



National Science Council

ISSN: 1607-3509

Science Bulletin

October 2003/Vol. 35, No. 10

Newly-Opened Si-Soft R&D Center Leads Semiconductor Industry into the Future

Taiwan's strength as a semiconductor manufacturing center will serve as a stepping-stone towards achieving a high added-value knowledge economy. The opening of the "Si-Soft R&D Center," which was formally inaugurated on July 31 in the presence of Executive Yuan Premier Yu Shyi-kun and the representatives of government, industry, and the academic community, marks a new and important milestone in the evolution Taiwan's semiconductor industry.

The Si-Soft R&D Center is one of the results of the Executive Yuan's National Si-Soft Project. Located on land provided by Philips Electronics Industry (Taiwan) Ltd., the Si-Soft R&D Center will provide System-on-Chip (SoC) services and conduct demonstrations of innovative new technologies. The Center will also provide intellectual property (IP), platform, testing, and training services in the future, and will offer laboratory facilities for R&D work. It will strive to build on Taiwan's superiority in IC manufacturing and wafer foundry ser-

vices by developing an IC design market, and eventually helping make Taiwan the world's semiconductor manufacturing and design headquarters.

Premier Yu noted that the Si-Soft R&D Center was built with active government support, and its completion signifies that the two-year preparatory phase of the National Si-Soft Project has come to an end. The main focus of the Center's efforts will be on the three aspects of R&D, manpower training, and hardware investment. The government plans to invest NT\$7.6 billion in the Center and the Si-Soft Program over the next three years, and will add 85 new technology seed instructors every year over the next four years. As far as hardware investment is concerned, the Science Park Administration plans to invest NT\$150 million in a hardware and construction fund.

Covering an area of roughly 20,000 square meters, the Center is currently occupied by 20 domestic and foreign firms. To accommodate the construction timetable, firms will



move into the Center in four batches. All occupant firms are expected to move in by May 2004. Because the wafer fab industry is approaching saturation, and room for market development is limited, Taiwan must actively develop such areas of the software services market as semiconductor design. Semiconductor design will offer considerable potential for growth in the future. It is hoped that the firms occupying the Si-Soft R&D Center will lead the semiconductor industry into the knowledge economy age.

New Treatment for Cervical Root Injury Developed at Veterans General Hospital

A neuroregeneration research team at Taipei Veterans General Hospital led by Hospital Superintendent Dr. Lee Liang-shong has made significant progress in the area of neural regeneration. This team, which published an article on spinal regeneration in *Science* magazine in 1996, has made further breakthrough in the cervical root regeneration of

animals, and has published this work in the April issue of the prestigious international journal *Experimental Neurology*. In addition, the team has received permission in June from the Department of Health's clinical trial committee to perform an initial stage of human trials aimed at verifying the safety of the new procedure.

This NSC-sponsored neural regen-

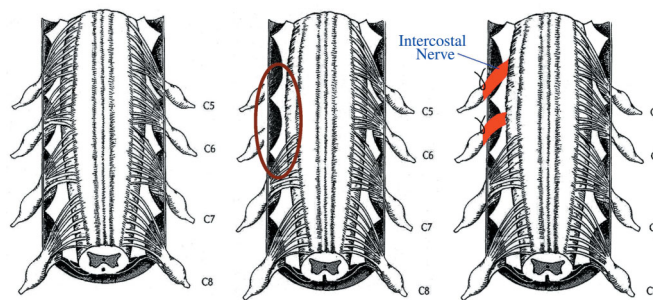
eration research project began four years ago. According to Dr. Huang Ming-chao, chief physician in the Neural Regeneration and Repair Division of the Neurological Institute at Taipei Veterans General Hospital, in the experiment the 5th and 6th cervical roots of the white rats in the control group were cut between the neural root and the nerve's junction with

the spine. The team successfully verified that the closer the site of root severance to the spinal cord, the greater the death rate among spinal motor neurons, and the lower neuron viability and chance of successful treatment.

Microsurgical transplantation and repair was used to create bridges consisting of intercostal nerves in the experimental group rats. One end of each bridge was joined to the neural root, while the other was inserted into the spinal cord. A variety of drugs, including tissue glue and acidic fibroblast growth factor, were used to promote nerve growth. The results showed that white rats in the experimental group recovered their walking gait and grooming reflex to a statistically significant degree. Electroneuromyography verified that, in the vast ma-

jority of rats in the experimental group, the neural potential was restored in the muscles controlled by the injured nerves. There was also a significant increase in viability among spinal motor neurons in the experimental group.

Dr. Huang pointed out that there are as many as several thousand cases of injury to the brachial plexus in Taiwan every year, and roughly 70% of these cases also include severed cervical roots. While it has usually been felt that cervical root injury is untreatable, the team's animal experiment



Microsurgical Transplantation and Repair

has resoundingly demonstrated that microsurgical transplantation plus a special “cocktail” treatment can bring about the regeneration of severed cervical roots. This finding holds out the hope that patients suffering from injuries to the brachial plexus and cervical roots can benefit from clinical treatment.

Major Breakthrough in Genetic Technology — Production of Valuable Proteins in Mammary Glands of Transgenic Livestock

Drawing on the diverse strengths of industry, government, academia, and the research community, Taiwan's biotechnology research has started making significant progress over the last few years. A recent cooperative genetic research project jointly funded by the NSC and Ministry of Education, and implemented by National Taiwan University, National Chung Hsing University, Animal Technology Institute Taiwan, and Veterans General Hospital, has successfully created transgenic pigs harboring the human clotting factor IX gene (*alpha LA-hFIX*) and transgenic dairy goats harboring the human clotting factor VIII gene (*alpha LA-hFVIII*).

According to Project Director Dr. Cheng Teng-kuei Winston of the Department of Animal Sciences at National Taiwan University, hFVIII and hFIX are critically important proteins for patients with hemophilia A and B. The proteins are currently extracted from normal human plasma, and are

extremely costly. Retail prices average roughly US\$4,000 per gram for hFIX, and the price is as high as US\$3 million per gram for hFVIII. Another problem is that it is difficult to avoid infection by hepatitis or AIDS viruses when hFVIII and hFIX are extracted from human plasma. In light of these circumstances, the development of clotting factors not derived from blood has been considered an urgent priority worldwide. In addition, the mass production of hFVIII and hFIX through the mammary glands of transgenic livestock would be a great blessing for persons with hemophilia A and B.

This project used genetic design and intra-pronucleus microinjection allowing the human genes responsible for the production of clotting factors to be introduced into pig and dairy goat embryos, respectively. The first-generation transgenic animals were then bred to produce second-generation transgenic progenies. The milk of these animals was analyzed to verify

the presence of human clotting factors.

Experimental results showed that the transgenic pigs and dairy goats produced by the research team could readily pass on the genes coding for the hFVIII and hFIX proteins to their descendents. In addition, the genes were indeed expressed in the mammary glands of the transgenic animals. The researchers estimated that each milliliter of milk from transgenic pigs contained an average of 400 μ g of hFIX, which is approximately 40~100 times the concentration of hFIX in normal human plasma (3 mg per liter). In addition, the expression of the gene was found to increase progressively as the lactation period was extended. Furthermore, it was also demonstrated that hFIX produced in pigs was equally effective at clotting blood as hFIX in normal human plasma. The concentration of hFVIII in the milk of the transgenic goats bred in the experiment was shown to vary within the range of roughly 15~50 mg per liter.

This is as much as 200 times greater than the concentration in normal human plasma. The hFVIII in the goat's milk induced clotting activity as great as 13.4 U/ml.

The results described above show that the mammary glands of transgenic animals can be used to mass-produce very valuable proteins. Besides such medical proteins as hFVIII and hFIX,

proteins and enzymes used in industry and for environmental protection can also be produced. More than just feasible, the process offers great promise for commercial mass production.

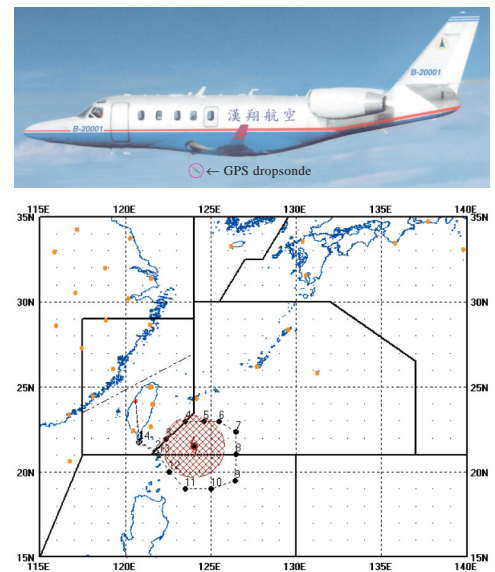
Taiwan's DOTSTAR Team Successfully Flies into Typhoon Dujuan

The August issue of this publication reported on the DOTSTAR (Dropsonde Observations for Typhoon Surveillance near the Taiwan Region) project involving aircraft surveillance mission. After a two-month wait, the first DOTSTAR mission has now been completed, setting a new milestone for domestic typhoon observations and research. This project was sponsored by the NSC, and employed an Astra SPX jet from the Aerospace Industrial Development Corporation. The research team included members from the Central Weather Bureau (CWB), National Taiwan University (NTU), National Central University, and Chinese Culture University. After taking off from Taichung at 12:30 PM on September 1, the aircraft followed the top of the peripheral circulation of Typhoon Dujuan at an altitude of 13 kilometers, and released its first dropsonde containing airborne sensors at 1:20 PM. The aircraft released a total of 11 GPS dropsondes at intervals of 200 kilometers. The dropsondes collected two pieces of data every second during the roughly 15 minutes that it took them to fall into the sea, and personnel on board the aircraft relayed this data to shore via satellite phone. The CWB began receiving data at 2:30 PM, and was still receiving observation data when the surveillance plane landed at 4:00 PM. The CWB used the Internet to transmit data in real-time to the US National Oceanic and Atmospheric Administration (NOAA), enabling both the CWB and NOAA to simultaneously analyze the data and make typhoon track forecasts.

"There has been an unfortunate lack of typhoon tracking and forecasting data among the countries of the region since the US discontinued typhoon surveillance flights over the Western Pacific Ocean in 1987," said project leader Dr. Wu Chun-chieh from NTU. The recent surveillance flight by Taiwan's research team is the first of its kind in the Western Pacific Ocean in close to 16 years, and makes Taiwan the first Asian country to observe typhoons using aircraft.

Dr. Wu pointed out that observation data from the Sept. 1 flight revealed that the structure of Typhoon Dujuan was stronger and tighter than had originally been forecasted. Moderate typhoons generally rise to a height of about 12 kilometers, so the original flight plan called for the aircraft to fly above the top of the typhoon. But since Typhoon Dujuan had such a compact and coherent structure, its clouds rose to an altitude of 13 kilometers or more, and the Sept. 1 flight had to pass within the storm circulation. Fortunately, wind speeds are low in the upper parts of typhoons, and the flight was not affected.

The project leased an Astra jet from the Aerospace Industrial Development Corp. to release GPS dropsondes. Temperature, humidity, air pressure, wind direction, and wind velocity information collected from the typhoon as the dropsondes fell to the surface provided a detailed cross section of the atmosphere. The flight's data led to the discovery that the typhoon's radius was larger than the 220 kilometers estimated from satellite photos,



and was very close to the 250 kilometers announced by the CWB.

The biggest problem facing typhoon forecasting is the lack of real observation data concerning a storm's sea level development. And since remote sensing data from satellites is all that most countries have to use, weather bureaus cannot accurately predict a typhoon's speed and direction of travel. America's experience shows that the use of a surveillance plane to release sensor-bearing dropsondes can improve the accuracy of 24~72 hour typhoon track forecasts by 10~30%. The DOTSTAR project plans to follow up on its first successful flight by performing six to seven more surveillance flights this year. While it will take careful assessment of the results of this project to show whether airborne dropsonde data can be used to improve typhoon forecasting, it is likely that this valuable data will lead to major breakthroughs in typhoon research.

Although Dujuan did not make a landfall on Taiwan, the strong winds and heavy rain that it brought caused extensive damage in southern Taiwan,

which testified to the typhoon's robust structure. Dujuan continued to develop throughout September 2, and ultimately caused widespread destruc-

tion in Hong Kong, Macao, and Shantou in China's Guangdong Province.

Taiwan Researchers Develop Advanced Applications of MPEG-4/7 Technology

The NSC has consistently tried to bring together the R&D abilities of the academic community with the practical experience of the industrial sector for the sake of developing products with high market potential. Besides achieving the rapid commercialization of research results, industry-university cooperative projects can also give young academic researchers skills and experience to meet the needs of the market. Prof. Wu Ja-ling of National Taiwan University joined forces with the CyberLink Corp. and Digimax Corp. in 2001 to implement the "Content Engineering: MPEG-4/7 Technology Project." This three-year project has sought to develop key technologies meeting market needs, accelerate the localization of the information industry, raise product competitiveness, and promote market globalization.

According to Prof. Wu, "MPEG" actually refers to the "Moving Picture Experts Group," which is an organization of video specialists. This organization has developed a series of international standards for the compression, storage, and transmission of digital audiovisual data. Early VCD audiovisual discs employed the MPEG-1 standard, while today's DVDs use the MPEG-2 standard for their inter-

nal storage format. The MPEG-4 standard was drafted in 1999, and the MPEG-7 standard in 2001. These recent standards offer even better compression and provide wider applications than their predecessors.

Besides its outstanding data compression performance, the MPEG-4 standard is capable of integrating virtual characters and scenes, and can specify the way this information is communicated and transmitted. These characteristics made the MPEG-4 standard particularly well suited to broadband networks. For its part, the MPEG-7 standard is very different from the MPEG-1, MPEG-2, and even MPEG-4 standards. The main intent of MPEG-7 is to define the way multimedia data is described, and it has succeeded in defining even more ways to define and search. For instance, MPEG-7 can be used to find relevant data when a photograph or entire film is used as search criteria.

Both MPEG-4 and MPEG-7 standards are extremely hot research areas worldwide. The NSC supported MPEG-4 research projects as early as 1998, and excellent results have been achieved. The current research project began in 2001, and has since that time incorporated the MPEG-7 standard within its scope.

The aforementioned industry-university cooperative project has covered a diverse range of areas. Within the domain of MPEG-4, the project has developed an MPEG-4 Interactive Scene Editor, the "Virtual Sculptor" system, an MPEG-4 Scalable Video Streaming Platform, Adaptive Rate Control Streaming Server System, MPEG-4 Multi-person World System, and an MPEG-4 Pocket PC Interactive Multimedia Player. In the area of MPEG-7, the project has developed a 3D object search engine, an audiovisual news data summarization and browsing tool, and an MPEG-7-based digital photo album possessing a semantic function that can automatically and efficiently manage digitized family photos.

The overriding purpose of the project is to create a comprehensive architecture encompassing both the MPEG-4 server end and the media player end. The project has developed some of the most critical technologies needed for this undertaking, and is expected to raise the standard of MPEG-4 technology and boost the domestic information industry. The completion of this project will also have a long-range impact on the development of a "4C" industry in Taiwan.

Editorial Office: Rm. 1701, 106 Sec. 2 Ho-ping East Road, Taipei, Taiwan 10622, Republic of China
Tel: +886 2 2737-7595, Fax: +886 2 2737-7248, Email: chenlee@nsc.gov.tw
<http://nr.stic.gov.tw/ejournal/SciNews/scibulletin.htm>

Subscription price for each copy: US\$1.00

Payment must be made in US dollars by a check payable to National Science Council.

國內：每份新台幣 25 元，訂閱請利用郵政劃撥儲金帳戶 0101222-5 號
戶名：行政院國家科學委員會。

ISSN 1607-3509



9 771607 350003

GPN: 2005800003