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Contents

2 Core Facility helps scientists envision research strategies

Director seeks to optimally use equipment, build professionalism

- 6 Sorting Genomes with Software Maxbin's development and future
- 8 Sigma Theta Tau honors TMU nursing researchers Hall of Fame awardees Tsai & Chou joined by Emerging Nurse Researcher Chiu

12 Asian Flushing Syndrome 36% of East Asians are diagnosed with ALDH2 deficiency

- 16 TMU pioneers the "i College" to cultivate a new generation of entrepreneurs
- **18** TMU Healthcare System joins Taiwan Healthcare Expo

Core Facility helps scientists envision research strategies Director seeks to optimally use equipment, build professionalism

irector Austin Changou says TMU's Core Facility is much more than an equipment center. In fact, the Core's director has modeled both staff and services on the professionalism he encountered at Memorial Sloan Kettering, a major U.S. cancer research center.

The TMU Core Facility operates as part of the Office of Research and Development, supporting researchers "by providing highly specialized services, equipment, and staff that would be too costly or impractical for a single laboratory or department to provide." Its operations include cores for imaging, mass spectrometry, nuclear magnetic resonance (NMR), flow cytometry and bioinformatics.

These staffed facilities provide researchers access to high-end instruments, technical support, expertise, and training. In fact, the website notes that several instruments in the Basic Research Core are available 24 hours a day. The Core Facility also hosts instrument-related seminars and training programs, because students and other users must show that they understand equipment before they can use it.

Dr. Changou is clearly proud that in two years he has built a devoted and capable workforce of technicians, some of whom now aspire to become researchers themselves. He says that the more training and experience a technician has on a machine, the more skilled they are in teaching others to understand it. The director seeks to further engage the TMU community to ensure that researchers are aware of the Core's ability to help them earlier in the research process, so they can fully utilize the machines to benefit their research.

Everyone can request new machines

Dr. Changou's role directing the Core Facilities unit is critical to the university achieving its research goals. He oversees acquiring the equipment, perfecting its use, training students and others to use it, and helping scholars decide the best ways to pursue their research.

Acquisition is so important that virtually everyone can have their say: the faculty is surveyed to nominate potential apparatus, and a multi-college committee makes recommendations. Since budgets are limited, it's important to spend carefully; the university's developmental directions matter too, with cancer research and other priorities factored into purchase decisions.

Dr. Changou's own research affiliation is the Ph.D. Program for Translational Medicine, and Ph.D. Program for Cancer Biology and Drug Discovery. He laughs that his "messy" career of doing research in many different U.S. laboratory settings, ranging from bacteria, yeast, drosophila,



Austin Changou Director of Core Facility Center

to mice, from genetics to biophotonics, made him a good candidate to run the Core.

He uses this unusual breadth of experience to optimize TMU's highest-tech resources. Asset allocation is the Core's puzzle: how to best use these machines that are expensive to operate and maintain, let alone purchase initially.

Beyond getting and wisely allocating equipment, Dr. Changou said the centralized core's mission statement provides that "everyone has access," with first-come, first-served policies that give students and senior staff equal priority. Second priority goes to non-campus users that help to finance Core operations; these are mostly businesses that do not want to purchase expensive laboratory setups when their needs are occasional.

'Making good things better'

Staff do not just sign things in and out – they train users and even help solve their methodology problems by suggesting equipment and measurement approaches. "We're not here to turn on a switch... We help make good things better" by expanding users' capabilities to solve scientific questions, Dr. Changousaid. "But we need more visibility."

Cultural differences are an important factor influencing how scientists access lab resources, he said. In his American laboratory work he saw more openness, with people actively seeking answers and discussing their projects with anyone they think might have good ideas. He believes that more sharing among TMU scholars would help enhance their knowledge about research strategies.

As he spoke of nurturing his technical staff, Austin was enthusiastic about building confidence and skills by giving even master's-level technicians ample work situations where they are teaching others and helping them solve complex research problems with optimal use of equipment. "Then they want their Ph.D., they know what they want to study," he said. "They're not just going onward because their parents want them to."

Students and technical staff benefit from working together to "spot the problem" and from learning how to ask for help, he said: "Both sides learn something, and they build experience and competence along with confidence and trust."

He is used to US laboratories where equipment technicians are career professionals who can make the most of the equipment based on diverse applications over years. In contrast, he said equipment assistants in other Taiwan labs tend to be master's or PhD students whose career interests are elsewhere.



Time-of-flight secondary ion mass spectrometer (TOF-SIMS)



Expanding 24/7 services

So far, only the flow cytometry core lab is open 24/7, but Dr. Changou plans for the imaging, mass spectrometry, and nuclear magnetic resonance core labs to similarly expand access.

He envisions students getting an idea and checking it out immediately – not waiting through a weekend or until they can book a slot if daytimes are busy. The rate for overnight is only 400NT while hourly use is 100NT, further encouraging midnight scholars.

Dr. Changou isn't running the machines to recoup their cost – he says he sets the fees lower than comparably available facilities to broaden access. Fees may or may not cover operating and staff costs, but they generally don't vary by the cost of the equipment itself.

"I want to make it affordable for everyone, especially the young professors – they need good data just to write the grant applications so they can gain a quick footing " he said. With low costs, TMU faculties and students can have more access to these machines earlier than in most universities, where they can be reserved for high-profile projects or high priority users.

The Core's educational mission

Users must first be trained and possibly certified to use equipment safely, so education represents another important part of the Core's operations. Most users must take a course and be tested – often with both a written test and hands-on observation of the new user's abilities.

This training protects the users and the equipment, though Dr. Changou is less worried about damage than about suboptimal use: "If it breaks, I can fix it. But you have to learn how to use the equipment, just like you have to learn to drive by learning how to start the car."

Certification of a user's abilities to

operate particular equipment is expanding, he said, because it gives users something extra for their later job searches: a proof of their ability to use complex equipment. This is currently a pilot program involving Nutrition and Pharmacology students, but Dr. Changou wants to expand this for better career opportunities in many fields.

"Taiwan undergraduates tend to be more focused on their career goals," Dr. Changou said. "By the time we get them, they've decided on medicine or dentistry. In the US, students can explore more" and get a diverse background for different career directions. Certification will expand career options for TMU students because it can prove their abilities in a way that is meaningful to employers.

TMU's TOF-SIMS expertise

Employers know that equipment operators need



Director Austin Changou with his technicains team

experience to get reliable and reproducible data. TMU's Core is internationally respected for such experience, notably with a notoriously difficult piece of equipment known as TOF-SIMS: the time-of-flight secondary ion mass spectrometer.

He laughed that it took the better part of two years, but his team's skill with this method has led to consistent reliable data, great discoveries, and even inquiries from international collaborators and companies – as they have actively sought to cooperate with TMU scientists because of the Core Facilities' excellence in this area.

As it is the age of big data, the fifth of the Core subsections lists not specialized machines but computerized data analysis services – a list that is bound to expand, and to connect all the cores as a whole, with this promising area of TMU research.



The flow cytometry core lab is open 24/7.

Sorting Genomes with Software

Maxbin's development and future

he traditional process of studying the microbiome (the aggregation of singlecelled organisms in a certain niche, like compost, your gut, or even the cup of coffee you're drinking) is slow and labor-intensive. More importantly, 95 to 99% of organisms can't be successfully cultured in this way.

Dr. Yu-Wei Wu, an assistant professor at TMU's Graduate Institute of Biomedical Informatics, has taken a different approach in metagenomics - the study of the microbiome - with his Maxbin software. "[We] take all the DNA from everything at the same time, then we try to analyze their diversity and how they constitute, collaborate, or compete with each other. It's really like playing a jigsaw puzzle, because you cannot really tell where the DNA is coming from." Maxbin is an automated algorithm that sorts genomic sequences from metagenomic datasets - a process known as binning.



Population genome of 'Ca. R. cellulovorans' recovered from metagenomics data from the 15 l cultivation. The genome was dispersed on 114 scaffolds (blue), with 2,814 predicted CDS (coding DNA sequences) in forward (red) and reverse (green) and average (orange) coverage. N50 is the shortest sequence length that includes 50% of the assembled genome, summing from the largest contig.

The idea for Maxbin struck Dr. Wu during a shower in 2013. "I'm a computational biologist, and I'm a lazy one. So I don't like to do these manual things and I want to try to make everything automatic. So I came up with an idea to integrate machine learning into this process." The next day he shared his idea with his supervisor, Dr. Steve Singer, at the Earth Sciences division of the Lawrence Berkeley National Laboratory (Berkeley Lab). "I wasn't sure if he really understood my idea, but he said just go ahead."

A month later a prototype was ready, and a year later

he had a workable tool for sorting and identifying the genomic material present in microbiomes. The original version focused on examining one sample at a time and didn't address cross-sample comparisons. After constant development, the 2.0 version can now integrate multiple samples of up to 1,000 organisms and produce a highly accurate genome. The algorithm is unsupervised, needing no prior database information or other assistance to perform classification.

Maxbin's first use was binning DNA from samples of plant-based compost to develop of better biofuels. The team at Berkley tested several hundred organisms to see which were able to best tolerate the toxic environments involved in fuel production, and came up with at least six promising organisms. Maxbin continues to be used in ongoing experiments at the U.S. Department of Energy's (DOE) Joint BioEnergy Institute (JBEI).

On the medical front, researchers are beginning to probe the relationships between the human microbiome and disease. Promising avenues of medical research involves finding bacteria types from DNA, genetic functions from RNA, and protein compounds produced by bacteria that can be correlated with patient recovery in patients with gut diseases such as diabetes and obesity, or correlated in a clinical setting with medical imaging data. At Taipei Medical University's Microbiota Core Facility, human microbiota samples are being collected for use by medical researchers. Dr. Wu has already been approached by physicians at TMU's affiliated hospitals to examine microbiome correlations with lung disease, and has had success using Maxbin and artificial intelligence to predict antibiotic resistance.

At present Maxbin needs some manual checks to confirm data quality, but Dr. Wu is working to increase accuracy using machine learning and artificial intelligence to the point where manual checks are unnecessary. Together with upgrades to computing hardware, these improvements will reduce processing times that for complex samples with many microorganisms might take several days.

Further software refinements will allow Maxbin to account for organisms that make up a smaller fraction of samples, and for the algorithm to be applied to other forms of biological information. "We need to see all 4 aspects [DNA, RNA, proteins, and compounds] to tell a good story about who the microbes are and what are they really doing in the environment, and what they are producing, and how do they compete [or collaborate] with each other."

Thanks to Dr. Wu and Maxbin, scientists have a tool that significantly reduces the complexity of microbiome analysis.





Dr. Yu-Wei Wu Assistant professor Graduate Institute of Biomedical Informatics Taipei Medical University https://tmu.pure.elsevier.com/en/persons/yu-wei-wu

MaxBin 2.0



Dr. Yu-Wei Wu is committed to keeping Maxbin available to the public for use in biomedical research. Maxbin 2.0 is available for download at www.sourceforge.net/projects/maxbin2/.

Sigma Theta Tau honors TMU nursing researchers

Hall of Fame awardees Tsai & Chou joined by Emerging Nurse Researcher Chiu



Dr. Kuei-Ru Chou





Dr. Pei-Shan Tsai

Dr. Hsiao-Yean Chiu

wo TMU nursing faculty members are being honored this year by the Sigma Theta Tau International Honor Society of Nursing, which recognizes the nursing world's outstanding researchers in an annual awards ceremony.

In 2016, Professor Pei-Shan Tsai was TMU's first inductee in the Nurse Researcher Hall of Fame. This year, Professor and Dean of Nursing Kuei-Ru Chou will be so honored, and Assistant Professor Hsiao-Yean Chiu is one of Sigma's three Emerging Nurse Researchers.

TMU's College of Nursing has been recognized worldwide for its excellence and innovations, as well as for its special programs in gerontology. Among the organizations noting this leadership are the Shanghai Ranking, which put the college at #15 in its latest table, well ahead of other Taiwan universities. The QS World University Rankings organization's Subject Ranking for 2018 puts TMU's nursing program in the top 100 worldwide.

TMU College of Nursing Dean Kuei-Ru Chou has acted as the principal investigator for several multi-center research projects supported by Taiwan's Ministry of Science and Technology and other agencies. These projects focusing on cognitive function training and cognitive behavior group therapy have markedly improved mental health care and gerontological patient care.

Wide-ranging research & service

Having published over 130 articles on nursing, gerontology and psychiatry, Dean Chou also has a strong record of mentoring doctoral and master's degree students,



fellow nursing faculty members and clinical colleagues.

Dean Chou pursued doctoral studies at Vanderbilt University in the United States after completing her degrees at Taiwan's National Defense Medical Center. In addition to serving TMU in many roles, she is a Convener for Mental Health Nursing at the Examination Ministry, has directed the Psychiatric Mental Health Nurses' Association, and has served the Oncology Nursing Society of Taiwan, the Taiwan Nursing Management Association, and the National Defense Medical Center in various capacities.

This service earned Dean Chou nearly two dozen professional awards in recent years. Her research interests include mental health nursing, long-term care, geriatric nursing, instrument development, cognitive behavioral therapy and meta-analysis.

When accepting the Sigma award, Dean Chou noted: "To be inducted into 'The International Nurse Researcher Hall of Fame' is a great honor. ... [I]t will also serve as a platform to collaborate with distinguished researchers worldwide... My heartfelt appreciation goes to STTI for the wonderful opportunity, for recognizing our work and inspiring future scientists."

An award for younger scholars

Another annual Sigma honor focuses on Emerging Nurse Researchers, and this year Assistant Professor Hsiao-Yean Chiu has been chosen as one of just three awardees. Her research focuses on links between sleep and cognitive functions, particularly in brain-injured patients and older adults. She also researches non-pharmacological strategies to manage sleep disturbances and cognitive impairments in clinical and community settings.

Before her work at TMU, she was a visiting researcher at Stanford University's Human Sleep Research Center, taught at Chang Gung University, and pursued research at Yang-Ming University's Institute of Clinical and Community Health Nursing. Assistant Professor Chiu's nursing experience includes trauma intensive care in Linkou Chang Gung Memorial Hospital, and she received her Ph.D. in 2013 from TMU. Her other interests include critical care and neurosurgical nursing and neurofeedback in symptom management.

Professor Pei-Shan Tsai in 2016 was TMU's first researcher to be honored by Sigma. Professor Tsai's experience in nursing includes many honors since taking her first degree at TMU and receiving her Ph.D. from the University of Florida. She has been a Distinguished Professor since 2015, and since 2005 has held a joint appointment as Deputy Director of Wan Fang Medical Center's Nursing Department. Her research interests include psychophysiology, exercise physiology, biofeedback, stress management and biobehavioral research.

In addition to her heavy involvement in research and teaching, Professor Tsai also has been instrumental in running the Office of Global Engagement (OGE), which in recent years has greatly expanded its resources and capacities to promote TMU's internationalization agenda.

Award launched in 2010

The awards announcement notes: "Created in 2010, the International Nurse Researcher Hall of Fame recognizes nurse researchers who have achieved significant and sustained national or international recognition and whose research has improved the profession and the people it serves. Each of these Hall of Fame honorees represents a lifetime of contribution to the nursing profession."

Dean Chou and Assistant Professor Chiu will be inducted as part of the 29th International Nursing Research Congress from 19 to 23 July in Melbourne, Australia. (3)



TMU's College of Nursing

The College of Nursing heavily focuses on enhancing research performance and academic achivements through thematic approaches. Three research groups have teamed up in a variety of areas including cancer, cardiovascular disease prevention and rehabilitation, and gerontology. These efforts have resulted in decades of research publications that place the College amongst other reputable research institutes and education providers in Nursing.

TMU's nursing research has been supported by private-sector funding and public grants from Taiwan's ministries of Science and Technology, Health and Welfare, and Education, as well as from the National Health Research Institutes and major hospital groups, including TMU's three affiliated hospitals.



For more information, please see the Nursing Research online link:



Dr. Kuei-Ru Chou's publications:



Dr. Pei-Shan Tsai's publications:



Dr. Hsiao-Yean Chiu's publications:



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Asian Flushing Syndrome

36% of East Asians are diagnosed with ALDH2 deficiency

hen you're at a get-together or at a year-end party, you might see a friend looking up after a few sips of their favorite drink with a bright red face; they're glowing with the "Asian Flush". The blushing face that affects over 560 million people worldwide might appear endearing, but Asian Flushing Syndrome is linked to high rates of esophageal and oral cancers, and possibly over 200 other serious health issues.

Alcohol is processed mainly by two enzymes: ADH, which breaks alcohol down into acetaldehyde — a class 1 carcinogen - and ALDH2, which breaks acetaldehyde down into acetic acid. But in the 36% of East Asians and almost half of Taiwanese people with ALDH2 deficiency, acetaldehyde builds up causing flushing, dizziness, tachycardia, and vomiting, and sharply increases the risk of cancer. For this group, more than two drinks per day increases the risk of esophageal cancer a staggering 400 times. The genetic basis for the flush reaction was discussed by Dr. Che-Hong Chen during his recent visit to TMU. A flusher himself, Dr. Chen began looking into the role of ALDH2 during his research on the cardio-protective effects of alcohol. For people with ALDH2 deficiency, these benefits did not apply, but attention to this issue was lacking in the US and Europe. After a visit in 2008, Taiwan was a clear option as a base for further research. "Taiwan has good medical data, uniform medical care, physicians are well trained, so data is reliable, [and] technology is advanced."

By 2015, Dr. Chen, with the help of former TMU president, Prof. Yun Yen, had set up the Stanford-Taiwan ALDH2 Deficiency Research (STAR) consortium to promote multidisciplinary research and education on ALDH2 deficiency-related diseases. Making Taiwan a model for disease prevention is now Dr. Chen's mission: "Every university should have someone doing this research... I want every doctor in Taiwan, every nurse in Taiwan, in five



Wet the center of the Band-Aid with ~0.1 ml of alcohol (at least 40 percent) Apply Band-Aid to your under arm area for 10 minutes





ALDH2 Deficiency Band-Aid Test For education & demonstration only. Not for diagnosis

Results Positive: red skin color means likely ALDH2 deficiency Negative: no red skin reaction means likely ALDH2 normal

*The accuracy of this test is around 80% *Use ethanol, ethyl alcohol. Do not use isopropanol or isopropyl alcohol

years from now to know about alcohol flushing and its health risks... We can study here and bring our findings to other parts of Asia."

Currently, Dr. Chen is not only conducting basic research on ALDH2 deficiency and human diseases at Stanford University, he also tries to seize everyone possible opportunity to educate the Asian communities about the danger of alcohol flushing in both the United States and Taiwan. In the near future, he also plans to organize a volunteer group called "Taiwan Alcohol Intolerance Education Society" to focus on public health education for the students and citizens in Taiwan.

Dr. Alexander Wu (also in this edition), associate professor at TMU's Center for Translational Medicine and STAR consortium researcher, spoke about other avenues of ALDH2 research that are opening up at TMU, including his own work on ALDH2 deficiency influences on liver cancer. "In Asia a large cohort of people are susceptible to these cancer risks, so there is definitely a need for more research. Neurodegenerative disease [like Alzheimer's, Parkinson's, and dementia] will be a focus for the next few years, so I think the addition of this ALDH2 deficiency component will be very meaningful and relevant to the Taiwanese population."

Yet challenges in awareness about the Asian flush remain. "Despite the high level of medical [services], still only few people know about ALDH2 deficiency." said Dr. Chen. It will require combined efforts from researchers, clinicians, educators, public health officials and resources from the government to make this awareness campaign successful in Taiwan. If you turn red when you drink, enjoy in moderation. Limit yourself to one drink two times per week. "It's our responsibility to tell people about this... once they have the knowledge, they are willing to change their drinking behavior. Spread the word."

Researcher highlight

Dr. Alexander Wu Associate professor Ph.D. Program for Translational Medicine Taipei Medical University



Opportunities for research: TMU's ALDH2 advantage

With evidence growing about the health risks related to a genetic mutation that affects one third to one half of people across Asia, Taipei Medical University is moving forward to become a leader in ALDH2 research.

We recently discussed the institution's direction with Dr. Alex Wu, an associate professor at TMU's Center for Translational Medicine and cancer researcher.

Dr. Alex Wu is an expert in mouse tumor models and has research interests in stem-like cancer cells and isolating anti-cancer compounds from natural plant sources. Over the past year he has co-authored papers on identifying targets for anti-cancer drug development for lung, liver, brain, and oral cancers.

Now Dr. Alex Wu is interested in the relationships between ALDH2 deficiency and cancers of the esophagus, head and neck, and liver. "In Asia a large cohort of people are susceptible to these cancer risks so there is definitely a need for more research," he said.

Dr. Alex Wu has begun mimicking ALDH2 deficiency in liver cancer cells. Using siRNA to remove the gene, he is investigating how reductions in enzymatic activity of ALDH2 can lead to more malignant types of cancer and is interested in how the deficiency might affect reactions to chemotherapy.

Dr. Alex Wu's cell line is not the only new avenue for research at TMU. Mice bred with ALDH2 deficiency were brought to Taiwan late last year by Dr. Che-hong Chen (also in this edition), and will be available for biological investigations at TMU's animal facilities.

In addition to cancer research, new links are being investigated between the ALDH2 deficiency mutation and other diseases.

With the support of President Chien-Huang Lin for TMU's Center for Neurodegenerative Disease and the neurodegenerative medicine program that will come on line this year, research into neurodegenerative diseases such as Alzheimer's, Parkinson's, and dementia is set to increase. "Neurodegenerative disease will be a focus for the next few years, so I think the addition of this ALDH2 deficiency component will be great," said Dr. Wu.

With access to the ALDH2 modified liver cancer cell line, ALDH2-deficient mice, and new facilities for neurological research, Taipei Medical University is positioning itself as a global leader in ALDH2 deficiency research for both cancer and neurodegenerative diseases.



Colon tumor spheres https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5446486/

Researcher highlight

Dr. Szu-Yuan Wu Director Department of Radiation Oncology TMU Taipei Municipal Wanfang hospital



Does cancer research from the West produce the best treatments for Asia?

Most cancer treatment guidelines are built on research from the U.S. and Europe, but according to Dr. Szu-Yuan Wu, these guidelines may not be ideal for Asian populations. During a break between his responsibilities as a physician, researcher, and educator, Dr. Wu spoke with Spotlight about his work.

The hardships faced by patients with esophageal cancer are a strong motivation behind Dr. Wu's research. Treatments often mean a difficult regimen of chemotherapy, radiation, and radical surgery to remove cancerous tumors, along with much of patients' facial structures. "[My patients] can't eat, they can't speak, they lose much of their face... How can I prevent local recurrence?"

Until now, most research used combined populations of patients with both subtypes of esophageal cancer: squamous cell carcinoma and adenocarcinoma. But Dr. Wu felt that genetic differences between research populations might not lead to ideal treatments in Asia, where more than 90% of Chinese and Taiwanese patients suffer from squamous cell carcinoma. "I always found differences between Western and Asian populations. Squamous cell carcinoma is common in Asia, but not in the West,"

He addressed the difference in three studies published in Cancer and Radiation Oncology last year. Taiwanese patients with squamous cell carcinoma did indeed benefit from treatments that differed from existing Western guidelines. For patients with stage 1 or 2 disease, either chemoradiotherapy or surgery alone were effective, while patients with stage 3 and 4 disease benefited from a higher dose of radiation; one that could even be an alternative when surgery is not an option. Dr. Wu thinks genetic differences likely influence other cancers as well. In Taiwanese with head and neck cancer, genetic interactions with betel nut chewing, smoking, and drinking may cause localized tumor recurrence not seen in Western patients. Taiwanese women with left side breast cancer have heart failure rates double that of women in the West, and drinkers with ALDH2 deficiency (a mutation found in a third to a half of Asians) have markedly higher levels of both squamous cell carcinoma and liver cancer.

This has important implications for cancer treatment guidelines in Taiwan, and across Asia. "If we always copy the NCCN (National Comprehensive Cancer Network) or the European guidelines treatment for Asian patients I think it's not reasonable...We should set up our own guidelines, because the disease and genetics are different. We cannot always follow Western guidelines."

Dr. Wu wants to build Taiwan's capacity for research through his position as an educator and research leader at Taipei Medical University. Speaking as a guide to the next generation of cancer researchers he said, "We have the responsibility to improve treatment outcomes for Taiwanese patients... If you want to be a physician-scientist, you can go to our lab where we can give you a good template for cancer epidemiology research. If you are interested in clinical trials, you can join us."

TMU pioneers the "i College" to cultivate a new generation of entrepreneurs



i College (College of Interdisciplinary Studies)

MU's newest college, i College (College of Interdisciplinary Studies) develops biomedical talent by promoting creative thinking and design education. These skills enable students to solve problems, and diverse coursework connects innovation with entrepreneurship to link many disciplines and professions. This college offers a much wider range of choices for students than traditional double majors.

The i College anticipates social and global developments and applies artificial intelligence, big data, programming, entrepreneurship and digital content to build solutions. Each micro-learning course is 3 to 6 weeks, and all TMU students are allowed to take these courses.

"Education is no longer only taught for the present, but for the future," President Chien-Huang Lin said. He added that although medical education is TMU's founding mission, the university must face this era of information overload by pursuing artificial intelligence in all matters. He also said that an interdisciplinary college can help TMU cultivate a broader vision.



3D printing workshop

For example, after a medical student has completed a micro-learning course on artificial intelligence, she is likely to be more helpful in developing "smart hospitals." If respiratory therapy or geriatric care students study AI, perhaps they can use these approaches in providing health services and long-term care. The interdisciplinary college will help TMU students develop humanistic qualities, innovation capabilities and an international outlook.

TMU has renovated offices and opened in April 2018. Various colleges can set up practical courses and workshops to strengthen students' practice and application capabilities; these will include carpentry, 3D printing and Lego robotics workshops.

"Education is no longer only taught for the present, but for the future."



TMU faculty members getting first-hand experience of i College facilities and interactive learning.



TMU Healthcare System joins Taiwan Healthcare Expo

TMU, Wanfang and Shuang Ho hospitals joined TMU Taipei Cancer Center to participate in the first Taiwan Healthcare Expo. This display demonstrated TMU Healthcare System's use of smart technologies and precision medicine.



TMU Healthcare System displays at expo site

TMU Hospital

The medical technology zone represents the evolution of its medical care and promotes the development of precision medical services. The hospital's Smart Intensive Care System was featured in the exhibition area. Patient physiological readings are automatically uploaded, forwarded, integrated, calculated and added to medical records, with information was displayed on a "dashboard" that saves nearly 800 hours of transcription time monthly and improves responsiveness to patient needs.

Wanfang Hospital

In synergy with long-term government development strategies for the medical sector, the hospital promotes integrated community medical and health care. The hospital displayed software and hardware to train hand-eye coordination, and offered interactive cognitive training for the public to experience how the limbs operate after middle age. The training combines with games to improve coordination between the limbs and the brain while allowing stimulating core fitness.



ROSA robot arm display (Credited to $ROSA^{m}$)



Software and hardware to train hand-eye coordination

Shuang Ho Hospital

Based on the university's development of specialized neurological care services, the hospital exhibited ROSA, the first robotic arm designed for spinal and brain surgery in Taiwan. The device is equipped with positioning navigation and 3D image planning to assist surgeons in responding to patient needs more flexibly, safely and accurately. The exhibit also increased public awareness of surgical techniques.

TMU Taipei Cancer Center

Focusing on "precision medicine in cancer treatment," doctors were among the staff who demonstrated the IBM Watson for Oncology system that computes the most promising cancer treatment strategies. Using precise genetic testing methods to scrutinize vast personal data, the Watson system proposes personalized ways for individuals to enhance treatment effectiveness. By adding new technologies for heat treatment and the new proton treatment center, TMU can offer optimal cancer treatment options.

TMU Healthcare System includes the world-class Taipei Medical University and six affiliated hospitals:

- La Taipei Medical University Hospital
- 🐣 TMU Taipei Municipal Wanfang Hospital
- TMU Shuang Ho Hospital
- Regional The Taipei Cancer Center
- Regional TMU LiHuiLi Eastern Hospital
- **2** Taipei Neuroscience Institute

A combined capacity of more than 3000 beds puts TMU Healthcare System among the largest healthcare systems in metropolitan Taipei. We deliver comprehensive and coordinated services by integrating primary and specialty care with research and education.





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