

HIGHLIGHTS

December 2021

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NTU



Campus Canals Restored

- Alumni Join Sustainability Practices
- NTU Contributes to Understanding of Ocean Pollution
- Higher Education Embraces Digital Collaboration

New Sparks in BioTech Research

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The hydrologic landscape project of Xinsheng South Road Section 3 executed by NTU and Taipei City Government demonstrates how an amenity-oriented environment can be built around canals.

Publisher: Chung-Ming Kuan
Editorial Consultant: Lin-Lin Ku
Editor: Gen-Shuh Wang
Executive Committee: NTU Secretariat
Published by National Taiwan University
Tel: 886-2-3366-2577
Address: No. 1, Sec. 4, Roosevelt Rd.,
Taipei 10617, Taiwan (R.O.C.)
Website: <https://ntuhighlights.ntu.edu.tw/>

Vice President for International Affairs Prof. Hsiao-Wei Yuan on International Collaboration in the Age of the Pandemic

Due to the impact of the COVID-19 pandemic and border control measures imposed by the CECC (Central Epidemic Command Center), most physical interactions between NTU and its international partners had to be suspended or postponed since the second semester of the 2019 academic year. According to Prof. Hsiao-Wei Yuan, Vice President for International Affairs, the sudden limitation of in-person exchanges in the international higher education system took the Office of International Affairs by surprise. However, solutions always emerge when there is a willingness to adapt, and NTU has responded with bold alternatives.

NTU and its partner institutions have brainstormed many innovative models to advance international collaboration. First of all, courses for international students are now offered online. Furthermore, the “**COVID-19 Special Visiting Student Program**” was launched for over 300 Taiwanese students who are not able to study abroad, allowing them to become visiting students while still at NTU.

With the vaccination program, border controls are gradually being loosened worldwide. During the 2021 academic year, many NTU students have embarked on exchange programs abroad. Prof. Yuan has urged the government to loosen border control measures as vaccine coverage increases so that more foreign students can come to Taiwan, revitalizing international exchange in higher education.

While many barriers have arisen in response to the pandemic, it has also brought unexpected benefits. For example, advances in video conference software and equipment have made online meetings the new norm, enhancing efficiency in communicating with our partner institutions. International seminars now utilize a



Prof. Hsiao-Wei Yuan

hybrid format with local participants attending in person while those overseas join online. To accommodate students in different time zones, class lectures and discussions are recorded and uploaded to the NTU teaching platform, NTU COOL, for maximum flexibility. Moreover, NTU has collaborated with the Association of East Asian Research Universities (AEARU) in developing the “**Global Learning Initiatives Program (GLIP)**,” so that students may take advantage of an international environment and collaborative resources as they learn together.

For Prof. Yuan, crisis is opportunity. It is true that the pandemic has greatly impacted regular international exchange, but it has also revealed NTU’s incredible ability to adapt and grow during a crisis.

NTU 93rd Anniversary Celebration

National Taiwan University celebrated its 93rd anniversary on November 15. Among the attendees were invited former presidents, vice presidents, and deans, as well as alumni and guests from home and abroad. The ceremony honored the recipients of the “Distinguished Alumni of the year” and students with outstanding achievements in various social and academic categories. Students who demonstrated significant altruism and contributed to society were bestowed the “Student Social Devotion Special Award,” while those with exceptional achievements were honored with “Outstanding youth selection” and “Outstanding Performance Scholarship.” In addition, the “Fu Bell Scholarship” was awarded to exceptional high school students to encourage them to pursue their studies at NTU.

At the ceremony, NTU President Chung-Ming Kuan conferred honorary doctorates on Distinguished Chair Professor Hsien-yung Pai and the CEO of MediaTek Inc. Ming-Kai Tsai in recognition of their tremendous contributions to society and the education scene.

During his student days at NTU, Distinguished Chair Prof. Hsien-yung Pai collaborated with several classmates on campus in launching *Modern Literature* magazine. Several of his early works were published in the magazine, which became a platform for aspiring young writers

several decades back. *Modern Literature* magazine inspired and nurtured many rising literary figures while introducing Western modernism to Chinese-language literary circles.

In *Taipei People* (台北人) and other works, Prof. Pai combined the writing techniques of western modernism with conventional Chinese literary expressions in depicting the lives and tales of people in changing times. Prof. Pai is now venerated as one of the greatest contemporary Chinese writers, and his works have been translated into a variety of languages to the acclaim of foreign readers and scholars. A number of his more popular works have been adapted for stage, television, and film productions. In his remarks, Prof. Pai expressed his appreciation for the freedom of expression upheld on campus, which made it possible for him to pursue his ideals by producing the *Modern Literature* magazine during his student days at the Department of Foreign Languages and Literature. In closing, he encouraged students in the College of Liberal Arts to inherit this tradition of writing and never stop creating.

Ming-Kai Tsai founded MediaTek Inc. in 1997 in Hsinchu. Now the company has 25 offices and is ranked the fourth of the world's top global IC-design companies. MediaTek focuses on wireless communications and digital multimedia



solutions, and its systems-on-chip (SoC) solutions support over two billion end-devices under prestigious brands worldwide. The company specializes in wireless communications, smart home devices, internet and broadband, and the Internet of Things. By continuously innovating its technology and business model, MediaTek always keeps ahead of market trends. MediaTek's many achievements and successes not only benefit the industry but also ensure that Taiwan maintains its leading position in the competitive global IC industry. Besides expanding his IC empire and driving innovation, Tsai is a steadfast supporter of higher education programs in science and technology. He has collaborated with various institutions of higher education in cultivating more science and technology talents to become not only outstanding professionals but innovators of cutting-edge technologies. In Tsai's remarks, he mentioned that along life's journey one will encounter many forks in the road. No matter one's background or vocation, one should keep open-minded and always be open to new knowledge and skills. Above all, one must never limit one's imagination or ability simply because something seems to be unrelated to one's field of study.

In his remarks, President Chung-Ming Kuan asserted that NTU's vision is to provide a fertile ground where students can grow their dreams and strive to realize their future. Consequently, the university is dedicated to helping students

discover diverse and flexible ways to develop their interests and cultivate their strengths. Moreover, President Kuan reiterated NTU's declared carbon reduction goal to reach 50% carbon neutrality by 2028 and 100% carbon neutrality by 2048 in keeping with the UN's sustainable development goals. President Kuan also announced the establishment of the "NTU 100th Anniversary Arrangements Committee"—charged with making the university a more inspiring, sustainable environment as NTU approaches a new century.

During this season of celebrations, NTU campus has a wide range of activities on offer—student activities, art and music performances, exhibitions, seminars, lectures, and alumni reunions.

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1. Alumni and guests from home and abroad attended the 93rd anniversary celebration.
2. President Kuan (Right) conferred an honorary doctorate on Distinguished Chair Professor Hsien-yung Pai (Left) for his achievements and contributions.
3. President Kuan (Right) conferred an honorary doctorate on the CEO of MediaTek Inc. Ming-Kai Tsai (Left) for his achievements and contributions.
4. Liu Chao-Shiuan, President of Foundation of Chinese Culture for Sustainable Development, delivering a speech as he received "Distinguished Alumni of the year."
5. Chien-Yi Chen, recipient of the "Student Social Devotion Special Award," represented the NTU Autistic Children Service Club at the ceremony.



NTU Signs Memorandum of Intent to Cooperate with Indiana University in Furthering Mandarin Teaching and Inter-University Cooperation

Founded on August 1, 2021, the International College of National Taiwan University is intended to be an interdisciplinary platform of higher education that features Taiwanese characteristics and academic strengths. As NTU's crucial milestone in globalizing education, the International College has two core missions: (1) set up English-taught international degree programs and (2) promote a Mandarin teaching program in cooperation with international partners. Subsidized by the Ministry of Education, the International College's Taiwan Huayu Bilingual Exchanges Selected Talent Program (BEST) cooperates with sister schools, including Indiana University, Harvard University, University of Texas at Austin, and Temple University, in furthering Mandarin education. To this end, the International College works closely with NTU's ICLP, CLD, and the Graduate Program of Teaching Chinese as a Second Language.

Witnessed by representatives of the 12 universities in the BEST program and the Taipei Economic and Cultural Office in Chicago, the online signing ceremony between NTU and Indiana University was held on September 28. The two

universities were represented by NTU's Executive Vice President Chia-Pei Chou and Indiana University's Vice President for International Affairs Hannah Buxbaum. Other attendees included NTU's Dean of International College Shu-Jen Wang, Associate Dean of the College of Liberal Arts and Director of ICLP Ya-Feng Wu, Director of the Language Center Li-May Sung, Director of the Graduate Program of Teaching Chinese as a Second Language Li-Ping Chang, Indiana University's Dean of the Hamilton Lugar School of Global and International Studies Lee Feinstein, Chair of the Department of East Asian Languages and Cultures Ethan Michelson, Director of the Chinese Flagship Program Yea-Fen Chen, and Associate Director of International Partnerships Shawn Conner-Rondot.

Several measures have been prioritized to strengthen the cooperation, including sending NTU faculty members to Indiana University, recommending Mandarin teachers and teaching assistants to assist with Mandarin teaching at Indiana University, setting up the BEST scholarship, receiving Mandarin

students selected by Indiana University to study at NTU, launching a one-on-one online Mandarin teaching program, organizing teaching seminars, and related academic activities.

Despite the ongoing global pandemic, the International College has worked proactively with Indiana University throughout the process. NTU sent teachers and teaching assistants to Indiana University in August. Moreover, twelve students will be selected by Indiana University this coming spring to study Mandarin at NTU, paving the way for a fruitful cooperation model in the future.



1. Indiana University campus.
2. Class activity: interview native Chinese speakers.

NTU Contributes to Global Higher Education Through Digital Collaboration

Vice President for International Affairs Prof. Hsiao-Wei Yuan delivered a keynote speech titled, “Innovating Global Learning in the Digital Era,” at the QS APPLE 2021 Conference and Exhibition on November 3. Prof. Yuan stressed the importance of building momentum for higher education and the necessity to develop innovative short courses for international students during the pandemic. By integrating resources inside and outside of campus and utilizing the internet, universities can strengthen regional cooperation as well as sharpen students’ awareness of sustainable development goals.

Prof. Yuan also related how National Taiwan University partnered with Kyung Hee University via NTU Plus Academy to launch “Understanding of Sustainable Development Goals Through Food and Culture”— a short course that combined interdisciplinary studies, such as biotechnology and geography, with sustainable development and local culinary culture. Prof. Yuan also proudly introduced NTU’s Global Learning Initiative Program, a collaborative project with 6 members of The Association of East Asian Research Universities (AEARU), including Osaka University and Pohang University of Science



National Taiwan University, The University of Melbourne, and Tohoku University promoted digital collaboration at the QS APPLE 2021 Conference and Exhibition.

and Technology. The program boasts over 20 online courses and attracts more than one hundred students.

Other speakers included Deputy Vice-Chancellor International Prof. Michael Wesley of The University of Melbourne, who discussed the concept of Global Classroom; and Kazuko Suematsu, Special Advisor to the President for International Affairs and the Deputy Director of the Global Learning Center, who spoke about Tohoku University’s Be Global Project.

This year’s conference invited leaders and experts in higher education to exchange views on the “Future Rebalance: Emerging Trends and Workforce in the Asia Pacific.” The event also featured speakers from

Harvard University, Imperial College London, and Kyoto University who exchanged their views on future trends in interdisciplinary research, innovative education, and international studies. They also explored opportunities for cooperation. During the event, Prof. Fernando M. Reimers of Harvard highlighted the importance of innovation in education and how the pandemic has created a perfect occasion for educators to integrate resources. Participants from across Asia graced the event. Devoted to international affairs, they explored opportunities to build strategic relationships, discussed the demands in contemporary education, and inspected the potential and promise of AI.

New Sparks in BioTech: T⁴GIP Participates in 2021 BIO Asia-Taiwan

Enlisting Taiwan's top universities, T⁴GIP—the Global Industry Platform of NTU System—participated in 2021 Bio Asia-Taiwan, hosted over 70 exhibits highlighting breakthroughs in artificial intelligence (AI) and big data applications in biotech, agriculture, and advanced medical device development, attracting individual and corporate interest.

The opening ceremony was graced by the leaders of the participating institutions, including NTU President Chung-Ming Kuan, CGU President Ming-Je Tang, NTUST Vice President Tzu-Chuan Chou, NTNU Associate Vice President of Research and Development Chia-Jung Lu, NTU Hospital Superintendent Ming-Shiang Wu, as well as representatives of the Ministry of Science and Technology (MOST) and various industries. The guests all voiced their firm support and high expectations for the promise of T⁴GIP. Distinguished Prof. Pai-Chi Li, Vice President of Research and Development and Director of the Industry Liaison Office, stated in his opening address that “The development of the biotech, medical, and agriculture industries and markets is inevitable, and the BIO Asia-Taiwan exhibition provides a forum where experts and scholars in Taiwan can gather and share their latest research findings. T⁴GIP brings

together the research capabilities of multiple institutions. It is our firm hope that this will become a driving force for progress in the biotech, medical, and agriculture industries.”

President Chung-Ming Kuan affirmed his vision for future academia-industry collaboration: “As universities have the responsibility for cultivating talents, we have consistently striven to apply superior research capabilities in the service of industry and society, and have worked with industry to foster long-term collaboration. Active collaboration can help the students connect with society, as well as facilitate the formation of mutually beneficial objectives.”

T⁴GIP provides one-stop consulting services for fostering academia-industry collaboration. These services are aimed to generate more research capabilities and also provide a strong foundation for the future prosperity of Taiwan. In addition, T⁴GIP provided “Cutting-Edge Biotech Onsite Guided Tours” of the exhibition for high school and college students, offering them a better understanding of industry trends as they plot their academic and career paths. Overall, T⁴GIP hosted this joint exhibition to promote academia-industry collaboration and stimulate new advances in the biotech, medical, and agriculture industries.



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3	

1. President Chung-Ming Kuan (first right) and Executive Vice President Shan-Chwen Chang (second right) visited NTU's exhibit.
2. President Chung-Ming Kuan (second right) and Executive Vice President Shan-Chwen Chang (second left) visited NTU's exhibit.
3. President Chung-Ming Kuan (second left) tried the sample product.

NTU RDCMD Hosts 2021 WACBE Taiwan Chapter

The World Association for Chinese Biomedical Engineers (WACBE) holds a prestigious event—the bi-annual WACBE World Congress. Leading worldwide Asian biomedical engineers are invited to share their findings and insights into biomedical engineering at this event. This year, Taiwan was chosen to host the 2021 WACBE Local Chapter.

The 2021 WACBE Taiwan Chapter, chaired by Jaw-Lin Wang, Director of the NTU Research and Development Center for Medical Devices (RDCMD) and Professor of the NTU Department of Biomedical Engineering, was held November 3-4. The year, the main theme of the WACBE was the relationship between biomedical device development and the unmet needs of medical practitioners.

At the event, cardiology and ultrasonic imaging expert, Yoshifumi Saijo, Professor and physician of the Tohoku University School of Medicine, shared the cooperation experience between medical practitioners and biomedical engineers at Tohoku University. Prof. Saijo also related how he had been inspired by Stanford Bio-Design and had incorporated practice research into his lectures.

Meigen Liu, Professor of Department of Rehabilitation Medicine, Keio University School of Medicine, shared his insights into rehabilitation medicine and highlighted the effectiveness of hybrid assistive neuromuscular dynamic stimulation in treating upper limb paralysis as well as stressing the promise of using brain-machine interface in clinical practice.

Next, J Mocco, a renowned professor and neurologist at Mount Sinai, discussed ways to improve cardiovascular surgery as well as how he

revolutionized neurosurgery instruments by executing complex clinical trials with multiple hospitals.

Associate Director Michael J. Cima, Koch Institute for Integrative Cancer Research, took a different perspective and shared his experience in entrepreneurship and medical device development. In his talk, he touched upon nano-based drugs, preventative medicine, monitoring, personalized medicine, and controlled drug release.

The Center also hosted related forums for the local audience, including: “Funding Resources from Government,” “Case Studies of Globalization for Medical Devices,” “How to Get the Reimburse Code for Innovative Medical Devices,” “Clinical Unmet Need for Long Term Care Medical Devices,” “Which One Is More Important? Academic Excellence vs. Entrepreneurship,” and “Medical Devices Thesis Publishing.” Also, the team from NTU SPARK was invited to share their experience. The hybrid event attracted experts from home and abroad, hoping to create opportunities for the industry, academia, and medical practitioners to collaborate and innovate.



A group photo of Chairman Jaw-Lin Wang with the technical team at 2021 WACBE Taiwan Chapter.

Beyond 2nm Technology Nodes: The Tallest Transistor in the World

Prof. Chee Wee Liu and his research team at TSMC-NTU Joint Research Center conduct experiments on technology nodes beyond 2nm. The team's latest findings were published in the *2021 IEEE VLSI Symposium on Technology and Circuits (VLSI)* as the highlight paper. Their work also appeared in the Research Highlights section of *Nature Electronics*.

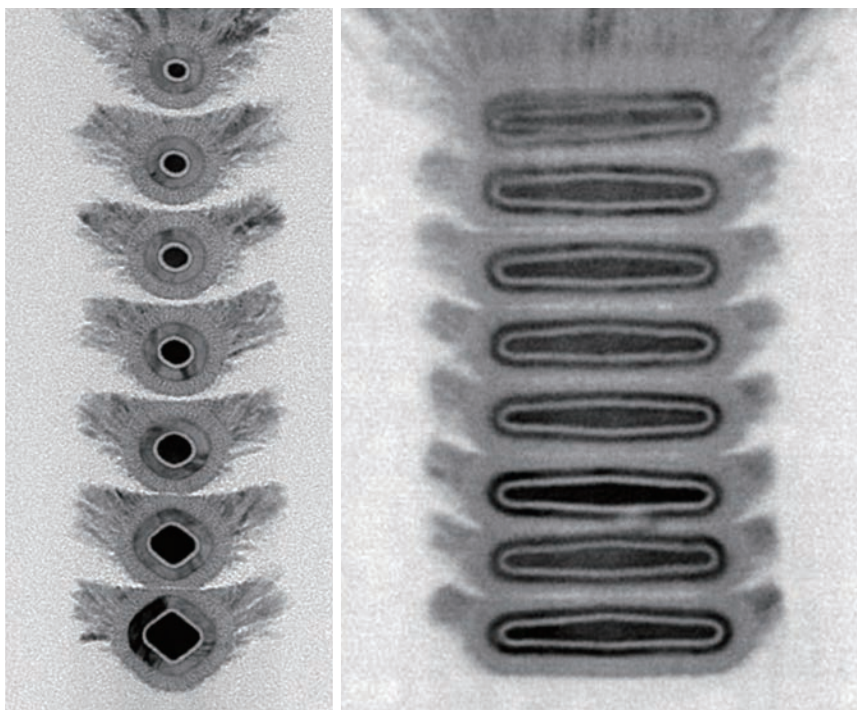
TSMC has used the high mobility channel (HMC) in the 5nm node. The HMC operates like a sports car that achieves the high speed with high horsepower, yielding a high-performance transistor. Samsung (3nm), Intel (2nm), and TSMC (2nm) take advantage of the gate-all-around (GAA) transistor structure for advanced technology nodes. The GAA structure is like a powerful, no-leak faucet, providing the

transistor with low leakage current to save energy. Moreover, the GAA structure with channel stacking functions like a multi-level bridge which accommodates much more traffic flow than an ordinary single-level bridge. Therefore, the GAA structure with channel stacking provides large drive current for a given footprint to achieve high performance and area scaling (for example, Intel has 4 stacked channels and TSMC has 3 stacked channels). Consequently, the highly stacked GAA transistor with HMC is the key for advanced nodes.

In June 2021, Prof. Chee Wee Liu and his research team at National Taiwan University reported the first 7 stacked $\text{Ge}_{0.95}\text{Si}_{0.05}$ nanowires (figure 1) and 8 stacked $\text{Ge}_{0.75}\text{Si}_{0.25}$ nanosheets (figure 2) in *VLSI*

2021. Outside of industry, National Taiwan University is the only university with the ability to demonstrate highly stacked GAA transistors. The 7+ stacked $\text{Ge}_{0.95}\text{Si}_{0.05}$ nanowires are also named SpineFET due to their shape that resembles the human spine. The team's drive current of 7 stacked $\text{Ge}_{0.95}\text{Si}_{0.05}$ nanowires was the highest achieved among reported Ge/GeSi 3D nFETs. The team's results were also featured in the Research Highlights of *Nature Electronics* in July 2021.

Prof. Chee Wee Liu and his research team remain dedicated to stacking more channels to achieve even higher drive current to improve chip performance. They have made significant progress working with the 16 stacked channels, and consider the 24 stacked channels epitaxially possible.



Scan the QR code to read the journal article in *VLSI 2021*.



Scan the QR code to read the journal article in *Nature Electronics*.

1 2

1.7 stacked $\text{Ge}_{0.95}\text{Si}_{0.05}$ nanowires.
2.8 stacked $\text{Ge}_{0.75}\text{Si}_{0.25}$ nanosheets.

NTU OLED Research Team Deciphers the Role of Host–Guest Interactions in Organic Emitters Using MR-TADF

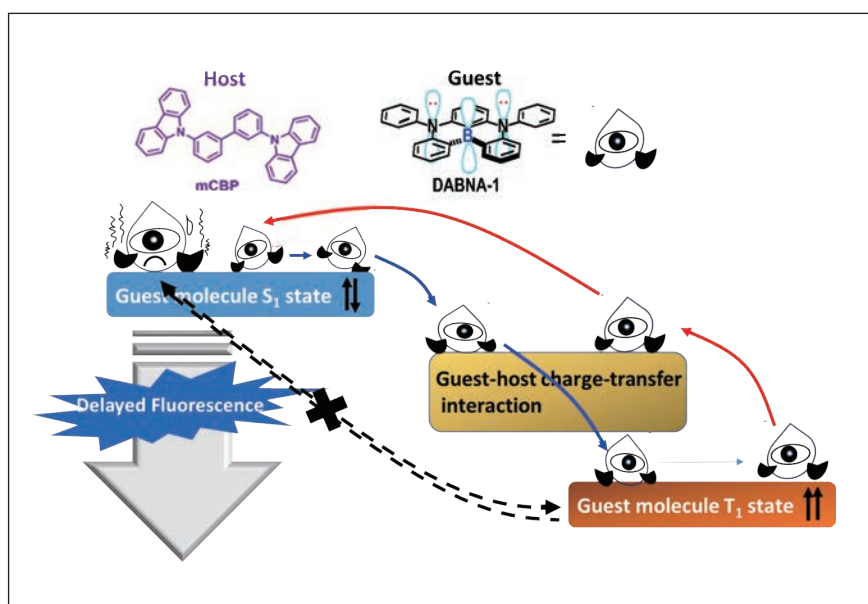
A research team led by Prof. Pi-Tai Chou of the NTU Department of Chemistry has deciphered the role of host–guest interactions in organic emitters employing multiple resonance (MR)-thermally activated delayed fluorescence (TADF). Prof. Chou co-published the team's finding with Profs. Wen-Yi Hung of National Taiwan Ocean University and Weiguo Zhu of Changzhou University in *Nature Photonics*, a finding which will have a far-reaching influence on the development of display technology.

Owing to their slight difference of charge separation, the emerging MR-TADF materials are superior to the standard TADF materials in terms of narrow emission bandwidth and high color purity. Also featuring high emission yield and metal-free organic properties, they have attracted considerable interest in the field of organic light emitting diodes (OLEDs) and the display industry. Despite MR-TADF's favorable properties, researchers have puzzled over a mystery: several MR-TADF compounds demonstrate strong fluorescence upon photo-excitation but show no sign of delayed fluorescence.

To unravel the mystery, Prof. Chou's team synthesized a series of novel MR-TADF molecules. They found that host and guest could interact to generate transient charge transfer intermediates. In turn, such intermediates could “bridge” the singlet and triplet states of the guest fluorescent molecules, thereby accelerating the rate of intersystem crossing and reverse intersystem crossing from singlet to

triplet, as well as “creating” delayed fluorescence. Figure 1 shows how the formation of host-guest charge transfer intermediates accelerates the rate of the molecules' intersystem crossing and reverse intersystem crossing to achieve TADF.

While preserving the purity of light and color, the guest/host transient interaction achieves efficient use of dark triplet state excitons. This new mechanism will enable OLED researchers to re-examine some singlet and triplet states whose energy gaps are small enough to be thermally activated, but which lack observable delayed fluorescent properties despite intense prompt fluorescence. Prof. Chou's laboratory has set several milestones in the photophysics of organic and organometallic molecules. In the past four years, they published three original papers in the leading journal *Nature Photonics*, demonstrating significant results.



Scan the QR code to read the journal article.

The formation of host-guest charge transfer intermediates accelerates the rate of the molecules' intersystem crossing and reverse intersystem crossing to achieve TADF.

Bluefin Tuna Reveals Global Ocean Pollution and Cycling of Mercury

Bluefin Tuna (BFT), a fish species in high commercial demand, are known to accumulate mercury pollutants as neurotoxic methylmercury (MeHg) with age. BFT is an apex predatory and long-lived pelagic fish species, which migrates widely in the oceans and forages in different ranges of timing and locations. A mercury research team (hereafter Team Hg) led by Prof. Chun-Mao Tseng of the Institute of Oceanography, NTU (IO-NTU), initiated a new tool to measure the mercury accumulation rate (MAR) as a global barometer of Hg pollution and bioavailability in the world's oceans.

Commenting on the research report, an anonymous reviewer said: "This paper provides a standard basis of comparison to examine spatial and temporal trends of Hg pollution across the world's oceans using tuna fish as a biological indicator. This article answers the question we have been asking for 50 years: is there a relationship between the mercury accumulation in tuna

fish and the MeHg content in seawater? Thus, it's a breakthrough in understanding the Hg cycle in the oceans."

Team Hg demonstrated that the MARs in BFT varied considerably, with the highest rates reported for BFT in the Mediterranean Sea, followed by the North Pacific Ocean, the Indian Ocean, and the North Atlantic Ocean, respectively. Moreover, the inter-basin variation in MARs among BFT populations is primarily controlled by the bioavailability of MeHg in seawater and the base of the food webs. Observed global patterns of MARs correspond to levels and inventories of MeHg in each ocean sub-basin, which are closely linked to Hg inputs into each ocean basin from both natural and anthropogenic emissions and global ocean circulation. Overall, variations in Hg bioaccumulation among Bluefin Tuna and other marine fish with widely dispersed populations could be used to

help study global Hg pollution, manage marine fisheries, and provide a reference for human health guidelines.

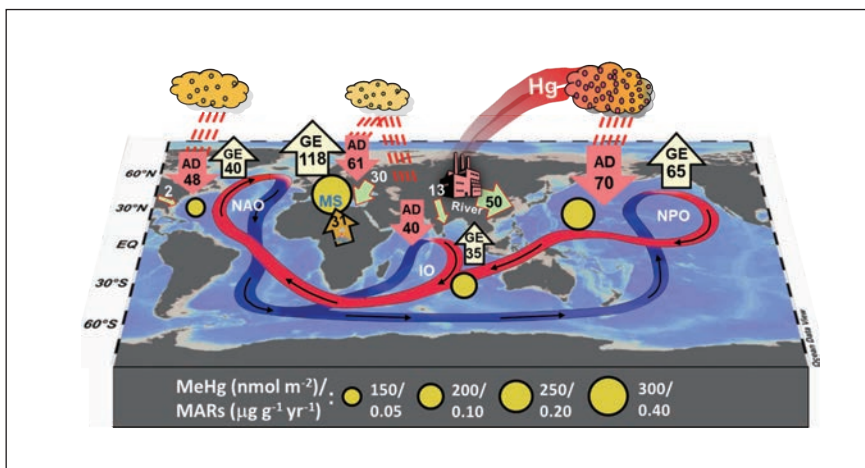
Team Hg includes Prof. Jen-Chieh Shiao, Master's student Yi-Sheng Chen, and research assistant Shin-Jing Ang of the IO-NTU, in collaboration with researchers from Rutgers University and University of California-Santa Cruz (UCSC), USA. This study was published in the prestigious *Proceedings of the National Academy of Sciences (PNAS)*.



Scan the QR code to read the journal article.

1 2

1. Bluefin Tuna (BFT) reveal global patterns of Hg pollution and cycling in the world's oceans.
2. Bluefin Tuna (BFT) hunt forage fish in the ocean. What they eat determines how much mercury is accumulated, which in turn is linked to the dissolved MeHg in seawater and the base of the food web. (Image courtesy of Nchan Zion Tseng).



NTU Awarded for Inventing Solid-State Na-CO₂ Battery with High-Capacity Energy Storage and Carbon Neutral Application

Distinguished Professor Ru-Shi Liu of the Department of Chemistry received the 2021 Future Tech Award from the Ministry of Science and Technology for inventing the solid-state Na-CO₂ battery with high-capacity energy storage and carbon-neutral application. The solid-state Na-CO₂ battery is the first of its kind anywhere. (See Figure 1)

As countries worldwide become more environmentally conscious, research that promises energy savings and carbon reduction has attracted significant investments. The carbon dioxide battery has been a focus of research interest because it would produce electricity from the main greenhouse gas. Meanwhile, the price of lithium carbonate is soaring with the widespread use of lithium-ion batteries. As a result, the cheap and easily available sodium dioxide offers promise as an important replacement for lithium in batteries. In other words, the Na-CO₂ battery promises the best of both worlds as it consists of greenhouse gas and cheap metal.

The Na-CO₂ battery can be charged and discharged at room temperature. Moreover, since many countries are engaging in

Mars explorations, demand exists for using Na-CO₂ batteries in space.

The atmosphere of Mars is very different than the Earth's atmosphere. Martian air consists of carbon dioxide (95.32%), nitrogen (2.7%), and argon (1.6%). Na-CO₂ batteries could utilize the ample carbon dioxide in the Martian atmosphere to produce electricity to power the machines and equipment, manned or unmanned, used to explore Mars. Additionally, plans for Mars immigration would require electricity from carbon dioxide batteries. (See Figure 2)

While Na-CO₂ batteries in organic liquid electrolyte form demonstrate excellent performance, they can precipitate explosions during chemical reactions. The solid-state Na-CO₂ battery with high-capacity energy storage and carbon-neutral application shows great promise since it can be charged and discharged at room temperature. Under the conditions of a current density of 100 mA g⁻¹ and a cut-off capacity of 500 mAh g⁻¹, the battery can be cycled stably 105 times.

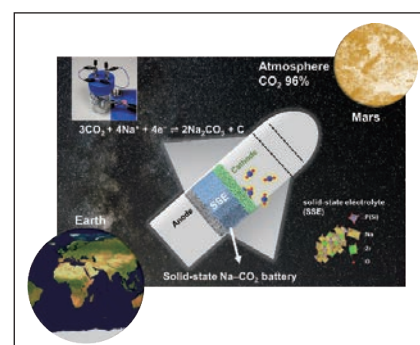
A patent is pending for the invention, and the research

finding was published by Prof. Ru-Shi Liu et al. in "Na-CO₂ battery with NASICON-structured solid-state electrolyte" (*Nano Energy*, March 16, 2021).



Scan the QR code to read the journal article.

1. Solid-state Na-CO₂ battery lighting the red LED.
2. Using CO₂ to produce energy, the Na-CO₂ battery provides a reliable energy supplement for future Mars exploration.



NTU CBE Advances National Goals

Last year, the government announced its goal of becoming a bilingual nation by 2030, hoping that people across the country will achieve a high degree of English proficiency within a decade. To help realize this ambitious goal, National Taiwan University and the Ministry of Education actively support English as a Medium of Instruction (EMI) by working closely with experts to develop teacher training programs to remove language barriers in higher education.

On September 16, the NTU Center for Bilingual Education (CBE) held its first event—the NTU EMI Seeding Faculty Workshop. Experts were invited to exchange views on EMI teaching. In her opening remarks, Executive Vice President Chia-Pei Chou stressed the importance of the CBE, stating: “We understand and foresee the challenges of turning Taiwan into a bilingual nation, that is why it is necessary to have the CBE to guide us along the way.”

The event commenced with the rich, insightful presentations by Associate Professor Gina Wen-Chun Chen of National Chung Cheng University and Assistant Professor Keith M. Graham of National Taiwan Normal University. They offered practical tips for conducting

English-instructed courses and ways to support students in an all-English classroom.

During the second session, Associate Professor Albert Y. Chen of the NTU Department of Civil Engineering, Distinguished Professor We-Fang Su of the NTU Department of Materials Science and Engineering, and Professor Helen K. Liu of the NTU Department of Political Science shared their EMI strategies and precious personal teaching experiences.

Finally, Associate Professor Heng-Tsung Danny Huang of the NTU Department of Foreign Languages and Literatures led a brainstorming session in which the participants openly discussed their frustrations and expectations about teaching in English. Participants shared observations on their EMI teaching experiences and also developed a list of useful resources.

To help elevate the level of English proficiency in Taiwan as well as promote English as a medium of instruction on campus, the NTU Center for Bilingual Education will remain dedicated to assisting faculty members by providing the insights and resources shared by experienced educators, practitioners, and researchers.





CBA's Double Degree Program Reaps Success

The College of Bioresources and Agriculture (CBA) boasts an unparalleled Master Double Degree Program supported by leading experts at leading universities, aimed to equip students with a solid interdisciplinary foundation. By partnering with prestigious agricultural universities in Japan, Indonesia, and France, the program offers students the opportunity to explore varied disciplinary perspectives as well as the experience of studying overseas through academic exchange or interdisciplinary academic collaboration.

The Master Double Degree Program was first launched in 2015 between NTU and the University of Tsukuba in Japan. Since then, the University of Brawijaya in Indonesia, Kyoto University in Japan, and the University of Bordeaux in France subsequently joined the program. To date, CBA has sent

14 NTU students to study abroad and welcomed 16 international students from its partner universities to study in the Departments of Agronomy, Bio-Mechatronics Engineering, Forestry, Plant Pathology and Microbiology, Animal Sciences and Technology, Agricultural Chemistry, Horticulture, and Biotechnology.

The number of international students decreased from 2020 when the pandemic broke out, and many students had to cancel their exchange plans due to safety concerns and mobility restrictions. Some students chose to continue their studies at home while others chose to stick with the original plan. For example, on one hand, two students from the University of Tsukuba and Kyoto University who had originally planned to study in Taiwan decided to stay in Japan, while two NTU students who were scheduled to

begin their studies at Kyoto University in April 2021 decided to continue their dual degree program, on the other hand. Although the two NTU students were unable to attend the courses at Kyoto University in person, they completed the registration process and attended the lectures and experiments virtually under the guidance of their Taiwanese and Japanese supervisors.

Despite the many setbacks, this year CBA recruited its first double degree student from the University of Bordeaux, who enrolled in the Department of Agronomy in September. In the future, NTU will continue to promote the Master Double Degree Program and expand its partner university network so that students worldwide will have the opportunity to receive excellent multidisciplinary training at top-ranking institutions.

Journeying into Nature in the Classroom: Presentation of the Forest Adventure Virtual Reality Project

Associate Professor Chia-Pin YU of the Department of Forestry & Resource Conservation utilized VR technology to bring nature into the “Introduction to Forest Recreation” classroom in the spring semester of the 2020 academic year. Through this advanced technology, the students learned wilderness survival tips and observed wild animals from their desks in urban Taipei. The students were divided into 5 groups to prepare and present their term projects on September 13 in the Future Classroom. NTU President Chung-Ming Kuan, Vice President for Academic Affairs Shih-Torng Ding, and Vice President for International Affairs Hsiao-Wei Yuan attended their presentations and complimented the students on their efforts.

In order to promote the “Technology Enabled Active Learning (TEAL),” an innovative teaching approach, the Digital Learning Center of the Office of Academic Affairs has purchased 20 sets of VR equipment and assisted Prof. Yu in organizing the course. Prof. Yu had experienced courses using VR while serving as a visiting professor at Harvard University. He began to incorporate the technology in his courses at NTU with the support of Vice President for Academic Affairs Shih-Torng Ding.



Prof. Yu also worked with staff at the palliative care ward of Far Eastern Memorial Hospital in offering introduction to forest recreation to comfort the patients by transporting them into nature with VR. Since the technology has matured and is widely-used in research and teaching, he would like to develop its potential for educational purposes and train students to create VR content for NTU. With the assistance of the Digital Learning Center and HTC, the course combined VR with knowledge of forest recreation resources and outdoor safety. Prof. Yu expects that the VR content created by the students might be used to market forest recreation activities in the future.

With projects focusing on environmental education,

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- 1.The Epidemic Prevention Pack offered to international students in quarantine by the Office of International Affairs included the VR headset co-created by the Department of Forestry & Resource Conservation and HTC.
- 2.President Chung-Ming Kuan experienced VR technology.
- 3.Group photo.

wildlife, teaching materials for elementary/junior high school as well as virtual trips into nature, the course is a testament to the Digital Learning Center’s effort to promote digital instruction. The course received generous support from HTC both in procuring the VR equipment and hosting a 3-day workshop on recording and editing VR clips. It is anticipated that more faculty members will utilize VR to conduct cross-disciplinary teaching and facilitate cross-domain learning.

Responsibilities of Social Media Platforms: NTU Graduate Institute of Journalism Brings Different Players to the Table

Professors at NTU's Graduate Institute of Journalism closely follow the issue of digital platform payment. For the Institute's 30th anniversary symposium on November 12, they organized a dialog with representatives from such platforms as Facebook and Google to explore the possibility of digital platforms issuing payment to local news media outlets.

According to a Google survey, there are approximately 250 small and medium-sized media sources in Taiwan. Anita Chen, Google's Head of Government Affairs and Public Policy in Taiwan, stated that Google does not make money through Google News. Rather, it hosts 24 billion views for the media per month. Maximilian Chen, the Public Policy Senior Manager of Facebook Taiwan, asserted that Facebook offers a free communication platform and referral traffic. It is up to the media sources whether they want to share news stories on Facebook.

Hsin-fang Wei, a commissioner of Taiwan's Fair Trade Commission asserted that mainstream platforms, such as Google and Facebook, face little pressure from competition, and the monopoly or oligopoly situation is exacerbated by the rigid market structure. She further pointed out that

online companies and news media compete for digital advertising, but the competitive positions of the two sides is asymmetrical. In her opinion, Taiwan needs laws and regulations to protect the media news sources by requiring search engines and platforms to pay them, and Article 25 of the Fair Trade Act might provide a basis for negotiations between the media and social platforms to this end.

Taiwan is not the first country to take up this issue; Australia and France reached agreements with Google and Facebook in 2021 requiring those companies to comply with regulations to pay for the news releases posted on their platforms. Professor Lih-Yun Lin, a commissioner of the National Communication Commission (NCC), confirmed that the NCC is looking into this issue and making efforts in support of legislation to require the digital platforms to issue payment to local news media in order to level the playing field.

Invitees from the government, industry, and academia discussed the current situation of news convergence, news crisis, and the turning point of journalistic practice, innovation, and reconstruction at the 30th Anniversary Symposium of the Graduate Institute of Journalism.



Keep it Flowing: NTU and Taipei City Government Restore Campus Canals

National Taiwan University joined hands with Taipei City Government in developing an amenity-oriented environment on NTU campus where people can take walks and relax around the canal in the Xinsheng South Road area. Since the completion of the restoration and development project, the canal network has drawn camera bugs to the Gongguan area. It's common to see visitors arriving, relaxing, or waiting to snap an image or two of the Pallas squirrel or the Malayan night heron.

The waterway restoration plan was made in 2017 and the construction commenced in July 2020. After nearly a year of devoted effort, the restored area along Xinsheng South Road Section 3 was unveiled to the public in June 2021, signifying new life. The construction site extended from NTU's Main Gate to the Sports Center. The old campus walls were torn down and replaced by eco-friendly shrubbery and the old bicycle and motorcycle parking lot was transformed into a hydrologic area with sidewalks flanked by greenery. The design was inspired by agricultural waterways seen in rural areas, creating a pleasant water landscape with humanistic and water detention features.

Historically, Xinsheng South Road was called "Number One Special Route" in the 1932 Taipei City Planning Project during the

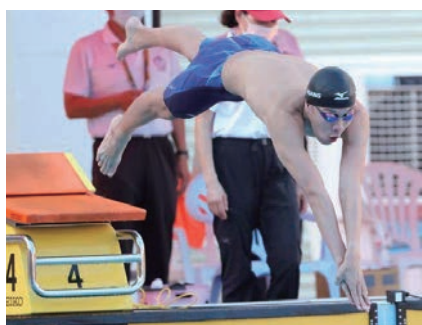
Japanese colonial era. Later, a canal was dug beneath the road between 1938 and 1942. Known as Hori River, it served water detention and irrigation purposes. Beautiful willow trees lined the two sides of the canal, adding a touch of soft green to the area. Back then, the popular shaved-ice shop Taiyi Milk King was called the Haiyuen Dessert and Teashop(海源飲料總匯). The proprietor would place wooden planks out front so the students could cross the canal to savor their tea and desserts. From 1973, the canal was concealed beneath the cement road surface of Xinsheng South Road.

Now, water from the Xindian stream flows along the Liugongjun(瑠公圳) waterway and through the canals along Xinsheng South Road, forming a comprehensive hydrologic landscape across the campus. Moreover, the canal connects the green belt area outside NTU, creating a vibrant and idyllic space for people to appreciate the historical and ecological beauty of the area.

The hydrologic landscape project of Xinsheng South Road Section 3 executed by NTU and Taipei City Government demonstrates how an amenity-oriented environment can be built around canals.



Twenty Years of Staying the Course— NTU Swimming Team



Their arms stroking sharply and feet kicking fiercely against the water, the swimmers thrust through the water, forcefully but gracefully. They come within milliseconds of taking the gold medal. Coaches Chien-Ju Lin and Yi-Chung Chen stand at poolside in rapt attention with the team. Every eye is on the swimmers; they await the outcome with bated breath. The NTU swimmer in the center lane suddenly shoots ahead and hits the wall with a huge splash! When his hand strikes the wall, the team cheers in delight. Their jubilant spirit fills the air—the swimmer will bring home another gold medal! This is a moment that will be savored for years to come.

Continuing its thirty-year reign of dominance over collegiate swimming in Taiwan since 1982, the NTU Swimming Team has made a clean sweep of over 20 gold medals in competitions over the past two years. Swimmers in the General group are continuing a winning streak in both individual and relay events, having seized the honor of Team Champions several times over. Hailed as King of the Breaststroke in the General

Group, Yu-Ping Huang drew his participation in ten Intercollegiate Athletic Games to a perfect close by winning 9 consecutive championships in the 100-m and 8 consecutive championships in the 200-m breaststroke. Players in the Professional group also stole the spotlight in competition at home and abroad. Mei-Chien Huang, the only Taiwanese female competitor in the swimming events, competed in the Women's 50-m freestyle at the 2020 Tokyo Olympics. And, Cheng-Chi Cho who is strong in open water competitions has his heart set on competing in the 2024 Paris Olympics.

It is not just glamor and glory. Every NTU swimmer must undergo rigorous training and daily practice so the Swimming Team will achieve ever better and more consistent performances. Outside the pool, the team bonds like an extended family, often hanging out and holding activities together. Nothing beats a pleasant gathering after a difficult day practice, and nothing beats having trusty comrades to share those moments of glory in the pool.

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| 1 | 1.Group Photo of NTU Swimming Team. |
| 2 | 2.Group Photo of NTU Swimming Team. |
| 3 | 3.NTU swimmer Cheng-Chi Cho. |
| 4 | 4.NTU swimmer Mei-Chien Huang. |
| 5 | 5.NTU swimmer Yu-Ping Huang. |

NTU Alumni Keep the Lights Blinking

NTU strives to incorporate sustainability practices into every aspect of campus life, for example by protecting such precious wildlife species as Collared Scops Owls, Malayan Night-herons, Crested Goshawks, Muller's Barbets, and Red-bellied Tree Squirrels. Using the donations raised at the "50th Alumni Reunion" in 2016, NTU Campus Planning Office initiated firefly conservation work on campus and cleared a space at the NTU Experimental Farm to construct a clean, friendly residence for *Aquatica ficta*.

On August 28, NTU hosted a "Firefly Conservation Project" activity. Recent graduates of NTU nursery school and their parents were invited to release snails into the waters at NTU Experimental Farm. Since the fireflies prefer to dwell in humid areas near standing water and feed on small animals such as snails, the release of snails would provide sustenance for the larva until they pupate and become adults. It is hoped that these actions will help the campus be lit up by fireflies on summer evenings.

"In recent decades, NTU Experimental Farm has made efforts to create an organic environment. We've seen a few fireflies in the past, but we want to increase their population and improve our overall ecosystem. With the help of Adjunct Professor Ping-Shih Yang and the generous donations of our alumni, we will create ideal habitat conditions so that humanity can live in harmony with nature and promote environmental education," asserted Distinguished Professor Huu-Sheng Lur, Dean of the College of Bioresources and Agriculture.

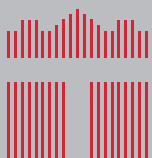
NTU Vice President for Financial Affairs Pei-Cheng Liao especially thanked Yu Wang, a former Dean of the College of Science, for assembling the alumni graduating in 1966 and for encouraging the class to support the cause.

Currently, there are over 300 thousand NTU alumni around the world. Every year they participate in NTU alumni activities and gatherings. Many members graduating in 1996

have immigrated to the United States, yet some of them returned to Taiwan to take part in the "50th Alumni Reunion" and demonstrate their love for their alma mater. In future years, it won't just be the memories that bring them back, but the magical lights of myriad fireflies on campus.



1. Releasing river snails and *Semisulcospira libertina* into the waters at NTU Experimental Farm.
2. A tour around the NTU Experimental Farm.



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