

# NTU



# HIGHLIGHTS

Special Report:

# R&D Showcase

- 
- NTU, Kyoto U Strategic Partners  
• Climate Change Affects Water Resources  
• Promise of Silicon Photonics

## Beyond the Sea: NTU Launches Research Vessel

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R/V New Ocean Researcher 1 is entrusted to NTU by the Ministry of Science and Technology.

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# Message from Prof. Louis Yu-Ning Ge, Vice President for General Affairs

NTU's Office of General Affairs (OGA) is responsible for all the administrative work related to the activities of NTU colleges and departments. Our work ranges from as small as cleaning up sidewalks and caring for campus trees, to as big as procuring equipment and constructing buildings. It is our mission to take good care of the lives of our staff and students and ensure they have the logistic support to continue their studies and research on campus.

NTU boasts a large and beautiful campus. The main campus alone sits on 110 hectares. Besides the main campus, there are also other campuses, farmlands, and experimental forests, occupying nearly approximately one percent of the total land area of Taiwan. Managing such a large campus is not an easy task, yet thanks to the collaborative efforts of our nine divisions and 300 staff members, OGA has delivered proper maintenance and received various ISO certifications.

During the pandemic, we have worked hand in hand with our colleagues from other offices to ensure the campus remains a safe environment for everyone, as well as safeguard the health of our faculty and students. Despite the virus, we have continued with our construction projects and striven to make NTU a safer, friendlier, smarter, and more beautiful campus.

Regarding campus construction work, we are collaborating with the city government to renovate the Liugong Canal. In the future, the area stretching from the New Moon Pavilion to the NTU Sports Center will become a scenic river corridor. A new theater, covered courts, and new dormitories will be constructed, as well. Also, we are collaborating with nearby hotels to provide better living quarters for our faculty members.



Prof. Louis Yu-Ning Ge, Vice President for General Affairs.

We also leveraged the power of IoT to make our campus smarter. This January, we implemented the Youbike2.0 Pilot Project, and many users responded positively. By offering more incentives and increasing the number of Youbike stations on campus, we expect to reduce the number of private bicycles on campus.

Currently, NTU has a total enrollment of 32,000 students and over one thousand faculty members. It is our hope that our students can feel at home at school and our teachers can take pride in their work.

# Onwards to the Great Voyage: NTU Launches the R/V New Ocean Researcher 1

Commissioned by the Ministry of Science and Technology (MOST), the newest and largest ocean research vessel R/V New Ocean Researcher 1 has been entrusted to NTU for future operations. R/V New Ocean Researcher 1 replaced Ocean Researcher 1, which had been maintained and operated by NTU's Institute of Oceanography for 35 years. The new vessel will continue to lead the way in ocean research by completing education and training missions, as well as serving the academic circle and fulfilling the purpose of national construction. Dr. Chung-Ming Kuan, President of NTU, presided over the launch ceremony on August 25, 2020 in the port city of Keelung together with members on the administrative team and staff from the

Institute of Oceanography. The ceremony was followed by a routine meeting onboard.

Costing over NT\$460 million to build, R/V New Ocean Researcher 1 measures 2,155 tons in gross weight, 66 meters in length, 14.8 meters in width, and a draft of 4.3 meters. A total of 19 crew members and a 9-member research team have been assigned to the vessel, with the capacity to carry an additional 19 researchers for research trips. An electric-powered twin propeller was adopted for the propulsion system, and the ship is powered by four diesel generators in rotation. The special features of the new vessel include a dynamic positioning system, which generates real-time position by taking the wind speed, wind direction, current speed, and wave data into consideration. The system facilitates precise fixed-point surveys at sea, deep-sea core sampling, and navigating unmanned remote-control vehicles below the surface.

Two sets of multibeam echosounders with different audio frequencies were equipped for detection, which are used separately for high-resolution scanning of seabed topography in shallow and deep waters. In order to measure the



R/V New Ocean Researcher 1 is entrusted to NTU by the Ministry of Science and Technology.

velocity profile of ocean currents during navigation, two sets of Acoustic Doppler Current Profilers with the audio frequency of 75 kHz and 150 kHz were installed. In addition, the chirp sonar frequency-modulated (FM) system can be used to profile the sub-bottom. The multibeam echosounder and the multibeam echosounder fish finder are employed to accurately measure water depth and apply acoustic waves to biometrics. The ultra-short baseline positioning system can accurately locate core samplers, underwater vehicles, etc., thereby greatly improving the research vessel's detection capabilities, data resolution, and accuracy.

R/V New Ocean Researcher 1 is the only research vessel in Taiwan equipped with a meteorological tower facility. The meteorological data collected during the voyage is sent to the Central Weather Bureau through the communications satellite, breaking the confines of terrestrial meteorological observation. The detection equipment and capabilities of R/V New Ocean Researcher 1 have greatly enhanced the vision of ocean research in Taiwan, raising its level from regional ocean research to a global scale of ocean voyages and future-oriented explorations that will further connect Taiwan to the world. This newfound capacity helps to create a marine industrial chain and potential opportunities for international cooperation, thereby building a comprehensive national marine database and marine ecology/resource maps to promote the sustainable development of marine research. Based on this foundation, Taiwan will officially enter a new era of "sailing the blue sea," as envisioned in the plan proposed by MOST.

On September 19, 2020, R/V New Ocean Researcher 1 participated in the "Kiss Science" event organized by the MOST by opening its doors to the general public at Keelung Port. A total of 180 visitors were offered an in-depth guided tour by the crew as well as the research team of the Institute of Oceanography, who gave detailed explanations about the various spaces and research equipment onboard. A free visit



Group photo taken at the launch ceremony of R/V New Ocean Researcher 1 on August 25, 2020.



NTU President Chung-Ming Kuan receives a briefing with administrative team members on R/V New Ocean Researcher 1.

area was set up by the pier with interactive booths showing marine instruments, with the technicians and instrument experts from the Precision Instruments Center sharing their working knowledge about the instruments with enthusiastic visitors. The Institute of Oceanography mobilized over 50 staff members, technicians, and crew members for the event, hoping the general public could better understand the significance of marine science and explorations, as well as the highlights and value of this endeavor. The praise and feedback received by the team were beyond expectation, with the Institute of Oceanography receiving many requests from high school teachers who wanted to organize a visit to R/V New Ocean Researcher 1 even after the event was over. They shouldn't feel discouraged, however. With all the big plans that MOST and NTU researchers have in store, another chance will arise soon, for sure!



# NTU Dazzles and Shines at BIO Asia 2020

The 2020 BIO Asia International Conference was hosted at Taipei Nangang Exhibition Center Hall 2 during July 22-26. A first-time exhibitor, NTU showcased the results of many recent significant R&D projects at the “NTU Pavilion” to demonstrate its excellent and diverse achievements. The pavilion had the latest R&D innovations on display from over 16 research divisions and 20 professors, addressing such issues as pandemic prevention, drug and vaccine R&D, novel medical devices, precision medicine and various testing technologies, smart healthcare, as well as innovation highlights from a range of industries, notably agriculture, forestry, fishery, and animal husbandry. Conference participants were offered a glimpse of cutting-edge technology as well as NTU's core competitiveness in the fields of biotechnology, medicine, and agriculture.

President Chung-Ming Kuan presided over the opening ceremony of the "NTU Pavilion" in the morning of July 23 affirming that this displayed the fruit of the university's first large-scale attempt at integrating its biotechnology research capabilities and R&D results while proactively reaching out to industries and asserting NTU's potential as the best partner in facilitating industrial upgrade and added value.

Prof. Pai-Chi Li, NTU's Vice President for Research and Development, said that the NTU Pavilion was made possible through the joint efforts of multiple divisions coordinated by the Office of Research and Development. Cross-domain collaboration is a standing R&D tradition at NTU and has become a trending model due to the pandemic. Founded in 2006, the Graduate Institute of Biomedical Electronics and Bioinformatics is the perfect example of merging the different fields of biotechnology, electrical engineering and information science to engage in advanced research and cross-field teaching in biomedicine. In addition, teams from the Department of Mechanical Engineering, the College of Engineering, and the College of Electrical Engineering and Computer Science have



The NTU Pavilion presents the latest R&D innovations from over 16 research divisions and 20 professors.

engaged in research projects in biomedicine and will surely deliver more breakthroughs and research results in the near future.

With 11 colleges, 56 departments, 112 graduate institutes, and 18 graduate programs, NTU not only stands out as Taiwan's leading comprehensive university, but also boasts exceptional R&D capacity. According to information made available by the university, a total of 39,351 papers have been published during 2013-2018, with as high as 40% rated as the top 10% critical publications by international organizations. Moreover, NTU is home to 400 research teams and holds nearly 2,000 patents. In 2019, the funds invested in all research projects had reached NT\$7 billion. As a result, NTU has long been the top pick when international companies and universities seek partners in Taiwan.

Prof. Pai-Chi Li also pointed out that the scope of R&D at NTU covers a wide range of fields. Besides the biotechnological and medical research results showcased at Bio Asia, NTU is also a leader in semiconductor and fintech research. Its collaboration projects with E.SUN Financial Holding Company and Cathay Financial Holdings have exemplified NTU's highly appreciated and much sought-after R&D capabilities, scope, and technical expertise.

Since its inception, the Office of Research and Development has been dedicated to facilitating academic research, strengthening research infrastructure and industry-academia collaboration, while integrating university resources, building a top-quality environment for research and industry-academia collaboration, as well as promoting team research. It is the Office's fondest hope to attract top talents at home and abroad, maximize the value derived from intellectual property outputs, and ensure NTU's leading position and sustainable development in global academia.

Under the Office of Research and Development, the Center of Industry-Academia Cooperation acts as a bridge between academic research and



President Chung-Ming Kuan (second from left) and Executive Vice President Dr. Shan-Chwen Chang (first from right) at BIO ASIA 2020.

industrial innovation, handling such tasks as patent applications, technology transfer and licensing, selection of partners for industry-academia collaboration, and contract discussions. According to Prof. Pai-Chi Li, as the number of industry-academia collaboration projects continues to rise, NTU has set up a dedicated Division of Industrial-Academic Cooperation to provide services and support for teams engaging in research and innovation. To sustain the momentum of research and development, on the one hand, innovative research funds and assistance for long-term projects are made available to R&D projects of young and middle-aged faculty members; on the other hand, senior faculty with long-term experience and an excellent track record in research and development are recruited to lead research teams in order to pass on their expertise and experience.

With abundant resources in manpower, infrastructure, and opportunities for industrial collaboration, the outlook of research and development at NTU is brighter than ever. As a member of the global academic community, NTU's ultimate goal is to make as many contributions as possible to broaden the knowledge horizon for the entire human race as well as create practical applications that benefit society as a whole.

# NTU Enters Top 100 in THE Rankings

According to the latest announcement by Times Higher Education (THE), NTU rose to 97th in the THE World University Rankings 2021—marking the first time that NTU has entered the ranks of THE’s top 100 universities. Since 2009, NTU has been improving in the Quacquarelli Symonds (QS) rankings, as well, rising to 66th and still the only university in Taiwan to be listed among the world’s top 100 universities.

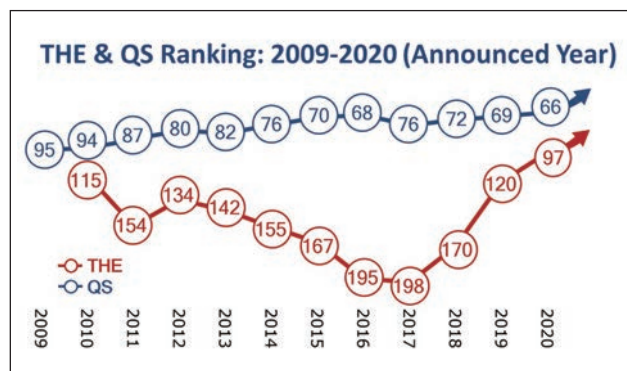
The metrics used by THE included teaching, research, citations, industry income, and international outlook, with research and citations accounting for 60 percent of the total score. Similarly, the scores for academic reputation and citations per paper also constitute 60 percent on QS’s evaluation. These figures highlight the weight of teaching and research in higher education, and NTU was ranked 56th in the category of research according to THE. To date, NTU has published 663 highly cited papers and has been cited 876,213 times on SCI, SSCI, and A&HCI, a 13 percent increase compared to last year, showing NTU’s outstanding research prowess.

For the past 92 years, NTU’s presidents have striven to make NTU one of the world’s leading higher education institutions. In 2008, during the celebration of NTU’s 80th anniversary, President Si-Chen Lee set the goal “NTU at 80 going for the top 100,” and this goal was reached when NTU ranked 95th in QS the following year. With the announcement of this year’s ranking, NTU can now boast its success for entering the top 100 in both the QS and THE rankings.

President Chung-Ming Kuan attributed the ascent in world university rankings to the collective effort of all NTU members and affirmed that NTU would continue striving towards ever higher goals. “2028 will mark the 100th anniversary of our



Former President Si-Chen Lee (right) set the goal of “NTU at 80 going for the top 100” in 2008; President Chung-Ming Kuan (left) achieved the goal of entering top 100 in both QS and THE this year.



THE and QS rankings.

school, and it is indeed our aspiration to become one of the world’s top 50 prestigious universities. To achieve this goal within the next 8 years, we must go the extra mile,” asserted President Kuan. He further pointed out that higher education requires the government’s long-term financial and legal support as well as cooperation among different stakeholders. As the most prestigious university in Taiwan, NTU upholds the highest standards and will remain dedicated to striving for excellence.



# Enrichment Camp Connects High School Students to the World

Organized and hosted by the Office of International Affairs (OIA) during August 5-7, the 2020 NTU Plus Academy Enrichment Camp was aimed at broadening the horizon for talented students from international schools in Taiwan, as well as spotlighting NTU's outstanding research environment. The participants came from diverse backgrounds, including schools with different systems, such as Kang Chiao International School, Morrison Academy, and VIS Experimental High School. Some of the students had already been accepted by world-class universities, such as the University of British Columbia, the Hong Kong Polytechnic University, the University of California at Berkeley, and the University of Washington. With different nationalities in play, the students added an extra dimension of diversity to the program.

A total of five professors from different departments were invited to offer courses covering such topics as life sciences, forestry and resource conservation, evolutionary biology, geography, civil engineering, and creativity and entrepreneurship. Besides giving the students a taste of what university classes are like, another highlight of the program was the manner in which the professors explained profound concepts in



Prof. Hsiao-Wei Yuan, Vice President for International Affairs, leads a birdwatching tour on campus.

their respective fields in simple language while employing an interactive pedagogy.

Besides lectures, the OIA also arranged various lab visits, giving the students rare opportunities to observe the conduct of experiments firsthand. The GAME BABY program provided food for thought on how computers can speed up complex work processes for humans; the Zebrafish Model Lab gave a glimpse into how biological research is conducted; and a visit to the seismic isolation layer of the Civil Engineering Research Building revealed a seismic device that is normally hidden in buildings. Visits to the Gallery of NTU History, NTU Farm, and a plant dye session also proved to be both engaging and inspiring.

Leadership and team spirit were actively fostered during the 3-day event. In a poster session themed "Vision of NTU as a Leader," the students were guided to think from a leader's perspective, brainstorm ideas that would better represent NTU, and give group presentations. In the Creative Thinking & Innovation class, the professor organized a group competition to see which group could build the highest structure with a variety of materials, showing them the value of good teamwork.

The OIA hopes that the camp could offer precious opportunities of connecting local high school students to the rest of the world, as well as enhancing the visibility of NTU among international schools in Taiwan. Given the strongly positive feedback of the participants, the camp is likely to be expanded to accommodate even more high school students in the future.



Group photo taken at the campus tour.

# NTU and KU Signs MOU on Strategic Partnership

On August 5, NTU and Kyoto University (KU) signed a Memorandum of Understanding on Strategic Partnership online, a commitment that will encourage future collaboration and interdisciplinary international research.

Since 2005, NTU and KU have signed nearly 30 cooperation agreements and worked closely through frequent research collaborations and exchanges, student and faculty exchange programs, and dual degree programs. To further their collaborations, the two schools hosted three campus-wide interdisciplinary seminars, attracting over 500 attendees from both sides and opening up collaboration opportunities in 14 research fields. Despite the pandemic, NTU and KU's dedication to education remains unwavering and the signing ceremony was held online. The auspicious event was joined by NTU President Chung-Ming Kuan; NTU Vice President for International Affairs Hsiao-Wei Yuan; KU President Juichi Yamagiwa; KU Provost Nagahiro Minato, doubling as Executive Vice-President for Strategy Coordination, Research, Planning and Hospital Administration; and KU Vice-President for International Strategy Yasuyuki Kono. After greeting one another, the administrators from both universities discussed key areas of future

research cooperation as well as the initiation of new projects and connections. During the event, NTU was also praised and recognized by KU for its excellent achievements in keeping the campus safe amidst the COVID-19 pandemic.

President Yamagiwa also seized the chance to formally introduce the incumbent Executive Vice-President Nagahiro Minato as the incoming President of KU. It was a moment of historical importance, and as Dr. Minato was inaugurated on October 1, he will surely continue passing down the school's heritage and strive to reach international consensus.

NTU currently has over 600 partner universities. Starting from 2013, NTU has established strategic partnerships with various prestigious universities worldwide, including the University of Tokyo, Kyoto University, the University of Tsukuba, Peking University, the University of Sydney, the University of Hamburg, and the University of Illinois at Urbana-Champaign. These strategic partnerships are aimed at encouraging schools to fund key areas of research and bilateral faculty exchanges that are focused on tackling global issues and fulfilling the UN's Sustainable Development Goals (SDGs). The International Collaboration Seed Funding, a project launched by the OIA, has already supported over 40 collaboration projects between NTU and KU to date. It is believed that this strategic partnership agreement will greatly enhance the collaboration between the two schools in the future and fully unleash their research potential in various fields.



Group photo at the Strategic Partnership Agreement Signing Ceremony.



# Decoding the Secret to Hair Growth through Goosebumps

An international research team led by NTU faculty published major findings on how cell types that induce goosebumps also regulate hair follicle stem cells in the world-renowned journal, *Cell*.

Hair, the tresses and locks covering our heads, has always been important to us. Everyone fears bad hair days and takes pride in good hair days. A full head of smooth, shiny hair symbolizes youth and vitality. Consequently, hair growth and treatments for hair loss have always been crucial areas of regenerative medical research. An international research team led by researchers from NTU has discovered that hair growth regeneration is dependent on the activation of hair follicle stem cells. This new finding will certainly usher in new directions and methods for effective hair loss treatment.

With support from the Ministry of Science and Technology, NTU Hospital, and Taiwan Bio-Development Foundation (TBF), Prof. Sung-Jan Lin, Deputy Director of NTU's Research Center of Developmental Biology and Regenerative Medicine, and his team in collaboration with Harvard University Professor Ya-Chieh Hsu studied the activation of hair follicle stem cells. Their research findings, which shed fresh light on how hair follicles are regenerated, were published in *Cell*.

By analyzing goosebumps, or the phenomenon of piloerection, the team studied the contraction of the arrector pili muscle (APM) and the mechanism whereby hair stands up. They found that when subjected to cold, the sympathetic nerves were activated, and besides stimulating the APM to contract and produce goosebumps, hair follicle stem cells were also activated, inducing hair regeneration and generating warmth. This finding likely explains why wildlife in cold climates, such as polar bears, have thick fur. The study showed that the correlation between



Prof. Sung-Jan Lin, Deputy Director of NTU's Research Center of Developmental Biology and Regenerative Medicine & Attending Physician at the Department of Dermatology, NTU Hospital.

sympathetic nerves and the activation of hair follicle stem cells is the key to hair regeneration.

Another breakthrough discovery made by the team was the process whereby the sympathetic nerves activate hair follicle stem/progenitor cells (HFSCs) via synapse-like contacts when they are in the proximity of hair follicle stem cells. This enables the sympathetic nerves to release norepinephrine, which stimulates the activity of hair follicle stem cells. Synapse-like contacts were previously thought to exist only at the juncture between nerves or that between nerves and muscles. This pioneering study demonstrated that synapse-like contacts can modulate stem cells in the body. It was also found that hair follicle regeneration is triggered by ADRB2 receptors receiving sympathetic nerve signals.

The research team members from NTU included one of the first authors, Dr. Chih-Lung Chen, as well as Dr. Sabrina Mai-Yi Fan and Dr. Edrick Tai-Yu Lin, all of whom are faculty members of the Department of Biomedical Engineering. The research team is also indebted to NTU Hospital's Department of Medical Research for their generous technical support as well as NTU's Centers of Genomic and Precision Medicine for assistance with managing transgenic mice.



Scan the QR code to access the journal article.

# NTU Realizes the Promise of Silicon Photonics

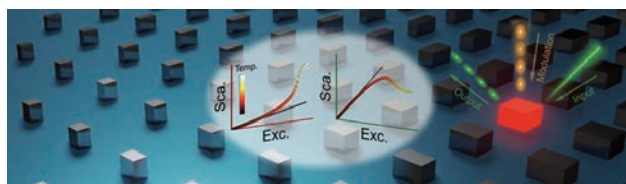
Taiwan holds a global edge in the production of electronic components and is recognized as the leading manufacturer of semiconductors and chips. These advanced nanotechnology-based integrated circuits (ICs) are mostly made from silicon, the second most abundant element on Earth. Currently, silicon has limited applications with respect to circuit size and operation speed; however, if photonics could be used for operations, data processing and transmission speed would be greatly enhanced. This would lay a solid foundation for future research on silicon photonics, enabling industry to leverage these advantages to generate innovative designs. In electronics, the key to success lies in producing nonlinear components (e.g., transistors) that can control electrical signals via voltage or current. Similarly, in silicon photonics, light-control-light, or all-optical control, is a critical function. However, at present, the optical nonlinearity of silicon is too weak to achieve efficient all-optical control.

With the funding of MOST's Outstanding Young Scientist Project and Add-on Grant for International Cooperation, Prof. Shi-Wei Chu of NTU's Department of Physics and Molecular Imaging Center formed an international research team, including Prof. Junichi Takahara and Prof. Katsumasa Fujita of Osaka University, Prof. Xiangping Li of Jinan University, Dr. Kung-Hsuan Lin of Academia Sinica, Dr. Chih-Wei Chang of NTU, and Prof. Kuo-Ping Chen of National Chiao Tung University. The team has successfully enhanced the optical nonlinearity of silicon 10,000 fold, reducing response time to nanosecond-scale. These results may facilitate the development of all-optical circuit components and replace current ICs with silicon photonic ICs.

The team's two latest studies were published in the prestigious journal, *Nature Communications*. Their findings revealed that silicon nanostructures



Prof. Shi-Wei Chu (second from right, back row) and the research team members.



The team has successfully enhanced the optical nonlinearity of silicon 10,000 fold, reducing response time to nanosecond-scale.

exhibiting special electromagnetic resonance mode can enhance light interaction. The results also showed that in a thermally isolated nano-environment, the optical nonlinearity's magnitude of enhancement increases by 3-4 orders and reaches nanosecond-scale response time. Additionally, the fast nonlinearity enables nearly 100% all-optical modulation of scattering light from a single silicon nanoparticle at GHz speed. The team also discovered that this technology could achieve 40-nm resolution, improving the resolution not only by one order but allowing label-free imaging in silicon nanostructures.

These groundbreaking discoveries offer significant insights into silicon photonics and open up new possible applications of these high-speed, high-contrast all-optical nanoscale components as well as the super-resolution imaging of silicon.

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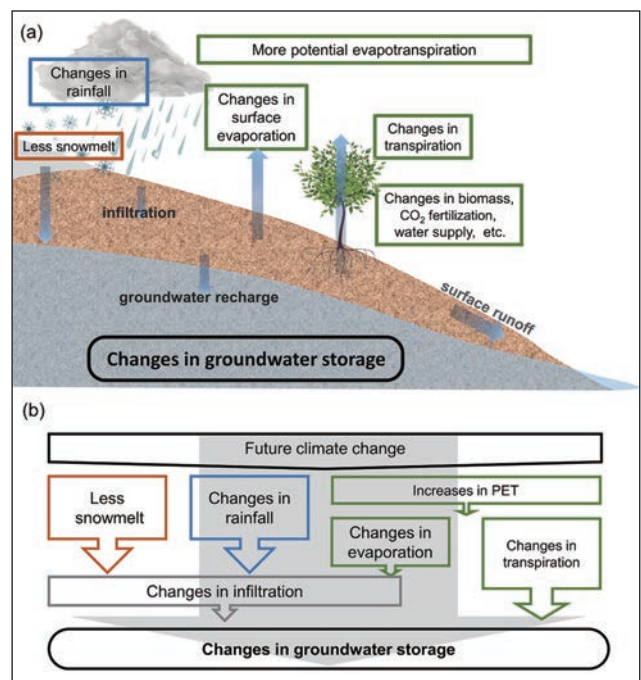
# Impacts of Climate Change on Terrestrial Water Cycle and Water Resources

Groundwater provides critical freshwater supply, particularly in dry regions where surface water availability is limited. As a result, impacts of climate change on groundwater storage could play a role for maintaining the sustainability of freshwater resources. An international research collaboration led by Prof. Min-Hui Lo of NTU's Department of Atmospheric Sciences and his former master's student, Wen-Ying Wu, investigated potential terrestrial water storage changes in the 21st century. For the first time, the team used a fully-coupled (including atmospheric, oceanic, land, and sea ice components) climate model to simulate groundwater changes in seven vital aquifers in the world, given the assumption of a warmer climate in the future. The study findings were published online in *Nature Communications* in July 2020.

The team assessed potential climate-driven impacts on changes in groundwater storage during the 21st century under the business-as-usual baseline scenario of global warming. The results showed that climate-driven effects on groundwater changes do not necessarily reflect the long-term trend in surface precipitation. Instead, the trend may result from increased evapotranspiration and reduced snowmelt, which collectively lead to divergent responses across different aquifers. The research team further compared the climate-driven and anthropogenic pumping impacts. The decline in groundwater storage is mainly caused by the combined results of over-pumping and climate factors. However, the amount lost due to pumping could far exceed natural replenishment. This important finding can contribute to improving sustainable groundwater management.



Wen-Ying Wu (left), first author of the paper and PhD candidate at the University of Texas at Austin, and Prof. Min-Hui Lo (right).



Changes in groundwater storage and future recharge.

In a pioneering effort, the team addressed climate change impacts on the groundwater budget using a fully-coupled Earth System Model. This study will be essential to establishing a better understanding of future changes in the earth's vital but limited groundwater resources. Further investigation and incorporation of future socioeconomic development will be necessary to develop the scenarios for groundwater exploitation rates, as the anthropogenic effects are likely to exceed the natural climate change effects over irrigated and urbanized regions in the world.



Scan the QR code to read the journal article.

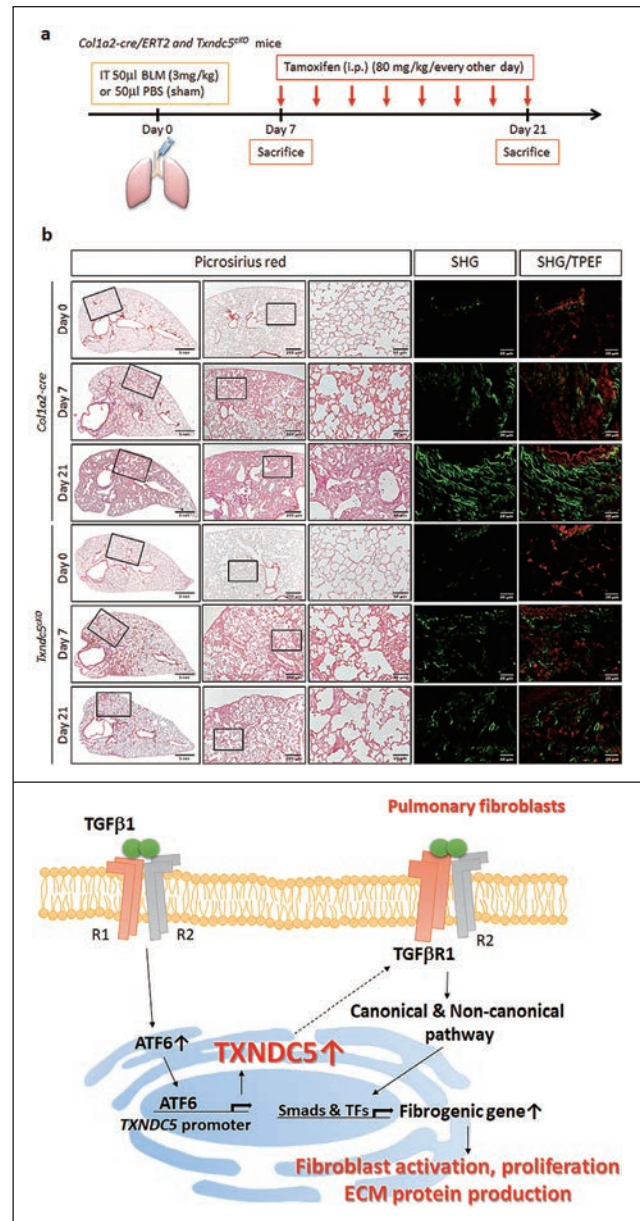
# NTU's Discovery Offers New Hope for Pulmonary Fibrosis Patients

A research team led by Dr. Kai-Chien Yang, Associate Professor of NTU's Department and Graduate Institute of Pharmacology, discovered the critical role that thioredoxin domain containing 5 (TXNDC5) plays in pulmonary fibrosis (PF). This finding, published in *Nature Communications*, may lead to a novel therapeutic approach against PF.

PF is a major public health problem due to the devastating morbidity rate and the vast amount of health care and economic costs associated with treating the disease. Currently, there is no cure for the disease, and medications used to relieve symptoms are often shown to be ineffective. As a result, a lung transplant is often the only option left for many patients. Therefore, novel therapeutic options are urgently needed to improve the treatment outcome and prognosis of PF patients.

TXNDC5, a fibroblast-enriched endoplasmic reticulum (ER) protein, is believed to be responsible for extracellular matrix (ECM) protein folding and linked to reactive oxygen species. In 2018, Dr. Yang and his team identified TXNDC5 as a possible novel mediator of cardiac fibrosis. Tzu-Han Lee, a Ph.D. student of Dr. Yang, later revealed in her research that TXNDC5 promotes fibrogenesis by enhancing TGFβ1 signaling through direct binding with and stabilization of TGFBR1 in lung fibroblasts.

The team identified increased protein expression of TXNDC5 and myofibroblast marker αSMA in PF patients' lung tissues. Through an in vivo experiment using a mouse model of bleomycin-induced PF, the team found that by deleting TXNDC5, the development of PF can be significantly reduced, thus preserving the lung's function.



Illustrations of the research results.

In the future, Dr. Yang and his team will continue working on developing medications that target TXNDC5, hoping to offer a more effective therapeutic approach to mitigating PF and improving patients' lung function and outcomes. It is the mission of the team to develop drugs that help mitigate cardiac fibrosis, PF, and other respiratory dysfunctions. The findings of the team will not only aid PF and cardiac patients but also possibly offer a ray of hope to those suffering from chronic kidney diseases and liver cirrhosis.



Scan the QR code to read the journal article.



# Students Amaze Viewers with Biological Scientific Illustrations

Fascinated by the vast variety of creatures in nature, mankind has wandered far and wide throughout history to observe and describe the shapes of flowers, birds, insects, and fish, as well as represent them by photography or drawing. In fact, “scientific illustration” originated from the observation and description of nature before evolving into a form of expression for recording and explaining scientific concepts.

Besides playing a pivotal role in the natural sciences, biological scientific illustration features prominently as a teaching medium in various disciplines, including taxonomy, morphology, cytology, anatomy, and human anatomy. Although photography and digital imaging have been widely adopted today, scientific illustration has remained relevant, as it simplifies complex information while allowing sketchers to make closer observations of the object during the process. Moreover, the specific presentation of biological scientific illustration has transformed into a unique branch that combines art with biology.

In the first semester of the 2020 academic year, NTU’s College of Life Science launched the

one-of-a-kind cross-disciplinary course “Biological Scientific Illustration.” Led by Prof. Jer-Ming Hu, Chair of the Institute of Ecology and Evolutionary Biology, the team of professors designed a curriculum that integrates lectures with weekly hands-on practice sessions. With the goal of cultivating both scientific and artistic literacy, the course gave the students the opportunity to have a taste of scientific illustration while gaining an in-depth understanding of various biological phenomena in nature. The theme focused on natural history, including the introduction of observation in nature, scientific records, the morphology of animals and plants, as well as basic techniques and presentation of biological scientific illustration.

Most of the materials were provided by NTU’s Museum of Zoology and Herbarium, with the specific object and medium left up to the students. The students’ efforts resulted in breathtaking works as their term projects. With their consent, these beautiful works were displayed on the ground floor of the Life Science Building in June 2020, allowing people from both on and off campus to appreciate the beauty of scientific illustration while spotlighting popular science education. Besides the event, several online sessions were organized with Kyushu University in Japan for in-depth exchanges both in class and during the exhibition. One such exchange featured a dialogue between the university museums on how to lay a solid foundation for further international cooperation in the field.



Group photo.

# NTU Library Signs MOU with RDMLA

NTU Library signed an MOU with the Research Data Management Librarian Academy (RDMLA) in June 2020 to launch an RDMLA online professional development program in traditional Chinese. The aim is to promote professional expertise in research data management (RDM) among researchers and librarians in the Mandarin-speaking world. The online course in traditional Chinese will be completed in June 2021, and it is expected to be available online in October 2021.

Following open access, open data has become another important issue for open science. The aim of open data is to enable researchers, research institutes, and the general public to reuse data, enhance research efficiency, improve research quality, and promote academic exchange, so as to optimize research data. RDM is vital to academic research today, and it is imperative that the process and results of research adhere to the Findable, Accessible, Interoperable, and Reusable (FAIR) principles.

RDMLA is an online professional development program for librarians, information professionals, and any other professionals who work in a data-intensive environment throughout the world. It features a unique partnership between LIS academic programs, academic health sciences, research libraries, and Elsevier. Partner institutions include Harvard Medical School, Harvard Library, Simmons University, Boston University, Brown University, Massachusetts College of Pharmacy and Health Sciences, Northeastern University, and Tufts University.

In 2019, the RDMLA Online Curriculum was launched on the Canvas platform, based on CC-BY-NC-SA authorization. The curriculum features eight online self-paced learning units that cover such topics as the foundations of RDM, research culture, advocating and marketing RDM services in libraries, project management, and an overview of RDM tools.



NTU Library signs MOU with RDMLA to launch curriculum in traditional Chinese.



NTU Library.

The RDMLA online course promises to equip those who complete the course with the ability to:

- Summarize research workflow and specify information professionals' role in each stage of the data life cycle
- Understand the value of and approaches to navigating research culture and partnering with members of the research ecosystem
- Identify institutional research data management stakeholders and describe strategies for advocating the library's role in RDM
- Design action plans to launch and manage data services in libraries
- Develop RDM project management plans and evaluate RDM processes, outcomes, and impact/value
- Describe the steps of data analysis and visualization and develop skills in using relevant tools such as R and Tableau
- Develop skills in appropriately using RDM programming tools, such as Python and Jupyter Notebook, to meet data needs
- Gain familiarity with a variety of platform tools for data sharing, storage, discovery, reuse, and reproducibility



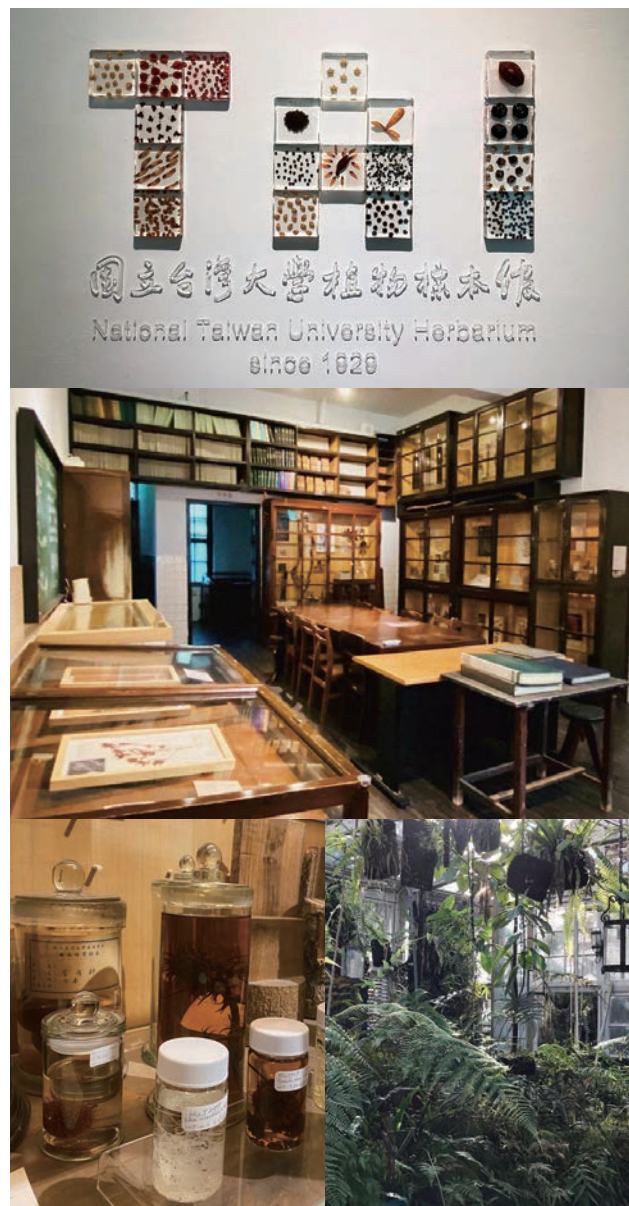
# Discovering the Beauty of Local Flora at NTU Herbarium

Located discreetly near the corner of Building No. 1 and the 5<sup>th</sup> Women's Dorm, NTU Herbarium was designed and laid out almost a century ago. Opened in 1929 when the university was known as Taihoku Imperial University, the Herbarium functioned as a venue for botany lectures. Nowadays, it belongs to the College of Life Science and serves the multiple purposes of teaching, research, preservation, as well as promoting popular science.

Home to nearly 300,000 specimens of which the majority are indigenous species, the Herbarium boasts almost 1,000 holotypes, which are of the utmost value in the field of botany. A holotype is the specimen of a plant collected when the plant was first discovered and named by a botanist, which explains the Herbarium's prominent position in academic circles. In addition to specimen displays, the Herbarium greenhouse is home to a wide variety of plants for academic research and experiments. An outdoor display area features different environments and showcases precious species that are rare in the wild.

When the Herbarium was closed during the outbreak of the COVID-19 pandemic in the first half of 2020, the team took the opportunity to update both the permanent and special exhibitions. According to co-curator, Mr. Shian-Tsan Geng, in recent years, the exhibitions were focused on the connection between plants and humans, adding humanistic value to the plant-related research while evoking shared feelings in the visitors. For example, in the "Map of Spices" exhibition, presented in the form of bureau drawers in the ethnic flora area, the team collected nearly 30 types of aromatic plants from all over the world. After reading the introduction, visitors could appreciate the unique aromas of the spices.

Open to the general public, NTU Herbarium holds the "Salon for Botany" every quarter, with educational sessions offering both popular science and professional-level content. One of the sessions in 2019 featured a Botanical Illustration Workshop. Since gardening is a rising trend in local these days, the workshop was attended by designers and artists as well as academics. Rather than using simple traditional displays, the current curator Jer-Ming Hu embraces the concept of curation and curates exhibitions on innovative themes in different forms. With more immersive experiences in store, the Herbarium curators look forward to introducing the richness and beauty of plants to ever more people.



A corner in the NTU Herbarium.

# In with the Freshmen! Opening Ceremony for the 2020 Academic Year

The Royal Palm Boulevard once again buzzed with the youthful energy of freshmen, marking the beginning of the 2020 academic year. NTU held the grand opening ceremony at the NTU Sports Center on September 6 with over 2,800 students and parents in attendance. There are 4,484 freshmen and 4,739 first-year graduate students in the 2020 academic year. The heart-warming opening ceremony was filled not only with words of encouragement from the faculty but also well-wishes from students in higher classes.

Presiding over the opening ceremony, President Chung-Ming Kuan welcomed the attendees, including administrators, faculty, as well as the freshmen and their parents. During his presentation, President Kuan said the COVID-19 pandemic had cast a shadow over the global economic outlook, making the international political order increasingly complicated and intricate. While the freshmen had to start their university education at a time of insecurity and uncertainty, they were fortunate in that Taiwan was handling this global crisis effectively. Unlike many university campuses abroad that had to stay closed, NTU was open and her students could attend the opening ceremony and their courses in person.



President Kuan addresses the audience at the ceremony.

President Kuan pointed out that a university education offers the best opportunity to absorb all the knowledge the world has to offer, and NTU is in the position to assist students with abundant learning resources. As long as they are willing to learn, there is no limit to the academic treasure they can take away to benefit themselves for the rest of their lives. He predicted that while the trend of globalization is not going to be reversed, it will inevitably be integrated with local forces to present a new outlook propelled by this new momentum. Consequently, NTU students need to come to terms with the importance of connecting to the world, as they will eventually have to tackle its impact regardless of their major and future career choice.

President Kuan closed his presentation with the following words of encouragement: "NTU is the beacon of Taiwan. The university has worked hard to shine brighter so that everyone can find Taiwan on the world map. Your achievements will also for sure cast a spotlight on the university. Therefore, it is paramount that you try your best." He also threw in a dash of humor by informing the parents that they can rest assured that the university will take good care of their children, but that it is also the hope of the administration that the students do not kick up too much fuss at school.

Two recipients of the Outstanding Youth Awards were invited to share their stories of personal growth, Yu-Hsiang Wang, a 6<sup>th</sup>-year medical school student, and Wen-Hsuan Tu, a senior of the Department of Drama and Theatre. Wang told



Freshmen attending the ceremony are dressed in this year's limited-edition T-shirt.





Freshmen are greeting each other at the ceremony.

the freshmen that he had been very active in student clubs since the beginning of his university years, and he ended up participating in the event organized by the International Federation of Medical Students' Associations in Canada during his 4th year. However, when the students from other countries engaged in lively conversations in English, he was not able to say very much, since his English was not proficient. That summer, he suffered another blow. He failed the first stage of the national exam. To get back on the right track, he put his studies at medical school on hold and concentrated on improving his English as well as taking some courses in finance that he had always wanted to attend. This decision allowed him to rediscover the joy of learning. Not only did he end up with the highest GPA that semester, he also passed the national exam. He succeeded in strengthening his capacity at NTU while enriching his life in the most unexpected way.

Wen-Hsuan Tu, on the other hand, has taken many classes in oral communications to overcome the psychological barrier caused by a congenital hearing impairment. She also has participated in a project organized by the Ministry of Education to share her story at elementary schools. By stepping out of her comfort zone time and time again, she has become a talented public speaker. A former athlete in the Deaflympics, she is also a licensed badminton coach and the captain of the varsity team. The stories told by these two students inspired the freshmen to seize their time at NTU to become better versions of themselves and live extraordinary lives.

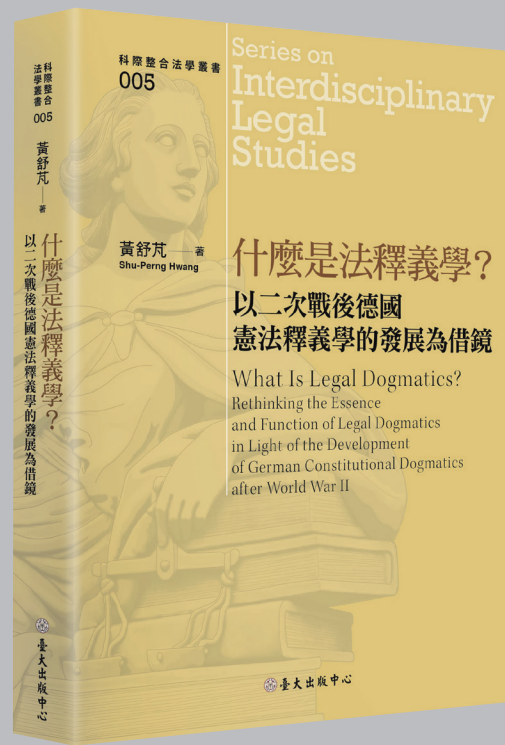
At the end of the ceremony, the freshmen saluted the teaching staff and their parents to show their gratitude, as well as greeting the fellow students around them. After singing the university anthem, the students participated in a lucky draw, which added an extra element of joy to this special day.



# *What Is Legal Dogmatics?* - Examining How Constitutional Dogmatics Resolves Political and Social Issues in Germany

Legal dogmatics is a discipline that explores how abstract legal norms are interpreted and applied to specific cases. Therefore, it is in the unique position of linking theory to practice, abstraction to concreteness, as well as the interpretation of general legal norms to their application to individual cases. While it is vital in the development of legal studies in Germany and Taiwan, the fact that legal dogmatics lays great emphasis on concepts and systems, as well as its characteristics of adhering to objective and consistent rules in the interpretation and application of laws, has tainted it with the stereotypes of being too abstract, out of touch with societal developments, and unable to keep up with the times in the legal circle of Taiwan.

With the goal of clarifying such misunderstandings, *What Is Legal Dogmatics? Rethinking the Essence and Function of Legal Dogmatics in Light of the Development of German Constitutional Dogmatics after World War II* discusses the development of constitutional dogmatics in Germany after the 2<sup>nd</sup> World War. By analyzing the challenges faced and the characteristics demonstrated by the constitutional order of the Basic Law in Germany



Book cover.

during the three stages of post-war development, this book examines whether and how German constitutional dogmatics can continue to play a role in providing viable solutions to political and social issues. To this end, the book is aimed to set the record straight on any confusion or myth surrounding the nature and purpose of legal dogmatics.

A researcher at Institutum Iurisprudentiae, Academia Sinica, author Shu-Peng Hwang answers the question "what is legal dogmatics?" by elaborating on the nature and purpose of German legal dogmatics. Moreover, her analysis of the background and context of the development of German legal dogmatics in a specific field may constructively show why and how legal dogmatics can help propel the evolution of law through its continuous development, as well as exert its influence on society.



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