TRADE OFFICE OF SWISS INDUSTRIES (TOSI)
瑞 士 商 務 辦 事 處

Rm. 3101/31F, 333 Keelung Road, Sec. 1
Taipei 11012, Taiwan, R.O.C.
Tel. 886-2-2720 1001 Fax 886-2-2757 6984
e-mail address: tosi@swiss.org.tw
website: www.swiss.org.tw

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Science, Technology and Education News from Taiwan
Number 03— March 2014

Simon Chang, head of the newly formed Ministry of Science and Technology, said his ministry will make good use of Taiwan's financial and human resources and serve as a catalyst for Taiwan's technology development. The ministry's policies will focus on encouraging research and innovation, strengthening the connection between academia and industry, and fostering high-caliber personnel in applied research, Chang said. It will also work to bridge the gap between academia and industry, coordinate between technology and humanity, and promote the application of technology in the cultural and creative industries, he said. As part of its efforts to achieve those goals, Chang told, the ministry will set up two advisory panels on academic research and academia-industry relationship, which will be headed respectively by Academia Sinica President Wong Chi-huey and National Taiwan University professor C.K. Lee. The Ministry of Science and Technology is established on the basis of the former National Science Council. Chang had served as a minister without portfolio and head of Google Asia-Pacific hardware operations before assuming the new position.

A Taiwan physicist is among a US research team that reported the first direct evidence of cosmic inflation. Cosmic inflation is the theory that the universe expanded extremely quickly in the first fraction of a nanosecond after it was born -- the big bang. Kuo Chao-lin is a co-leader of the Background Imaging of Cosmic Extragalactic Polarization 2 in the South Pole. Kuo is scheduled to return to his alma mater, National Taiwan University, as a visiting scholar between April and June.

National Chiao Tung University develops a chip to detect and control seizures: Taiwan has over 200,000 people suffering from epilepsy, about a third of which cannot be treated through medication alone. To help them and others afflicted with this dangerous condition, a research team from National Chiao Tung University has developed a chip that can be implanted in the brain to detect and suppress seizures. The chip is unique for both its success rate and its externally charged power source. This small chip comes encased in titanium and is designed to be permanently implanted into the human skull. The procedure does not require major surgery or medication, and it can allow for the detection and inhibition of epileptic shock within 0.8 seconds. It has a 92 % success rate. Human trials are expected to begin in three years, with success leading to more clinical trials.

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Taipei 11012, Taiwan, R.O.C.
Tel. 886-2-2720 1001 Fax 886-2-2757 6984
e-mail address: tosi@swiss.org.tw
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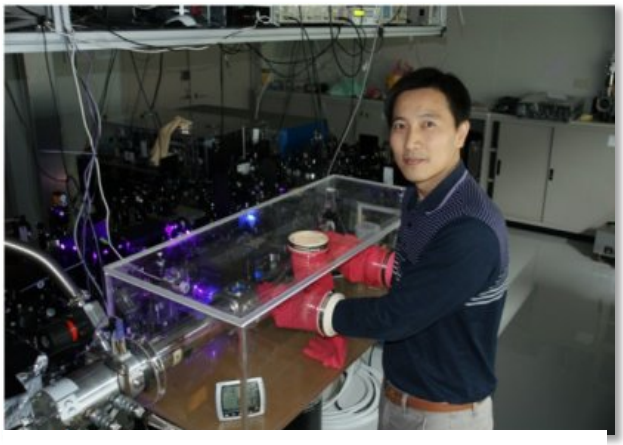
1. US physics journal lauds Taiwan science miracle

(Taiwan Today, 05 03 2014)



NCTU professor Luo Chih-wei, a homegrown scientist, works on ultrafast optical techniques in his laboratory.

"Taiwan's science miracle," an article highlighting the country's research and education, was published in the March issue of Physics Today, the membership journal of the American Institute of Physics. The 1994 return of Taiwan's first Nobel Prize winner, Lee Yuan-tseh, to take over as president of Taipei City-based Academia Sinica is described as a turning point in Taiwan's scientific research development in the article, written by senior editor Toni Feder. Lee said the two main tasks facing him at the time were to get a substantial increase in funding and to attract top talent, and he succeeded at both over the next decade. The ROC government had the same idea, and the science budget increased from 1.6 percent of gross domestic product in 1994 to more than 3 percent in 2013. This effectively quadrupled research funding, as GDP almost doubled to US$470 billion over the period. According to Lee, another focus was to capitalize on the wealth of local talent that had traveled abroad to study and teach. "I put enormous effort into attracting excellent scientists to return to Taiwan." The huge influx of returned scientists has been crucial to making Taiwan an attractive alternative for local students to pursue higher degrees. The number of Taiwan students in the U.S. peaked at 37,581 in the 1993-1994 academic year. That number dropped to 21,867 in 2012-2013 as more scientists opted to stay home where education and research have matured over the past two decades. The article highlights Luo Chih-wei, a specialist in ultrafast optical techniques at Hsinchu City-based National Chiao Tung University's Department of Electrophysics, as a prime example of the quality of this new breed of homegrown talent, quoting a string of innovative projects that Luo and his team are involved in. Luo graduated from NCTU in 1998 and received his doctorate there in 2006. "The advantages of staying are not having to put in the time, effort and money to apply to study abroad; the lower prices in Taiwan; and tighter ties to the local physics community," Luo said. International networking opportunities that would be afforded by a few years overseas are to some extent made up for by the Internet, and the government and scientific advisers are also working hard to boost global links, Luo added.

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2. Taiwan gets advanced health care leg up

(Taiwan Today, 12 03 2014)

An integrated magnetic resonance imaging and positron emission tomography scanner (MR-PET), as well as Taiwan's first proton therapy center, are set to commence operations in northern Taiwan in the first half of 2014. The MR-PET center was inaugurated March 11 by National Taiwan University Hospital in Taipei City. Free of the interference between MRI and PET subsystems plaguing older models, the new unit has the added benefit of reducing radiation doses by two-thirds, according to NTUH. The facility is expected to make substantial contributions to diagnosis and treatment in clinical oncology. Also benefitting from the MR-PET scanner is clinical practice in neurodegenerative and cardiovascular diseases, NTUH added. In addition, Chang Gung Memorial Hospital in Linkou District, New Taipei City, invested NT$4.5 billion (US$148.5 million) in Taiwan's first proton therapy center. Pilot sessions are scheduled to start in April, with the official launch set for October, according to CGMH's Department of Radiation Oncology. It is estimated that the new facility in Linkou will be able to treat around 1,500 cancer patients each year, Department Director Dr. Hong Ji-hong said. CGMH also revealed plans to invest NT$5.5 billion in setting up a southern Taiwan proton therapy center in Kaohsiung City, with operations commencing October 2018.

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3. Local team sheds light on colorectal cancer treatments

(Taipei Times, 17 03 2014)

New findings by a team of researchers from National Yang Ming University and Taipei Veterans General Hospital have shed light on drug resistance in colorectal cancer. Colorectal cancer is the most common type of the disease in the nation, with an average of more than 13,000 people diagnosed with that form of cancer every year. The condition is also the third-leading cause of cancer-related death in the nation, claiming more than 4,000 lives a year. Patients with stage IV colorectal cancer are treated with targeted therapies, of which epidermal growth factor

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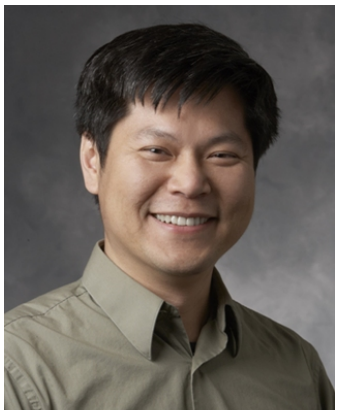
receptor (EGFR)-targeting therapy is the main strategy. Responsiveness to the therapy is assessed by screening for a mutated KRAS gene, the presence of which is indicative of resistance to anti-EGFR therapy since it is estimated that more than half of all colorectal cancers manifest in patients whose KRAS gene contains no mutation. However, about 30 to 40 percent of those who test negative for KRAS mutations and receive EGFR-targeting therapy still go on to develop resistance to the drugs, the research team said. The researchers said that past studies have shown that malignant colorectal cancer stem cells can exacerbate cancerous tumor growth. In their research, the team discovered that it is the transcription factor "Snail" in colorectal cancer stem cells, which regulates miroRNA-146a, that directs the tumor-growth-promoting symmetrical cell division of the stem cells. This in turn leads to metastasis and resistance to EGFR inhibitors, the team said. "If we can repress [the activity of] microRNA-146, the cancer can also be repressed," said Wang Hsei-wei, a professor of microbiology and immunology at National Yang Ming University and a co-author of the study. "Detecting microRNA can also help determine how serious the cancer and drug resistance afflicting a patient are," Wang said. The study's results were published in leading scientific journal Nature Cell Biology this month.

http://www.taipeitimes.com/News/taiwan/archives/2014/03/17/2003585860

4. ROC researcher helps find evidence for Big Bang

(United Daily News, 19 03 2014)



Taiwan researcher Kuo Chao-lin of Stanford University, California, is a key member of a team that recently discovered gravitational waves. (Courtesy of Stanford University)

Taiwan researcher Kuo Chao-lin played a crucial role in designing the main instrument recently used to detect gravitational waves, a discovery that confirms the Big Bang theory and makes the research team a strong candidate for the Nobel Prize.Kuo, a graduate of Taipei City-based National Taiwan University's Department of Physics and assistant professor at Stanford University in California, designed the Background Imaging of Cosmic Extragalactic Polarisation detector fitted to an astronomical telescope in Antarctica. Kuo is a co-leader of the Stanford team, which used the device during a nine-year project to find direct evidence of the waves. "This has been like looking for a needle in a haystack, but instead we found a crowbar," BICEP2 co-leader Clem Pryke of the University of Minnesota said at a media conference March 17.The team chose Antarctica as the location for the hunt for evidence of the Big Bang, as they were looking at the polarization of faint cosmic microwave background. As well as sensitive instruments designed by Kuo, they also needed very clean and dry air, because even water vapor in the atmosphere would be enough to mask the effects. "The universe has been expanding for almost 14 billion years. The gravitational waves formed at its inception are so faint they are hardly even measurable," Taichung City-based National Museum of Natural Science Director-General Sun Wei-hsin said. According to experts, the findings are the most important discovery since it was suggested that the universe is rapidly expanding, and of similar importance to the 1998 confirmation of the existence of dark energy, which netted its research team the 2011 Nobel Prize for Physics. The BICEP2 team said it looked for a special type of polarization, called B-modes, in the cosmic microwave background. Gravitational waves, which can have left- and right-handed polarizations just like light, squeeze space as they move, producing a distinct pattern. According to Kuo, the swirly B-mode pattern that was found is a unique signature of gravitational waves. "The Big Bang took 10 to the power of minus 35 of a second to happen," NTU physics professor Chen Pisin said. "In less than a second the universe went from the size of an atom to that of the solar system."

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5. NCKU makes rocket launch breakthrough

(Taiwan Today, 26 03 2014)

An interdisciplinary team from Taiwan's National Cheng Kung University successfully launched two small rockets at a testing ground near Tainan City in the south of the country, scoring breakthroughs in GPS technology and multistage rocket decoupling, NCKU announced March 25. The team, led by professor Juang Jyh-ching of Tainan City-based NCKU's Department of Electrical Engineering and supported by the rocket and satellite program of the ROC Ministry of Science and Technology, launched and recovered two small hybrid rockets March 20 at Shalun Farm in the city. Following the success, the team said it will attempt to launch a 1,000-kilogram rocket to a height of 30 kilometers in May. Many countries are currently researching hybrid rockets because of their low cost, greater safety and environmental friendliness, NCKU said. The university's Aerospace Science and Technology Research Center and Department of Aeronautics and Astronautics have already had notable successes in developing this

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field. GPS systems are a critical component for accurately targeted rocket launch. Rockets are subject to extreme G-force as they accelerate, and GPS receivers commercially available in the market cannot be used on the rockets. The team used a high dynamic GPS receiver it developed that can withstand G-forces of more than 10 G's and properly track Doppler frequency shift during the launch. Stage decoupling is a crucial process for any multistage rocket, with extremely reliable mechanisms a prerequisite, as later stages can only fire once expended fuel tanks have been jettisoned. The NCKU team successfully employed a V-shaped release mechanism. According to Juang, successful recovery of the rockets enables a full record of flight details to be retrieved. A high-altitude balloon was also released before the launch to obtain prevailing atmospheric temperature and wind conditions for use in subsequent analysis of the launch. More than 50 people participated in the launches.

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6. Taiwan cancer drug gets OK for US clinical trials

(Taiwan Today, 26 03 2014)

A Taiwan-developed anti-cancer drug was recently greenlighted by the U.S. Food and Drug Administration for phase one human clinical trials, according to the ROC Ministry of Science and Technology March 25. MPT0E028, a potent histone deacetylase inhibitor, has shown promising results in treatment of cancer as demonstrated in Taiwan tests involving 60 different human tumor cell lines. The drug was developed by researchers from National Taiwan University College of Medicine and Taipei Medical University, with funding from the MOST and Formosa Pharmaceuticals under the National Research Program for Biopharmaceuticals. According to the researchers, MPT0E028 is especially effective in suppressing tumor growth in the treatment of colorectal, hepatic, lung and pancreatic cancers, as well as leukemia and lymphoma, with animal test subjects exhibiting no significant side effects. The drug is set to assist global efforts in combating cancer by furthering the development of targeted cancer therapies, which have gradually replaced the traditional chemotherapy, the researchers added. TMU's Liou Jing-ping, a leader of the research team, said the drug is being reviewed by the Food and Drug Administration under the ROC Ministry of Health and Welfare. It is expected that phase one of clinical trials will kick off in Taiwan in the second half of the year, he added. The first homegrown anti-cancer drug developed by Taiwan's tertiary institutions to win FDA approval for clinical trials in humans, MPT0E028 holds patents in Taiwan and has approvals pending in 19 countries and territories, including Australia, the EU, New Zealand and Russia. MPT0E028's Taiwan test results were published in prestigious international medical journals such as Cell Death and Disease and Clinical Cancer Research, respectively, in late 2013 and earlier this year. MOHW data shows that cancer is Taiwan's No. 1 cause of death since 1982, and according to the World Health Organization, the number of people with cancers worldwide is expected to increase 57% over the next two decades.

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7. NTU announces important advance in cancer research

(China Post, 27 03 2014)

National Taiwan University (NTU) announced that it has successfully developed an in vitro cultivation method to create stem cells in lung cancer cases that can help increase the survival rates for cancer patients. The university held a press conference to announce that the school's research team led by NTU President Yang Pan-chyr successfully used the paracrine agent to cultivate stem cells in lung cancer tumors in vitro. According to NTU, the results of the research were published in Nature Communications, an internationally renowned Internet magazine. Yang, who has been studying lung cancer for some time, said that there are a lot of stem cells inside a human body, which can make people younger. However, Yang said, the stem cells of cancer cells makes tumors continue to grow so they cannot be removed easily. "Even if the cancer patients receive chemical treatments to minimize the amount of stem cells of the cancer, they will continue to grow back after a while," said Yang. "And that is the key reason why cancer recurs and is the hardest part of cancer treatment." Yang said that the team spent six years and finally discovered that the carcinoma-associated fibroblasts (CAF) can use paracrine agents to stimulate cancer cells to grow. Chen Wan-chun, of the NTU research team, said that in order to better research the cancer stem cells, the team created an in vitro cultivation method that allowed the cancer's stem cells to grow in an environment that is similar to a human body. "Through observing the message transporting path between stem cells and other cells, the team can develop a way to cut off the message-transporting path that can be applied on the research to create medicine to treat cancers," said Chen. "Even though this research targeted the cells of lung cancer, the basic idea of the research can also be applied on the treatments of other cancers," said Chen. According to Chen, there is not much research on lung cancer, so there were not sufficient amounts of medicines invented to treat lung cancer. NTU said that this new breakthrough in lung cancer research can be applied to clinical trials that can benefit the development of medicines and raise the survival rates of cancer patients.

http://www.chinapost.com.tw/taiwan/national/national-news/2014/03/27/403778/NTU-announces.htm

Rm. 3101/31F, 333 Keelung Road, Sec. 1
Taipei 11012, Taiwan, R.O.C.
Tel. 886-2-2720 1001 Fax 886-2-2757 6984
e-mail address: tosi@swiss.org.tw
website: www.swiss.org.tw

8. Taiwan's new battery applications attract interests

(Central News Agency, 28 03 2014)

Some new lithium-ion (Li-ion) battery applications developed by Taiwan's largest high-tech research and development institute have attracted interest at the world's largest battery exhibition in Japan, according to the institute. The Industrial Technology Research Institute (ITRI) said in a statement Thursday that it debuted a heavy-duty motorcycle battery, emergency backup power supplies and motor power batteries, based on its self-terminated oligomers with hyper-branched architecture (STOBA) battery technology, at the ongoing 5th International Rechargeable Battery Expo. STOBA is a material technology developed by ITRI and is used to enhance battery safety. The technology won the R&D 100 Award in Energy Devices in 2009.

http://focustaiwan.tw/news/ast/201402280004.aspx

9. TTRI unveils 3-D printing technology for shoes

(China Times, 31 03 2014)

Revolutionary 3-D fiber printing technology used in the production of shoes was unveiled by Taiwan Textile Research Institute March 28 in Taipei City, underscoring the strong development of Taiwan's footwear sector. It is expected that the technology will enable Taiwan to begin mass production of 3-D shoes in 18 months, with clothing applications set for launch in 2017, according to New Taipei City-based TTRI. The technology, which is already used by two leading international sports shoe brands, reduces labor costs by streamlining design, cutting and affixing processes, the institute said, adding that a pair of trainers can be produced within two minutes using the new procedure. In addition, since the 3-D printer requires non-woven instead of regular fabrics, manufacturers can save 33 percent in material costs. Non-woven fabrics are antibacterial, breathable, eco-friendly, recyclable and waterproof, according to TTRI. If 3-D printed shoes retail at similar prices as other runners on the market, shoe companies can expect profit margins of at least 30 percent, the institute said. The 3-D printing technology is patented in the EU, Taiwan and mainland China, TTRI said, adding that efforts are underway to apply for patents in Japan and the U.S. According to the institute, other applications for the technology include the commonly available N95 face masks and interior design for insulation against heat and sound.

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10. NCKU successfully launches small rocket

(China Times, 31 03 2014)

A National Cheng Kung University (NCKU) research team, led by Jyh-Ching Juang from the Department of Electrical Engineering, successfully launched two small-scale hybrid sounding rockets at Shalun Farm, Tainan, the university revealed. The NCKU team responsible for executing the National Science Council (NSC) project titled "Development of the Earth's Upper Atmosphere Measurement Rocket, Satellite and Instrumentation System," accomplished technical breakthroughs with the rocket launch. The team, comprising professors, technicians and students from multiple departments, is led by Juang who also revealed plans to launch a rocket weighing 1,000 kilograms over an altitude of 30 kilometers.He also said that hybrid rockets have become a subject of development in many countries due to their low cost, high level of safety and environmental friendliness. In these two launches, the first rocket was used to verify and validate the performance of a self-developed GPS receiver to withstand the high altitudes and speed associated with rocket flight. "The second launch, on the other hand, was designed to verify the performance of an innovative piston-driven separation device with the aim that the separation is conducted precisely and reliably," Juang revealed.

http://www.chinapost.com.tw/taiwan/national/national-news/2014/03/30/404012/NCKU-successfully.htm

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11. Scientists Uncover how a Viral DNA Polymerase Breaks the Golden Watson-Crick Rule

(Press of Academia Sinica, 31 03 2014)

Replication of DNA occurs in all living organisms and forms the basis of biological inheritance. Replication of DNA famously occurs through the pairing of the nucleic acid (base) building blocks of DNA in a specific pattern, (guanine pairs with cytosine and adenine pairs with thymine). This rule of base pairing is named Watson-Crick base pairing. The synthesis of new strands of DNA is facilitated by enzymes called DNA polymerases. For many years scientists have been fascinated by the fidelity of the DNA polymerase reaction – the way in which the pairing rule is invariably followed. Over the last 10 years, however, polymerases have been discovered that do not follow the Watson-Crick rule of base pairing, and exactly how these enzymes function remains a great wonder to scientists. Recently, a research team led by the director of the Institute of Biological Chemistry, Academician Ming-Daw Tsai has demonstrated the mechanism by which a certain DNA polymerase overcomes Watson-Crick pairing, a discovery of fundamental importance in the understanding of life processes. The research was published in the top chemistry journal, Journal of American Chemical Society (JACS), on March 11, 2014. Academician Ming-Daw Tsai and his team studied a DNA polymerase from African Swine Fever Virus named Pol X. Pol X is unusual because it can get guanine (G) to pair with itself, as well as being able to follow conventional Watson-Crick base pairing. A DNA polymerase reaction (catalysis) is conventionally considered to proceed first through the binding of the enzyme to DNA, and then the binding of MgdNTP (deoxynucleotide triphosphates, the building blocks for the newly synthesized DNA strands complexed with magnesium). The team found, however, that Pol X is able to bind MgdNTP in the absence of DNA. "Kinetic studies suggested that Pol X does not follow the established mechanistic paradigm that DNA polymerases bind DNA before binding to a nucleotide" Tsai explained. The research team studied the enzyme in solution by nuclear magnetic resonance (NMR) spectroscopy to determine structures of Pol X in the free, binary (Pol X:MgdGTP), and ternary (Pol X:DNA:MgdGTP with dG:dGTP non-Watson-Crick pairing) forms. The results demonstrate the first solution structural view of DNA polymerase catalysis and a novel mechanism for non-Watson-Crick incorporation by a low-fidelity DNA polymerase.

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