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Good Things Take Time

Second Edition of the Flora of Taiwan Receives Engler Silver Medal

Completed after 12 years of intensive labor by a joint international team led by Taiwanese scholars and including participants from the US, Japan, the Netherlands, Australia, Singapore, and China, the second edition of the *Flora of Taiwan* has earned acclaim from botanists the world over and recently received the "Engler Silver Medal" – the highest honor conferred by the International Association of Plant Taxonomy (IAPT). IAPT deputy director and Royal Netherlands Academy member Pieter Baas personally granted the Engler Medal to Huang Tseng-chieng, professor emeritus of National Taiwan University and chief editor of the *Flora of Taiwan*, on behalf of the research team on September 26.

The IAPT is a very longstanding and prestigious international academic group. First offered in 1987, the IAPT's Engler Award consists of gold and silver medals and is considered the greatest honor in the field of botany. The Engler Gold Medal is awarded once every six years to scholars who have outstanding contributions to plant taxonomy, and the Engler Silver Medal is awarded every year as a commendation to notable plant taxonomy books and their authors. The recent award of the Engler Silver Medal to the *Flora of Taiwan* was the first time this award has been given to a completed national flora from Asia, showing the significance of this volume.

The first edition of the *Flora of Taiwan* was written over the period of 1975 ~ 1979 by an international team consisting of Charles E. DeVol, Liu Tang-shui, and Prof. Huang Tseng-chieng (executive editor) of the National Taiwan University Department of Botany, Li Hui-lin (editor-in-chief) of the University of Pennsylvania, and Prof. Tetsuo Koyama of the New York Botanical Garden. However, due to time and funding constraints, as well as ongoing rapid changes in the ecological environment, this edition unavoidably suffered from many errors and omissions. In 1984 the NSC therefore appointed Huang Tseng-chieng to start work on a second edition of the *Flora of Taiwan* in an effort to remedy this situation. The project eventually involved close to a hundred scholars from many countries. The resulting second edition of the *Flora of Taiwan*, in six volumes, contains more than 4,077 species of plants, of which 3,815 are native to Taiwan and 1,067 are endemic to the island. The *Flora* also contains 262 naturalized or important exogenous species. This flora may be considered a bible for those interested in the botany of Taiwan.

According to participant Dr. Peng Ching-I, research fellow of the Academia Sinica Institute of Botany, Taiwan is situated in the subtropical zone and contains many different types of topography and landforms. Climatic zones ranging from cold high mountains to warm seacoasts harbor a wealth of varied plant communities. Taiwan's over four thousand plant species include more than a thousand species that are unique or endemic to Taiwan. Compared with countries with a monotonous topography, Taiwan is a botanist's heaven. The most significant feature of the second edition of the *Flora of Taiwan* is its more than four thousand detailed and accurate illustrations and drawings. There is an illustration or photo for almost every species of plant, including such endemic species as *Epilobium nankotaizanense* Yamam., *Senecio tarokoensis* C. I Peng, *Cirsium arisanense* Kitam., *Begonia austrotaiwanensis* Y. K. Chen & C. I Peng, *Begonia ravenii* C. I Peng & Y. K. Chen, and *Amorphophallus henryi* N. E. Br. The book's photographs allow readers to see at a glance the rare plants of Taiwan. The *Flora*'s attention to detail is the chief reason the IAPT has bestowed the Engler Award on it.

Looking ahead to the future, Prof. Huang Tseng-chieng feels that Taiwan should quickly establish a national-level botanical museum, such as the Netherlands' museum containing over five million specimens. In Prof. Huang's view, National Taiwan University, National Taiwan Normal University, the Academia Sinica, and the National Museum of Natural Science should work together to found a national-level botanical museum and continue to improve botanical research.

A New Topic in Molecular Medicine

Regulation of Alternative Precursor mRNA Splicin

All living organisms store their hereditary information in the form of DNA, and genes are the segments of DNA that guide the production of proteins to maintain the life of the cell. Unlike bacteria, the genes of eukaryotic cells are interrupted by noncoding intervening sequences termed introns, and eukaryotic cells possess a double membrane surrounding the nucleus that separates the DNA present within the nucleus from other cellular organelles.

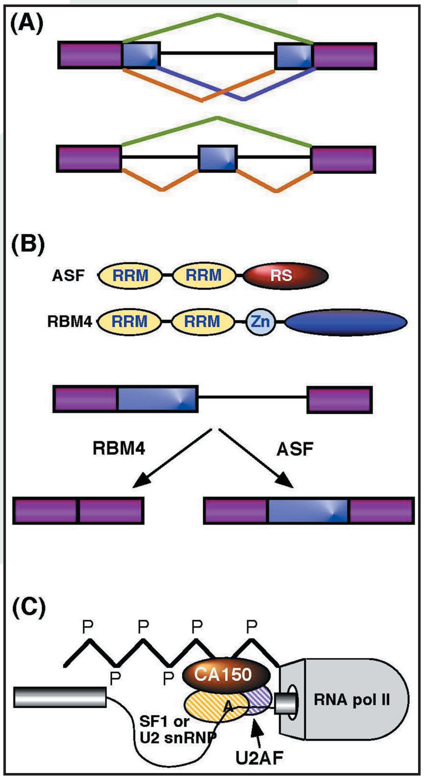
Since eukaryotic genes are discontinuous, newly synthesized precursor message RNAs (pre-mRNA) must undergo process of splicing to remove intron sequences. In higher organisms, each gene contains about eight introns and can therefore generate multiple mRNA isoforms through a mechanism termed alternative splicing. While this process greatly increases the diversity of proteins, aberrantly spliced mRNAs may be degraded, even resulting in down-regulation of the gene.

Alternative splicing is a fundamental mechanism for gene regulation in higher eukaryotes, and any errors in splicing may disturb cellular function. For example, genetic alteration of splice sites can cause such human diseases as β-thalassemia and cystic fibrosis. At present, it is widely accepted that single nucleotide polymorphisms would vary penetrance of mutations on phenotypes through their effect on alternative splicing. This concept currently has a great impact on molecular diagnosis and personalized therapy in the 21st century.

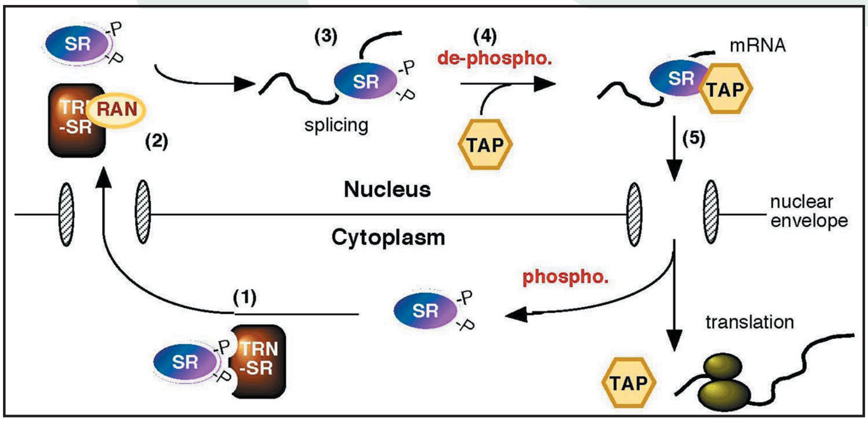
Over the past several years, Dr. Tarn Woan-yuh of the Institute of Biomedical Sciences, Academia Sinica, has been studying the mechanisms of alternative splicing under a grant from the National Science Council. Her group has recently published their research results in the *Proceedings of the National Academy of Sciences of the United State of America* and the *EMBO Journal*, and the latest data will soon appear in an upcoming issue of *Molecular and Cellular Biology*. The following is a brief summary of Dr. Tarn's research.

First, Dr. Tarn's group unveiled several transcriptional regulatory proteins capable of affecting pre-mRNA splicing, such as the transcriptional activator E2 encoded by human papillomaviruses linked with epidermodysplasia verruciformis, and the cellular transcriptional regulatory factor CA150. These proteins mediate the regulation of pre-mRNA splicing via different molecular pathways.

Further, Dr. Tarn's group investigated how RNA binding proteins modulate alternative splicing. These proteins determine splice site selection probably by binding to the specific elements within the pre-mRNA, thereby affecting the assembly of the spliceosome. It is also known that phosphorylation of some splicing regula-



Regulation of alternative pre-mRNA splicing. (A) Alternative splicing is the process that allows the selection of different combinations of splice sites within a precursor mRNA. (B) RNA binding proteins such as SR proteins and hnRNP proteins regulate alternative splicing. A novel protein RBM4 modulates splice site selection and antagonizes the activity of SR proteins (ASF). (C) A transcriptional regulator CA150 interacts with RNA polymerase II and preferentially associates with a set of splicing factors to facilitate the utilization of intron's 3' splice site of emerging mRNA precursors.



Nuclear transport of SR proteins. Transportin-SR (TRN-SR) is a nuclear import receptor that delivers phosphorylated SR proteins into the nucleus. (1) Nuclear Ran protein binds to TRN-SR to dissociate the SR protein from the import complex. (2) SR proteins participate in pre-mRNA splicing. (3) Subsequently, some SR proteins become dephosphorylated and recruit mRNA export adaptor TAP. (4) It is possible that SR proteins export mRNA in a hypophosphorylated form. (5) Taken together, the nucleocytoplasmic shuttling of SR proteins likely involves a phosphorylation-dephosphorylation cycle.

tors influences their splicing activity or subcellular localization.

Several years ago, Dr. Tarn's group found a nuclear import receptor that delivers phosphorylated splicing regulators (particularly SR proteins) into the nucleus. Her group recently reported that dephosphorylation of SR proteins likely occurs during or after splicing in order to recruit an mRNA export factor. This process may allow mRNA export to the cytoplasm. Therefore, phosphorylation not only regulates the activity of splicing factors but also directs their nucleocytoplasmic shuttling. Dr. Tarn and her colleagues also reported that splicing factors can be degraded due to aberrant phosphorylation. Therefore, cellular signaling in response to outside stimuli (such as hormones or drugs) may have influences on mRNA splicing via modulation of splicing regulatory factors.

At present, Dr. Tarn continues to study how splicing regulatory proteins are delivered to the nucleus to fine tune gene expression. Moreover, she is also investigating the relationship between differential splicing and cell physiology. These are all important topics in molecular medicine for the new millennium. Finally, this line of research is expected to greatly benefit molecular diagnosis and therapy in the near future.

Important Breakthrough in Plant Sciences

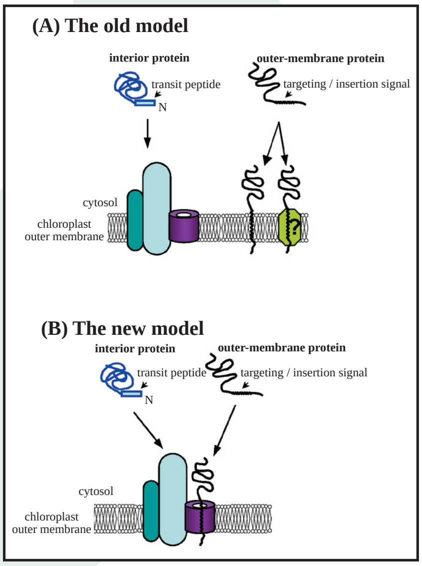
Mechanism of Chloroplast Proteins Transportation Successfully Revealed

As every student of biology knows, chloroplasts are the site for photosynthesis – the reaction that provides the earth with carbohydrates and oxygen. In addition to photosynthesis, chloroplasts also synthesize a variety of other compounds important to human health, such as carotenoids and essential amino acids. Chloroplasts require a special set of proteins to carry out these special functions, but most chloroplasts proteins are not synthesized within chloroplasts but in the cytosol outside of chloroplasts. The process of correctly targeting chloroplast proteins to chloroplasts, therefore, has been a topic of intensive research.

The outer membrane of chloroplasts controls the interaction of chloroplasts with other organelles within a cell, and is also the place for important steps in the synthesis of carotenoids and galactolipids. Therefore if scientists wanted to use transgenic technology to modify these products, it was necessary to find a way of correctly directing the transgenic protein to the chloroplast outer membrane. However, the scientific community understood very little of how proteins were targeted to the outer membrane of chloroplasts.

It had previously been thought that different pathways were used for protein import into the interior of chloroplasts and protein insertion into the chloroplast outer membrane, since these two processes had different requirement of energy and protease-sensitive receptors. However, research conducted by the laboratory of Dr. Li Hsou-min at the Institute of Molecular Biology, Academia Sinica, revealed that both pathways converged at the outer membrane protein-conducting channel.

Funded by the National Science Council and Academia Sinica, Dr. Li's laboratory had first identified the targeting/insertion signal to the chloroplast outer membrane in previous research. In this recent published finding, they further used chemical cross-linking to identify the protein that mediates insertion of an outer-membrane protein, and found that the insertion site turned out to be the channel that translocates interior proteins across the membrane. In collaboration with the laboratory of Dr. Danny Schnell at the University of Massachusetts, the research team used a porteoliposome system containing the reconstituted channel protein, and directly showed that the channel protein mediated the insertion of the outer membrane protein. This data demonstrated that an outer membrane protein needs only the channel protein, rather than the protease-sensitive and energy-consuming receptor proteins that are essential for interior protein import. This difference was the cause of the decade-long misimpression that outer-membrane and interior proteins used different pathways.



(A) The old model for the past decade indicates that chloroplast interior and outer-membrane proteins use different inport pathways. While the interior proteins are imported through a translocon complex containing protease-sensitive receptors and a membrane-embedded channel, the outer-membrane proteins are inserted directly into the lipids or through an unknown receptor. (B) The new results from Dr. Li Hsou-min's laboratory indicates that outer-membrane proteins are inserted into the outer membrane through the membrane channel for the interior proteins. Therefore the two pathways converge at this membrane channel.

These results have already been published in the August 2004 issue of *The Plant Cell*, the most prominent journal in plant sciences. Dr. Li indicated that a complete understanding of the mechanism of targeting proteins to the chloroplast outer membrane could be an essential tool for future modifications of chloroplast products.

Taiwan's First Supernova Discovery

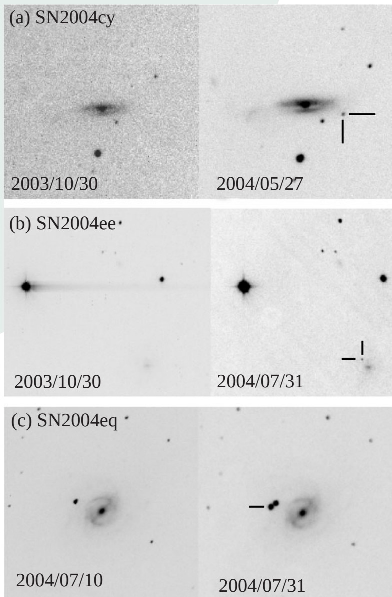
NCU's Lu-Lin Observatory Discovers Three Internationally-Confirmed Supernovas

The "Program for Promoting Academic Excellence of Universities," which is jointly sponsored by the NSC and Ministry of Education, and its continuing projects are yielding many extremely promising findings. For instance, the "Taiwan Supernovae Survey" conducted by the National Central University (NCU) Graduate Institute of Astronomy and directed by Prof. Ip Wing-huen has discovered three supernovas (SN2004cy, SN2003lz, and SN2004ee) using the one-meter telescope at NCU's Lu-Lin Observatory. The discovery of these supernovas was announced in the 8364th, 8371st, and 8399th issues of *International Astronomical Union Circulars* (*IAUC*) respectively. These were the first supernovas ever discovered in Taiwan.

According to Prof. Ip, supernovas are among the most energetic physical phenomena occurring in the universe. Supernovas release a colossal $10^{52} \sim 10^{53}$ ergs of energy in the space of roughly one second, and the process of explosion generates vast quantities of high-energy neutrinos and large amounts of such heavy elements as gold and silver. The explosion of a supernova signifies the death of a star and the birth of a neutron star, and the elements created in the supernova can give rise to a new generation of stars. Supernovas are currently one of the hottest topics in astrophysics. Furthermore, astronomers can use supernovas to measure the distance to far-away galaxies, which provides valuable data used to determine whether the expansion of the universe is accelerating and whether both dark matter and dark energy actually exist. The discovery and observation of supernovas is therefore extremely important to cosmology. NCU's Graduate Institute of Astronomy is participating in the NSC's Program for Promoting Academic Excellence of Universities (Phase II) with the topic of "Taiwan Supernovae Survey."

The Taiwan Supernovae Survey is being conducted as a joint international project in conjunction with KAIT of the University of California at Berkeley Astronomy Department and the Beijing Astronomical Observatory. The observation of supernovas is limited by latitude, and observatories in a dozen countries can only observe stars in the northern half of the sky. Only Taiwan, Australia, Hawaii, and Chile have observatories able to observe the stars of the southern hemisphere. Since there are so few competitors, this is an area where Taiwan can excel. By taking advantage of Taiwan's low-latitude location and selectively targeting galaxies in the southern sky, Taiwan's astronomers can be expected to discover even more supernovas. By providing more data and targets for observation, this work can make a big contribution to supernova research and give Taiwan a higher profile in the science of astronomy.

The supernovas discovered by the Taiwan Supernovae Survey include SN2003lz (IAUC No. 8371) in ESO 428-G13 and SN2004cy (IAUC No. 8364) in ESO 403-G9. While the first of these supernovas to be announced – SN2004cy – was found in April 2004, supernova SN2003lz was discovered while reviewing images that had actually been taken in October of last year (2003). The third supernova to be discovered in Taiwan – SN2004ee (IAUC No. 8399) – was found in August of this year.



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
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