



# *ntu beats*

National Taiwan University Official Quarterly

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## Positive Circles of Inspiration

- Garmin Co-Founder's Donation to Improve Faculty Quality of Life
- Revolutionizing Agriculture
- Major Discovery in DNA Research



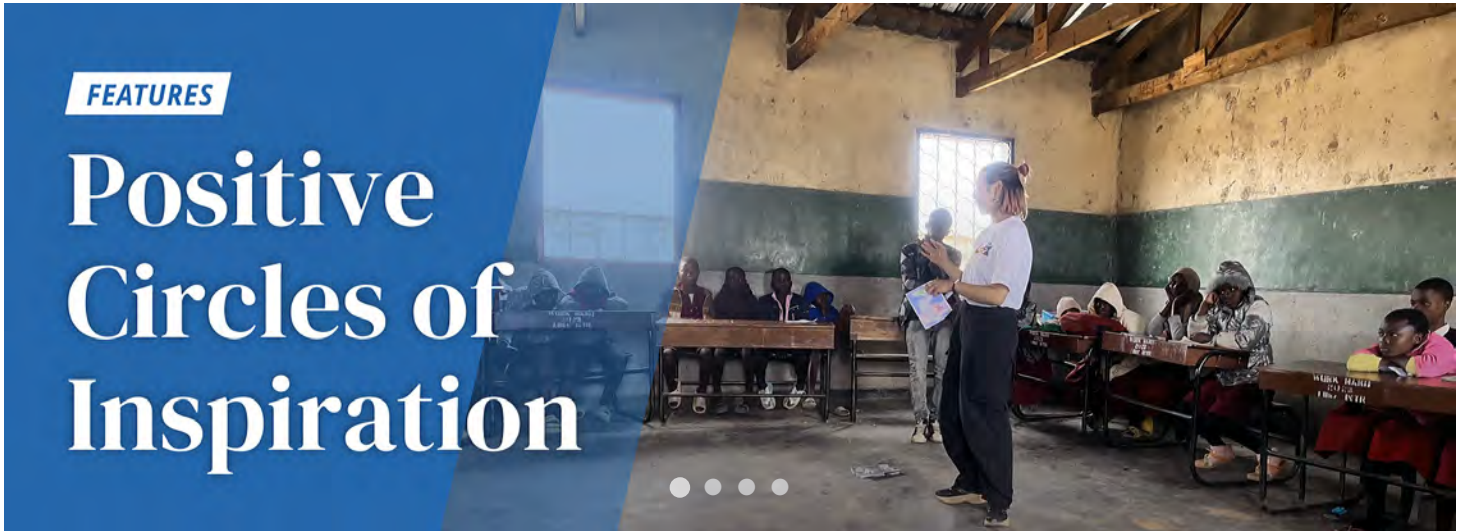
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## FEATURES



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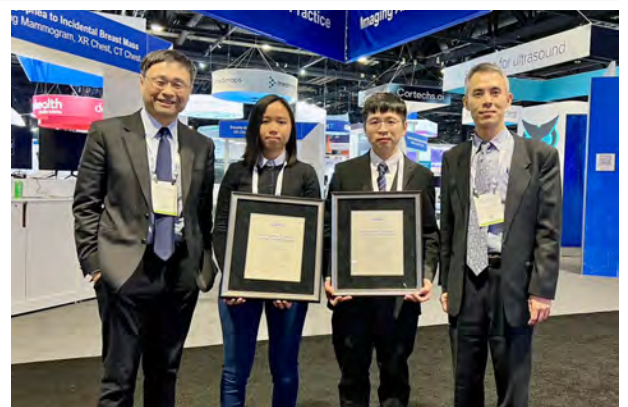
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## HONOR

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# GLOBAL OUTLOOK



## Biocredit Taiwan Initiative Wins Approval at COP28

A Taiwanese team led by NTU Prof. Ming-Jer Tsai was invited to present a solution to the ecological crisis at COP28 in 2023. In particular, the proposal won high praise for the application of “Biocredit Taiwan” and was hailed as a significant contribution to the conference.

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## Joint Conference with UTokyo on Sustainability Following the Lecture by UTokyo President Teruo Fujii

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## Director of Saxony State Ministry of Science and Culture Visits NTU Fostering Global Tech Talent through Collaborative Engagement

Dr. Sebastian Gemkow, Director of the Saxony State Ministry of Science and Culture, along with his Chief of Staff, Dr. Michael Schmischke, visited NTU in March, accompanied by Dr. Josef Goldberger, the head of the Saxony ...

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## Orientation and Welcome Ceremony of “STIPT”

National Taiwan University (NTU) hosted the Orientation and Welcome Ceremony for the “Semiconductor Talent Incubation Program Taiwan (#STIPT)” on March 6. NTU officially began its collaboration with the program this year as the exclusive partner institution of TSMC and the Saxony government. The objective of the “Semiconductor Talent ...

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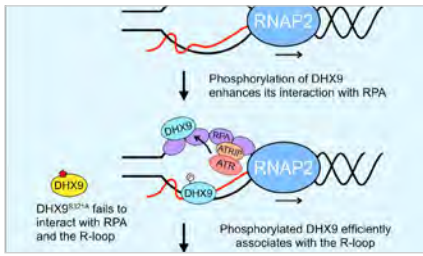


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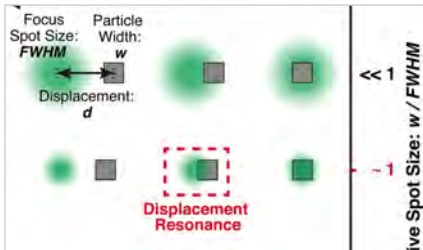
# ACHIEVEMENTS



## Unraveling the DNA Mystery: ATR and DHX9 in Genome Stability

The DNA in the billions of cells within the human body is under constant assault from various threats, both internal and external, collectively known as genotoxic stress, which can lead to DNA damage. If left unrepaired, this damage can result in genome instability, a significant factor in the development of cancer and various genetic diseases.

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## A Nanophotonic Breakthrough: Mie-Tronics Under Microscopy

For centuries, the mesmerizing colors of stained glass windows and the Lycurgus Cup captivated us, their physics shrouded in mystery. It took Gustav Mie's electromagnetic wave scattering theory in the 20th century to explain the magic behind these colors – grinding metals to specific sizes creates optical resonances, intensifying absorption and scattering to produce vivid hues. Fast forward to the 21st century, this nanoscale Mie resonance...

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## Revolutionizing Agriculture: NTU Wins National Agricultural Science Award

The R&D team led by Distinguished Professor Ta-Te Lin from NTU Department of Biomechatronic Engineering has been awarded the first prize in the Industrial Pioneer Category of the Ministry of Agriculture's 2023 National Agricultural Science Award. This prestigious national recognition honors outstanding achievements in developing agricultural science and technology. The team's groundbreaking project— Smart Pest Monitoring...

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# TEACHING & LEARNING



## From Classroom to Community: Exploring the Realm of Biodiversity Assessment and Conservation Management

At the heart of the Master's Program in Biodiversity (MPB) lies the "Biodiversity Workshop," a comprehensive course led by Assistant Prof. Chun-Chia Chou. This dynamic class is designed to cultivate both theoretical understanding and ...

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## “Design Your Life”: Creating a Wonderful Life by Making Your Dreams a Reality

“Design Your Life” is one of the popular courses at NTU D-School. This course focuses on guiding students to explore themselves;...

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## Applying Generative AI to Produce VR Teaching Materials

The Digital Learning Center (DLC) of NTU Office of Academic Affairs continues to promote VR immersive teaching. Among the courses, “Applying Generative AI for Producing VR Teaching Materials” taught by Prof. ...

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# PEOPLE



## Students' Voices Valued at the College of Life Science Symposium

Earlier this year, the College of Life Sciences held an engaging symposium, bringing together nearly 50 enthusiastic master's and doctoral students along with Dean Bor-Luen Chiang. Dean Chiang set the tone for the event by sharing his vision for the future of the College. "While the College of Life ...

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## Lifting Others Up: Students Devoted to Social Work

Each year, NTU's Student Social Devotion Special Award recognizes the exceptional efforts of students dedicated to promoting social well-being and demonstrating the spirit of altruism. These students are awarded for taking tangible actions to address the needs of the disadvantaged. The 2023 award...

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## Garmin Co-Founder, Dr. Min-Hwan Kao, Pledges US\$20 million to NTU for Professorships and Faculty Housing Construction

Dr. Min-Hwan Kao, recipient of the National Taiwan University (NTU) Distinguished Alumni Award and Chairman and Co-Founder of Garmin Ltd., has pledged US\$20 million to his alma mater. This donation, facilitated through the Kao Family Foundation, aims to bolster NTU's College of Electrical Engineering and Computer Science (EECS) and...

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FEATURES

# The Positive Circles of Inspiration

## Interviews with TIWACT Members

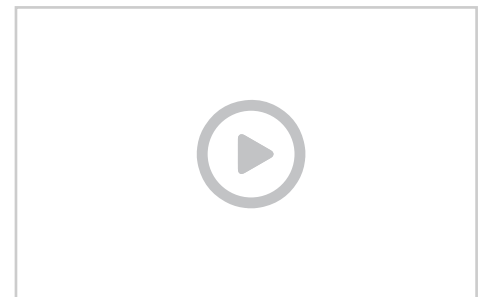


On the eve of summer vacation in 2023, a group of university students, teachers, and community volunteers visited Chiputula Primary School in Mzuzu, Malawi. They announced the upcoming English reading workshops scheduled for mid-August and enthusiastically invited children to participate. Among the group, one Asian face stood out—Yokogawa Rena, a student from the Department of Sociology at National Taiwan University.

Rena, along with Blessings Chirambo from Mzuzu University, founded TIWACT in early 2023. They subsequently invited Jasmine (Zi-Ying Lee), Anna (Anna Lao), and Jennifer (Xin-Wei Chen), also from NTU, to join the team. Their mission was to reduce the dropout rate among Malawian students. Organizing English reading workshops and inviting local community members to share their career experiences, they worked to enhance learning opportunities for local children and provide them with role models.

### Creating Synergy through Transnational Action

Rena first visited Mzuzu, Malawi's largest city, in 2022 as part of the course "Global Health Project Planning and Implementation" taught by Professor Chen Chi-Hsin



Intro video of TIWACT.

and MOE's USR project "SHANTU". There, she learned about the high dropout rates among Malawian primary school students. Upon returning home, Rena remained concerned about the local children and continuously discussed potential solutions with Blessings. Initially, she only thought of returning to Malawi to help the children. Blessings's response, "Sure, let's do it together!" gave her great confidence and marked the first step in their project.

Facilitated by Blessings, they visited the principal of Chiputula Primary School and members of local NGO organizations. They discovered reasons behind Malawian children's high dropout rates, including early marriages for girls leading to leaving school prematurely and uneven distribution of English learning resources resulting in significant disparities in academic performance among children in public schools. After multiple discussions, Rena and Blessings focused the project's goals on "enhancing children's English reading abilities" and named the project "TIWACT," representing "Together We Act." The initial "TIWA" stands for the Chewa language phrase "Tiwalimbikitse," meaning "We encourage them together."

In mid-2023, as Rena pondered how to promote the project in Taiwan to gain more resources, she found Anna. Anna had just completed work on community management, making her a perfect fit for Rena's team. She began introducing TIWACT through cute illustrations and brief essays on Instagram and Facebook.

Jasmine, who conducted research on social issues for the team, was inspired by Rena's sharing during a mentoring event. Rena expressed her desire to join international NGOs after graduation, but her professors pointed out the challenges Taiwan faces in international affairs. Jasmine wondered, "As a Taiwanese, what can I do for Malawians to build relationships beyond formal diplomacy?" She wanted to join Rena and see what changes they could bring about.

In September, Jennifer, who had been engaged in community service, joined the team. Jennifer, who was deeply concerned about rural education issues, was invited by Rena to participate in online meetings. Inspired by the team's enthusiasm and ideals, she contributed her experiences to TIWACT.

## Bridging the Gap with Goodwill

Due to the six-hour time difference between Malawi and Taiwan, when it was time for TIWACT's online meetings, it was already late evening in Taiwan. Anna and Jennifer noted that due to English accents and evening fatigue, communication could be challenging, but Malawian partners always smiled, which dissipated any awkwardness during discussions and conveyed a strong sense of goodwill and thoughtfulness.

Another challenge of transnational cooperation was the lack of information. Rena pointed out the scarcity of courses related to African culture and society in Taiwan, reflecting Taiwan's long-standing lack of interest in African affairs. Anna mentioned that NTU has few exchange activities with African countries, making it difficult to collect relevant information.



Yokogawa Rena, a co-founder of TIWACT, along with the team members Jasmine (Zi-Ying Lee), Anna (Anna Lao), and Jennifer (Xin-Wei Chen).



Yokogawa Rena (second from the left) with Blessings Chirambo, also co-founder of TIWACT.



The goal of TIWACT is to enhance children's English reading abilities, aiming to contribute to the reduction of the dropout rate among Malawian students.



TIWACT team members brought many English books to Chiputula Primary School to conduct English reading workshops.

Therefore, Rena actively sought advice from Prof. Chen Chi-Hsin, who had experience in collaborative projects in Malawi. Malawian partners also helped confirm the accuracy of their information and provided feedback online. Additionally, the Yulen Project and Autonomous Learning Project of NTU provided support in knowledge and funding. Prof. Wu Chia-Lin from the Department of Sociology also kindly wrote recommendation letters for the team members, for which they were very grateful.

## Returning to Malawi with Everyone's Encouragement

In July 2023, Rena returned to Mzuzu, Malawi, preparing to put the project into action—five English reading workshops. After announcing the activities on the last day of the semester, the team brought many English books to Chiputula Primary School and read with the children. Surprisingly, on the first day of the workshop, three hundred students showed up, leaving Rena both astonished and moved.

During the last workshop, a child arrived two hours late. He explained to Rena that he had to assist his family farming and couldn't attend in the morning, but he really enjoyed reading books. Rena said that the children's motivation to learn was high. Given the opportunity and resources, they could enjoy learning English. This further solidified Rena's direction, and the team began planning grammar courses to improve the children's English proficiency.

James, a Malawian member of TIWACT, established a 24-hour library near Chiputula Primary School a few years ago. After the workshops, the team placed the books purchased at the library, where primary school children visit daily to read. In Taiwan, TIWACT members plan to establish a club and organize activities with the African Student Association to recruit members and accumulate African knowledge. However, Rena, Anna, Jasmine, and Jennifer's biggest vision is for this educational project to continue long-term, even after they graduate.

"We want to do this for ten years!" Recalling Blessings's words to her, Rena was amazed at the powerful encouragement among her companions. She said that if she were alone, she might have given up halfway. Rena encourages classmates with similar aspirations to share their ideas with others, thereby turning ideas into action.



Children selecting the English books they want to read.



**I HONOR**

# Breakthrough in AI Medicine: NTU Wins the Alexander R. Margulis Award for Scientific Excellence

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An NTU research team won the 2023 Alexander R. Margulis Award for Scientific Excellence from the Radiological Society of North America (RSNA) for their development of an AI pancreatic cancer detection tool. *Radiology*, the official journal of RSNA, points out that the study discovered a new route for early pancreatic cancer detection to enable timely treatment, greatly increasing the chance of survival and benefiting millions of patients worldwide.

Pancreatic cancer is the seventh leading cause of cancer deaths in Taiwan, and is expected to become the second leading cause of cancer deaths in the United States by 2030. Pancreatic cancer metastasizes rapidly and has the lowest five-year survival among cancers. Therefore, effective early detection tools are urgently needed.

To address these key clinical obstacles and needs, an interdisciplinary team led by Prof. Weichung Wang at NTU Institute of Applied Mathematical Sciences and Prof. Wei-Chih Liao at the School of Medicine developed the world's first AI computer-aided detection/diagnosis tool for pancreatic cancer. When tested with nationwide real-world clinical data, the diagnostic accuracy exceeded 90%. Whereas radiologists' detection rate for pancreatic cancers smaller than 2 centimeters is approximately 60%, the tool detected 75% and 86% of such small cancers in the national and internal tests, respectively.

Dr. Po-Ting Chen of NTU Hospital, a first author of this study, concluded that this study takes advantage of advanced AI technology to enable automated detection of pancreatic cancer which can be difficult to diagnose with the naked eye. It improved the diagnosis accuracy and could hasten the diagnosis to provide timely care for patients. More importantly, this study achieved nationwide real-world verification which is rarely seen with medical AI research, providing strong scientific evidence for the correctness and general applicability of the AI model.



NTU researchers Weichung Wang, Tinghui Wu, Po-Ting Chen and Wei-Chih Liao (from left to right) receiving the 2023 Alexander R. Margulis Award for Scientific Excellence from the Radiological Society of North America (photo credit: RSNA website).



Click or Scan the QR code to read the journal article in *Radiology*.



Click or Scan the QR code to learn more about the award-winning team.



Click or Scan the QR code to learn more about the Alexander R. Margulis Award.

GLOBAL OUTLOOK

# Biocredit Taiwan Initiative Wins Approval at COP28

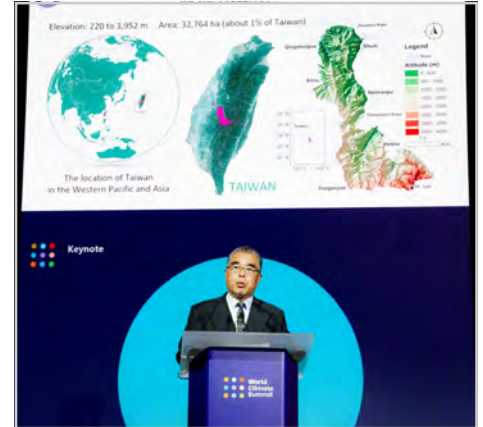
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A Taiwanese team led by NTU Prof. Ming-Jer Tsai was invited to present a solution to the ecological crisis at COP28 in 2023. In particular, the proposal won high praise for the application of “Biocredit Taiwan” and was hailed as a significant contribution to the conference.

Prof. Tsai proposed the “Biodiversity Credit” initiative in his keynote speech, which will further cooperation between financial institutions and other industries on biodiversity issues. Having received widespread attention from professionals attending the conference, this new model combines green economy and biodiversity preservation. The team shared the case of lowland restoration in NTU Experimental Forest, highlighting nature-oriented solutions and the results of improving biodiversity with carbon-negative technology.

The certification mechanism of “Biocredit Taiwan” is regarded as a solution to the ecological crisis, demonstrating Taiwan’s vision, determination and ability in ecological preservation. At COP28, Prof. Tsai reiterated the importance of this initiative three times in a row. The team members including Prof. Tzung-Su Ding, Chair of the School of Forestry and Resource Conservation, and Prof. Shu-Yuan Pan from the Department of Biomechatronics Engineering further discussed the technical details for implementation during two subsequent dedicated forums. The discussions enhanced the understanding and support for this initiative by experts and scholars around the world.

With the conclusion of COP28, the global trend of green transformation has officially moved on to a new phase. The “Biocredit Taiwan” initiative proposed by Taiwan demonstrates its commitment to sustainable development and calls for global cooperation in terms of addressing the ecological crisis.



At the COP28 forum on innovative solutions, Prof. Ming-Jer Tsai, Director of NTU Experimental Forest, proposed solutions to the ecological crisis.



Team member Dr. Tzung-Su Ding (right) from NTU School of Forestry and Resource Conservation participating in the forum featuring global experts and scholars.

| GLOBAL OUTLOOK

# Joint Conference with UTokyo on Sustainability Following the Lecture by UTokyo President Teruo Fujii

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Teruo Fujii, President of TokyoU, was invited to give a speech as part of the NTU Royal Palm Lecture Series on “Transcending Boundaries: from Underwater Robotics to Molecular Computing.”

The 2023 NTU-UTokyo Joint Conference took place in last December, with scholars from both universities uniting under the theme “Towards a Sustainable Future Challenges and Resilience.” The conference featured an opening ceremony and plenary session, followed by 18 parallel sessions over two days. President Wen-Chang Chen of NTU and President Teruo Fujii of UTokyo both spoke at the opening ceremony, looking back on twenty years of strategic partnership and reaffirming mutual goals to advance research, education, and society. The plenary session included an International Collaboration Panel in which four panelists shared their experiences spearheading international research collaborations.

Over 350 faculty members and students from both universities joined the parallel sessions, discussing the latest research trends across fields and engaging in interdisciplinary collaboration focused on sustainability. Topics included veterinary medicine, agriculture and environmental sciences, medicine and public health, engineering and material sciences, and humanities and social sciences.

This year marks the 7th Joint Conference between UTokyo and NTU. By bringing together researchers from different disciplines and highlighting common goals, the conference generated robust discussions and sparked innovative ideas for further research collaborations between the two universities.

In the meantime, President Teruo Fujii was also invited to deliver a speech of the NTU Royal Palm Lecture Series. President Fujii, an internationally renowned scholar of engineering, gave a lecture titled “Transcending Boundaries: from Underwater Robotics to Molecular Computing.” In his speech, President Fujii introduced the underwater autonomous monitoring robot project he has led in recent years, explaining how the instrument designs, measurement system, etc. are planned to meet sustainable development goals and coordinate with future university courses. In addition, he spoke about his academic experience, the reason for choosing the field of engineering, as well as explaining in detail the research projects he has involved in during his academic years.

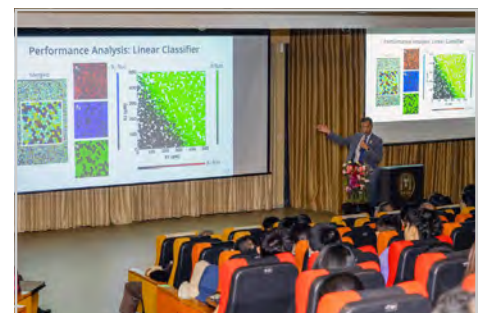
President Teruo Fujii believes that in the face of multiple complex and unknown challenges such as environmental changes, biological resources and social relations, everyone needs to have the ability to ask precise questions. In order to solve the problems raised by the public, in addition to communicating and cooperating with the outside world, it is key for universities to think further about their positioning and future development.



NTU and the University of Tokyo have been in collaboration for nearly 20 years. The joint conference was launched in 2015, and last year marked the 7th edition. The long-term collaboration has not only opened up diverse exchanges between the two universities but also promoted academic progress in East Asia.



Teruo Fujii, President of TokyoU (right), answered questions from faculty and students after his speech. President Fujii patiently answered questions from marine expertise to campus governance, while NTU President Wen-Chang Chen served as the host (left).



President Fujii encouraged NTU students not to fear unfamiliar or exploring unknown fields, but to have the courage to step out of their comfort zone, make use of their knowledge in new fields, and “enjoy the unknown.”

GLOBAL OUTLOOK

# Director of Saxony State Ministry of Science and Culture Visits NTU

## Fostering Global Tech Talent through Collaborative Engagement

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Discussions on the collaborative "Semiconductor Talent Incubation Program Taiwan (#STIPT)" between NTU, TSMC and the government of the Free State of Saxony.

Dr. Sebastian Gemkow, Director of the Saxony State Ministry of Science and Culture, along with his Chief of Staff, Dr. Michael Schmischke, visited NTU in March, accompanied by Dr. Josef Goldberger, the head of the Saxony State Ministry of Science and Culture's Taiwan office. They were warmly received by President Wen-Chang Chen, Associate Vice President for International Affairs Prof. Jiun-Haw Lee, and Chair of the Department of Electrical Engineering, Prof. Chien-Mo Li.

The main focus of the meeting was to discuss the collaborative "Semiconductor Talent Incubation Program Taiwan (#STIPT)" between NTU, TSMC and the government of the Free State of Saxony. With TSMC, a global semiconductor manufacturing leader, planning to establish a facility in Dresden, Saxony, Germany, the Saxony State Government and TSMC are jointly undertaking the "2024 Semiconductor Talent Development Program." Under this program, students will be selected to undergo specialized training at schools in Taiwan for one semester, followed by a two-month practical training at TSMC's Fab in Taichung.

Starting this year, NTU is the exclusive coordinating institution for the inaugural Talent Development Program. In March 2024, the university officially launched a semester-long training program. Eight professors from various departments including Electrical Engineering, Mechanical Engineering, Computer Science, and Information Management at NTU are serving as mentors for the program, offering eight courses. Thirty selected students from Dresden University of Technology, Freiberg University of Mining and Technology, and Leipzig University of Applied Sciences representing Germany, Poland, India, Pakistan, Bangladesh, and South Korea, among other nationalities, are expected to contribute

to global technological and economic prosperity through the collaborative efforts of the three parties, marking a new milestone in NTU's international talent development initiatives.

Furthermore, Dresden University of Technology and the Leonardo Office for Internship Programs within Saxony will also sign talent development agreements with NTU, providing bilateral students with more diverse internship opportunities. Through these exchanges of outstanding talent, the aim is to promote closer cooperation between Taiwan and Germany.

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GLOBAL OUTLOOK

# Orientation and Welcome Ceremony of “STIPT”

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NTU collaborates with TSMC, the government of Saxony, Germany, and Dresden University of Technology (TU Dresden) to cultivate the future semiconducting talents.

National Taiwan University (NTU) hosted the Orientation and Welcome Ceremony for the “Semiconductor Talent Incubation Program Taiwan (#STIPT)” on March 6. NTU officially began its collaboration with the program this year as the exclusive partner institution of TSMC and the Saxony government. The objective of the “Semiconductor Talent Incubation Program” is selecting 30 students from three German universities and six countries for a semester-long academic training in Taiwan. As the pioneering and sole partner, NTU is leading the way in a groundbreaking model of cross-border collaboration between industry and academia to foster talent development in Taiwan.

In addition to the semiconductor educational training program, NTU’s Office of International Affairs will organize career training workshops, Mandarin courses, and local cultural immersion activities throughout the semester. This comprehensive approach aims to develop students’ soft skills for the workplace and enhance their understanding of Taiwanese culture. After the summer break, the students are expected to return to Germany with professional semiconductor training experience and a deep appreciation for Taiwanese culture.



International students gathered to participate the Welcome ceremony and orientation of “STIPT”.

President Prof. Wen-Chang Chen stated that the global semiconductor industry has been experiencing continuous growth, leading to talent shortages that challenge governments and enterprises worldwide. To this end, NTU is taking on the responsibility of nurturing talent. Apart from providing comprehensive training in the College of Electrical Engineering and Computer Science, Engineering and Management, NTU has launched the new “International Bachelor’s Degree Program in Semiconductors” at the International College in 2024, which is taught in English. This program, along with the semiconductor-focused programs in the Graduate School of Advanced Technology with a particular emphasis on IC design, collectively contribute to the development of international semiconductor talent in Taiwan.

NTU has a rich history of cultivating multinational semiconductor talents. In 2023, in collaboration with the Ministry of Foreign Affairs, NTU organized the “Taiwan-Europe Semiconductor Short-term Training Program,” offering a two-week intensive semiconductor course for 39 outstanding students and young professionals from Lithuania, the Czech Republic, Slovakia, Poland and Italy. NTU will continue to enrich its industry-academia collaboration with TSMC and establish long-term technological, academic, and talent exchanges with Germany. Furthermore, it aspires to expand this pioneering model of cross-border industry-academia cooperation in talent cultivation into more diverse fields.



NTU President Wen-Chang Chen delivering a speech on the Welcome ceremony.



GLOBAL OUTLOOK

# NTU, Yonsei U Forge Partnership in Quantum Science and Engineering

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Both university presidents highly anticipated this collaboration to yield groundbreaking discoveries and technological advancements. They anticipate that this partnership will profoundly transform the landscape of global quantum research and development.

On December 7th, President Seoung Hwan Suh of Yonsei University led a distinguished delegation to National Taiwan University (NTU), including Vice President for University Planning and Development Kabsung Kim, Vice President for External Affairs and Development Heejun Park, and Prof. Hakbae Lee from the Department of Applied Statistics. They were warmly received by President Wen-Chang Chen and Vice President for International Affairs Hsiao-Wei Yuan. The primary purpose of their visit was to formalize the Memorandum of Understanding (MoU) between NTU's Centre for Quantum Science and Engineering (CQSE) and Yonsei University's Institute of Quantum Information Technology.

Yonsei University has strategically recognized NTU's CQSE as a key partner, following a trilateral MoU previously signed on Quantum Computing with Keio University of Japan. The signing ceremony of this bilateral MoU represents the initial step toward establishing a robust collaboration. This partnership aims to bolster scientific advancements, foster knowledge exchange, and generate innovative solutions to global challenges within the field of quantum science and engineering.



Under the leadership of President Seoung Hwan Suh, Yonsei University established the Institute of Quantum Information Technology in March 2022. The institute is dedicated to contributing to the creation of a quantum ecosystem for society as a whole. This includes various research endeavors in quantum information technology, systemic education, comprehensive applications, and the establishment of research networks through international collaboration.

GLOBAL OUTLOOK

# Enhancing Bilateral Research Between NTU and Northwestern U

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On December 5th 2023, NTU had the honor of welcoming a delegation from Northwestern University, including Vice President for International Relations Dévora Grynspan, Vice President for Research Eric Perrault, and seven faculty representatives from Biomedical Engineering, Electrical Engineering, as well as Entrepreneurship and Innovation.

After being graciously received by President Wen-Chang Chen, the delegation engaged in discussions with NTU leadership to explore further bilateral research and mobility partnerships. The discussion centered around joint research seed funding, with the anticipation that following the establishment of a student exchange program in 2023, both universities will continue to engage in a broader range of exchange initiatives. During their visit, the delegates had the opportunity to tour the Nano-Electro-Mechanical-Systems (NEMS) Research Centre, where they explored potential collaborative projects in Biomedical Engineering and Electrical Engineering.

Prof. Hayes Fergus, Director of Northwestern's Farley Center for Entrepreneurship and Innovation, also engaged in discussions with NTU Vice President for Academic Affairs Hung-Jen Wang and Vice President for Student Affairs Shi-Wei Chu on the cultivation of innovative and entrepreneurial talents in higher education.

This visit marks the first in-person delegation from Northwestern University to NTU following the online matchmaking events in 2021 and 2022. NTU looks forward to expanding academic collaboration between the universities in the near future.



The discussion centered around joint research seed funding, with the anticipation that following the establishment of a student exchange program in 2023, both universities will continue to engage in a broader range of exchange initiatives.



The delegation toured the NEMS Research Centre, exploring potential collaborative projects in Biomedical Engineering and Electrical Engineering.

ACHIEVEMENTS

# Unraveling the DNA Mystery: ATR and DHX9 in Genome Stability

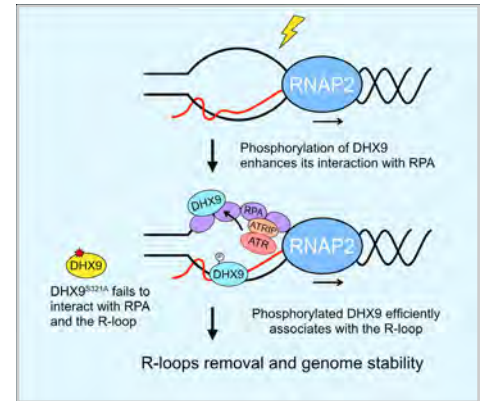
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The DNA in the billions of cells within the human body is under constant assault from various threats, both internal and external, collectively known as genotoxic stress, which can lead to DNA damage. If left unrepaired, this damage can result in genome instability, a significant factor in the development of cancer and various genetic diseases.

Led by Assistant Professor Ching-Shyi Peter Wu from the NTU Department and Graduate Institute of Pharmacology, a research team has made a groundbreaking discovery. For the first time, they have demonstrated that ATR, a pivotal protein kinase in the DNA damage response, plays a crucial role in preventing genotoxic stress-induced genome instability by regulating the RNA helicase DHX9, a critical RNA processing factor with functions in several physiological processes, including transcriptional regulation, RNA splicing, and R-loop resolution.

ATR acts as a key kinase in the DNA damage response, becoming activated when cells encounter genotoxic stress. Once activated, ATR phosphorylates proteins involved in the DNA damage response, allowing them to maintain genome stability. Notably, during DNA replication and transcription, genotoxic stress can trigger the formation of R-loops, contributing to DNA damage and genome instability.

DHX9, an RNA helicase, has been identified as a key factor in reducing R-loop accumulation, thereby preserving genome stability. In their recent study, the research team discovered that ATR directly phosphorylates DHX9 to reduce the accumulation of R-loops during genotoxic stress. Phosphorylation of DHX9 at S321 enhances its interaction with DNA damage proteins H2AX, BRCA1, and RPA32, facilitating its association with R-loops in response to DNA damage. More importantly, compromised phosphorylation of DHX9 at S321 leads to increased R-loop accumulation and hypersensitivity to genotoxic drugs in cells. These findings establish a critical connection between ATR, RPA, and DHX9 in responding to DNA damage-induced R-loops, highlighting ATR's direct regulation of RNA helicase DHX9 to prevent genome instability. Insights into the molecular mechanisms governing DHX9's function and its dysregulation in diseases offer promise for the development of targeted therapeutic interventions and diagnostic approaches.



A diagram demonstrating ATR phosphorylates DHX9 regulating DHX9 and genome stabilization.



Click or Scan the QR code to read the journal article in *Nucleic Acids Research*.

ACHIEVEMENTS

# A Nanophotonic Breakthrough: Mie-Tronics Under Microscopy

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For centuries, the mesmerizing colors of stained glass windows and the Lycurgus Cup captivated us, their physics shrouded in mystery. It took Gustav Mie's electromagnetic wave scattering theory in the 20th century to explain the magic behind these colors – grinding metals to specific sizes creates optical resonances, intensifying absorption and scattering to produce vivid hues. Fast forward to the 21st century, this nanoscale Mie resonance now extends to high-refractive-index semiconductors like silicon.

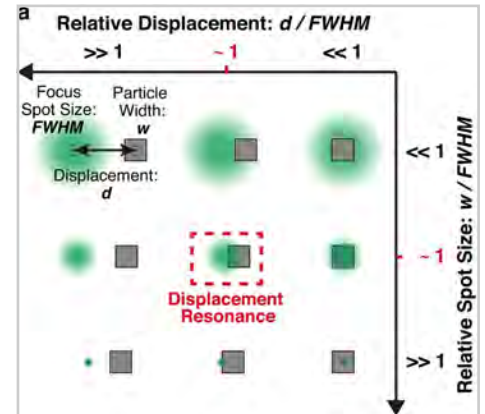
Conventionally, the Mie theory clarifies how structuring metals or semiconductors generates optical resonances, focused on normalized frequency, overlooking non-paraxial incidence symmetry. However, an international collaboration involving Osaka University, Jinan University, National Tsing Hua University, and National Taiwan University revealed a groundbreaking phenomenon that altering the relative positions of the light spot and nanostructures triggers previously unseen resonances, termed “displacement resonance”.

The discovery was enabled through the amalgamation of a common tool in life science, the confocal laser scanning microscope, and nanoscale resonance in material science. Intriguingly, when the focused light spot diameter and a silicon nanostructure are comparable in size, shifting their relative positions initiates displacement resonance, leading to unexpected results.

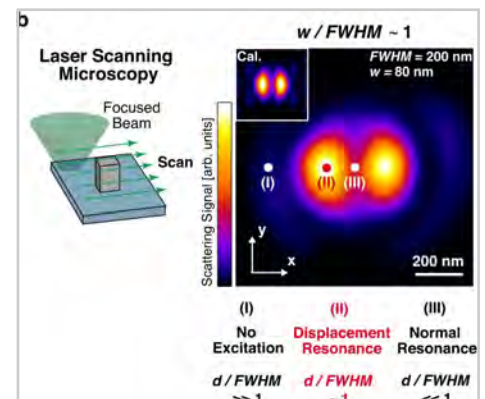
The study challenges established perceptions, indicating that the most effective interactions between light and matter happen when the laser focus deviates approximately 100 nanometers from the center. This unorthodox displacement resonance, linked to higher-order multipolar modes, expands upon the century-old light scattering theory and presents fresh opportunities for diverse applications.

One highlighted potential application involves the all-optical switching of a single nanoparticle, demonstrating the capability of displacement resonance in nonlinear nanophotonics. The research introduces an innovative tuning mechanism, illustrating that scattering nonlinearity changes sign by slightly moving the light spot, offering novel perspectives for applications in optical computing and super-resolution microscopy. The enhanced light-matter interaction at nanoscale may assist the signal read/write efficiency for quantum computing as well.

In essence, the revelation of displacement resonance introduces a novel spatial dimension in nanophotonics, challenging established resonance concepts and presenting intriguing possibilities for interdisciplinary applications.



Schematic illustration of displacement resonance. The green circles and gray rectangular, respectively, indicate a focus spot with the size of FWHM and a dielectric particle with the width of  $w$ . The displacement  $d$  indicates the distance between the focus spot and the particle. We defined the condition of displacement resonance, in the case that both  $d/\text{FWHM}$  (relative displacement) and  $w/\text{FWHM}$  (relative spot size) are close to unity.



Example of displacement resonance. When a crystalline silicon particle diameter ( $w = 80 \text{ nm}$ ) is comparable to the focus spot size ( $\text{FWHM} = 200 \text{ nm}$ ), the particle shows maximum scattering intensity as the beam center is slightly displaced, forming a non-gaussian laser scanning image. Each pixel in the laser scanning image corresponds to a unique displacement between particle and beam center, as indicated by the (I), (II), and (III) spots in the scanning image. The upper left inset shows the simulated LSM image.



Click or Scan the QR code to read the journal article in *Nature Communications*.

ACHIEVEMENTS

# Revolutionizing Agriculture: NTU Wins National Agricultural Science Award

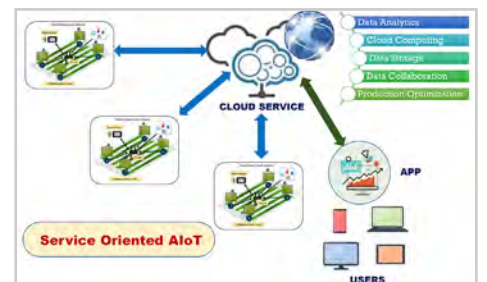
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The system used in greenhouse for long-term pest monitoring and alerts.

The R&D team led by Distinguished Professor Ta-Te Lin from NTU Department of Biomechatronic Engineering has been awarded the first prize in the Industrial Pioneer Category of the Ministry of Agriculture's 2023 National Agricultural Science Award. This prestigious national recognition honors outstanding achievements in developing agricultural science and technology. The team's groundbreaking project— Smart Pest Monitoring System—was developed through a collaborative effort involving experts from NTU's Department of Biomechatronic Engineering, the Department of Entomology, the Ministry of Agriculture's Tainan District Agricultural Research and Extension Station, and Taiwan Hipoint Corporation. The system has been lauded for its innovative approaches and wide applications in the agricultural sector.

The Smart Pest Monitoring System leverages advanced AI image recognition technology, as well as rapid computing and wireless communication capabilities of embedded systems. By combining these cutting-edge technologies with the



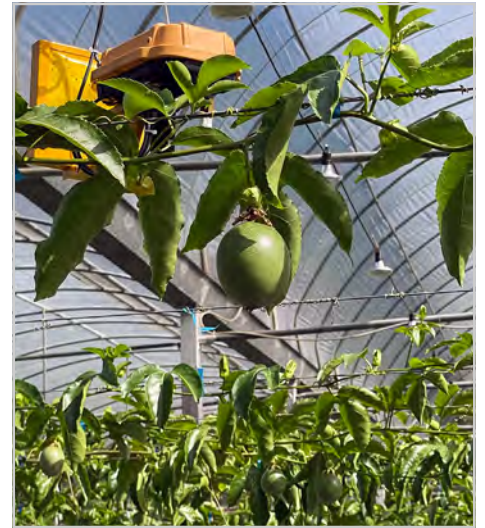
The architecture of the Smart Pest Monitoring System and its digital services.

expertise of agricultural professionals, the system can accurately and automatically identify various pest species and assess their population levels. By continuously monitoring pest activity and its impact on crops and the environment over extended periods, the system enables farmers to engage in pest control and cultivation management digitally. This versatile monitoring system can be seamlessly implemented in greenhouse and outdoor cultivation environments. It effectively reduces pesticide use, human labor, and environmental impact while promoting sustainable agricultural practices.

Through ongoing innovation and collaboration, the interdisciplinary team successfully developed the first-ever pest and environmental monitoring module tailored specifically for agricultural use. By transferring technology and implementing it extensively in various agricultural settings, the system has been effectively utilized in more than 10 extended experimental locations and 114 agricultural sites. The system provides targeted pest and disease alerts for each crop, establishing an innovative model for smart pest and disease management. This has resulted in a significant improvement in agricultural production efficiency and has propelled the industry towards a new era of technological agriculture and sustainable development.



The system implemented in a honey angel garden for long-term pest monitoring and alerts.



This commercialized system is also applied to passionfruit gardens for pest monitoring and alerts.



The award ceremony of the 2023 National Agricultural Science Award.

TEACHING & LEARNING

# From Classroom to Community: Exploring the Realm of Biodiversity Assessment and Conservation Management

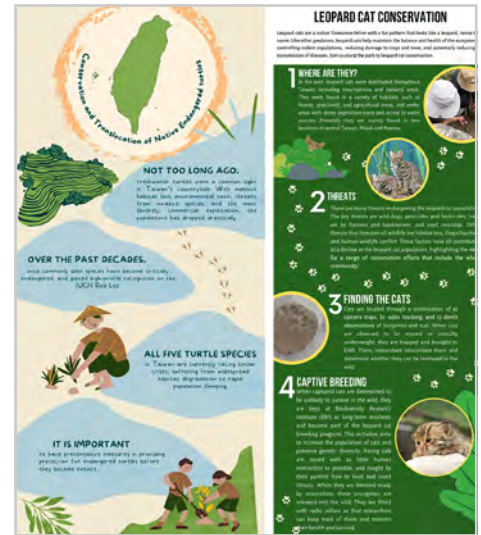
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At the heart of the Master's Program in Biodiversity (MPB) lies the "Biodiversity Workshop," a comprehensive course led by Assistant Prof. Chun-Chia Chou. This dynamic class is designed to cultivate both theoretical understanding and practical skills in the realm of biodiversity conservation management.

The course focuses on fundamental ecological surveys, monitoring techniques, the application of survey data in the scientific decision-making process, and resolving conflicts at conservation sites. Students embark on field visits to diverse conservation experimental sites, including the National Museum of Natural Science, the Research Center for Biodiversity at Academia Sinica, zoos, botanical gardens, and more. Through these experiences and the guidance of experts, students acquire hands-on proficiency in field survey techniques such as population estimation of intertidal zone animals, composition analysis of forest-mammal assemblages, terrestrial turtle tracking, and other essential skills.

Wildlife conservation extends beyond the expertise of conservationists, and effective communication with different stakeholders is crucial. To reach a consensus, it is integral to have the participation and support of local communities. A researcher from Research Center for Biodiversity, Academia Sinica was invited as a guest speaker to share on the topic of leopard cat conservation. Students learned how to leverage research data to assist farm owners in constructing protective fences to minimize the use of traps. This method prevents leopard cats from preying on livestock while conserving the leopard cat population, successfully addressing the conflict.

Taking the learning experience beyond the classroom, students engaged with local fruit farmers in leopard cat-friendly orchards and farmland in Nantou County. These interactions provided valuable insights into the conservation process and fostered an understanding of the delicate balance between conservation goals and local interests. Through practical fieldwork and the guidance of research experts, students gain a wealth of firsthand experience, preparing them to make meaningful contributions to the field of biodiversity conservation.



Students are required to participate in the execution, education, and promotion of Taiwan biodiversity and share their efforts with partner organizations.

**Left:** This poster created by students during the course promotes the rewilding and restoration of Chinese box turtles.

**Right:** Poster created by students on human-wildlife conflict and leopard cat conservation.

TEACHING & LEARNING

# “Design Your Life”: Creating a Wonderful Life by Making Your Dreams a Reality

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Even after graduation, the seniors set up the Detour Team to continue to support the course, allowing students to find out their own life paths through conscious attempts, and realize the blueprint of their ideal life.

“Design Your Life” is one of the popular courses at NTU D-School. This course focuses on guiding students to explore themselves; moreover, at the end of the semester, the significant others in the students’ lives will be invited to a sharing session, where they will reflect on their process of exploration, their new understanding of themselves, as well as their future aspirations.

“Can life be designed?” is a question that is often raised in this course. Huang, a student from the Department of Business Administration, said that the core of life design includes “community, time and practice.” Courses like this build a supportive community and give students the courage to do what they have always wanted to do. This process takes time and requires practical actions.

Ying, a student from the Department of Biomechatronics Engineering, mentioned: “Although many of us met one another in this course for the first time, everyone at D-School is kind enough to offer great support and encouragement to



Students review the past, reflect on the present, and learn to take action through the course. These experiences become the stories they tell their significant others. Through exploration, they share their hesitations, growth paths, and future directions.



their respective plans.” The guests included not only classmates but also partners, friends and family. Prof. Shi-Wei Chu, Vice President for Student Affairs, pointed out that such companionship and support are the most precious assets in life. Students spend a lot of time thinking about their lives in this course, which is rare in university studies.

With the dedicated support from a team of students and faculty members, “Design Your Life” has been on offer for 5 years. Prof. Pin-Hao Chen from the Department of Psychology and Prof. Wenn-Chieh Tsai from D-School acknowledges and appreciates their contribution along the way.



This is an occasion for honest sharing where everyone can hear each other's plans and offer support.

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| TEACHING & LEARNING

# Applying Generative AI to Produce VR Teaching Materials

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| The students giving a detailed introduction to their VR lesson plans.

The Digital Learning Center (DLC) of NTU Office of Academic Affairs continues to promote VR immersive teaching. Among the courses, “Applying Generative AI for Producing VR Teaching Materials” taught by Prof. Chia-Pin Yu at the Department of Forestry and Resource Conservation teaches students to efficiently script VR lesson plan structures with generative AI tools, as well as learn teaching design principles, capturing real-life images with 360° cameras, image editing and other technologies, allowing the students to create VR lesson plans through team-based learning.

When scholars from Indiana University (IU) in the United States and University of Hamburg (UHH) in Germany visited NTU, they had an exchange with the students taking this class. After each group of students explained the design philosophies of their VR lesson plans, the scholars had the opportunity to actually experience the VR lesson plans and provide feedback and comments, such as how to reduce discomfort and dizziness through shooting techniques, allow users to



| Lively group discussion with the scholars.



| The scholars sharing feedback with the students.

move more freely and adjust shooting angles to enhance immersion, as well as match the tactile sensation from the actual environment with the virtual world. The exchange of opinions has greatly benefited the students. A student said: “What I remember the best is a professor saying general VR was all about physical movement, but our lesson plans can help people overcome their fears and get out of their comfort zone, which is a great idea.”

DLC will continue to expand and promote immersive teaching by assisting faculty and students to create VR lesson plans for the VR courses to be available all over campus.



The scholars sharing their views on teaching with each other.



Group photo with IU and UHH scholars.

| PEOPLE

# Students' Voices Valued at the College of Life Science Symposium

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| Students enthusiastically participated in symposium.

Earlier this year, the College of Life Sciences held an engaging symposium, bringing together nearly 50 enthusiastic master's and doctoral students along with Dean Bor-Luen Chiang. Dean Chiang set the tone for the event by sharing his vision for the future of the College. "While the College of Life Science is still young, I envision it as a hub for cultivating the next generation of professionals in life science and biochemical technology, laying the groundwork for Taiwan's advancement in this field," remarked the Dean.

During the event, students and the dean enjoyed a meal and engaged in lively discussions on various topics ranging from campus facilities and scholarships to international conference participation and overseas education programs. Dean Chiang patiently addressed each question, promising to work towards enhancing the College's resources and support for students.

International students actively participated in the discussions, offering valuable insights on course selection and NTU COOL. Their suggestions included



| International students offering suggestions regarding the facilities of the Life Science Building.

implementing bilingual signage in the College building, fostering an English-friendly environment, and establishing a dual tutor system to support international students in adapting to a new country and culture. The symposium concluded with a cheerful photo session, highlighting the vibrant spirit of the College of Life Science.

This event was a powerful platform for students to voice their concerns and gratitude, deepening the connection between the dean and students. As the inaugural event of its kind, the College is committed to hosting this symposium every semester, aiming to nurture strong relationships and proactively meet students' needs.



International students openly voice their thoughts.



Students and Dean Bor-Luen Chiang in a group photo, demonstrating the lively and engaging vibe of the College of Life Science.

PEOPLE

# Lifting Others Up: Students Devoted to Social Work

Share:     



Pei-Shen Shi putting growing bags on guavas with Geti, a local colleague, during her time on the fruit tree production and marketing project in Eswatini.

Each year, NTU's Student Social Devotion Special Award recognizes the exceptional efforts of students dedicated to promoting social well-being and demonstrating the spirit of altruism. These students are awarded for taking tangible actions to address the needs of the disadvantaged. The 2023 award celebrated three individual winners and one group winner: Pei-Shen Shi from the Department of Chemistry in the College of Science, Wu-Qi Wang from the Department of Political Science in the College of Social Science, Ke-Xuan Shao from the Department of Bio-Industry Communication and Development, and TIWACT, a transnational education program.

Shi actively contributes to the Taiwan International Cooperation and Development Fund's technical mission in Eswatini. Engaging in the fruit tree production and marketing project, she imparts knowledge to local farmers, enhancing their harvest and cultivation management techniques. This not only improves their livelihoods but also contributes to the sustainable development of the environment.



Wu-Qi Wang and panelist Tse-Chou Chang in a group photo at the first "Wormhole White Terror Workshop".

Acknowledging the uneven distribution of social resources between urban and rural areas, Wang founded the local organization "Tsuilu" in Yunlin. Dedicated to addressing public issues, this initiative aims to heighten historical awareness among the community, fostering a connection to the past and advocating for human rights values and social justice.

Another awardee, Shao, dedicates himself to a social prosperity project centered on reviving millet cultivation. Collaborating with local organizations in Xinyi Township, Shao shares his knowledge about the diverse varieties of millet and his discoveries through field studies. Through these efforts, he aims to preserve the cultural heritage, tribal knowledge of the Bunun people, and the rich cultural and ecological diversity of the island.

The group awardee, TIWACT, has established transnational partnerships to enhance the quality of education in Malawi. They conduct English reading workshops and future career workshops, helping children strengthen their English skills and inspiring their imaginations for future lives



Ke-Xuan Shao raising millet seedlings at the Institute of Plant Biology's greenhouse.



TIWACT co-founder Rena Yokogawa speaking on behalf of the awardees at the NTU 95th Anniversary Ceremony.

PEOPLE

# Garmin Co-Founder, Dr. Min-Hwan Kao, Pledges US\$20 million to NTU for Professorships and Faculty Housing Construction

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Dr. Min-Hwan Kao, recipient of the National Taiwan University (NTU) Distinguished Alumni Award and Chairman and Co-Founder of Garmin Ltd., has pledged US\$20 million to his alma mater. This donation, facilitated through the Kao Family Foundation, aims to bolster NTU's College of Electrical Engineering and Computer Science (EECS) and College of Engineering (COE) by establishing the "Garmin Chair and Garmin Scholar Award Fund" and the "Garmin Faculty Dormitory Construction and Maintenance Fund." The fund will appoint 22 distinguished individuals as Garmin Chair Professors and Garmin Scholars, each receiving an annual incentive of US\$30,000 for three years, with the possibility of reappointment. Additionally, US\$6.25 million will be allocated to the construction and maintenance of the "Garmin Faculty Dormitory."

Dr. Wen-Chang Chen, NTU President, shared that Dr. Kao, through discussions with Garmin Asia R&D Assistant General Manager J.W. Liao, also an NTU graduate, recognized the university's initiatives for its upcoming centennial milestone in 2028. Dr. Kao emphasized the importance of talent recruitment and housing provisions for young talents. In response, he pledged to fund the establishment of chair professorships, scholar fellowships, and faculty dormitories to enhance NTU's appeal to top-tier candidates.

Expressing gratitude to his family for their steadfast support, Dr. Kao has been committed to educational philanthropy. He established the Kao Family Education Foundation in 2019, benefiting over 4,000 high school students annually, with more than half passing national qualification tests. Dr. Kao's ties to NTU trace back to his graduation from the Department of Electrical Engineering in 1971. His visionary leadership at Garmin, founded in 1989, propelled the company to global prominence in GPS and wearable technology. With nearly 10,000 employees in Taiwan, Garmin is renowned for its innovation and was ranked second on Forbes' list of America's Best Employers among large companies in 2024. Dr. Kao himself received a Distinguished Alumni Award from NTU in 2009.



Completion Simulation of Garmin Faculty Dormitories.



Groundbreaking Ceremony for Garmin Faculty Dormitories.



Dr. Kao highlighted, "NTU graduates have played pivotal roles in Taiwan's economic growth. As technology evolves, attracting international talents is crucial. Faculty excellence and competitive compensation are paramount for a thriving university. Through the establishment of Garmin Chair Professors and Scholars, along with modern dormitories, we aim to fortify NTU's global connections and sustain its growth."

An NTU committee, led by an Executive Vice President, will oversee the selection of award recipients. Public ceremonies will honor Garmin Chair Professorships and Scholar Fellowships recipients annually.

<https://ntubeats.ntu.edu.tw/enews/006>

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