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KAILASH SATYARTHI INSPIRES DREAMS AT NTHU

ⓐ Mr. and Mrs. Satyarthi with members of NTHU's International Volunteer Society and Ms. Sophie Chang, .
ⓑ President Hong Hocheng presenting Mr. Kailash Satyarthi with the NTHU school motto in calligraphic script.

On January 16 Kailash Satyarthi, winner of the 2014 Nobel Peace Prize, gave a lecture, "My Life Story and Dream" at the international conference center, NTHU. Mr. Satyarthi pointed out that everyone was once a child and there is a child that lives on in each person's heart. He then exhorted the audience to preserve that sense of inner innocence and apply it to learning and speaking out against child labor.

In his lecture he pointed out that a nation's youth are its energy, future, and source of glory. He then stated that despite our limitations to resist negative external influences, as long as we have a dream and the will to engage in good actions, then we will become someone who make history rather than merely reading or writing about it.

The lecture was preceded by two welcoming addresses. In the first address Nobel laureate and NTHU alumnus Yuan T. Lee emphasized the importance of social justice and being willing to stand up for what is right. He also expressed his admiration for Satyarthi's courage and perseverance in carrying out his noble mission. In the second address Sophie Chang, the director of the TSMC Volunteer Society, lauded Satyarthi's dedication to child welfare and exhorted young people to apply the same spirit of sacrifice and compassion to plant the seeds of wisdom and happiness.

Satyarthi stated, "We are all happy and fortunate to be sitting in this beautiful hall. You have dreams, you have aspirations, and your parents had dreams and aspirations for you. . . . But today while I am talking to you, millions of children—millions—are trapped in child slavery . . . producing shoes, which you may be wearing; making clothes, that you may be wearing. You may have eaten a chocolate today, but you don't know how many children, hundreds or thousands, are engaged in that industry in the Ivory Coast and Ghana, at the cost of their liberty, childhood, and future."

Recalling how he was inspired to become an activist, Satyarthi stated that on his very first day of school he saw a boy outside the classroom working as a cobbler. He asked the teacher why the boy wasn't attending class, and the teacher replied that he was from a poor family and had

to work and earn money. He later asked the boy's father the same question, and was told that none of the children in their caste went to school. Taken aback, Satyarthi wished that the boy could somehow become his classmate. That was the beginning of his lifelong career as a human rights advocate.

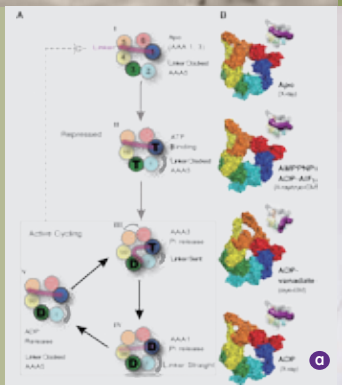
Satyarthi went on to recount how during a trip to a remote village in the Ivory Coast he noticed that many children had injured hands and feet. Upon inquiring further, he discovered that this was the result of picking coco beans for making chocolate. He was even more surprised to find out that these children had never actually tasted chocolate before, and didn't even know what coco beans are used for. On another occasion his work took him to a workshop in Pakistan where children were employed stitching soccer balls. He asked them, "What is your dream?" After some coaxing they finally answered, "to play with a soccer ball; to really kick the ball with my foot."

From right to left: Chung-Kwang Tien, Mrs. Tien, Sophie Chang (director of the TSMC Volunteer Society), Mr. Kailash Satyarthi, Mrs. Satyarthi, President Hong Hocheng, Academician Yuan T. Lee, Ong Wen-Chyi (chairperson of Chunghwa Post), and Ms. Banu Prakash (Deputy Director General of the India-Taipei Association).

As Satyarthi puts it, "all the children in the world are our children." Yet many of these children are spending their childhood working in factories. Although few people realize it, in today's globalized economy many of us are actually the consumers of products produced by children working under dangerous and highly exploitative conditions.

The closing address was given by Chung-Kwang Tien, the director of the Taipei Economic and Cultural Center (TECC) in India. Tien said he was grateful that Satyarthi chose to make Taiwan his second overseas trip since receiving the Nobel Prize, especially since he currently has some 11,000 invitations to choose from. He also stated that India is very fortunate to have such a courageous and inspiring champion of children's rights, and that due to his efforts the world is a better place. Tien concluded by quoting Satyarthi: "the Nobel prize means a lot but it is a comma in my life. My full stop will come only when I see the child labor vanishes from the face of the earch."

After completing his lecture Satyarthi was presented with a scroll with the NTHU school motto: *Self-discipline and social commitment*. President Hocheng expressed his admiration for Satyarthi's selfless and untiring efforts to promote social justice, and said that through his lifelong dedication to protecting the human rights of children, Satyarthi is truly the embodiment of our school motto.



CHENG HUI-CHUN'S GROUNDBREAKING RESEARCH ON THE DYNEIN MOTOR DOMAIN

a The structural change of dynein and the catalytic cycle of ATPases.
b Professor Cheng Hui-Chun of NTHU's Institute of Bioinformatics and Structural Biology.

Dr. Cheng Hui-Chun, an assistant professor at the Institute of Bioinformatics and Structural Biology at NTHU, has recently had her paper titled "*Allosteric Communication in the Dynein Motor Domain*" published in the prestigious journal *Cell*. Her groundbreaking research focuses on how dynein ATPases control structural change and how dynein controls the ATP hydrolysis environment. Cheng's findings promise to extend our understanding of the nerve degeneration characteristic of such conditions as Alzheimer's disease and Parkinson's disease.

In the paper Dr. Cheng states that the molecular motor consists of a group of proteins with a very interesting function and structure, and that it plays many important roles in the cell, such as DNA replication, protein synthesis and degradation, energy generation, mass transport, and flagella and cilia oscillation. As one of these molecular motors, dynein is responsible for the transport of both waste and useful substances—two processes essential to maintaining the body's functions. Comparing human cells to a city, she likens dynein to trucks responsible for transporting essential materials.

In recent years, molecular motors have become a hot research topic. While the mechanisms by which many molecular motors function have been solved, dynein remains an exception. Although dynein was discovered back in the 1960s, we still have a rather limited knowledge of its mechanism of action. This is mainly due to dynein's very high molecular weight, making it difficult to carry out purification and further quantitative analysis.

However, Dr. Cheng came up with a way to overcome the problems of purification and crystallization. Simplifying the procedure by using the techniques of protein engineering, she managed to cut the dynein, leaving only the core part, to increase the yield of the protein and enhance the success of its crystalization rate. In addition to addressing the problem of purification, Cheng used X-ray diffraction to obtain the three-dimensional structure of dynein. Working together with Dr. Gira Bhabha of the University of California, San Francisco, she used a cryo-electron microscope to discover a number of dynein's movement mechanisms, including its structure in a three-dimensional space, and how it changes shape when transporting substances. These discoveries are highly significant, for this is the first time researchers have gained in-depth information on the mechanism underlying the movement of dynein.

Dr. Cheng says that from the perspective of basic scientific research, it is important to increase our understanding of the mechanism underlying the structural changes of dynein, since doing so increases our understanding of the molecular motor. In medicine, dynein has been implicated in many neurodegenerative diseases, such as Parkinson's disease, Huntington's disease, and Alzheimer's disease. Research on dynein will have a key role to play in the development of drugs for treating these diseases by either speeding up or slowing down molecular motion.

MR. WANG MO-JEN PRESENTED WITH AN HONORARY DOCTORATE IN LITERATURE

Wang Mo-Jen (birth name: Wang An-Tai) was born in 1935 in Huang Mei County, Hubei Province, China. After coming to Taiwan in 1948 and due to the turmoil of the Civil War, he was unable to continue his formal education and thus began a long period of self-study. While working as a reporter during the 1950s he began to write novels, an undertaking which soon became his major pursuit. A prolific writer, to date Mr. Wang has penned some 71 novels and short stories. His most notable works include the full-length novels *Foreign Land* (1972) <外鄉> and *The Leaping Globe* (2010) <跳躍的地球>. The short stories of Mr. Wang have been published in numerous collections, including *The Tears of Orphans* (1958) <孤雛淚>, *Unstoppable Steps* (1968) <留不住的腳步>,*Wingless Birds* (1974) <沒有翅膀的鳥>, Underground (1976) <地層下>, *The Comedy of Zhou Jinmu* (1979) <周金木的喜劇>, *Wang Mo-Jen: An Anthology* (1979) <王默人自選集>, *A-Lian Return to the Gorge River* (1984) <阿蓮回到峽谷溪>, and *The Collected Works of Wang Mo-Jen* (1998) <王默人小說全集>.

The central theme of Mr. Wang's writings is the personal and social upheaval brought about by the transition from an agrarian to an industrial society. With the sober, precise, and down-to-earth style of a news reporter, Mr. Wang describes in great detail how his characters cope with the travails and vicissitudes of life. Wang once described himself as both conscientious and stubborn, such that he is never swayed by external influences and only writes about topics which he himself finds meaningful. In fact, his strong personality is reflected in most of his writings. In view of his achievements, the University Honorary Degree Committee enthusiastically recommended NTHU to award an Honorary Doctorate in Literature to Mr. Wang Mo-ien. An award ceremony was held on Jan. 25, 2015 in San Francisco, U.S.A.

a President Hocheng (left) awarded Honorary Doctorate in Literature to writer Mr. Wang Mo-Jen (right).

b From left to right: Chairman Chen Jian Chung, Dean Yin-Chun Tsai, Honorary Doctor Wang Mo-Jen, President Hocheng and Secretary General Prof. Lee, Min)

ENVIRONMENTALLY FRIENDLY PROCEDURE FOR MANUFACTURING NYLON DEVELOPED AT NTHU

About 3.5 billion kilograms of adipic acid is produced worldwide each year, mainly for use in manufacturing of nylon. However, the production of adipic results in the emission of large amounts of nitrous oxide (N_2O), a substance which depletes the Earth's ozone layer and is also a potent greenhouse gas. In light of this situation, imitating the process by which ozone and ultraviolet light dissolve organic materials, Professor Hwang Kuo Chu of NTHU's Department of Chemistry has discovered a way to use ozone and ultraviolet radiation at room temperature to oxidate cyclohexane into adipic acid, a process which doesn't involve the emission of N_2O. His report on this process has been published in the journal *Science*.

According to President Hocheng, researchers at NTHU publish around 1,800 papers each year. Yet Hwang's report stands out for the contributions it makes to academic research, industry, and environmental protection. Moreover, this research was entirely conducted at NTHU by Hwang and post-doctoral researcher Sagadevan Arunachalam, making it abundantly clear

A press conference announcing Prof. Hwang's research.

that NTHU is a world-class research institute.

According to Professor Hwang, the demand for adipic acid is increasing by about 5% per year. At present, nearly 95% of adipic acid is produced by oxidizing nitric acid, a process which requires high temperatures (125–165 ℃), high pressure (8-15 atm), a highly concentrated nitric acid solution, and large amounts of energy.

Currently the production of adipic acid accounts for about 5-8% of global N_2O emissions. The widespread adoption of this new manufacturing technique would not only decrease the cost of producing adipic acid, but also reduces energy consumption (thereby reducing carbon emissions) and the emissions of nitrous oxide.

Professor Huang also mentioned that while C-H bond functionalization is a very important topic in the field of chemistry but extremely difficult to study. Professor Robert G. Bergman of the University of California, Berkeley sees C-H bond activation as the Holy Grail of chemistry. The main significance of this newly developed manufacturing process is that it doesn't use any catalyst, and can be carried out in extremely mild condition, i.e., room temperature and one atmosphere of pressure.

The title of the research report is "*One-Pot room-temperature Conversion of Cyclohexane to Adipic Acid by Ozone and UV light*," and appears in the December issue of *Science* 2014. This discovery was also reported in other scientific publications, such as *Chemistry* World, *Scientific American*, C&EN as well as *ScienceNews*.

ⓐ Professor Hwang Kuochu.
ⓑ Professor Hwang Kuochu (right) and post-doctoral researcher Sagadevan Arunachalam.

GROUNDBREAKING RESEARCH UNCOVERS THE BIOLOGICAL MECHANISMS FIREFLIES USE TO EMIT LIGHT

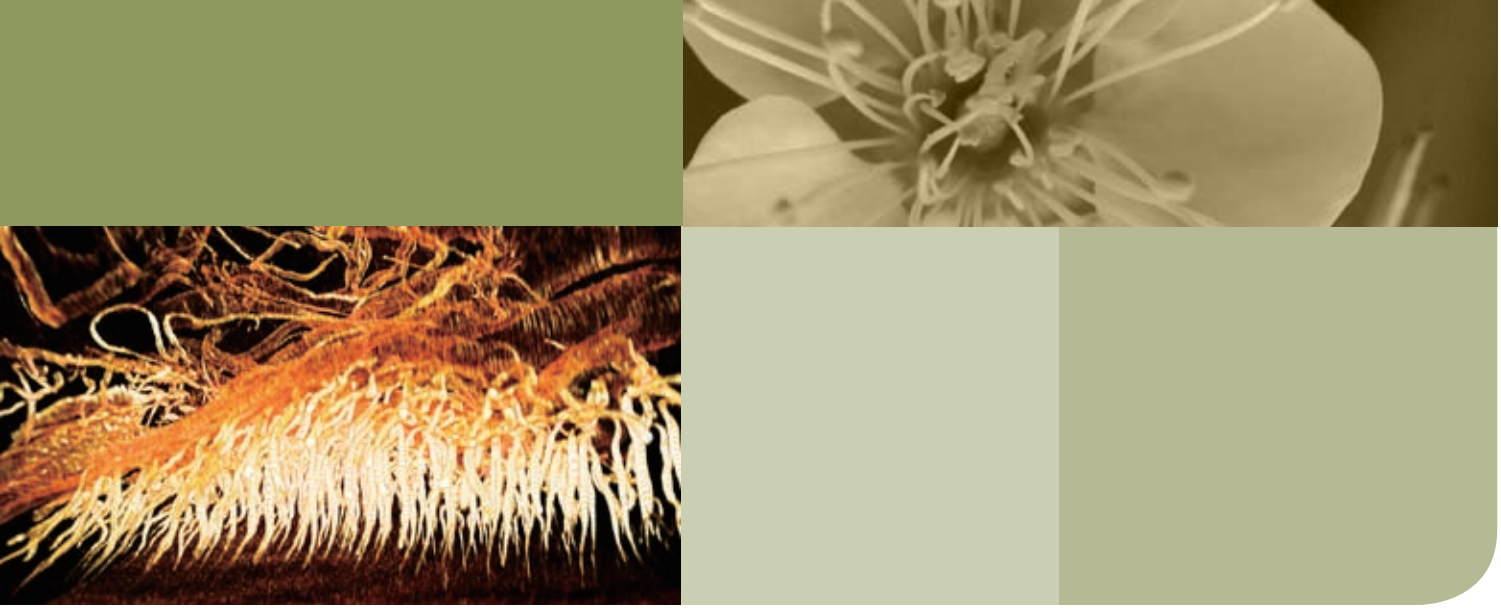
The mechanism by which fireflies emit light has long been an unsolved mystery in the biological sciences. However, in a recent study researchers at NTHU's Institute of Molecular and Cellular Biology working in conjunction with researchers at Academia Sinica's Institute of Physics used synchrotron phase contrast micro tomography and transmission x-ray microscopy to observe the biological mechanism by which these fascinating insects produce light.

Some time ago scientists succeeded in identifying the enzyme by which various insects produce light, and then went on to extract and synthesize it for use in a wide variety of applications. However, fireflies are unique in their ability to control their glow and use it for mating and communicating with one another.

According to Tsai Yue-lin, the lead author and a 2013 graduate of NTHU's Master Program in molecular and cellular biology, until recently there were two main theories for explaining the mechanism by which fireflies control the rate at which they flash: 1) Fireflies use their highly efficient tracheal system to simultaneously supply a sufficient amount of oxygen to their light-producing cells as well as the mitochondrion and the fluorescence mechanism; and 2) Prior to flashing, the amount of oxygen consumed by the mitochondrion is reduced in order to have enough oxygen for the fluorescence mechanism.

In order to test these two theories it was necessary to first gain a sufficient understanding of the efficiency with which the firefly's tracheal system supplies oxygen. According to the former theory, since the oxygen supply is more than sufficient, there is no need to consider the possibility of the mitochondrion and the fluorescence mechanism competing for oxygen. According to the latter theory, the firefly's tracheal system is unable to simultaneously supply enough oxygen to

Lead author Tsai Yue-lin (right) and contributing author Hsu Su-ting, both graduates of NTHU's Institute of Molecular and Cellular Biology.



both the mitochondrion and the fluorescence mechanism.
When one uses the traditional methods of biological research to study a live insect, one will not be able to carry out a real-time imaging analysis with a sufficiently precise dot per inch (DPI) level, and will not be able to test these two theories.
To solve this problem, the research team used synchrotron phase contrast micro tomography and transmission X-ray microscopy to obtain a three-dimensional image of the firefly's flash mechanism, including the highly complex structure of its tracheal system and its bronchial tubes, which are less than 200 nanometers in diameter. After quantifying the results, it was possible to precisely calculate the rate at which oxygen flows to the light-producing cells and the amount of energy they consume. Based on this data they then estimated the overall efficiency of the mechanism by which the oxygen is supplied and consumed.
Having already confirmed the relationship between the mitochondrion and the duration of the luminescence, it was possible to infer that under normal metabolic conditions, when all the oxygen supplied by the tracheal system is consumed by the mitochondrion, then no oxygen would be available to enter into the illumination system. They found that the flash rate depends on the deactivation of the mitochondrion, as demonstrated by using nobelium to suppress the action of the mitochondrion, which resulted in a flash due to oxygen being made available to the illumination system.
In addition to Tsai, the research team included Professor Li Chia-wei (Tsai's academic advisor), Hong Tzay-ming of NTHU's Department of Physics, Hu Yu-kuang of Academia Sinica's Institute of Physics, and several researches from the Endemic Species Research Institute in Nantou County and the Faculté des Sciences de Base, Ecole Polytechnique Fédérale de Lausanne in Switzerland. The research took over

The tracheal system of a firefly as seen through synchrotron phase contrast micro tomography and transmission X-ray microscopy.

one year to complete, and the results have been published in the prestigious journal *Physical Review Letters* (DOI: 10.1103/physrevlett.113.258103).
Describing the research carried out while he was still completing his Master degree, Tsai states, "We had to try out a wide variety of possible solutions. We also had to continually overcome our own limitations." Corresponding author Li Chia-wei commented that he is proud that one of his students has successfully conducted such painstaking and fruitful research, and that such an interdisciplinary approach is the best way to solve difficult problems.

SEARCHING FOR GAMMA RAYS FROM THE EDGES OF THE GALAXY

a COSI mounted on the gondola of a high-altitude balloon. The semispherical device at the top center of the photo is an iridium satellite antenna.

b Members of Taiwan's COSI research team at McMurdo Station. From left to right: Tseng, Martin, M.A. student in NTHU's Institute of Astronomy; Professor Chang Hsiang-kuang; Chiu Hen-lun, who earned his Ph.D. in physics at NTHU and is now a researcher at U.C. Berkeley; and Yang, Chien-Ying, Ph.D. student at the Institute of Astronomy.

On December 29, 2014 NASA successfully launched the Compton Spectrometer and Imager (COSI) from the McMurdo station in Antarctica. Jointly developed by research teams from Taiwan and the Space Sciences Laboratory at the University of California, Berkeley, COSI was carried by balloon some 40 kilometers into the atmosphere to gather information on gamma rays from distant corners of the universe. The launch represents a milestone in terms of gamma ray detection in astrophysics.

The heart of COSI consists of 12 high-purity germanium detectors capable of detecting gamma rays with a photon value of one million volts. Though extremely weak, such gamma rays offer a wealth of information about the galaxy.

According to NTHU physics professor Chang Hsiang-kuang, the leader of Taiwan's research team, the main purpose of this launch was to monitor activity near the center of the Milky Way, where there are strong emissions of annihilation radiation which contains electron-positron pairs. The source of this large amount of positrons has been puzzling astronomers for over half a century. At present the leading theories are that they come from high-density black holes, neutron stars and other black holes, or even low-density dark matter.

Professor Chang stated that they hoped during its long flight COSI might even capture a fleeting image of a gamma ray burst and collect data on photon polarization that could help solve yet another mystery in astrophysics.

As the new generation of Compton telescopes, COSI is not only smaller and lighter than its predecessors, but also more sensitive. According to Chang, this increased sensitivity is of vital importance to advancing our knowledge of the galaxy. For example, it is generally believed that heavy elements were formed by a supernova explosion, but due to the limited sensitivity of the instrumentation the accompanying gamma-ray radiation has never been clearly observed. Of the several teams working on developing a high-sensitivity Compton telescope, the COSI team has had the fastest progress.

Like X-rays, gamma rays are unable to penetrate the Earth's atmosphere. Thus the observation of gamma rays has to be done from outer space, by mounting the instrument on a satellite or spacecraft. Before conducting such a space mission, it is necessary to make a high-altitude test flight to verify that the telescope is working properly. Thus in 2009 COSI was tested in the United States during a 40-hour test

flight in preparation for this Antarctica launch.
After arriving in Antarctica in October the COSI team set about preparing and testing the equipment. After waiting some time for suitable weather, COSI was finally launched on December 29. Although the team was hoping to keep COSI in flight for one hundred days, the balloon developed a leak and on the second day after being launched COSI landed about 560 kilometers from McMurdo Station. Nonetheless, COSI was still able to gather a considerable amount of information which will prove valuable to prepare for future satellite missions. The development of this highly sensitive gamma-ray detector will also have a positive impact on other fields. For example, if adapted for use in medical imaging technology, such a highly sensitive device will make it possible to reduce the dose of tracer radiation injected into the patient. The other core members of the Taiwan research team were Prof. Chang Yuan-han, the Department of Physics at National Central University, and Lin,Chih-Hsun, Associate Research Scientist of the Institute of Physics at Academia Sinica. Taiwan's COSI team was initially supported by Taiwan's National Space Organization and is currently funded by the Ministry of Science and Technology.

Part of the COSI research team at McMurdo Station.

a

b

NTHU COMMUNITY CELEBRATED THE YEAR OF THE GOAT

NTHU's Chinese New Year celebration was held on February 24 in the university Auditorium, with a spectacular performance by the campus Drumming Club serving as the curtain-raiser. Inspired by the "24 festival drums" style of Malaysia, the undulating and thundering sound shook the rafters. Large numbers of faculty and staff, some of them have already retired, were on hand to usher in the year of the goat, making it a lively and memorable occasion.

In the opening speech, President Hocheng wished everyone a happy and prosperous new year. He then expressed his appreciation for all their hard work and diligence over the past year, thanks to which NTHU remains one of the most prestigious universities in Taiwan.

President Hocheng went on to admonish the NTHU community not to rest on its laurels, pointing out that difficult circumstances often bring out the best in people. Citing an example, he reminded the audience that it was during its phase as one of the three universities which made up the National Southwestern Associated University during World War Two that NTHU achieved some of its most important accomplishments. He also asserted that as long as everyone continues to carry out their work in a conscientious and creative manner, then the year of the goat is sure to be a good one.

Additional highlights of the celebration included splendid

c

musical performances by the Chaonan Faculty Band led by NTHU Vice President Wu Cheng-Wen; a trio consisting of professors Chao Shiuh, Liu Yi-Wen, and Chang We-Fu; and the Seagull-K Vocal Band, the members of which are NTHU alumni. There was also a dazzling Tahitian dance performance by the female members of the Office of the Secretariat.

The final act was a spectacular magic trick in which Chen Guohua of the Physical Education Office appeared to chop off the arm of his lovely female assistant. The festivities came to a dramatic close when Chen and the other performers tossed tangerines (the traditional symbol of prosperity) into the audience.

ⓐ President Hocheng announcing the winner of the raffle.
ⓑ The campus Drumming Club performing the curtain-raiser.
ⓒ Tahitian dance performers.
ⓓ The Seagull-K Vocal Band.
ⓔ Trio consisting of professors Chao Shiuh, Liu Yi-Wen, and Chang We-Fu.
ⓕ President Hocheng (center) leading a group felicitation.
ⓖ Chaonan Faculty Band led by NTHU Vice President Wu Chengwen (1)

a Professor Chien and his staff.
b Professor Chien and student researchers.

ENABLING A+ DECISION FOR SMART PRODUCTION VIA "INDUSTRY 3.5"

NTHU Chair Professor Chen-Fu Chien is currently serving as the Director of the NTHU-TSMC Center for Manufacturing Excellence and presiding over the Semiconductor Technologies Empowerment Partner (STEP) Consortium. Sponsored by the Ministry of Science and Technology, the STEP Consortium includes industry leaders from most of the leading manufacturers such as TSMC, Delta, Quama, GUC, VisEra as well as many hardware/ software providers such as Acer, IBM, SAS and Eta.

The Decision Analysis Laboratory of the Consortium, under Prof. Chien's directorship, is transferring the accumulated research capability and analysis technologies on decision analysis, data mining and resource optimization to various high-tech companies along the supply chain to enhance their analytical capability and foster a "virtual vertical integration" among them. By so doing, the Laboratory hopes to enable Taiwanese companies which used to focus on horizontal layers to compete with the vertical integrated manufacturers worldwide. For example, German manufactures have recently announced a national strategic plan, i.e., the Industry 4.0, to focus on smart production, green and urban manufacturing empowered by internet of things and big data analytics. Likewise, U.S. has also initiated a "re-industrialization" policy and promoted the advanced manufacturing programs through innovation and intelligence to revitalize its industry.

The STEP Consortium is also conducting a Semiconductor Big Data Grand Challenge with realistic scenarios to support and train interested Taiwanese students to learn big data analysis via effective training and empirical studies and hopes to incubate a group of young talents with an interdisciplinary background for the further development of Taiwanese high-tech industry. To this end, Prof. Chien and his team have shared their case studies and materials learned from long term collaborations with leading companies and published a number of journal articles, patents and a textbook on data mining and big data analysis.

While it is unrealistic to hope that Taiwanese industries can leap up to the level of their Germany and U.S. counterparts, Prof. Chien believes that Taiwanese manufactures can consolidate their successful past experience with an advanced analytic technology of big data and proposes the concept of "Industry 3.5" as a hybrid strategy for disruptive innovations to maintain competitive advantages in the fast changing environment.

NTHU AND NCTU CAME OUT EVEN IN THE MEICHU TOURNAMENT

ⓐ NTHU teams at the opening of this year's Meichu Tournament.
ⓑ The Meichu trophy being received by both schools.

At this year's annual Meichu Tournament both NTHU and National Chiao Tung University (NCTU) won five of the ten events, resulting in a draw. NTHU won the chess, tennis, women's basketball, men's volleyball, and table tennis contests, while NCTU won the badminton, baseball, men's basketball, bridge, and women's volleyball contests.

In his speech following the tournament, President Hocheng congratulated all the NTHU contestants for their memorable performances. He also stressed that the most important part of the Meichu Tournament is not who wins, but the long-term friendships which have emerged over the years, such that everyone comes out a winner.

Ever since the first Meichu Tournament was held in March of 1969, one of its primary goals has been to encourage students to participate in activities which cultivate physical fitness and other non-academic skills. The tournament promotes friendship and cooperation between the two universities and was named after the presidents of NTHU and NCTU at that time, Mei Yi-qi and Ling Chu-ming, respectively.

The three-day tournament opened on March 9 at the NCTU stadium with rousing performances by the cheerleading squads of both schools. There was also a spirited rendition of the NTHU school song led by the Seagull-K Vocal Band. Despite the heated competition, during the awards ceremony the contestants exhibited the spirit of sportsmanship by applauding one another.

NTHU

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