the application of BNCT to other forms of cancer.

a Professor Chin Yu.
b Professor Sheng-Tsaing Tseng.
c Professor Kuo-Ning Chiang.
d Professor Tsai-Fu Wu.

TEN NTHU PROFESSORS HONORED WITH THE 2014 MINISTRY OF SCIENCE & TECHNOLOGY OUTSTANDING RESEARCH AWARD AND MERIT RESEARCH FELLOW AWARD

Ministry of Science & Technology recently announced the 2014 recipients of Outstanding Research Award and Merit Research Fellow Award. Professors Chin Yu (Department of Chemistry), and Sheng-Tsaing Tseng (Institute of Statistics) were honored with the Merit Research Fellow Award, and Kuo-Ning Chiang (Department of Power Mechanical Engineering), Tsai-Fu Wu (Department of Electrical Engineering), Ray-Kuang Lee (Institute of Photonics Technologies), Yu-Chen Hu (Department of Chemical Engineering), Fan-Gang Tseng (Department of Engineering and System Sciences), Wei-Chang Yeh (Department of Industrial Engineering and Engineering Management), Ruey-An Doong (Department of Biomedical Engineering and Environmental Sciences), and Yi-Chou Tsai (Department of Chemistry) won the Outstanding Research Award.

Professor Chin Yu specializes in biochemistry, biotechnology, drug design, MRI, molecular simulation among other fields. He has been teaching at the Department of Chemistry for 30 years since 1985. Professor Yu engaged in the research of NMR after his returning to Taiwan, and devoted himself in the quest of protein's 3D structure. In 1993, Professor Yu became the first researcher in Taiwan to publish the 3D structure of Taiwanese cobra's venom protein in *Biochemistry* and continued to publish researches regarding the 3D structure and backbone dynamics of other snakes' venom protein from 1993 to 2000. From 2002 to 2007, Professor Yu switched his research to the 3D structure and stacking of fibroblast protein. Since 2010, Professor Yu has focused on protein-protein interaction, and has obtained many fruitful and brilliant results.

Prof. Sheng-Tsaing Tseng, Institute of Statistics, specializes in Run-to-Run control and reliability analysis. Run-to-Run control plays an important role in monitoring IC manufacturing process. When the output of manufacturing process follows a dynamic transfer function-noise model, Prof. Tseng proposed a quasi MMSE Run-to-Run controller. The major achievement of this research is that it completely solved the problem where the conventional EWMA controller fails to satisfy the long-term stability conditions. In addition, aiming at a life testing for high–reliable products, Prof. Tseng proposed a systemic approach, which included the construction of a general exponential dispersion (ED) degradation model and determined the optimum test plan of accelerated degradation experiment. On winning this Award, Prof. Tseng acknowledges the Institute of Statistics for providing a great researching environment and for the constant support from his loving family.

Prof. Kuo-Ning Chiang, Department of Power Mechanical Engineering, focus on nonlinear computational mechanics with high-performance computational theory and statistical mechanics theory. He applies them to the simulation analysis of mechanical behavior, and extends them to the study of fatigue and long-term reliability analysis. Prof. Chiang successfully combines his specialties, fundamental mechanics theory, design, and simulation analysis, and applies them to packaging, semiconductor, nano-manufacturing and MEMS development. His researches greatly enhanced the competiveness of domestics industries. Prof. Chiang has directed/co-directed several research projects sponsored by the Ministry of Science & Technology, National Program on Nanotechnology, and academia-industry collaborative projects. Due to his excellent performance in the field of high-performance computing, he was appointed as the Director General of National Center for High-Performance Computing (NCHC). Under his leadership, the center constructed ACPS, nicknamed Winder, a super computer ranked the 42th in the top 500 worldwide. Moreover, his center has built two self-designed super computers, Formosa 3 and 5 that are also ranked in the top 500 lists.

From the Department of Electrical Engineering, Prof. Tsai-Fu Wu's research interests include power electronics, signal processing and control. Making flexible use of plasma behavior and integrating interdisciplinary studies, Prof. Wu has developed electronic ballasts, drivers for plasma display panels, pulsed electric fields for sterilizing bacterium on rice and in fruit juice, and electrical stunner for humanely animal slaughter. Recently, Prof. Wu focuses his research efforts on the development of green power generator. With his research team, he has developed a harmonized DC micro-grid energy generating system. The system can adjust its operation mode according to environment, load, and power change of the grid, while supplying high quality and stable power. Prof. Wu's research results have been published in international journals such as *IEEE Trans. on Industrial Electronic and Power Electronics.* Among Professor Wu's researches, D-Σ digital control receives most attention. It improves the abc-dq frame transformation method, which has been used for over 50 years. This technology can be applied to the control of DC converters, single/three phase power converter and modular multi-level converters, and it has a significant contribution toward the developments of electrical engineering, machine tools, electric vehicle, and renewable power generator industries.

Prof. Ray-Kuang Lee's (Institute of Photonics Technologies) research interests include quantum optics and the construction of theoretical models related to nonlinear physics. Prof. Lee has been teaching at Tsing Hua since 2005, and his researches focus on the formation of optic patterns, nonlinear dynamics, quantum memory, and quantum information science. Prof. Lee collaborates intensively with domestic and foreign research teams in this research on vertical-cavity surface emitting lasers, photoreactive crystals, cold atom systems and nanospheres. On winning this award, Professor Lee would like to thank the Institute of Photonics Technologies for providing a conducive research environment, a friendly atmosphere, and plentiful resources.

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At the Department of Chemical Engineering, Prof. Yu-Chen Hu's research interests cover the whole spectrum of biotechnology, such as the development of viral vector, virology, and cell biology as well as vaccine development, tissue engineering, and cancer treatment. Prof. Hu's research result has expanded the application of baculovirus on vaccine development and gene therapy, which made him the world's first to open up the possibility of applying baculovirus on tissue engineering. With these research accomplishments, Prof. Hu has applied and obtained five patents in Taiwan, two in the US, 1 in China and has successfully transferred the technology he has developed to industry. On winning the Outstanding Research Award again, Prof. Hu would like to acknowledge NTHU for providing a well-equipped research environment and the help and support from his colleagues. He also would like to express his sincerest gratitude to his forerunners and partners such as Professors Jaw-Ching Wu, Tzu-Chen Yen, Yu-Han Chang, Kun-Ju Lin, Dr. Shiaw Min Huang and many others for their help and collaboration.

A faculty member at the Department of Engineering and System Sciences, Prof. Fan-Gang Tseng is also the Deputy Director of the Biomedical Science and Engineering Center. His research interests focus on nano/micro bio and fluidic system and its application on cancer marker protein and screening of circulating cancer cells, medical diagnosis application on 3D cell/tissue chip/nano-particle, biomedical sensor and micro fuel cells. This is Prof. Tseng's second time winning the Outstanding Research Award. Prof. Tseng has successfully developed double sided multifunctional surface-enhanced Raman spectroscopy nano particles, and integrates it to the micro-fluid system driven by surface tension and applies them on screening of circulating tumor cells. Prof. Tseng would like to acknowledge Ministry of Science & Technology, NTHU, Ministry of Economic Affairs and companies for their financial support. He is also very thankful for the collaboration and support of his colleagues and the team work of his lab members.

Prof. Wei-Chang Yeh has been teaching at the Department of Industrial Engineering and Engineering Management since 2005. His research interests include reliability analysis and soft computing. Having published several algorithms on binary, multistate, single or multiple merchandise, combination of cost from repair or buying, Prof. Yeh has established himself as an authority figure in the field of reliability research. In addition, Prof. Yeh also improved non-flow network reliability, simplified UGFM and overcame the problem of UGFM's obstruction toward circulatory network, as well as applying it to solve traditional flow network reliability problems. Prof. Yeh not only creates a novel soft computing (SSO), but also combines Monte Carlo method with response surface methodology, and uses simulation method and soft computing to solve the reliability approximation. In the field of soft computing, Prof. Yeh not only focuses on its optimization, but also develops a novel SSO and applies it on optimization of supply chain management, RFID network, smart grid, grid/cloud computing, and RAP as well as on data mining. On winning this award, Prof. Yeh would like to acknowledge NTHU and Ministry of Science and Technology for their research support. He would also like to express his sincerest gratitude to the forerunners of the Department of Industrial Engineering (IE) for their kind encouragement and assistance; as well as to the scholars and experts he worked with for their cooperation. Moreover, he would like to thank his devoted team members for their important contributions.

Prof. Ruey-An Doong joined in the Department of Nuclear Science (now the Department of Biomedical Engineering and Environmental Sciences) in 1994. His research interests include environmental chemistry, the functioning of environmental nanomaterials, biomedical sensor technology and the application of energy materials. He has focused on the development of environmental-friendly multifunctional materials, and the use of novel methods to dispose the organic or mixed pollutants in water or multi-pore mediums. At the same time Prof. Doong studies the reaction rate of trace toxic substances on the surface of compound materials and microscopic changes of the reaction mechanism. He has tested theories that explain the reaction mechanism and dynamic of pollutants on natural or man-made environments and the roles of each substance. Prof. Doong actively pursues interdisciplinary researches, maintained many collaborations with scientists and scholars in the US, South Korea, Czech Republic and Argentina. On winning this award, Prof. Doong would like to acknowledge NTHU and Ministry of Science and Technology for their support, and would also like to thank his family for their loving support and his students for their important contributions.

Professor Yi-Chou Tsai's (Department of Chemistry) research specialties include synthetic inorganic, organometallic and organic chemistry. Two important required courses in the department of chemistry are organic and inorganic chemistry. The former deals with the chemistry of organic compounds, while the latter is concerned with the properties and behavior of inorganic metal compounds. One question that Prof. Tsai's lab tries to answer is whether these two disciplines have anything in common? By synthesizing metal-metal quintuple bonded inorganic compound that have properties similar to carbon-carbon multiple bonded compound, Prof. Tsai comes to the conclusion that inorganic compounds have properties similar to organic compounds; that is, organic chemistry and inorganic chemistry have much in common. Prof. Tsai thanks NTHU for providing him with research resources and facilities. He also acknowledges his colleagues for their assistance, support and encouragement. He would like to acknowledge the financial support from Ministry of Science & Technology and the loving support from his family as well as the brilliant works that his students have accomplished.

a Professor Ray-Kuang Lee.
b Professor Yu-Chen Hu.
c Professor Fan-Gang Tseng.
d Professor Wei-Chang Yeh.
e Professor Ruey-An Doong.
f Professor Yi-Chou Tsai.

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PROFESSOR CHIU PO-WEN'S RESEARCH ON STRUCTURAL DEFECTS IN TWO-DIMENSIONAL MATERIALS IS PUBLISHED IN *NATURE COMMUNICATIONS*

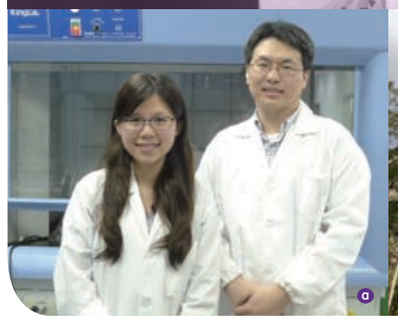
Three student research groups working under the guidance of Professor Chiu Po-Wen, Department of Electrical Engineering & Institute of Electronic Engineering, have recently had reports on their innovative research published in the internationally renowned British journal *Nature Communications*. The group led by Ye Jhao-Hui developed a two-dimensional monolayer WSe2 monocrystalline; the group led by Teng Bo Yuan converted a desktop CD burner into a low-energy laser engraving machine which uses the photochemical reaction of ozone to reduce defects in the high-density lattice points of single-crystal monocrystalline; and the third group led by Lin Yung-Chang used a scanning transmission electron microscope with spherical aberration correction at low voltage to observe the kinetic reactions of lattice point defects, thereby discovering the trefoil structure of the two-dimensional lattice defects. For more details see the latest issue of *Nature Communications* (DOI: 10.1038/ncomms7736).

Prof. Chiu's research team in Tokyo celebrating the completion of their research. From right to left: Ye Jhao-Hui, Lin Yung-chang, Chiu Po-Wen, and Kazutomo Suenaga.

Only a few atoms thick, the two-dimensional semiconductor material has a number of advantages over existing electronic and optoelectronic components, and is the new darling of electronic and optoelectronic nano-devices. Chiu points out that the discovery of two-dimensional monolayer graphene could be separated from its three-dimensional base material and has set off a wave of research on two-dimensional material. This has currently been extended from graphene to transition metal dichalcogenides (TMD) with the characteristics of semiconductors. Such two-dimensional material has a thickness of only 1 to 3 atoms, a plane size that can be infinitely extended, and does not have a dangling bond, so that when it contacts the base plate or other material it forms a van der Waals coupling pattern. Moreover, their unique dimensions and crystal structure allow these materials to be made into electronic or optoelectronic components with unique characteristics. For example, transistors made from this material consume very little power, making them highly suitable for wearable devices. Also, the structure of three-dimensional silicon-based transistors has made it possible to overcome the short channel effect. Finally, due to its flexibility and responsiveness, semiconductor and photovoltaic manufacturers can study this type of novel two-dimensional material without investing a lot of resources.

Since TMDs have a thickness of only three atoms, any form of defect structure will be directly reflected in their energy band structure, affecting the transmission of charge carriers and the photoelectric effect. Therefore, understanding the structural defects of TMDs is the first step in controlling their energy band structure and physical properties. In this research one can start by using chemical vapor deposition to grow a TMD such as monocrystalline WSe2. Then one can use photochemical reactions to make the monocrystalline WSe2 produce high-density selenium atom vacancies. While observing these lattice defects, because the heating of the electron beam causes the selenium atoms to move, when the vacancies of the selenium atoms undergo polymerization they appear in the lowest energy form. As a result, the selenium atoms rotate in a triple rotation symmetrical pattern with six rings that form into a new symmetrical structure with eight rings. The really amazing part is that when these defects reach the right density, this new eight-ringed symmetrical structure polymerizes into a symmetrical trefoil pattern.

"Keen observation is the key to new scientific discoveries, and seamless collaboration is the shortcut to success!" exclaims Prof. Chiu. This study was conducted in conjunction with research teams from Finland, Japan, and the National Taiwan University of Science and Technology. All aspects of the research—the growth of the material, the development of the laser-induced electrochemical reaction apparatus, the theoretical computations, the minute observations made with an electron microscope—were carried out using a seamless division of labor, thereby bringing about remarkable results. Such smooth cooperation is built upon a long-term partnership, and keen observation comes from a wealth of knowledge accumulated through long-term study and experience.



IS YOUR SALMON FRESH? PUT YOUR MIND AT EASE WITH A TEST PAPER RECENTLY DEVELOPED AT NTHU

A research team led by Professor Wan De-hui and M.A. student Tseng Shih-Yu of the Institute of Biomedical Engineering has recently developed a test paper for determining the freshness of salmon. When placed near salmon, the nanometer test paper changes color in response to any molecules relating to decay which the fish may be emitting. A patent for this test paper is pending but negotiations are underway to start production on a commercial basis.

In the wake of recent food-safety scares, consumers in Taiwan are becoming increasingly aware of the importance of a convenient way to test food quality. According to Dr. Wan, there are currently many ways to test food safety, but they tend to be complicated, time-consuming, and expensive. With these considerations in mind, Dr. Wan's research team set out to develop a nanometer test paper for determining the freshness of salmon which would be inexpensive, sensitive, and easy to use.

Using common paper as the medium, a simple preparation process was used to attach the nanometer particles to the paper so that it

ⓐ A research team led by Professor Wan De-Hui and his M.A. student Tseng Shih-Yu at Institute of Biomedical Engineering has recently his developed a test paper for determining the freshness of salmon.

ⓑ Tseng Shih-Yu (third from right) was awarded a prize for the best student paper at the 8th IEEE International Conference on Nano/Molecular Medicine and Engineering.

can detect the gaseous molecules emitted by spoiled salmon, something which can't be easily detected by the naked eyes. Not surprisingly, such a quick and easy way to determine the freshness of salmon has attracted considerable attention in both Taiwan and abroad. Last September Ms. Tseng was honored with an invitation to present this test paper at the 40th International Micro and Nano Engineering Conference. Moreover, in November of last year Ms. Tseng presented the test paper at the 8th IEEE International Conference on Nano/Molecular Medicine and Engineering and won the prize for the best student paper.

RESEARCH IN TWO-DIMENSIONAL MATERIALS AT NTHU GAINS INTERNATIONAL SPOTLIGHT

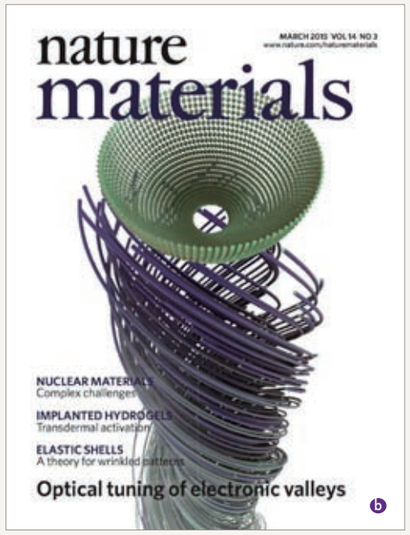
During the past year a research team headed by Professor Albert Yi-Hsien Lee of the Department of Material Sciences and Engineering has had its findings on two-dimensional semiconductor materials published in three leading journals. Furthermore, in recognition of the significant contribution they have made, the team was invited to present their findings at the March 2015 meeting of the American Physical Society. Such rare achievements have brought considerable international attention to the materials research program at NTHU.

According to Dr. Lee, research in two-dimensional materials has grown rapidly in recent years, as demonstrated by the 2010 Nobel Prize in Physics being awarded to Andre Geim and Konstantin Novoselov for their groundbreaking experiments regarding the two-dimensional material graphene. Moreover, since the success of much research and development depends on the availability of suitable materials, the field of two-dimensional materials is becoming increasingly important in both science and industry. A graduate of NTHU, Lee decided to return to his alma mater to teach and to establish an international research team to develop two-dimensional materials.

Prof. Lee's research team is unique. Most of the team members are undergraduate students, They, however, have succeeded in developing a wide variety of two-dimensional materials and synthetic crystalline materials. Recently the team has developed a monocrystalline with a level heterogeneous

ⓐ Professor Lee (sixth from the left) with his research team.

ⓑ The latest findings of a research team headed by Professor Albert Yi-Hsien Lee, Department of Material Sciences and Engineering, have been published in the March issue of *Nature Materials*.



structure, thereby opening a new chapter in the history of the components utilized in nanometer photoelectricity. Their research on this topic has been published in the January issue of *Nano Letters.*

Working in cooperation with the Physics

Professor Lee's proud and happy team members.

Department at the City University of New York, undergraduate team member Lin Erh-Chen developed a process for the fabrication and transfer of special materials and then used it to combine two-dimensional semiconductor material with an optic resonance microcavity. This was the first time the excitons of photons and two-dimensional materials have been observed coupling at below room temperature. Referred to as"microcavity polaritions," these coupling particles have a Rabi splitting energy which exceeds 46 meV. The success of the research relied on the purity of the surface used and the high quality of the crystals, and the results will make it possible to develop a new generation of lasers and illumination devices. Working in cooperation with a team of optics researchers with no previous experience in two-dimensional materials, the NTHU team succeeded in charting new territory in the field of photoelectricity. Their research has been published in the January issue of *Nature Photonics*.

Working with an optics team from the Department of Physics at the Massachusetts Institute of Technology (MIT), the NTHU team made use of the strong spin inherent in the coupling of two-dimensional materials and combined the precision control of an ultrafast laser with the Stark effect to discover that in a superfast optics system only at ultra-low temperatures is it possible to observe the particles of the III-V group of materials, including excitons, trions, and high-index excitons. The results, which have already inspired a considerable amount of follow-up research, made front page news at MIT and were featured in the March issue of the prestigious journal *Nature Materials*—the first time a research group from Taiwan has received such recognition. By investing a considerable amount of resources in training and promoting international cooperation, NTHU's Two-dimensional Materials Research Team has not only greatly enhanced the international profile of scientific research in Taiwan, but has also become a fine example of how NTHU students gain the skills and experience they need to succeed in today's highly competitive international environment.

DEPARTMENT OF LIFE SCIENCES INAUGURATES THE CENTER FOR THE PRESERVATION OF BIOLOGICAL RESOURCES AND THE CHIN-TUI HO PROFESSORSHIP

On May 28 the Department of Life Sciences held a ceremony to inaugurate the Center for the Preservation of Biological Resources (CPBR) and the Chin-Tui Ho Professorship. On the same day the CPBR teamed up with the Taipei Zoo and the Cecelia Koo Botanic Conservation Center by signing a Memorandum of Understanding to set out a cooperative projects in the areas of nature conservation and environmental education.

During the ceremony President Hong Hocheng congratulated Professor Li Chia-Wei of the Department of Life Sciences for his appointment as a Chin-Tui Ho Professor, and expressed his thanks to NTHU alumnus Dr. Charles Hsu for his generous financial support for the new center. In his address President Hocheng emphasized the significance of the CPBR, and encouraged everyone in the Department of Life Sciences to continue their exemplary efforts in research, education, and cooperation with industry.

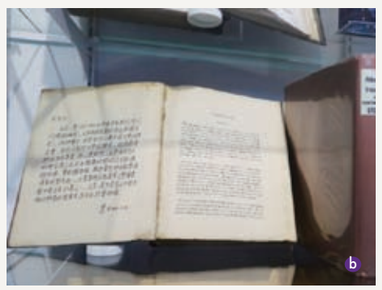
Established under the leadership of Professor Chiang Ann-Shyn, Dean of the College of Life Sciences, the CPBR has been well received in both academia and industry. The initial focus of the CPBR will be on collecting specimens; academic

ⓐ Dean Chiang Ann-Shyn (left) along with Prof. Li Chia-Wei (center) representing the Cecelia Koo Botanic Conservation Center, and Chin, Shih-Chien (right), director of the Taipei Zoo, displaying a Memorandum of Understanding they signed.
ⓑ The CPBR exhibition area in the lobby and courtyard of the Life Sciences Building II.
ⓒ President Hocheng appointing Professor Li Chia-Wei as the Ho Chin-Tui Professor.



exchanges; species propagation; sustainable management; and environmental education. The CPBR has set up an exhibition area in the lobby and courtyard of the Life Sciences Building II featuring a display of nearly 100 varieties of pineapples, an ancient meteorite, models of the skulls of early humans, fossils of dinosaur feathers, a collection of beetle specimens, and a number of volumes of the *Philosophical Transactions of the Royal Society of London* dating back to the eighteenth century.

The Chin-Tui Ho Professorship was established by Jen-Shyong Ho, honorary chairman of Tung Ho Steel, to help NTHU recruit and retain first-rate scholars. Since he began teaching at NTHU in 1985, Li Chia-Wei has been honored three times with the Outstanding Professor Award. His research papers have been published in such prestigious journals as *Science* and *Nature*, and he is well known for his untiring efforts in the field of science education.



a Prof. Li Chia-Wei introducing the"Orchard of One Hundred Pineapples," an exhibition of tropical plants.

b Several volumes of the *Philosophical Transactions of the Royal Society of London* dating back to the eighteenth century, donated by Academician Huang I-Lung.

2015 COMMENCEMENT: MAINTAINING CURIOSITY, PERSONAL INTEGRITY, AND SPORTSMANSHIP WHILE TREADING THE ROAD TO SUCCESS

On June 13 NTHU held two commencements；one for new baccalaureates and the other for graduate students. Inspiring commencement addresses were provided by Jaclyn Tsai, Minister of the Mongolian and Tibetan Affairs, and Chou Chun-Chi, Chairman of Sinyi Realty. This year NTHU awarded 1,694 bachelor degrees, 1,547 master degrees, and 329 doctorates.

In his address President Hong Hocheng encouraged the graduating students to approach life with the spirit of a true sportsman, for whom the most important thing is not who wins, but how one plays the game—making one's best effort, and respecting and learning from the other competitors. Thus a true sportsman cares about fair play, teamwork, and respect the rules of the game.

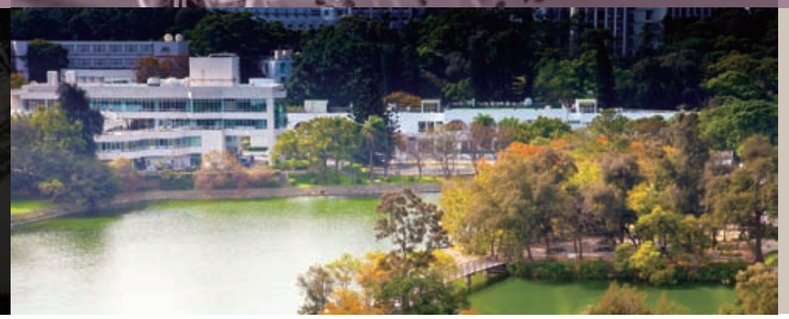
President Hocheng went on to say that being a true sportsman means persevering against the odds. If life were such that everything always went exactly as planned, it would lose much of its meaning and become rather boring. We have to accept that there will always be some discrepancy between our expectations and how things actually turn out. Thus we have to be willing to take not only risks, but also responsibility for our decisions and actions; this makes life more meaningful.

In her address Minister Tsai mentioned that although her son graduated from NTHU's Department of Power Mechanical Engineering ten years ago, he did not become an engineer. Instead, he has set up website which uses virtual reality to promote tourism in Taiwan. Such cases of people working in fields other than what they studied at university should be taken as a positive sign, for they indicate that higher education is fulfilling its most important

a Chairman Chou Chun-Chi stressing that personal integrity is essential for achieving true suc.

b Minister Jaclyn Tsai encouraging graduates to remain curious as they explore the world.

c President Hocheng in a group photo with graduates.



purpose—teaching people to think creatively and independently. While encouraging the graduating students to realize their dreams and to strive on with diligence, Minister Tsai pointed out the importance of curiosity as a motivating force for exploration and innovation.

In his address Chou shared his experience of founding Sinyi Realty and pointed out that ethics, morals, and treating others with respect are essential for a successful career. The true measure of success is not how much fame and fortune one has gained, but is what one has accomplished in promoting the happiness of one's fellow human beings. Emphasizing that true success brings happiness to others, Chou stated that success comes from empathy, helping others succeed, and treating others as you would like them to treat you. He also mentioned that a virtuous and benevolent person—the ideal put forth by Confucius some 2,500 years ago—will most likely be a successful person, for he has no enemies. Indeed, anyone who possesses unshakable personal integrity is already a success.

Representative of the graduating graduate students Cheng Wen-chi gave an address in which he stated that he regarded NTHU as a"palace of knowledge" where he also learned about the importance of humility and emulating the strengths of others. He also stated that while he found graduate school to be harder than he expected, the many hardships he faced were actually an essential part of the learning experience.

Representative of the graduating undergraduates, Su Kuan-yu, reminded her classmates to always remember NTHU school motto—Self-discipline and social commitment. She also encouraged everyone to persevere in the face of adversity and to be as generous and kind as the Earth in everything we say and do.

During the ceremony the Mei Yi-Chi Memorial Medal—NTHU's highest academic honor—was awarded to seven undergraduates: Yu Chia-ying of the College of Humanities and Social Sciences; Lu Cheng-wei of the Department of Biomedical Engineering and Environmental Sciences; Hsu Tzu-Hsiang of the Department of Electrical Engineering; Chang Yu-shan of the Department of Engineering and System Science; Cheng Shao-chi of the Department of Chemical Engineering; Feng Sheng-fu of the College of Life Sciences; and Yang Hui-ru of the Department of Chinese Literature.

ⓐ President Hong Hocheng exhorting the graduating students to approach life with the spirit of a true sportsman.
ⓑ Graduating members of the NTHU Chorus posing in front of *The Thinker*.