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Science, Technology and Education News from Taiwan
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News Highlights:
A research team of the National Taiwan Ocean University (NTOU) found an identifiable marker gene that can help distinguish germ cells and somatic cells in coral bodies and it succeeded in developing an antibody and a method to ascertain the early germ cells and the specific location of coral development during both the breeding season and the non-breeding season – Researchers at the National Cheng Kung University developed microalgae biomass energy technology and other application of health food and skin care products – A radiation oncologist developed a high-precision robotic image-guided therapy system called Arc-Knife for cancer treatment – Corning Taiwan will co-develop roll-to-roll processing of ultra-slim flexible glass together with the Industrial Technology Research Institute (ITRI) – Taiwan and Canada signed a memorandum of understanding on technological cooperation – Taiwan and Canada began developing preventive vaccines against hospital-acquired infections – A medical team made a breakthrough in identifying a gene that causes a degenerative disorder of the nervous system – Applied Materials will focus on cooperation projects with four universities and ITRI – Five members of Academia Sinica have been elected to the Italy-headquartered Academy of Sciences for the Developing World – A research team made a breakthrough in carbon dioxide (CO2) capture biotechnology by up to 50 % - Local researchers made progress in reaching a new treatment for frontotemporal dementia – A research team at Academia Sinica uncovered a key molecular player in hepatitis C virus replication – a research team of the National Cheng Kung University (NCKU) published findings on the Higgs transition of north and south poles of electron spins in a magnet.

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1. NTOU Identified Germ Cells and Somatic Cells in Coral Bodies for the First Time in the World

(Central News Agency, 03 09 2012)

In an NSC press conference on August 29, National Taiwan Ocean University (NTOU) presented the findings of a research team led by the university's president Ching-Fong Chang on coral development and reproduction. The research result contributed by the team took the lead in the world unveiling the mechanism of sexual reproduction of scleractinian coral, the understanding of which has opened a heavy door to factitious establishment of coral populations. First of all, the team for the first time in the world found an identifiable marker gene that can help distinguish germ cells and somatic cells in coral bodies, following which, moreover, the team succeeded in developing an antibody and a method to ascertain the early germ cells and the specific location of coral development during both of the breeding season and the non-breeding season. The findings yield better understanding about the cell development of coral bodies, and the research report has been published in the July 27 issue of *PLoS One*. The so-called rain forest of the ocean, coral reefs are underwater structures made from calcium carbonate secreted by corals and consist of many polyps that cluster in groups. In response to the decreasing coral coverage, Taiwan tried to restore the corals for a few decades. The main means of restoration are inefficient clonal fragmentation and annual sexual reproduction. As the result of evolution, coral bodies have no distinct organs and the somatic cells and the germ cells are intermingled together, so we can not obtain the information about the germ cells and their distribution in coral bodies by separating it from somatic cells via traditional histological analysis. According to Ching-Fong Chang, vasa gene, which determines germ cells, is widely used as marker gene for germ cells in both vertebrates and invertebrates, which means as long as the vasa gene can be identified, the location of the germ cells can be ascertained. The research team first collected the information about the germ cells in coral bodies by means of biopsy and immunohistochemistry. Then the team succeeded in selecting and colonizing the vasa gene of coral germ cells, producing an antibody, and locating the specific venue of germ cells' development. This was a significant breakthrough in the studies of corals, which do not have sexual organs. Besides, the team also found for the first time that the early germ cells exist in the whole reproduction cycle and they continue the reproduction in turn once they are stimulated by certain signals. Ching-fong Chang said, this discovery is not easy, for corals do not have sex organs. He continued, the findings bring forth much understanding about the reproduction mechanism of corals and they points out several promising directions and possible methods to activate the development of coral germ cells. Chang said, in the future the team will try to specify the factors or hormones relating to the development of coral germ cells. The goal is to develop methods for artificial coral propagation. If the development hormones are identified, the methods to accelerate the development of coral germ cells or to promote the emission of sperms and ova may be developed. This will largely benefit the restoration of coral reefs. Related Website:
http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0041569
http://web1.nsc.gov.tw/techwp.aspx?id=1010829002&ctunit=208&ctnode=287&mp=7

2. NCKU Researchers Develop Novel Application of Microalgae

(NCKU News, 03 09 2012)

Researchers at National Cheng Kung University (NCKU), southern Taiwan, have developed microalgae biomass energy technology and other application of health food and skin care products recently. A team, led by distinguished Professor Chia-hsiu Chang at NCKU Department of Chemical Engineering, has collaborated with China Steel Company to establish a pilot system for microalgae cultivation from flue gas and also to develop platform technology for microalgae biodiesel production using the microalgae yielded from consuming the flue gas CO_2. What makes the study so prominent is that the team has cultivated microalgae using heat extracted from chimneys at China Steel Company. Microalgae grown in this method can endure high temperatures, according to Prof. Chang's research team which has developed a technology that allows for wet processing of microalgae into bio-fuels, which helps save drying costs. Prof. Chang said that microalgae are the best working platform for CO_2 reduction and reutilization. According to Wen-Teng Wu, Chair Professor of Chemical Engineering and Director of NCKU Research Center for Energy Technology and Strategy, the cultivation of microalgae can help dealing with the problems of the greenhouse effect and meet the urgent need of alternative energy. Taiwan's rich microalgae resources give it a great advantage in developing a microalgae industry, said Chang adding that the industry can be very helpful in reducing carbon levels because algae captures carbon dioxide during photosynthesis. Every 1 gram of microalgae grown by the team, for example, can consume 2 grams of carbon dioxide, he said. Chang said that microalgae biomass contains a variety of valuable components, such as oils, carbohydrates, proteins and pigments which can not only be converted to biofuels but be used in the development of high value products, such as DHA/EPA, healthy foods, and feeds of animals and aquatics. Aside from the above mentioned applications, microalgae cosmetic is another promising line of products, according to the team, adding that microalgae extract can promote cell restoration and cohesion, making it a perfect ingredient for skin care products.

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3. Taiwan doctor develops Arc-Knife for cancer treatment

(Central News Agency, 04 09 2012)

A New York-based Taiwanese radiation oncologist said he has developed a high-precision robotic image-guided therapy system called Arc-Knife, which offers the best and most cost effective cancer treatment. K.S. Clifford Chao, chairman of the Combined Program in Radiation Oncology at New York's Presbyterian Hospital, said the therapy system can map the exact location of a tumor and accurately direct radiation toward malignant cells without damaging surrounding healthy tissue. After five years of painstaking development, Arc-Knife's breakthrough technology is now mature enough for mass production, Chao said. The technology has already drawn interest from foreign investors, but Chao said he wishes to bring the system to Taiwan to contribute to the country's biotechnology sector. Traditional radiation therapy uses X-ray beams that go through the cancerous tissue, destroying both healthy and cancerous areas along the path of the beam, he said. In order to block the radioactive beams, thick walls are built around the therapy equipment, which takes up a huge chunk of space in a hospital, Chao added. As for the more advanced proton therapy, it enables targeted radiation beams that kill the cancerous tissues while avoiding hurting healthy tissues, he said. But from the hospital end, this therapy costs at least US$30 million just to introduce one proton device to a hospital in New York, which is not affordable for most general hospitals, he added. In contrast, Arc-Knife enables both targeted radiation beams and costs 1.6 percent and 2.5 percent of the cost of traditional radiation therapy and proton therapy devices, respectively, Chao said. It is cheaper because "beam stoppers" are inserted in Arc-Knife equipment, which drastically reduce the thickness of the concrete shield walls, from 150 centimeters in other devices to 25 cm, he said. That means the equipment no longer needs to be placed in a bunker-like room, making the technology easily adoptable in most hospitals without having to remodel their existing facilities, which drives down costs dramatically, Chao said. In addition, Arc-Knife is more compact in size. It is about 2.5 meters high, compared to traditional radiation therapy equipment that are up to 5 meters high, he said. Chao, who has nearly 30 years of experience in oncology care, received his medical degree from Kaohsiung Medical School in Taiwan. He is also a director and professor at the prestigious Weill Cornell Medical College and Columbia University Medical Center.

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4. Coring Taiwan, ITRI Co-develop Roll-to-roll Processing for Ultra-slim Flexible Glass

(Central News Agency, 05 09 2012)

Corning Display Technologies Co. (Corning Taiwan), a Taiwanese subsidiary of the world's leading supplier of glass substrates, announced recently that it would co-develop roll-to-roll processing of ultra-slim flexible glass--representing the advent of the next-generation display industry—together with the Industrial Technology Research Institute (ITRI). Corning Taiwan showed off its latest display-related products, such as large-sized Corning Willow Glass, Corning Gorilla Glass 2, Eagle XG Slim, and Corning Lotus Glass, at the 2012 Touch Taiwan Exhibition. Corning Willow Glass was the most eye-catching of all the displays. This new 50-200 micrometer (μm) glass can, so far, be produced in a roll with a width of one meter and a length 300 meters. The thinness, strength, and flexibility of the glass make well-wrapped displays possible, and the glass can be processed at temperatures as high as 450° C—much too high for polymer films. This high-temperature processing capability is essential for high-end displays. This new glass was developed with the requirements of continuous high-temperature roll-to-roll processing techniques for the printing industry in mind. It can be applied to such uses as solar devices, electronic paper (ePaper), color filters, organic light-emitting diode (OLED) lighting, large-scale sensors, and display backplanes. Y. R. Chan, chairman of ITRI's Electronics and Optoelectronics Technologies Laboratories, reports that ITRI has cooperated with Corning Taiwan in the joint development of this new glass from the very beginning, carrying out research related to the related equipment and the applications of roll-to-roll processing.

http://cens.com/cens/html/en/news/news_inner_41310.html

5. Taiwan, Canada sign technological cooperation deal

(Central News Agency, 06 09 2012)

Taiwan and Canada signed a memorandum of understanding on technological cooperation to mark 15 years of partnership between them in that area. Liu Chih-kung, Taiwan's representative to Canada, said the agreement represents a new milestone that will strengthen the ties between the two sides. Over the years, the partnership between the two countries has been growing steadily, with various cooperation projects launched in fields such as biological optics, nanotechnology and bioproducts, he noted. He expressed the hope that the cooperation will move toward more advanced technology to help promote economic prosperity in both countries.

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6. Taiwan, Canada to jointly develop vaccines

(Central News Agency, 06 09 2012)

Taiwan and Canada officially began a project aimed at developing preventive vaccines against hospital-acquired infections, Science Minister Cyrus Chu announced Thursday during a visit to Toronto. Under the project, researchers are being asked to develop new vaccines within three years and to start the trial stage on new drugs in the fifth year of the program, said Chu, who heads Taiwan's National Science Council. Chu made the announcement along with John R. McDougall, president of the National Research Council of Canada, and Sean Wang, president of ITRI International Inc., a subsidiary of the Taiwan-based Industrial Technology Research Institute (ITRI). He said hospital-acquired infections, which refer to infections not present and without evidence of incubation at the time of admission to a health care setting, are a big challenge to both Taiwan and Canada. Several hundred thousand patients are infected at hospitals in Taiwan each year, Chu said, prolonging the time patients need to stay in hospitals and increasing patients' risk of death. In Canada, hospital-acquired infections cost its medical system 9.6 billion Canadian dollars (US$9.8 billion) in 2011 alone, according to the Canadian research institute. The development of new vaccines will be the most effective way to prevent and control such infections, Chu said.

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7. Taiwanese team finds gene responsible for cerebellar atrophy type 22

(Central News Agency, 12 09 2012)

A Taiwanese medical team said it has made a breakthrough in identifying a gene that causes a degenerative disorder of the nervous system. The findings could lead to new medical treatments for the genetic disease, known as cerebellar atrophy type 22, the team of researchers from Taipei Veterans General Hospital and National Yang-Ming University said at a press conference. "We're happy to make the discovery" of a gene that causes that particular type of cerebellar atrophy, hospital doctor Soong Bing-wen said. The team is now conducting further research on cells and animals with the aim of finding a medical cure for the disease, he said. Cerebellar atrophy usually causes unsteadiness and lack of coordination in the movements of patients. Walking usually becomes difficult as the disease progresses. One of the people involved in the study by the Taiwanese researchers is an 82-year-old man who began having trouble walking at the age of 45. He also began losing his ability to speak clearly and would often choke on his drinks. About 10 of his relatives also have balance problems and have gradually developed other symptoms related to the disease. They had consulted many doctors but could not find the cause of the problem. After he sought medical attention at Taipei Veterans General Hospital about a decade ago, the man said his condition was brought under control. At present, Soong said, there are more than 40 known types of cerebellar atrophy. However, in more than 30 percent of the cases, the cause of the disease cannot been identified. The incidence of cerebellar atrophy worldwide is five to 10 people out of every 100,000, he added. The findings of the Taiwanese researchers were published in the Annals of Neurology journal July 23.

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http://www.taipeitimes.com/News/taiwan/archives/2012/09/14/2003542735

8. Taiwanese, Australian teams make breakthrough in nano storage research

(Central News Agency, 18 09 2012)

A new type of nanotechnology developed by research teams at National Chiao Tung University (NCTU) in Taiwan and Swinburne University of Technology (SUT) in Australia will make it possible to at least double data storage density, NCTU said. The new technology has improved data storage density from 1.1 terabits (Tb) per cubic centimeter to 2.75, which can allow a Blu-ray dual-layer DVD-ROM to write in 80 times its original storage capacity, said Allen Lan, who holds a doctoral degree at NCTU, at a press briefing. A DVD-ROM using the new technology will be able to store 4 terabytes (TB) of data, said Lan, who went to Australia in 2011 and worked with a team led by professor Gu Min, director of SUT's Centre for Micro-Photonics. One TB is equal to 1 trillion bytes, or 1,000 gigabytes (GB). A 50 GB Blu-ray DVD can store an eight-hour full HD movie or some 10,000 MP3-encoded songs. The research project represents a breakthrough in the development of three-dimensional polarization engineering in nano-optics, said Tien Chung-hao, an associate professor of photonics who supervised Lan during the project. In addition to optical storage, Tien said he hopes to apply the concept to producing semiconductors and imaging molecules in 3D. The results of the study were published on the website of the international scientific journal "Nature Communications" on Aug. 14.

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9. U.S. chip maker signs deal with Taiwan universities, research body

(Central News Agency, 20 09 2012)

U.S. chip equipment manufacturer Applied Materials Inc. signed a memorandum of understanding (MOU) with four universities and a state-funded research institute in Taiwan with the aim of focusing on cooperation projects and providing hundreds of internship opportunities abroad. The company signed the MOU with National Taiwan University, National Chiao Tung University, National Tsing Hua University, National Cheng Kung University and the Industrial Technology Research Institute (ITRI), Taiwan's top industrial research body. The MOU covers exchange of personnel, information and equipment, co-hosted seminars, research cooperation projects, as well as internship programs. Beginning next year, the company will provide hundreds of internship opportunities abroad for students from the four universities, according to Applied Materials. Interns who excel will have the opportunity to be directly recruited after graduation to join a rotational training program where they will be transferred to different departments every three months during their first year on the job to fast track their career prospects, the company said. Taiwanese universities and research institutes are pioneers in the global high-tech industry, which was the major reason Applied Materials signed the MOU, said Mike Splinter, the company's chairman and CEO. The company will provide research funding and share lab and research resources available at Maydan Technology Center in Santa Clara, California, with the universities and ITRI, Splinter said. NTU President Lee Si-chen said Applied Materials is one of the most upstream companies in the semiconductor supply chain and a leader in the manufacturing process. The cooperation will help support co-op efforts between schools and industries, he added.

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10. Academia Sinica scholars elected to scientific organization

(Central News Agency, 21 09 2012)

Five members of Academia Sinica, Taiwan's top academic research institute, have been elected to the Italy-headquartered Academy of Sciences for the Developing World (TWAS), the institute said. In addition, Chang Tzu-ching, an assistant research fellow at the Academia Sinica Institute of Astronomy and Astrophysics, was elected a 2012 TWAS Young Affiliate, an honor awarded annually to exceptional scientists under the age of 40, the institute said. Chang is known for her success in developing new techniques to draw the observable universe, which consists of the galaxies and other matter that humans can in principle observe from Earth in the present day. Four of the five academicians were elected TWAS fellows: Wang Kuan, director of the Academia Sinica Institute of Chemistry; Wang Lu-hai, acting president and distinguished investigator of the National Health Research Institutes' Division of Molecular and Genomic Medicine; Liang Kung-yee, president of National Yang-Ming University; and Chu Shih-i, director of the Kansas Center for Advanced Scientific Computing. Hu Chenming, a professor of electrical engineering and computer science at the University of California at Berkeley, was elected an associate fellow of TWAS, an international scientific organization made of more than 1,000 members from 90 countries. The main mission of the TWAS is to promote scientific excellence and capacity in developing countries for science-based sustainable development. The new members were elected at the TWAS 2012 general meeting, which took place in Tianjin, China Sept. 17-21. Apart from the Academia Sinica members, Hsu Hung-kun, a professor in applied mathematics at National Sun Yat-sen University, was also elected a TWAS fellow, while Chiang Ann-shyn, a professor at National Tsing Hua University, was awarded the TWAS prize in biology, the Academia Sinica said.

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11. FEATURE: Breakthrough reached in CO2 capture biotechnology

(Central News Agency, 22 09 2012)

A Taiwanese research team has reported a breakthrough in carbon dioxide (CO2) capture biotechnology that it hopes to contribute to the reduction of greenhouse gas emissions in an efficient and environmentally friendly way. The research team, led by Chuan-Hsiung Chang, an associate professor at National Yang Ming University's Center for Systems and Synthetic Biology, said the new process developed by the team has enhanced the ability of microalgae to capture carbon dioxide by up to 50 percent. "We've set the goal of doubling the efficiency of the CO2 capture by the end of this year and tripling it next year," Chang said. As concern over global warming has risen, scientists have studied different ways to capture carbon dioxide emitted into the air and store it. Chang said carbon capture technologies generally fall into three main categories -- chemical and physical processes (which concentrate CO2 through combustion under a high pressure and temperature) and biological processes. The first two processes, Chang said, are costly (mostly due to their high consumption of energy and large volume of chemicals required) and face severe storage and leakage challenges. The biotechnology developed by the university, on the other hand, not only reduces carbon dioxide emissions, but turns the carbon fixed in the process into biomass (such as carbohydrates) through photosynthesis. The biomass can then be converted into biofuel or other high-value materials. "It is an eco-friendly biotechnology that does not harm the environment and can re-utilize the captured CO2 through

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natural processes like photosynthesis," he said. Chang said other research teams have studied biological methods to capture CO2 but have faced obstacles because of relying on traditional metabolic engineering approaches rather than his team's genome engineering process. "Our team is the first to achieve such a high rate of CO2 capture efficiency using a biological approach," Chang said. He explained that microalgae, in their living environment, only absorb the carbon dioxide they need to survive, but his team has been able to enhance their carbon capture ability by 50 percent through genome analysis, design and engineering. That was made possible in 2008 when his team developed a genome analysis platform that enabled scientists to get a complete picture of how genes of microorganisms function and are regulated. In the process developed by Chang and his team, microalgae grow in water that has a high concentration of dissolved CO2, which then is transported into microalgal cells through controlled gene regulation. Through photosynthesis, the CO2 (and water) absorbed by the algae is transformed into carbohydrates, which can then be converted into valuable products, such as small molecule drugs, chemical compounds, and biofuels. "In this way, we help reduce greenhouse gas emissions and turn them into renewable biofuels," said Chang, who published the results of the study in the August issue of "Energy & Environmental Science," a leading journal in the field of energy research. The new biotechnology has been applied in the factory of Chung Hwa Pulp Corp in Hualien since earlier this year, with the company's gas emissions collected and then diverted to photobioreactors, where the microalgae consume the carbon dioxide. At present, the scale of the approach's carbon dioxide capture is limited, with an initial target of between 3,000 tons and 10,000 tons per year, because the process is still in the developmental stage. Chang said the team needs to learn more about the different kinds of microalgae and gene manipulation needed to take on each specific job. Microalgae that might be effective at the pulp plant, for example, might be less effective in digesting the carbon dioxide at a petrochemical plant because of the different mixtures of emissions produced. The team is also studying a wide range of microalgae to see which absorb the most carbon dioxide to begin with. It has already tested several freshwater and marine microalgal species and is now focusing on algae strains found in salt water and high-temperature water (such as hot springs). More than 20 companies and research institutions at home and abroad have expressed keen interest in this new genome-based biotechnology and have contacted the team for possible licensing, funded-development, partnerships, or other arrangements.

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12. New treatment being researched for dementia

(Central News Agency, 26 09 2012)

Local researchers said that they have been researching a new treatment for frontotemporal dementia that involves the use of an antibiotic that is normally used for treating cancer. By using rapamycin, an antifungal antibiotic, on mice with early-stage frontotemporal dementia, researchers were able to rescue the mice's learning and memory functions, as well as slow down their loss of motor function. Even when using the drug in later stages of the disease, motor function was significantly improved, said Tsai Kuen-Jer, an assistant professor at the Institute of Clinical Medicine at National Cheng Kung University, one of the lead authors of the research. Frontotemporal dementia, caused by damage to the front of the brain and likely to cause personality change, loss of memory and the ability to communicate, as well as loss of motor function, usually occurs to people with a family history of the disease. Among other types of dementia -- Alzheimer's disease, Lewy body dementia and vascular dementia -- frontotemporal dementia tends to occur among a younger age group, Tsai said. For people aged 65 and older, frontotemporal dementia is the fourth most common cause of dementia, trailing behind Alzheimer's, Lewy body dementia and vascular dementia, although it is ranked the second most common cause of dementia for people aged under 65, he said. The antibiotic is normally used to treat cancer, Huntington's disease -- a neurological disorder that causes progressive degeneration of cells in the brain, and Alzheimer's, he said. The new use of the drug will help people cope with a problem that affects about nine in every 100,000 people, according to Tsai. The study was co-written by Tsai and Shen Che-kun, a distinguished research fellow at the Institute of Molecular Biology of Academia Sinica, Taiwan's top research body. It was published in the Sept. 11 edition of the Proceedings of the National Academy of Sciences of the United States of America.

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13. Biologists at Academia Sinica Develops a New Molecular Strategy to Suppress Hepatitis C Virus Replication

(Academia Sinica Newsletter, 20 09 2012)

A research team at Academia Sinica led by Drs. Michael M.C. Lai at the Institute of Molecular Biology and Tien-Hsien Chang at the Genomics Research Center recently uncovered a key molecular player in hepatitis C virus replication. The team found that reducing the abundance of a cell component called the "40S ribosomal subunit" in a host cell could significantly cut down hepatitis C virus replication without negatively impacting host-cell health. This finding suggests a new strategy for combating hepatitis virus infection. The study was published in the June 28 issue

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of the scholarly journal *PLoS Pathogens*. Hepatitis C is a blood-transmitted virus that causes chronic liver diseases that threaten roughly two percent of the world's population. So far, there is no hepatitis C vaccine and current therapies are only effective in a fraction of infected patients. Viruses rely heavily on their host cells to replicate. Research Associate Jing-Ying HUANG, the first author of the article, and her colleagues in the Institute of Molecular Biology used RNAi technology to systematically search for the components of the host cell that the hepatitis C virus must borrow to successfully reproduce itself. She singled out the 40S ribosomal subunit. The 40S ribosomal subunit is normally found in sufficient abundance to satisfy the needs of both the host cell and the virus, but when the amount of the 40S ribosomal subunit is reduced below a certain threshold, the hepatitis C virus apparently becomes the weaker competitor and dwindles to its demise. Dr. CHANG made an interesting analogy of this finding: "It is like how, under favorable conditions, counterfeit cell phones may work nearly as well as the well-designed name brands in drawing signals. However, once the bandwidth of the signals falls below a certain threshold, those counterfeits fail to work, yet the name brands remain fully functional. Sooner or later, those counterfeits will fade away from the market, i.e., they will not be able to compete effectively with the name brands". The finding provides a new strategy through which it becomes realizable to develop effective drugs to combat the hepatitis C virus. Conventionally, drugs have been designed to target the viral proteins, but mutations that accumulate through rapid cycles of viral replication often lead to emergence of drug-resistant viral strains. In contrast, the host cell's ribosomal 40S subunit has been perfected over millions of years of evolution, thus is extremely unlikely to morph or mutate as freely as viruses. "Finding a good way to fine-tune 40S ribosomal subunit level as part of an hepatitis C virus therapy may not only be feasible, but also superior in terms of minimizing the drug-resistance problem" said Dr. Lai.

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14. NCKU Researcher Team's Findings on Higgs Transition of North and South Poles of Electrons in a Magnet Published in “Nature Communications”

(Academia Sinica Newsletter, 09 09 2012)

Minimal evidence of a Higgs transition of north and south poles of electron spins was observed in a magnet Yb2Ti2O7 at the absolute temperature 0.21 K. A fractionalization of these monopoles from electron spins was observed on cooling to 0.3 K. On further cooling below 0.21 K, the material showed the ferromagnetism to be understood as a superconductivity of monopoles. The work is reported in an online science journal *Nature Communications* on August 7, by an international collaboration team of Dr. Shigeki Onoda (Condensed Matter Theory Lab., Riken Advanced Science Institute), Dr. Lieh-Jeng Chang (Quantum Beam Science Dictorate, Japan Atomic Energy Agency and Dept. of Physics, National Cheng Kung Univ.), and Dr. Yixi Su (Jülich Center for Neutron Science JCNS-FRM II, Forschungszentrum Jülich), and coworkers. The principal investigator of the project Dr. Lieh-Jeng Chang with the help of the neutron scattering spectrometer scientist from München, Germany, Dr. Yixi Su, uses the polarized neutrons in the reactor of FRM-II to conduct the experiment. The project is supported by National Synchrotron Radiation Research Center (NSRRC) and National Science Council (NSC). The experiment suggests that the model “quantum spin ice” developed by the team is plausible and has reached a conclusion that Higgs Transition temperature is 0.21 K. The international research project has successfully integrated the experimental and theoretical results. Remarkably, the decisive role of the neutron scattering experiment in the project indicates the significance of the technology of neutron scattering in the advanced materials studies, especially in the research and development of nano- and quantum-materials.

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