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A Step Forward in Herbal Medicine Research: Production and Use of Dendrobii caulis

The retinal pigment epithelium (RPE), an epithelial monolayer juxtaposed between the choriocapillaris and the neural retina, supports adjacent photoreceptors and is known to be essential for normal visual function. It has been reported that the numbers and function of RPE cells decrease with aging.

Dendrobii caulis is a Chinese herbal medicine traditionally used to maintain eyesight, but the mechanism underlying such an effect is still unclear. In light of this ignorance, the Department of Life Sciences, NSC, has chosen to fund research on *D. caulis*. The Research Center for Drug Discovery at National Yang-Ming University has been responsible for studying the biological activity of this plant. The Taiwan Agricultural Research Institute (TARI) has been responsible for the collection, identification, and breeding of varieties, and Yuen Foong Yu Biotechnology Inc. has been in charge of using tissue culture techniques to select superior clonal strains and performing large-scale greenhouse propagation.

The team headed by Dr. Rong-tsun Wu, Research Center for Drug Discovery, found that extracts of *D. caulis* promoted phagocytic activity and the production of nitric oxide (NO) and hepatocyte growth factor (HGF) in the RPE. NO has been shown to serve as a mediator of physiological and possibly pathological processes in the retina. Inducible NO synthase, found in the

RPE, may be involved in RPE cells' normal phagocytic activity. In addition, HGF, a polypeptide growth factor, was found to enhance the phagocytic activity of RPE. These findings possibly substantiate the therapeutic effects of *D. caulis* as described in traditional Chinese medicine.

It was also found that extracts of *D. caulis* reduce the expression of genes of bFGF, VEGF, and TGF-β in the RPE. The physiological significance of this finding awaits further investigation.

This research also succeeded in isolating and characterizing the substances in *D. caulis* that are active in modulating the function of the RPE. Information on these substances was passed on to the Yuen Foong Yu Biotechnology Inc. to guide its efforts to select, breed, and propagate superior strains. Application is currently being made for US patents. Because Western medicine does not yet have any drug with therapeutic effects similar to those of *D. caulis*, the researchers have concluded that *D. caulis* can potentially be developed into a uniquely efficacious ophthalmological herbal drug.

After participating in this project, the Yuen Foong Yu Biotechnology Inc., with assistance from National Yang-Ming University, has employed its specialty of tissue culture to select and propagate superior strains of *D. caulis*. The company has successfully grown strains of *D. caulis* containing highly active substances, and is now performing large-scale tissue culture and greenhouse propagation.

Solving the Riddle of Current Transport in the Taiwan Strait

Located between the South China Sea and the East China Sea, the Taiwan Strait is an important conduit for mass exchange between these two large marginal seas. In addition, understanding the currents through the Straits is important for navigation, fishing and ocean engineering. For scientists, the fluxes of matter and heat associated with ocean currents have a strong impact on climate and ecology. Dr. Chih-an Huh of the Academia Sinica indicates that materials transported through the Taiwan Straits may provide as much as one-third of the sediments deposited in the East China Sea. In addition, supply of nutrients through the Strait may account for up to one-third of the total nutrients brought into the East China Sea in summer, while the nutrient supply in winter is relatively scanty. This information hints on the flow condition in the Strait that the current is northward year-round, but the transport

is reduced in winter, probably related to the prevailing northeast monsoon.

Scientists became interested in the transport of water through the Taiwan Strait as early as forty years ago. Using a small body of sea level and hydrographic data in conjunction with the principle of hydrodynamic balance, the researchers of that time were able to roughly estimate current transport as 1×10^6 m^3/s, and discovered that the predominant current flowed from the South China Sea into the East China Sea in summer and reversed itself in winter. In recent years Japanese scientists issued the new estimate of 2×10^6 m^3/s in a northward direction in summer, and proposed that while this flux fell by one-half in winter, the net flow was still from south to north. But since these estimates were based on theoretical derivation and numerical calculation, rather than actual observations, it is difficult to assess their reliability.

Because the Taiwan Strait is very shallow, with an average depth of only 60 m, and have an average width of about 200 km, the flow condition is dominated by tidal motion, which makes measuring the net transport quite challenging. Fortunately, although tidal motion is very complex, it is quite predictable. If the current in the Taiwan Straits is measured in all areas, we can use mathematical and statistical methods to filter out the tidal signal. In addition, the net transport is dependent on the wind condition and seasonality, which must be taken into consideration.

Previous measurements with moored current meters deployed by the Institute of Oceanography, National Taiwan University (NTU) demonstrated that there was indeed a persistent northward all year-round. When the northeast monsoon of winter was at its strongest, the current occasionally reversed and flowed south. However, since these direct observations were limited to a small number of points, the data was sufficient only for a qualitative description, and not for calculation of transport through the Strait.

To develop a nowcasting system for the Taiwan Strait, scientists at the National Center for Ocean Research (NCOR) of NSC need to know the mean current in the Strait. Therefore, over the last three years, with the assistance of Prof. Tswen-yung Tang of the NTU Institute of Oceanography, the NCOR used bottom mounted and shipboard acoustic Doppler current profilers (ADCPs) to measure current transport through the Taiwan Straits.

Scientists at NCOR used shipboard ADCP units aboard the research vessels Ocean Researcher I, II, and III to survey the Taiwan Strait. According to the tide-free results obtained by tide filtering techniques developed only during the last two years, the average current transport through the Taiwan Strait ranges from 2×10^6 m^3/s to 3×10^6 m^3/s, which is dramatically higher than early estimates of less than 1×10^6 m^3/s. In addition, the net transport is from south to north throughout the year, and average current speed is distinctly higher on the Taiwan side than on the China side. The southwest monsoon, which blows during the summer months from May to September, and the northeast monsoon, which blows during the remainder of the year, were shown to have a significant influence on current flux.

Precise current forecasts for the Taiwan Strait would be important for passing ships and fishermen, and can help marine dredging and drilling projects to correct necessary parameters. Furthermore, the currents flowing through the Taiwan Strait have an intimate relationship with undersea topography and topographical changes. Scientific research on the transport of sediments, nutrients, or heavy metal pollutants also requires information on current transport. Finally, heat flow caused by the year-round movement of water through the Strait from south to north certainly has a highly significant impact on climate. The NCOR now plans to investigate seasonal variability in the current through the Strait using even more data that are now available. It is hoped that the data will be sufficient in the future to establish a nowcasting model for the Taiwan Strait. Able to forecast sea level and temporal changes in currents, such a model will be of great importance to sea rescue, disaster prevention, and academic research works.

NSC to Implement International Program "Thematic Research on Taiwan"

To increase Taiwan's visibility in eyes of the international academic community, and enhance international society's understanding of Taiwan, the NSC has implement the "Thematic Research on Taiwan" program. By helping foreign scholars come to Taiwan to perform research, sponsoring major international academic periodicals to publish special issues addressing Taiwan, and sponsoring international academic seminars related to "Thematic Research on Taiwanm," the program will spur interest in Taiwan among the international academic community.

Via the Foundation for Scholarly Exchange, the NSC has already made a preliminary agreement with America's prominent Fulbright Foundation, which funds overseas research by young scholars and scientists, to provide dual support to researchers. Under the agreement, the NSC will provide funds to five young American researchers each year to perform research in Taiwan. If the results are promising, the NSC will negotiate similar agreements with leading academic organizations or foundations in other developed nations.

As Dr. Fan-sen Wang, Director of the NSC Department of Humanities and Social Sciences, has pointed out, historical, geographical, and linguistic fac-

tors have deterred many international scholars from studying Taiwan-related topics when performing research on Asia. Since its issues and voices have not been made known, it is all too easy to ignore Taiwan when international problems are studied.

Dr. Wang emphasized that Taiwan's developmental trajectory is rather unique among the world's developing nations, making it a worthy object of investigation. Wang hopes to interest foreign researchers in history, anthropology, sociology, economics, and other fields in performing work in Taiwan, and looks forward to seeing them publish papers in international academic periodicals. The NSC is sponsoring the publication of special issues addressing Taiwan by selected academic periodicals, and is also working together with major universities and research organizations overseas to hold seminars on Taiwan. The NSC's hard work is gradually increasing Taiwan's visibility in the international academic community, and is helping give the world a better understanding of Taiwan.

Fifth Anniversary of NSC-NRC Cooperative Research Program

To celebrate their successful cooperation over the past five years, the National Science Council (NSC), ROC, and the National Research Council of Canada (NRC) held a two-day scientific symposium at the Grand Hotel on June 24 and 25, 2002. Researchers at both sides were invited by the NSC and NRC to present their research outcome and the experience of collaborative work over the years. It is highlighted by the presentations and executives at NRC and NSC that the spirit of the collaboration will be continuously encouraged and large-scale joint projects on nanotechnology and biotechnology.

In retrospect, Taiwan and Canada signed the memorandum of understanding concerning scientific and technological cooperation in October 1997. The MOU gave an immediate boost to the bilateral relationship between Canada and Taiwan. The NSC and NRC have a long history of technology sharing and cooperation. The two parties have maintained regular cooperation with regard to the sharing of technological information, the training of doctoral students and post doctorial research students, and the holding of technical seminars in various fields. In addition, the two countries have conducted joint international research projects addressing such topics as nanometer electronics, nanostructures, and advanced semiconductor technology, etc. Bilateral cooperation with Canada has significantly helped Taiwan maintain its important status in the global contest between the major technological powers.

Speeches by Executive Yuan Vice Premier Hsin-I Lin, President Yuan-tseh Lee of the Academia Sinica, Representative Mr. Dave Murphy of the Canadian Trade Office in Taipei (CTOT), NRC Chairman Dr. Arthur Carty, and NSC Chairman Dr. Che-ho Wei kicked off the conference.

"The relation between our two countries is developing in a very encouraging way," noted Vice Premier Lin. "Our mutual trade is growing, and investment has become a two-way street. Scientific and technological cooperation continues to expand, and scientists and researchers have enriched our intellectual and cultural exchanges. In particular, the joint efforts of the NRC and NSC can be seen to exemplify a 'model approach' in bilateral scientific and technological cooperation." Vice Premier Lin also expressed his special appreciation of Dr. Carty for the latter's strong support and notable leadership in promoting cooperation between the NRC and NSC. Even before the memorandum of understanding was signed five years ago, Dr. Carty had set up numerous joint international programs between NRC and universities in Taiwan, and was personally involved in cooperative research with National Tsing Hua University.

As Chairman Wei of the NSC and Chairman Carty of the NRC stated at the press conference that followed the opening ceremony, the two parties will continue their cooperation over the next five years. It is expected that by adding large-scale projects to the joint research program, the NRC and NSC will also raise their funding. As Dr. Carty pointed out, the focus of future cooperation will be on nanotechnology and biotechnology. The two parties have discussed such aspects of nanotechnology as nanobiotechnology, quantum computation, and system manufacturing. The NRC plans to work closely with researchers in Taiwan in their new establishment of a Nanotechnology Research Center at the University of Alberta.

The 14 papers issued at the two-day bilateral conference included "Pathological Consequences of Mitochondrial Defects and Dysfunction in the Brain," "Serial Analysis of Gene Expression in Developing Rice Seed," "Electronic Relaxation Dynamics in Polyatomic Organics: Intersystem Crossing and Dissociation," "Nanoelectronics," "Nanostructure & Chemistry in Confined Spaces," and other topics in biochemistry, microbiology, nanotechnology, materials science, and information science. The findings presented underscored the highly productive sci-tech relationship that has emerged between Taiwan and Canada.

National Open Source Software Program

Currently, all major computer operating systems and office software are provided by a small number of large international firms. Taiwanese software users are faced with virtually no other alternative. The government and educational institutions set aside a large portion of their budget for personal computing software. According to the Bureau of Statistics, at the end of year 2000 there were more than 1.2 million computers installed in the government agencies and education sectors. If every computer were to use NT$ 6,000 (US$ 176) worth of Microsoft's operating system and office software, the licensing fee to Microsoft would be over US$ 200 million annually. Alternatively, mature free software is being developed in the form of "open source" software. Users can now choose the free software as an option. Thanks to widespread cooperation among the software development communities worldwide, open source software is achieving impressive popularity.

To encourage innovation, train local software professionals, and establish a localized software infrastructure, the NSC is implementing the "National Open Source Software Program." It is hoped that the outcome of this project will be to encourage the exchange of data in open formats, thus, insuring the free flow of information and establishing true information freedom. By creating a diversified software environment, the program will provide a solid infrastructure for the domestic computer software industry. In conjunction with the country's existing hardware development capability, raising software technology to an international standard will make Taiwan a leader in information technology.

Implemented by the National Center for High Performance Computing (NCHC), this program focuses on software development and educational promotion. By integrating information technology research, putting Taiwan's plentiful software design manpower to use, and fostering cooperation with educational organizations and the open source software community, the program seeks to advance software development and education in tandem.

The five main topics included under the heading of "software development" are: (1) graphical desktop environments, (2) office software, (3) software development environment, (4) educational and entertainment software development tools, and (5) file conversion systems. The implementation of software development work will take three different forms according to degree of urgency: (1) Development or modification in-house at the NCHC: This approach will be used for software that is needed urgently, is closely connected with the integrity and convenience of the user environment, and requires intensive input of professional manpower. (2) Development by private organizations: This approach will be used when the software has a highly additive function and requires considerable professional manpower input, but is only moderately urgent; this type of project can be turned over to professional organizations and the software community. (3) Development by university students and faculty in the form of formal projects: This approach is appropriate when the project is not urgent and does not involve key functions. The projects will also stimulate the students' creativity in the use and development of open source software tools. It is expected that the program will complete a "Fully Chinese Language-Enabled Open Source Operating Environment" that will meet the needs of users in Taiwan and, ultimately, worldwide. The program's software will be shared with government agencies and private organizations. It is estimated that the government will, over time, save more than NT$ 2 billion annually in software licensing fees, while private parties will save more than NT$ 10 billion.

The program's educational promotion calls for the creation of six education and training centers positioned among community universities and private organizations. These centers will offer elementary and technical training courses to beginning and advanced users. It is expected that the centers will train as many as 120,000 novice users within three years. It will also offer advanced courses to 9,600 technicians who will help promote open source software to schools and organizations. In addition, educational outreach and the full-scale adoption of open source software will lead to a diversified computing environment and safeguard the people's freedom of access to information.

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